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P/REFERENCES OF DESIGN

CUMULUS CONFERENCE PROCEEDINGS BUDAPEST 2024

VOLUME 1

Cumulus Association

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PRESIDENT MESSAGE FOR CUMULUS BUDAPEST PROCEEDINGS.

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Nestled in the vibrant cultural milieu of Budapest, the Cumulus Budapest 2024 Conference took place at the esteemed Moholy-Nagy University of Art and Design, an institution that proudly boasts a 143-year legacy of artistic and academic excellence. This setting seamlessly aligned with the conference's overarching theme, "P/references of Design," which encapsulates the multifaceted nature of contemporary design discourse: the shifting paradigms that influence our understanding and preferences in a world increasingly characterised by environmental degradation, social upheaval, economic instability, and the pervasive influence of data systems.

As traditional value structures erode, the design field is compelled to adapt and redefine its role. Conversely, the conference provided a fertile ground for scholarly exploration around a range of urgent topics, including: “Converging Bodies of Knowledge” as a means to enhance theoretical and practical support; global tensions between “Centres and Peripheries”; “Redefining Data Boundaries” due to the ever-shifting dynamics between data, humans, and non-humans; “Redefining Data Boundaries”; “Bridging Design and Economics” to shape and influence spaces of governance, business, and innovation; “The Power of Immersion” and its subtle impact on our daily lives; “Speculative Perspectives” to transcend established boundaries; “Taming Entropy: Systems Design for Climate and Change”; and identifying “Ways of Living Together.”

These discussions resulted in a variety of paper presentations, panel discussions, keynote speeches, and networking opportunities, where participants engaged in a profound examination of the tensions and parallels that guide contemporary practices, harnessing both human and machine creativity while navigating the social, physical, and virtual realms of design.

The space for inquiry and reflection offered by Cumulus Budapest 2024 calls for a rethinking of established norms and the embrace of new perspectives. Human-centered design has long been the cornerstone of design practice, prioritizing human needs and experiences. However, the pressing challenges of climate change, geopolitical instability, and the complexities of a post-truth society necessitate a paradigm shift. Designers must recognize that the spatial-temporal dimensions of design extend beyond anthropocentric considerations, requiring an acknowledgment of the interdependencies between human and non-human entities. In this liminal age, designers are urged to embrace a more holistic perspective that redefine the foundational principles of design, including its starting points and objectives. They must engage in an ongoing revaluation of the values that underpin their work, navigating alternative ontologies, particularly in the

context of pressing issues such as climate change, geopolitical tensions, the post-truth world, and the rise of generative content creation. Addressing this complexity requires the inclusion of various non-human agents that influence our world while transcending the established references inherited from modernism, ultimately adapting to the evolving needs and preferences of society. This requires a commitment to sustainability, inclusivity, and ethical considerations in the design process.

The Cumulus Budapest 2024 Conference catalysed a critical and speculative design culture aimed at addressing systemic global and local social issues while proposing new ways of convergence where communities can coexist. The insights gathered from this event underscore the imperative for designers to transcend traditional roles and exploit strategic design, systems thinking, co-creation, and more-than-human design approaches. The attendance from around the globe demonstrated collective resilience and commitment to fostering a design practice that engages with the complexities of our contemporary context, venturing into the realms of the speculative, the unconventional, and the transformative.

The proceedings collected in this volume stand as pillars of wisdom for the global design community, inviting reflection on the past while charting a course toward innovative and transformative futures. The enriching dialogue initiated at the Cumulus Budapest 2024 Conference establishes a trajectory toward conscientious, groundbreaking, and paradigm-shifting prospects within a global context where the threads of a sustainable, equitable, and responsive design intertwine with the fabric of our world, and the flow of information and collaboration continues to prevail.

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P/REFERENCES OF DESIGN

DESIGNING A DESIGN CONFERENCE: INSIGHTS AND RECOMMENDATIONS FROM ORGANISING CUMULUS BUDAPEST 2024.

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KEYWORDS | CONFERENCE ORGANISATION, EVENT EXPERIENCE, CONFERENCE THEME, STRATEGIC ALIGNMENT

ABSTRACT | Reflecting on the organisation of the Cumulus Budapest 2024 conference provides a valuable opportunity to summarise efforts, distil key takeaways, and share insights gained from the process. Coordinating such a large-scale, international event required meticulous planning, adaptability, and collaboration across various organisational units of the host university, Moholy-Nagy University of Art and Design Budapest. It also required close collaboration with the Cumulus Association and the leadership of a large team across institutions. Sharing details of the submission, review, and organisation process; examining participant feedback; summarising what worked well; identifying areas for improvement; and listing practical recommendations for future conference organisers aim to document and share learnings within the Cumulus network and beyond.

1. Introduction

Moholy-Nagy University of Art and Design Budapest (MOME) is a design university in the capital of Hungary, and one of the most prominent institutions in the Central-Eastern Europe region. While building on its 143-year legacy, the university has completely renewed its physical environment in the last decade. The new campus, which opened in 2019, provides the community and visitors with some of the most modern institutional infrastructure in the region. The university also aims to be the first carbon-neutral university in Hungary.

Cumulus Budapest 2024: P/References of Design was the semi-annual conference of the Cumulus Association, hosted by MOME from May 15–17, 2024. The event, which welcomed over 600 participants, was the largest international gathering ever hosted by the university and represented an unprecedented organisational effort.

Describing details of the organisation, submission and peer review processes, documenting challenges encountered through the process, sharing participant feedback and offering practical recommendations can benefit future conference organisers within the Cumulus network and beyond.

2. Organisation Process

The organisation of Cumulus Budapest 2024 started with alignment on strategic goals, refining the conference theme and defining tracks, logistical and spatial planning, setting up a dedicated team, and focusing on creating a rich conference experience.

Initial efforts centred on establishing strategic objectives with university leadership, guiding the event's overarching purpose, and ensuring support across MOME departments and functions. Addressing logistical and spatial constraints was essential, particularly given the academic semester timing and the venue limitations of the MOME Campus. For instance, working with the largest auditorium, which has a maximum capacity of 200, and managing catering for over 450 participants without disrupting the event schedule presented challenges that needed to be addressed upfront.

Pre-mortem sessions identified potential challenges early on, while feedback from previous organisers offered valuable insights to refine the planning process.



Figure 1–2. Master building and main entrance at Moholy-Nagy University of Art and Design Budapest, during the Cumulus Budapest 2024 conference. Photos: Máté Lakos.

2.1 Aligning Strategic Goals

The most important first step in organising the conference was to align strategic goals with the university leadership. This provided a baseline for our planning activities and decision-making throughout the organisation process. This was especially important because the undertaking required all MOME departments — Academia, Innovation Center, Doctoral School, Tech Park — and all functions — Brand Office, Campus, HR, Procurement, and Finance teams — to work orchestrated.

Strategic goals that were agreed upon by the university leadership and the core organising team:

- Provide a good conference experience
- Adhere to Cumulus Association requirements
- Adhere to academic conference principles
- Add local flavour
- Bring in local/peripheral perspectives
- Highlight MOME transition (2014–)
- Celebrate the new MOME campus, renewed in 2019
- Promote English master programs
- Introduce the ongoing transformation of the university
- Present the current and future rectors
- Raise the international visibility of MOME and Budapest
- Elevate MOME and local speakers
- Generate visibility of Cumulus Budapest 2024 beyond the in-person participants.

2.2 Logistics and Spatial Constraints

Regarding the timing of the event, the only viable option for a conference of this scale to be held on the MOME campus was to hold it during preparation week — the week directly after all semester classes end and before students present their work and the exams and diploma presentations begin. This scheduling allowed rooms, both auditoriums and seminar rooms, otherwise occupied, to be utilised for the conference. The obvious downside of this timing was that students, busy finalising their semester projects, were not available to join the conference as participants or volunteers.

Critical bottlenecks were identified in terms of available space, specifically the size of the main auditorium, the available rooms to host parallel sessions, and the space that could host catering for nearly 500 onsite participants.

The main auditorium in the Master Building, the largest on campus, has a maximum seating capacity of 200 people. Anticipating a larger number of onsite participants, the organising team decided to stream the plenary sessions to additional rooms, allowing those unable to fit in the auditorium to watch the talks in real-time. While it was not ideal for some in-person attendees to watch the sessions via live stream rather than experiencing them directly, this solution ensured that everyone could view the busiest plenary sessions —including interested MOME faculty members and students both in the additional rooms and online. It also enabled the event to remain on campus, which was an important strategic objective aimed at showcasing the venue.

An important question was on setting time and space constraints for parallel sessions. As seen later, nine thematic tracks were proposed, but it was understood that they do not need to run all parallel. Next to the main auditorium, six rooms were booked for parallel sessions, and six seminar rooms were booked for workshops, Cumulus Working Group meetings, and format X sessions. Additional rooms were reserved for impromptu meetings, interviewing, and video shooting. The available rooms and a preliminary programme schedule allowed the core organising team to define how many parallel sessions, and how many paper and slide deck presentations could physically fit into the timeframe of the 3-day event.

2.3 Pre-mortem

Three pre-mortem sessions were held: one with the university leadership, the second with track chairs, and the third with the organising team. In this session, potential risks and challenges that could occur were identified. For instance, it was highlighted that construction work and noisy garden work (e.g., lawnmowing) could easily destroy the participant experience. Some of these issues might seem banal, but discovering and managing such risks early on allowed the organising team to build the necessary support across the university.

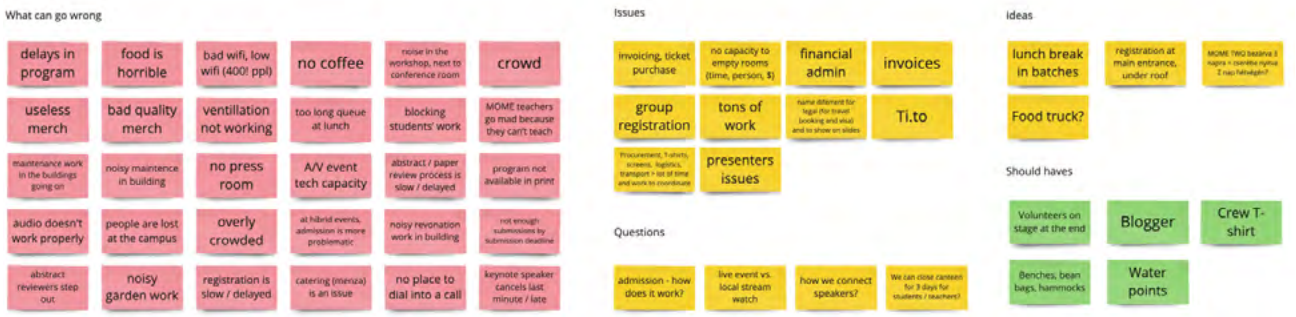


Figure 3. Combined outcomes of the three pre-mortem workshops.

2.4 Collecting Feedback from Previous Organisers

Requirements for the conference were provided by the Cumulus Association and regular meetings were organised between the organising team and Cumulus Association secretariat.

Some members of the organising team attended the Cumulus Antwerp 2023 and the Cumulus Beijing 2023 events, which provided valuable insight into the scale and organisational nuances of such an event.

Additionally, discussions with previous conference organisers, including Kristof Vaes (University of Antwerp), Maria Luisa Rossi (College for Creative Studies, Detroit), and Lorenzo Imbesi and Viktor Malakuczi (Sapienza University of Rome), proved to be immensely helpful.

2.5 Team Setup

After successfully earning the opportunity to host the event, organisational work commenced in July 2023 with the appointment of Attila Bujdosó as conference chair and Andrea Kovács as project manager and curator. Their initial tasks included drafting an organisational chart for the event, as shown in Figure 4.

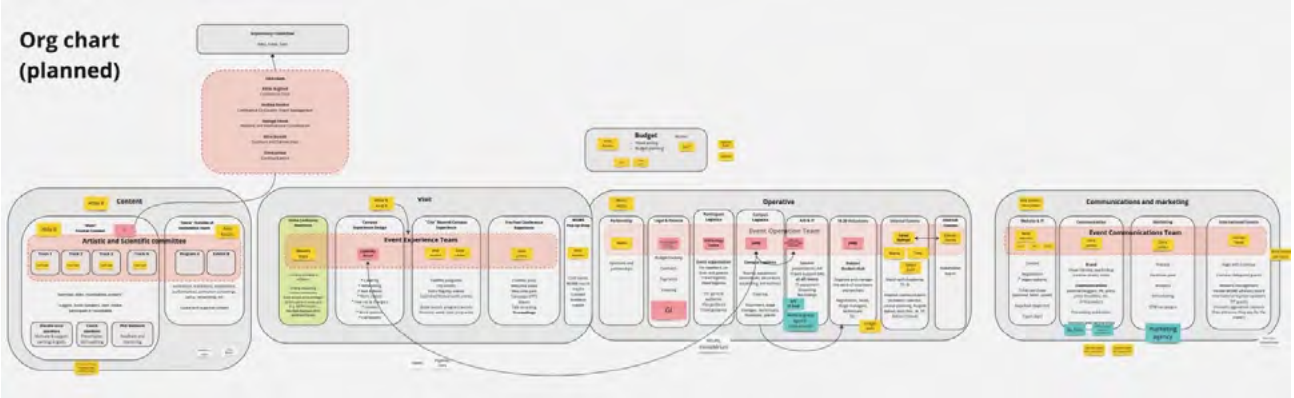


Figure 4. The initial team organisational chart.

In a parallel workstream led by the conference chair, the refinement of the conference theme, the establishment of the Scientific Committee, the definition of thematic tracks, and the preparation of the call for participation were started. The track chairs included Ágnes Karolina Bakk, Miklós Erhardt, Tamás Fogarasy, Boglárka Jakabfi-Kovács, Mary Karyda, Anna Keszeg, Ákos Schneider, Bori Fehér, Márton Szentpéteri, and Bálint Veres, who all contributed their expertise to the development of the call. An additional track was opened for doctoral students by the Cumulus PhD Network, led by Lorenzo Imbesi, Cumulus President. This work culminated in designing and developing the website and publishing the call for participation in September 2023.

The core organising team for the event began their work nine months prior, in September 2023, led by Attila Bujdosó as conference chair. The initial team included Andrea Kovács, responsible for curating the student exhibition and overseeing cultural and social programmes, as well as project management; Györgyi Falvai, managing network, and international coordination; Dóra Juhász, leading communications; and Nóra Comas-Demők, handling sponsors and partnerships.

Four months before the event, Dr. Judit Kollár joined to take on event management, and Vivien Andavölgyi expanded the team's capacity in communications and project management. Two months before the event, Júlia Horváth and Zsófia Zubay joined the team, with the former supporting workshops and working groups and the latter focusing on the virtual conference. By the time of the conference, the team had grown and evolved into a setup visible in Figure 5.

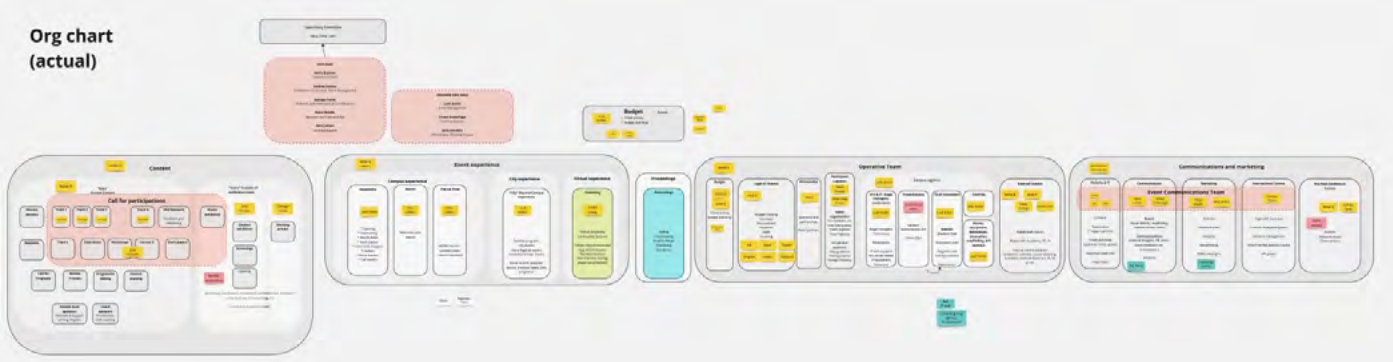


Figure 5. How the team organisational chart evolved.

It is important to highlight that, in addition to the core organising team, a large number of university staff were involved in the organisation process — from communications to invoicing, from procurement and contracting to accounting, and from campus logistics to website development. As shown in Figure 6, as the preparation work progressed, more and more contributors were required across multiple organisational units of the university. Specifically, during the week of the conference, an additional 54 staff joined, including hosts, moderators, stage managers, A/V technicians, and catering and cleaning staff.

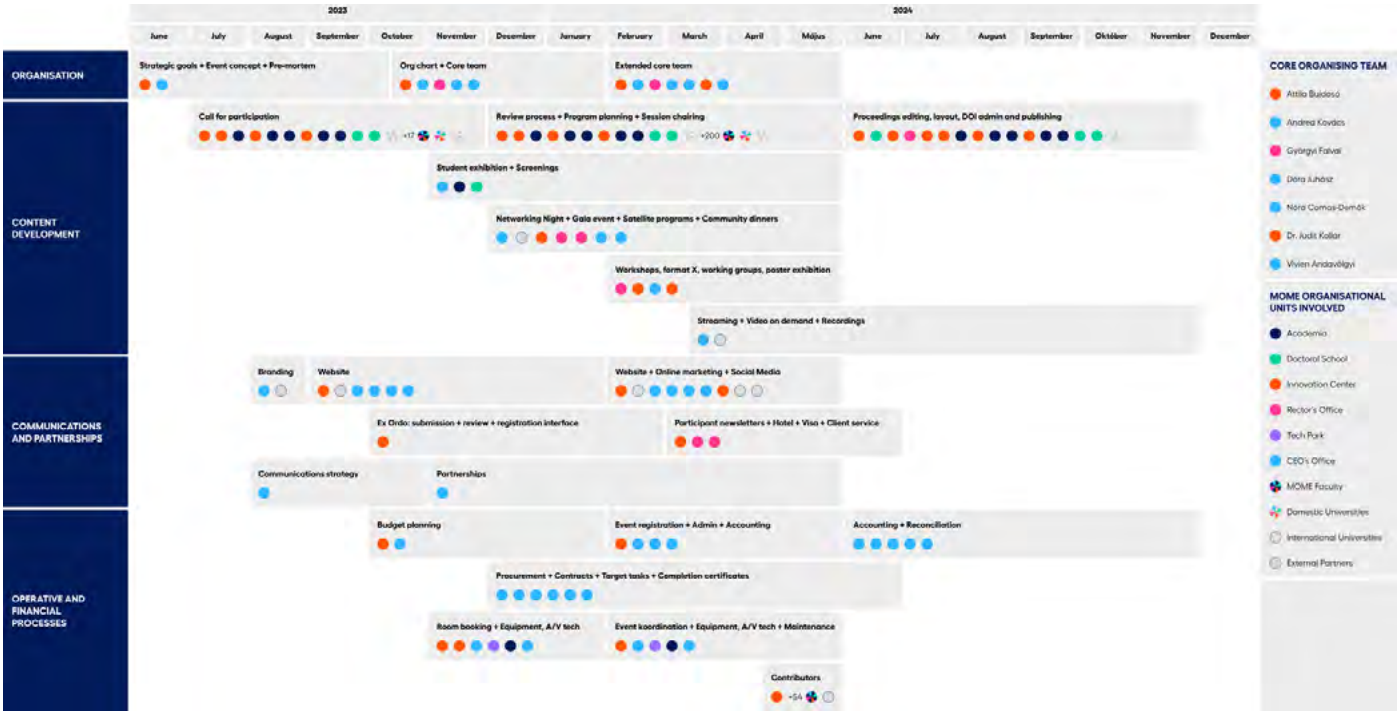


Figure 6. Breakdown of workstreams and contributors from different organisational units.



Figure 7. Most members of the core organising team and the Scientific Committee are on stage at the closing ceremony. Photo: Máté Lakos.

3. Conference Theme, Tracks, Keynotes, and Plenary Talks

The conference theme, "P/References of Design," was initially established prior to the submission of the application to the Cumulus Association's call for conference hosts in 2022. It was further refined and officially published alongside the call for contributions in September 2023, (P/References of Design: Cumulus Budapest 2024, 2023) as follows:

"Our references for understanding and relating to the world, as well as our preferences when we make our choices as humans are confronted by major ecological, socio-economic, and geopolitical challenges. The horizons of art and design are changing. Anchor points, both old and new, must be reconsidered. As modern value structures break down and new ones emerge, we find ourselves in an age of liminality.

A hundred years ago, during another time of global turbulence, Laszlo Moholy-Nagy, an emblematic figure of the Bauhaus movement, stated that "tradition must be dynamic."[1] As we see our own century unfolding, with collapsing ecosystems, struggling global and local communities, and failing economic paradigms, we must admit that Moholy-Nagy was right. Human references and preferences do shift, and must be shifted.

The Cumulus conference in Budapest aims to explore contemporary design culture[2] by examining its current tensions and parallels. Participants are encouraged to share their perspectives on the ongoing "revaluation of values"[3] which concern established references and competing preferences in design.

When the long-standing paradigm of human-centred design falls short in addressing the complexities and the variety of multiple non-human agents in our world, how should we approach design? Should the position and possibilities of the living, sentient, knowing and purposeful human being as the ultimate reference of any cultural activity be reconsidered in the face of the prevailing ideologies of 'humanness' inherited from modernism? Is design, as a tool for optimizing user experience and "streamlining the sales curve",[4] still preferable when facing the "limits to growth"[5]? Is the user still the legitimate source and focus of the design process? How should the starting points and objectives of design be set today?

What is the role of design and the designer in society anyway? Where will the expertise of designers be most crucial in the upcoming years? How should the design profession adapt to effectively address future needs and preferences? How are traditional references being challenged by alternative ontologies in the shadow of climate change, intensifying geopolitical tensions, the emerging post-truth world, and the rise of generative content creation?

During the conference, we will delve into various perspectives of strategic design, systems thinking, co-creation and more-than-human design. The event will also examine tensions and parallels that guide us towards contemporary practices which harness both human and machine creativity, and navigate the social, physical and virtual realms of design. The widening liminal space between value structures will also provide us with a chance to contemplate the dynamics between the centres and peripheries of the global design landscape, along with the history and institutional power structures of modern design.

As a transitional zone situated between the West and the East, the Balkans and the Baltics, Hungary has always encountered diverse and contesting values, resulting in a wide array of references and preferences. With its 143-year history and a recent major institutional renewal, Moholy-Nagy University of Art and Design Budapest invites academics, educators and art and design professionals from all over the world to discuss and consider the revaluation of established frameworks and explore future perspectives of design culture."

[1] Moholy-Nagy L., 1947. Vision in Motion. Chicago: P. Theobald, p. 22.
[2] Julier, G., 2000. The Culture of Design. London: Sage.
[3] Nietzsche, F. W., 1883-1885. (2006). Thus Spoke Zarathustra: a Book for All and None. Cambridge: Cambridge University Press.
[4] The famous sentence, "he streamlines the sales curve", is written under the portrait of iconic industrial designer Raymond Loewy on the cover of the October 31, 1949 issue of Time magazine.
[5] Meadows, D. H., Meadows, D. L., Randers, J., Behrens III, W. W., 1972. The Limits to Growth. New York: Universe Books.

3.1 Tracks

To support the strategic objectives outlined in section 2.1, multiple potential track structures were examined. Ultimately, the decision was made to adopt a holistic, all-encompassing approach that welcomes contributions across a wide range of focus areas rather than opting for a more focused yet narrow approach. The following nice tracks were established:

- Centres and Peripheries
- Converging Bodies of Knowledge
- Redefining Data Boundaries
- Bridging Design and Economics
- Speculative Perspectives
- The Power of Immersion
- The Future of Well-being
- Taming Entropy: Systems Design for Climate and Change
- Ways of Living Together

The potential tracks were formulated in a way that MOME faculty and lecturers from all relevant departmental units — Academia, Doctoral School, and Innovation Center — could serve as track chairs, fostering collaboration and bridging organisational silos within the university. Selecting track chairs from MOME allowed for a closer working relationship between the conference chair and track chairs while involving co-chairs from other — including international — universities introduced more diverse expertise.

When appointing co-chairs, and later reviewers and session chairs, emphasis was placed on including not only international contributors but also representatives from fellow domestic universities. This approach enabled academics from other Hungarian institutions, such as the Hungarian University of Fine Arts, Budapest University of Technology and Economics, Eötvös Loránd University, and Central European University, to engage with the network offered by the Cumulus Association.

Additionally, a special track was organised by the Cumulus PhD Network for doctoral students to present their research and get general feedback.

3.2 Formats

In addition to common conference formats like paper presentations, workshops, and posters, the organising team experimented with two formats.

“Slide deck” was proposed to encourage academic, industry, and art professionals to present their creative and professional works, whether it is research, design, or artistic.

“Format X” submissions were welcomed to propose new, experimental formats that actively involve 15+ participants and let them come together and discuss, debate, play, paint, scratch, bend, tear apart, or X a specific topic. Such formats were expected to be engaging, social, inclusive, cooperative, and highly interactive.

3.3 Keynotes

Eric Zimmerman, a renowned game designer, and NYU professor, delivered the first keynote exploring the intersection of play and systems design. His talk, *Gaming the System*, delved into how game design principles can challenge societal norms, inspire creative thinking beyond the digital realm, and be used to design social systems of scale. His talk highlighted themes from his latest book, *The Rules We Break*, advocating for play as a powerful tool for learning and engagement.

Vladan Joler, a professor at the New Media Department of the University of Novi Sad and an interdisciplinary researcher, examined the hidden mechanisms of contemporary technology in his keynote, *New Extractivism*. Focusing on the exploitation embedded in digital infrastructures and algorithmic systems, he unveiled the intricate connections between data extraction, labour, and ecological impact. His talk underscored the necessity of transparency and accountability in technological design and policy.



Figure 8. Vladan Joler delivered his keynote talk on Day 2, May 16, 2024. Photo: Máté Lakos.

Dr. Robin Schuldenfrei, a historian specializing in modern architecture and design, brought a nuanced perspective on materiality in her keynote. She explored the cultural and political dimensions of objects in modernism, drawing from her recent publication, *Objects in Exile*. By examining the migration of design and architectural ideas across borders during the mid-20th century, she illuminated the intersections of luxury, modernism, and identity. Schuldenfrei's insights bridged historical analysis with contemporary relevance, enriching the discourse on the enduring impact of modernist material culture.

3.4 Plenary Talks

In the plenary sessions, speakers brought in local perspectives by reflecting on the keynote talks and shedding light on various topics. Dr. Petra Aczél, a full professor at MOME, discussed educational design in the age of artificial intelligence (AI). Adam Somlai-Fischer, co-founder of Prezi.com, designer, media artist, and aspiring musician, talked about his passion for shaping futures and taming technology to make it more humane and less boring. Hedvig Harmati, textile artist, university professor, and head of the MOME Doctoral School, introduced the "Future Traditions" design research and curriculum development process. Dr. Dániel Barcza, strategic vice-rector of MOME, introduced the ongoing Future University project, a comprehensive redesign of the university's educational model. Finally, Lāsma Ivaska, director of the Innovation Center at Moholy-Nagy University of Art & Design, presented research projects aiming to design for life in an era of climate crisis.

4. Submission and Review Process

4.1 Initial Submissions

The call for participation received approximately 540 academic paper abstract submissions, significantly exceeding the organisers' prior estimate of around 400. The submission deadline was 15 December 2023. After removing duplicates and miscategorised submissions, 537 academic paper abstracts were reviewed.

The deadline for other formats — workshops, posters, Format X, and slide decks — was 25 January 2024. A total of 80 submissions were received across these formats, slightly fewer than expected (100), as detailed below:

- Slide decks: 37
- Workshops: 27
- Posters: 16
- Format X: 8

4.2 Review Process in the Abstract Phase

From 537 submissions, a total of 185 abstracts were accepted and invited for full-paper submissions. This represented a 34% acceptance rate across all tracks, ranging from 29% to 51% for individual tracks.

67 promising submissions (12%) were rejected but recommended for resubmission as Slide Decks (15), Posters (12), or Short Papers (40) in the Cumulus PhD Network track. For Slide Deck and Poster submissions, authors were offered additional time to submit their materials (between 2 February and 15 February), as the original submission deadline (25 January) was no longer realistic for them.

85% of accept/reject decisions were published on time (on 24 January 2024), and 98% of decisions within a two-day delay. The remainder of the authors were informed within 10 days. These were mostly submissions that were proposed to be moved to other tracks, which required alignment between track chairs.

4.3 Review Process in Full Paper Phase

Altogether, over 700 submissions were received. After the full submission of academic papers, all contributions underwent a double-blind peer review process. Finally, a total of 106 academic papers were accepted to the conference, representing a 19.7% acceptance rate. Additionally, 42 Short Papers, 23 Slide Deck presentations, 18 Posters, 11 Workshops, and 4 Format X submissions were accepted, as detailed in Table 1.

There was a slight delay in the review process, but 94% of authors were notified within three days of the planned decision announcement date. A few submissions were withdrawn by their authors after acceptance, and one was withdrawn following the conference.

Table 1. Contribution formats at the conference.

Format	Selection Process	Presentation Length/Format	Q&A Length	Presentation Mode	Submissions Received	Contributions Accepted
Keynote Talk	Invitation	35’	10’	In-person	N/A	3
Plenary Talk	Invitation	15’	5’	In-person	N/A	5
Academic Paper	Peer Review	15’	5’	In-person*	537	106
Short Paper	Peer Review	10’	5’	Hybrid	87	42
Slide Deck	Peer Review	15’	5’	In-person*	37	23
Workshop	Peer Review	45–180’	N/A	In-person	27	11
Format X	Peer Review	45–90’	N/A	In-person	8	4
Poster	Peer Review	70 x 140 cm print poster	two meet-the-authors sessions	Hybrid	16	12+5
Working Group	Coordinated by Cumulus Association	90’	N/A	Hybrid	N/A	23

5. Conference Experience Planning

5.1 Experience Planning

A multi-layered experience planning (see Table 2) aimed to deliver an engaging and memorable event for attendees.

Table 2. Layers of experience at Cumulus Budapest 2024.

Virtual Experience	Conference app | On-demand documentaries | Dance performance streaming
City Experience	Gala Dinner | City walks | Recommended programmes
Social Experience	Networking Night on day 0 | Reception on day 1 | Community Dinners
Campus Experience	Tech Park tour | Activities in campus garden | Morning yoga | Pop-up shop
Exhibition Experience	Student exhibition | Poster exhibition | Screenings
Interactive Experience	Workshops | Working groups | Format X
Presentation Experience	Keynotes | Plenary talks | Academic papers | Short papers | Slide decks | Q&As

5.2 Outdoor Activities

To harness the value of the MOME campus, several outdoor activities were planned. For instance, a game design workshop entitled “Rock, Paper, or Scissors” was led by keynote speaker Eric Zimmerman on the second day in the campus garden. Some workshops were held outside, and conference participants were invited to join MOME’s regular morning yoga sessions on the roof terrace of the MOME ONE building. Additionally, tours organised to the Tech Park were very popular among participants.



Figure 9–10. “Rock, Paper, or Scissors” workshop by Eric Zimmerman and “Sticks and Ladders - Physical and Theoretical Approaches to the Integration of Participatory Design into School Curricula” by Dr. András Cseh and Szilárd Köninger. Photos: Máté Lakos.

5.3 Pop-up Shop

As an experiment, the front area of the MOME library was turned into a pop-up shop for the three days of the conference. Over 40 design objects and books were showcased, highlighting the local talent and creativity of MOME students and faculty, and were made available for purchase at the location.

5.4 Voucher in the Gift Bag

MOME, as the host university, aimed to treat the large international audience with warm hospitality, which included offering complimentary conference gifts to in-person attendees. At the same time, the organising team sought to balance this generosity with sustainability considerations. Therefore, the gifts offered to participants were intentionally kept limited—to a tote bag, a notebook, and a pen. In addition to this, participants received a voucher. Participants could exchange their vouchers for a university-branded merchandise item, a reusable water bottle, or a booklet, or they could use the voucher to purchase any items on sale in the pop-up shop. This approach allowed useless merchandising objects to be kept to a minimum while allowing participants to select gifts according to their preferences or purchase and take-home local books, art, or design objects of their choice.

6. Key Challenges

6.1 Review Process

Completing the peer review process on time can be a major challenge for conference organisers. The organising team, together with track chairs and co-chairs, recruited over 200 reviewers. As described in sections 4.2 and 4.3, some delays occurred, but the review process was running mostly on time. In the process, some challenges occurred, as explained in the following.

6.2 Submission Process

There were a couple of cases (~5) where authors reached out to the organising team because they had not received feedback on their final paper acceptance. After careful investigation, it was found that some authors who were invited to submit their full papers started to upload their full papers but did not submit them. The Ex Ordo conference management system labelled such contributions as "pending." As it turned out, this label was somewhat misleading because it could be interpreted as "pending review," besides its intended meaning as "pending submission." Upon successful submission of full papers, contributions were labelled as "completed," and authors received an email notification confirming that — but this was not clear to all authors. Papers that were not completely submitted (along with 30% of abstracts that were invited but were not submitted as full papers) were not peer-reviewed and were excluded from the rest of the process.

In some cases, when this situation was discovered early (6–8 weeks before the conference), the conference chair decided to reinsert such submissions into the peer review process. When this was discovered later (in one case, just two weeks before the conference), time was insufficient to enrol the papers into the peer review process, and those papers had to be rejected.

The conference chair raised this issue with the Ex Ordo support team and suggested renaming the label of unsubmitted submissions to "draft." The product team at Ex Ordo committed to considering this feedback.

6.3 Anonymity of Submissions

Some submissions did not fulfil the requirement of anonymity and had to be rejected during the abstract phase or final submission phase.

One short paper submission was submitted non-anonymised. During correspondence with the author, it was found that the call for participation in the conference had not explicitly required short paper authors to submit their initial submissions anonymised. From the textual context, this requirement could have been assumed — since all other submission types required anonymity — but it was not a formal requirement. When this was discovered, the conference chair asked the author to resubmit their short paper in anonymised form, and it was assigned to new reviewers.

6.4 Written Feedback on Academic Paper Abstracts

After announcing accept/reject decisions on submitted paper abstracts, 44 authors reached out to conference organisers via email because they had not received written feedback on their abstract submissions. Some authors expressed doubts about whether there had indeed been a review process and reviewers. Some simply asked whether it was possible to review the decisions, while others genuinely asked for feedback so that they could improve their work. Additionally, ten accepted authors requested feedback to help them write their full papers.

The default setting in the Ex Ordo system required reviewers to share feedback with track chairs, and they were able to choose whether to make their feedback visible to authors or not. Many reviewers followed the default setting — hence, some reviews were visible only to track chairs and not to authors. Reviewers were also required to provide numerical ratings, but these were not visible to the authors either.

While it was not previously announced what kind of feedback would be given to authors during the abstract selection phase, this was a very unfortunate situation for multiple reasons. First,

- Invisible feedback could not help authors improve their work (regardless of whether they were accepted or not).
- The situation caused some authors to question whether there had been a review process at all.
- The organisers received many email queries after announcing the decisions, leading to an overwhelming two weeks of communicating with the authors.

The organisers and track chairs made efforts to reply to every author who reached out to them and shared feedback manually, either via email or within the Ex Ordo system. In four cases, the original decisions were revisited.

6.5 Hybrid vs. Onsite Experience: Remote Participation, Remote Presenting

Providing the option to present at the conference remotely or attend the event virtually was a major discussion item between the organising team and representatives from the Cumulus Association.

The following perspectives were taken into account:

1. Allowing authors to present remotely offers greater inclusivity to those unable to travel due to budget, health, or time constraints.
2. Having remote presenters can detract from the onsite attendee experience, as people are increasingly fatigued by online speeches and encounters.
3. Having remote presenters introduces additional technical risks to the preparation of sessions.
4. Remote presenting reduces the serendipity of encounters and decreases the networking value of the conference.
5. Charging the same registration fee for in-person and remote presenters may feel inappropriate, but the reality is that the bulk of conference organisational costs remain unchanged regardless of presentation format.
6. Charging a significantly lower registration fee for remote presenters introduces unpredictability to revenue planning, potentially jeopardising the budget.
7. Streaming presentations increase the visibility of the content presented at the event.
8. Streamed content, if done properly, can be shared later as recordings.
9. The cost of streaming (technology and team) can be significant if done professionally.

Considering all of the above aspects, the organising team decided to limit remote participation to streaming from one room — the Auditorium — and participation in Cumulus Working Groups. The Auditorium hosted all plenary sessions and a subset of track sessions, which were streamed throughout the three days. This decision also helped address the capacity issues of the Main Auditorium, as described in section 2.2.

Cumulus Working Groups announced their topics beforehand, and each session was provided with a separate Zoom link to allow for remote joining. Separate Zoom accounts were purchased just for the conference, but here, a small yet serious mistake was made: parallel sessions had been created from the same Zoom account. This was discovered late during the technical checks and fixing the invite links and properly communicating them to working group members and participants caused delays — resulting in one working group being inaccessible online and some other working groups starting late and under frustrating conditions.

Regarding remote presenting, the organisers announced the call for participation with the requirement that at least one presenter per paper be onsite and present in person. However, at the specific request of the Cumulus President and the chair of the Cumulus PhD Network track, an exception was made for

doctoral students. Additionally, already approved speakers who were not able to travel to the venue due to visa issues or last-minute health concerns were allowed to present remotely.

To reduce the risk of technical or connection issues and ensure a smooth transition between speakers, the organising team requested remote presenters to show a pre-recorded video. The videos, which included both the slides and the presenter's face, felt almost as if they were presented in real time. After the talk, presenters were invited to join live for the Q&A online via Microsoft Teams. This solution seemed to be a good compromise between accessibility, quality of experience, and enabling academic discourse. However, in some cases, due to a lack of appropriate communication between organisers and stage managers, dialling in for the Q&A was hectic and last minute. Additionally, some remote presenters expressed discontent as they were not able to follow the track their presentation was part of—since streaming was limited to one room only.

Due to local tax laws, taxation of registration fees differed for onsite and remote participants. This made the invoicing process more tedious, and participants switching from one form of participation to another created extra administrative work, as explained in section 6.8.

6.6 Food and Catering

The university canteen, which is already busy on normal university days, has limited capacity. Therefore, it was decided to close it for the event so that the space could be utilised by an external catering company. This required proactive communication with stakeholders, university leadership, and the student union. To ensure lunch was served smoothly and on time and to avoid jeopardising the packed conference schedule, food boxes were handed out to participants. This allowed for much quicker service and enabled participants to use multiple areas of the campus, including the garden, to eat their lunches — both of which proved to be highly effective. However, it also generated significant amounts of (recyclable) waste and offered less flexibility for participants to choose their meals compared to what would have been possible with a buffet-style catering solution.

6.7 Campus Wayfinding

MOME Campus has seven buildings, and the floor numbering can be difficult to understand. As a result, a consistent room naming convention, dedicated host personnel, wayfinding communication, and a detailed campus map (Figure 11) were implemented. Still, onsite participants often found it challenging to navigate and locate the 24 locations spread across six buildings.

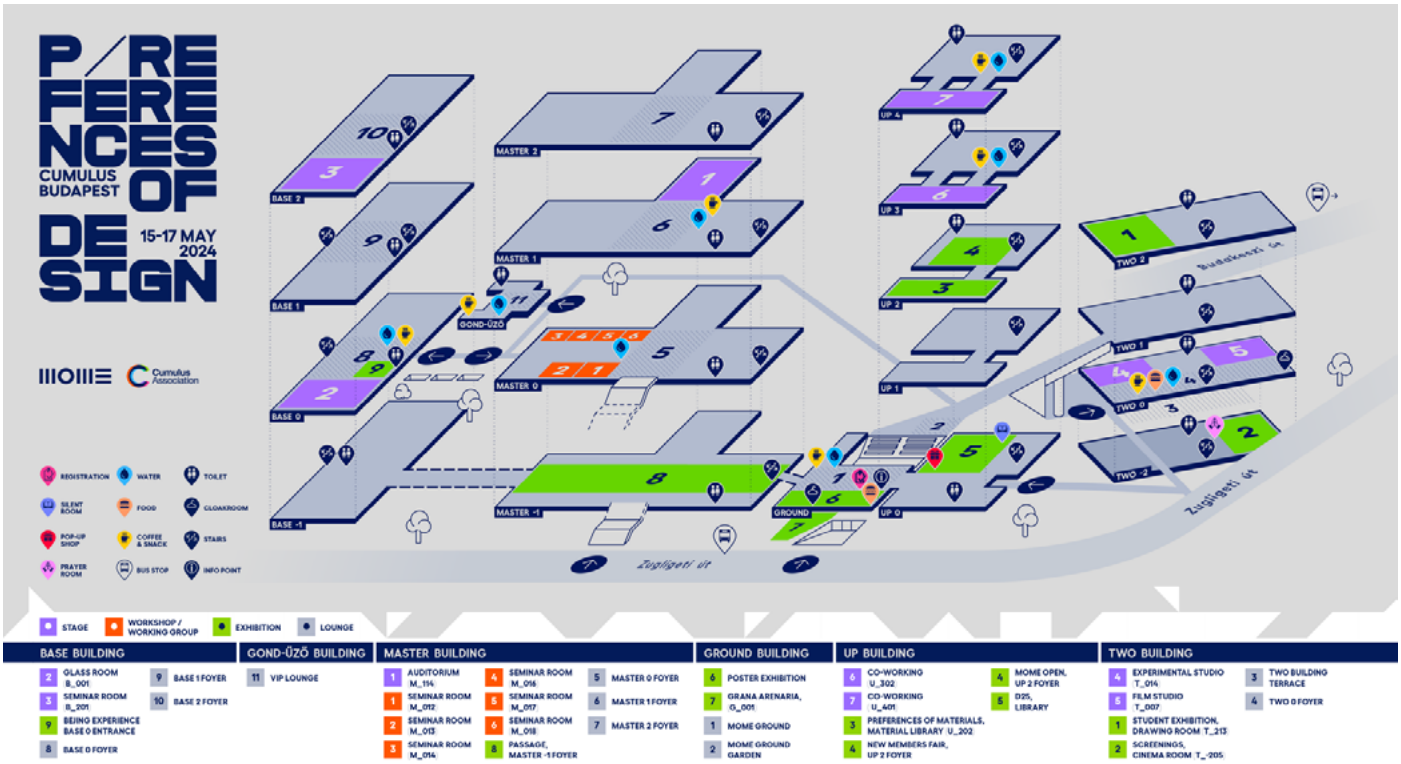


Figure 11. Conference and campus map.

6.8 Invoicing

Invoicing, though less visible, is a crucial aspect of the event organisation, and proved to be a significant challenge for the organising team. One of the reasons for choosing the Ex Ordo conference management system was that it covers most aspects of conference organisation: submission and review management, communication with authors, programme management and publishing, registration, and payments.

One shortfall discovered during the process was that the invoicing solution of Ex Ordo was not compliant with local tax authority requirements. For instance, the interface did not collect tax IDs, which are required for issuing invoices in Hungary for organisations. The hybrid participation model also posed challenges under local tax laws: the VAT rate for the registration fee differs for remote and onsite participants. A complex taxation scheme had to be followed based on the following criteria: whether the participant is onsite or remote, whether the buyer is an individual or an organisation, and whether the buyer is from Hungary, the EU, or a third country.

Taking all these complexities into account, and following a failed attempt to automate the process, the organising team and the finance team at MOME had to make the difficult decision to issue all invoices manually and accept it as an administrative overhead.

6.9 Communication with Authors

The organising team created a shared email inbox to manage all communications with attendees. While this worked well technically, the effort required to communicate with individual participants — whether regarding their submissions or the review process, practical details such as finding accommodation and issuing invitation letters, or last-minute changes requested by authors that affected the programme schedule — was vastly underestimated.

7. The Conference in Numbers

The conference showcased impressive submission and participation efforts. Over 700 submissions were received for the call for participation. Attendees hailed from 58 different countries, with more than 600 attendees in total, including 450 paying onsite registrants. The remainder of the participants were onsite contributors from MOME and other institutions, including track chairs and session chairs, representatives of the Cumulus Association, and online participants.

Communication with participants was overwhelming and required constant dedication: the central email address saw 300+ email threads; additionally, over 1,000 direct messages were exchanged through the Ex Ordo conference management platform, and over 5,000 system messages were sent out by the platform.

Administrative works had to follow: over 450 invoices were issued manually, 60 visa invitation letters were issued, and more than 100 certificates of participation were provided. Over 85 contracts were signed, and 100 incoming invoices were paid. Over 80 briefs were given to the graphic designer, reflecting the extensive work needed to prepare the venue and the event. The conference experience was totalled with exhibitions showcasing projects by 41 students and 12 screenings. Over 40 design items and books were featured in the Pop-up Shop.

The event reached 99,000 people with over 275,000 social media appearances and more than 20 press articles.

8. Participant Feedback

A feedback survey was sent out to participants approximately one month after the event. Due to the late send-out date, the number of respondents was relatively low: 43 people filled it out from 607 recipients (3 emails bounced back from the original 610 target recipients).

Table 3. Participant feedback was collected through a survey.

Number of responses within a question group (r), number of ratings (n), score on scale 1–5 average (a), % of positive responses (p).

	r	n	a	p
SUBMISSION AND REVIEW PROCESS				
Call for participation	41	36	4,47	91,7%
Ex Ordo submission interface	41	34	4,24	79,4%
Submission process	41	32	4,22	81,3%
Review process	41	31	4,03	71,0%
Communication with programme committee	41	33	4,55	90,9%
Programme finalisation and editing	41	33	4,12	78,8%
PREPARING FOR THE CONFERENCE				
Communication with the organisers	42	39	4,38	87,2%
Communication of programme	41	41	4,27	82,9%
Registration process	41	41	4,59	95,1%
Ticket options	41	36	4,08	75,0%
Conference website	41	41	4,41	90,2%
Conference mobile app	41	38	4,37	84,2%
Hotel, travel and city information	41	30	4,37	90,0%
Email updates sent via Ex Ordo	41	35	4,26	80,0%
Branding	40	34	4,59	91,2%

	r	n	a	p
IN-PERSON EXPERIENCE – SOCIAL AND CULTURAL PROGRAMMES				
Networking night at Lumen (Tuesday)	41	20	4,95	100,0%
Welcome reception at MOME (Wednesday)	41	32	4,69	100,0%
Community dinners at restaurants (Thursday)	41	16	4,81	100,0%
Gala dinner and party at Haris Park (Friday)	41	13	4,62	92,3%
Satellite programmes (City walks, LAM visits)	245	5	5,00	100,0%
Recommended programmes in Budapest	40	15	4,53	93,3%
IN-PERSON EXPERIENCE – HOSPITALITY				
Arrival to venue	40	35	4,74	100,0%
Registration	40	37	4,65	91,9%
Wayfinding on campus	40	37	4,32	83,8%
Accessibility	40	31	4,58	96,8%
Catering: coffee, tea, soft drinks and snacks	40	38	4,79	97,4%
Catering: lunch	40	37	4,24	81,1%
Hostesses and staff helpfulness	40	37	4,78	94,6%
Information desk availability and helpfulness	40	35	4,80	97,1%
Wi-Fi access	40	34	4,65	94,1%

IN-PERSON EXPERIENCE – PROGRAMME				
Keynotes and plenary talks	41	37	4,54	89,2%
Paper, short paper and slide deck presentations	41	35	4,11	82,9%
Workshops and Format X	41	27	4,30	85,2%
Poster exhibition	41	30	3,73	66,7%
Working groups	40	24	4,33	83,3%
How many programmes were running parallel	40	37	3,76	62,2%
Access to programme onsite	41	40	4,40	95,0%
Schedule, pace, being on time	41	40	4,45	92,5%
Moderation of sessions	41	40	4,53	90,0%
Overall quality of the programme	41	40	4,50	92,5%
IN-PERSON EXPERIENCE – SPECIAL PROGRAMMES AT CAMPUS				
Student exhibition	40	25	4,20	88,0%
Screenings	40	16	4,25	87,5%
Morning yoga	40	3	4,33	100,0%
Tech Park tour	40	7	4,86	100,0%
Outdoor activities	40	11	4,64	100,0%
Pop-up shop	40	34	4,32	88,2%
Networking opportunities	40	38	4,58	97,4%
Overall quality of exp. of special programmes	39	37	4,51	91,9%
Printing options	40	7	4,00	71,4%
Taxi service	40	8	4,63	87,5%
Overall quality of the experience at the campus	40	38	4,76	94,7%
IN-PERSON EXPERIENCE – LOGISTICS				
Audio quality of presentations	41	40	4,63	100,0%
Video quality of presentations	41	39	4,56	92,3%
Streaming from auditorium to other rooms	41	21	4,67	95,2%
Room and furniture	41	39	4,72	100,0%
Room ventilation	41	39	4,64	94,9%
VIRTUAL CONFERENCE EXPERIENCE				
Ex Ordo and Webex interface	31	11	3,45	54,5%
Audio quality of streaming	31	7	3,86	71,4%
Video quality of streaming	31	7	4,00	71,4%
On-demand videos of performances	31	3	3,00	33,3%
Quality of presentations streamed online	31	7	3,57	57,1%
Overall experience of virtual conference	31	8	3,63	62,5%
PRESENTING REMOTELY				
Technical setup for joining the Q&A remotely	32	7	3,14	57,1%
Overall experience for joining the Q&A remotely	32	7	3,14	57,1%
POST-CONFERENCE EXPERIENCE				
Video documentaries	40	21	3,86	85,7%
Access to press photos	40	27	4,30	85,2%
Quality of press photos	40	26	4,46	92,3%

Feedback gathered from open-ended questions can be summarised as follows:

Top positive sentiments:

- Networking Opportunities: Many participants highlighted networking as one of the best experiences, with comments like “meeting the participants,” “networking with other universities,” and “interaction with colleagues from all over the world.”
- Quality of Event and Presentations: Attendees appreciated the quality of the conference, mentioning “high-quality speakers,” “impactful presentations,” and “quality of conversation and papers.”
- Venue and Atmosphere: The venue and atmosphere were praised, with statements such as “fantastic campus,” “friendly and welcoming environment,” and “organised thoughtfully and in detail.”
- Organisation: The organisation of the event was described as having a “designerly quality,” being “very well organised, with passion and care,” and “organised very thoughtfully and in detail.”

Top negative sentiments:

- Hybrid/Remote Participation Issues: Remote presenters faced challenges like limited access to tracks, lack of proper communication and preparation, and technical issues with pre-recorded videos not being played on time.
- Program and Organisational Challenges: Participants expressed frustration over overwhelming schedules, too many programmes running parallel, complicated conference app, the late announcement of the final programme, and difficult campus navigation.
- Inclusion and Accessibility Concerns: There were mentions of limited tickets for the gala dinner and the lack of diverse voices in keynote presentations.

The feedback survey was sent out to all 610 attendees of the event. As such, it does not include feedback from academics who chose not to submit an abstract for any reason, whose contributions were not accepted, or those who withdrew their contribution from the conference.

9. Conclusions

As seen from the participant feedback collected, Cumulus Budapest 2024 was overall considered a successful event. The quality of the content, the breadth of topics discussed at the conference, and the networking opportunities provided a deep professional experience, while the venue setup, attention to detail, the variety of on-campus programme items, and the accompanying social and cultural programmes offered a rich visitor experience.

Identifying potential risks early in the organisation process helped mitigate key challenges. Most organisational or technical issues, except one — remote participants being unable to join one of the Working Group meetings as described in section 6.5 — were resolved promptly behind the scenes.

In terms of programming, three areas are recommended for reconsideration by future organisers.

Accepting over 170 contributions with presentations meant that presentation sessions were running in 7 parallel rooms while working group meetings and workshops were held in 6 additional rooms. Having 13 sessions running in parallel created audience fragmentation and evoked a sense of FOMO (fear of missing out) among participants.

Cumulus working groups enable members of the Cumulus network to engage in discussions about various topics regularly. Onsite meetings during the Cumulus conferences provide an opportunity for working group members to meet in person. However, some of the Working Group meetings were in fact mini symposiums embedded in the conference programme with local speakers invited. The value of such meetings should be revisited, as they may not always align with the intended goals of the working groups and create unnecessary competition for other sessions at the conference.

Enabling online presentation and participation, while inclusive, brings many logistical and budgetary challenges. Proper streaming is costly, and managing online audiences and presenters requires dedicated resources and attention.

9.1 Practical Recommendations for Future Organisers

- Run pre-mortem sessions to identify potential risks early and mitigate challenges.
- Thoughtfully and respectfully reject last-minute requests.
- Assign a dedicated person to manage the shared email inbox and correspondence with authors and attendees.
- Hire a dedicated event manager to oversee logistics, scheduling, and communication with conference staff.
- Dedicate personnel for specific tasks: event management, working groups, workshops, onsite host coordination, info desk, and exhibitions. These roles are critical to handling the scale and complexity of the event.
- Limit the number of working group meetings and parallel sessions to maintain a cohesive programme.
- Improve hybrid participation through robust technical checks, clearly defined roles and responsibilities, and detailed communications with track chairs, session chairs, stage managers, and A/V technicians.
- Enhance wayfinding and onsite support to assist with navigation.

- When planning the submission and review process timeline, account for submission deadline extensions, inevitable delays in the peer review process, and the time required to manage submissions, communicate decisions, and respond to inquiries.
- Provide templates for contributing authors to streamline the layout editing process.
- Define file naming conventions upfront to avoid working with files named like “Camera-ready.docx.”
- Remind authors with draft submissions to complete the submission process.
- Ask authors to always reference their submission ID in correspondence.
- Brief reviewers to provide actionable feedback to their reviewers.
- Configure the submission management system in ways that make written feedback mandatory and visible to authors.
- Develop strict timelines for presentation file collection and management, moderator and stage manager briefing, and technical checks.
- Integrate legal disclaimers (e.g., copyright statements) into the submission and registration workflows.
- Automate processes wherever possible, including issuing visa invitation letters or certificates of attendance or contribution.
- Avoid leaving technical checks or installation works for Day 0; complete them by Day -1.
- Avoid manual invoicing; outsource it to a company if at all possible. Choose a payment provider with whom you have prior experience.

Cumulus Budapest 2024 was a highly successful conference in terms of networking, quality content, and experience delivery despite the organisational challenges. The lessons learned and shared above provide a roadmap to streamline processes and improve future conferences of similar scale and complexity hosted by the Moholy-Nagy University of Art and Design Budapest and other universities within the Cumulus network.

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CENTRES AND PERIPHE— RIES

P/REFERENCES OF DESIGN

CUMULUS BUDAPEST 2024

P/REFERENCES OF DESIGN

CENTRES AND PERIPHERIES: DESIGN CAPITALISM BACK AND FORTH.

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The track was devoted to tantalising tensions between mainstream contemporary design cultures and those of (semi)peripheral capitalisms and emerging third world and global south countries. In this respect the issue of the total aestheticization of the world proved to be of high eminence considering the way how spectacularly did unsustainable late capitalism apply design and the hegemony of consumption as a means of the (an) aesthetization of consumers and the corresponding total virtualisation and alienation of citizens living in a "sublimated slavery" (Herbert Marcuse) in which basic human rights and dignified living conditions are no longer tenable. The neoliberal McDonaldisation, a particular type of colonisation that swept through the post-socialist region during and after the political regime changes is a unique phenomenon that is yet to be fully understood in the broader perspectives of the apparent failure of liberal democracies in the region. Neoliberal colonization went hand in hand with destabilizing processes of postmodernist relativism and criticism of classical liberalism which brought with it different anti-humanist and anti-Enlightenment subversion on behalf of mostly leftist cultural studies and critical theories that in turn gradually became hobbyhorses of new authoritarian and illiberal cultural and political streams as it is now rather clear from Fareed Zakaria's, the late Ulrich Beck's and Francis Fukuyama's recent works. Furthermore, the postcolonial situation of the global south was also in our focus, because thought- and meaningful comparisons help us better understand our pretty diverse anamneses and find mutual diagnoses and promising prognoses together on a global scale.

We invited scholars and design educators to discuss options for critical and speculative design and practice-oriented design culture studies interventions that can help better understand the recent past and in turn, create new perspectives for a better and more humane future with dignity. The power of criticism either written or built in art and design projects was of high interest in this respect as in the case of fashion and design education for example.

The global power structures within contemporary design cultures are converging in a specific field of design pedagogy, fashion and textile education. Fashion is often regarded as the “black sheep” of design, seen as excessively dominated by capitalist market forces and a no-go zone. However, it has recently become more receptive to speculative perspectives that offer systemic critiques of the industry. Concepts such as deep localization, design research as an ethical stance, and textile connectivity, alongside criticism of the overly optimistic promises of pluriversality, were central themes addressed by researchers in the sessions. While capitalism has traditionally anchored fashion to the market, education appears to be creating an alternative pathway -- one that challenges the system by cultivating a differently educated workforce. A fundamental question arised during the conference: “Could this be the foundation for systemic change? Could this guarantee a fundamental switch to a new paradigm?”

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DEEP LOCALISATION: A FUTURE OF INTERNATIONAL EUROPEAN FASHION SCHOOLS?

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KEYWORDS | LOCALISATION, CULTURAL RESILIENCE, INTERNATIONAL FASHION EDUCATION, TEXTILE KNOWLEDGE SYSTEMS

ABSTRACT | Western design cultures continue to propagate specific concepts of modernity, globally, at the expense of local, non-western and sustainable traditions which have been described as sacrifice zones in the expansion of the global fashion industry. In addition to the large number of international students that enrol in design schools in the UK and Europe each year, one of the enablers of this form of neocolonialism has been the international expansion of many Western design schools. Is there, now, a responsibility for these schools to help preserve and promote the cultural crafts and clothing systems that the global fashion industry has all but erased? Are there, in fact, some particular advantages that these schools might bring to supporting endangered traditions? This research offers a case study of ways that deeply-localised, design-led, project-based learning equips Indian students studying at an international fashion school in India with deeply-contextualised skills and knowledge. At the request of the artisan community of Kotpad, Odisha, mediated by project partner Creative Bee, Hyderabad, and guided by ongoing dialogue, the project aims to assist artisans in negotiating change by preserving knowledge of and promoting an at-risk textile tradition through a series of staged interventions, in the hope that this may defend their craft against macro and micro local and global challenges, including continuing forms of colonisation.

1. Introduction

1.1 Fashion and Capitalism

Fashion has been described as the favourite child of capitalism (Sombart, 1902): dependent on the rapid obsolescence of goods that must be replaced by the *new* in a cycle of perpetual growth, and therefore is dependant on a system of escalating resource extraction (Hickel, 2021, Marx, 1990). An insatiable quest for modernity in wealthy countries has resulted in enormous volumes of low-quality, discarded or unsold garments being exported to less affluent countries in the Global South, much of which ends up in vast dumps, and where eighty percent of the negative environmental impacts of fashion are felt (Greenpeace, 2022).

Western fashion exemplifies a particular paradigm of modernity that has been imposed on non-Western clothing cultures, undermining local expressions and systems of fashion and thus leading to what has been termed as 'fashion sacrifice zones' (Niessen, 2020: 864, Escobar, 2018, Cheang et al, 2021, Torretta and Reistma, 2019). It is beyond time to realise that,

> "…we are living with the legacies of ways of thinking that took their modern shape in the nineteenth century, and it is high time to subject them to the best thinking of the twenty first." (Appiah, 2018: XIII)

1.2 Western Fashion and Its Sacrifice Zones

Fashion sacrifice zones are cultures whose identity – as expressed through clothing and/or specific materials and techniques - has become obscured or even erased (directly or indirectly) by Western fashion (Niessen, 2020: 864). Multinational brands have arisen from the West that contribute to the erosion of local clothing traditions in a number of ways: they continue to colonise more sustainable systems of clothing creation by asserting how fashion should be designed, produced, sold, and consumed at the expense of local, pluriversal clothing cultures that might otherwise articulate their own paradigms of modernity (Niessen 2020, Jansen, 2020, Escobar, 2018, de Sousa Santos, 2014). Fashion sacrifice zones are compounded by the depletion of local resources; changes in local labour opportunities (for example, towards industrial garment production); the transition of a community to become consumers for industrialised fashion; and the swamping of local markets with second-hand clothing from Western countries; and ultimately the loss of knowledge systems on which a local clothing culture is dependent (Niessen, 2020: 865, Jansen, 2020). The extractive practices of capitalism include the ways that traditional cultures are mined and appropriated as inspiration by the fashion industry in clothing collections that rarely acknowledge the source of this cultural intellectual property, or else objectify artisan communities in their reductive marketing communications (Bota Moisin, 2017).

2. Western Fashion Education Today

Much like its fashion system, a Western model of fashion education has been exported to many other parts of the world. Rooted in Eurocentric design histories, ideals of beauty, and the values of unregulated capitalism, the Western model of fashion education trains students to join a fashion industry that is tied to extractive, colonial practices and in thrall to the orthodoxy of growth (Fletcher and Tham, 2019, Torretta and Reistma, 2019, Vettorello, 2023). Until relatively recently, Western education has been unquestioning of its role as a propagator of specific concepts of modernity, globally, that no longer serves us (Machado de Oliveira, 2021, Orr, 1994:5, Dawson, 2019, Vettorello, 2023). We reap what we have sown:

> "Without significant precautions, education can equip people merely to be more effective vandals of the earth." (Orr, 1994:5)

2.1 International Students Studying Design in the UK

UK art and design schools enjoy an international reputation for creative excellence - indeed the two best design universities in world rankings are first the Royal College of Art (for the ninth consecutive year) and then University of the Arts London (QS Top Universities, 2023). A seductive article by the British Fashion Council in India invites potential students to,

> "Step into a world of limitless possibilities in the United Kingdom, where academic excellence meets innovation." (British Council India, 2023)

International students studying in the UK currently contribute approximately £2.25 billion to the UK economy (London Economics, 2023). The largest group of these are from Asian countries (HESA 2023), in particular from China and India. Enrolments from these countries increased significantly between 2017/2018 and 2021/2022, to 151,690 enrolments and 126,535 enrolments respectively, as shown in Figure 1 (HESA, 2023).

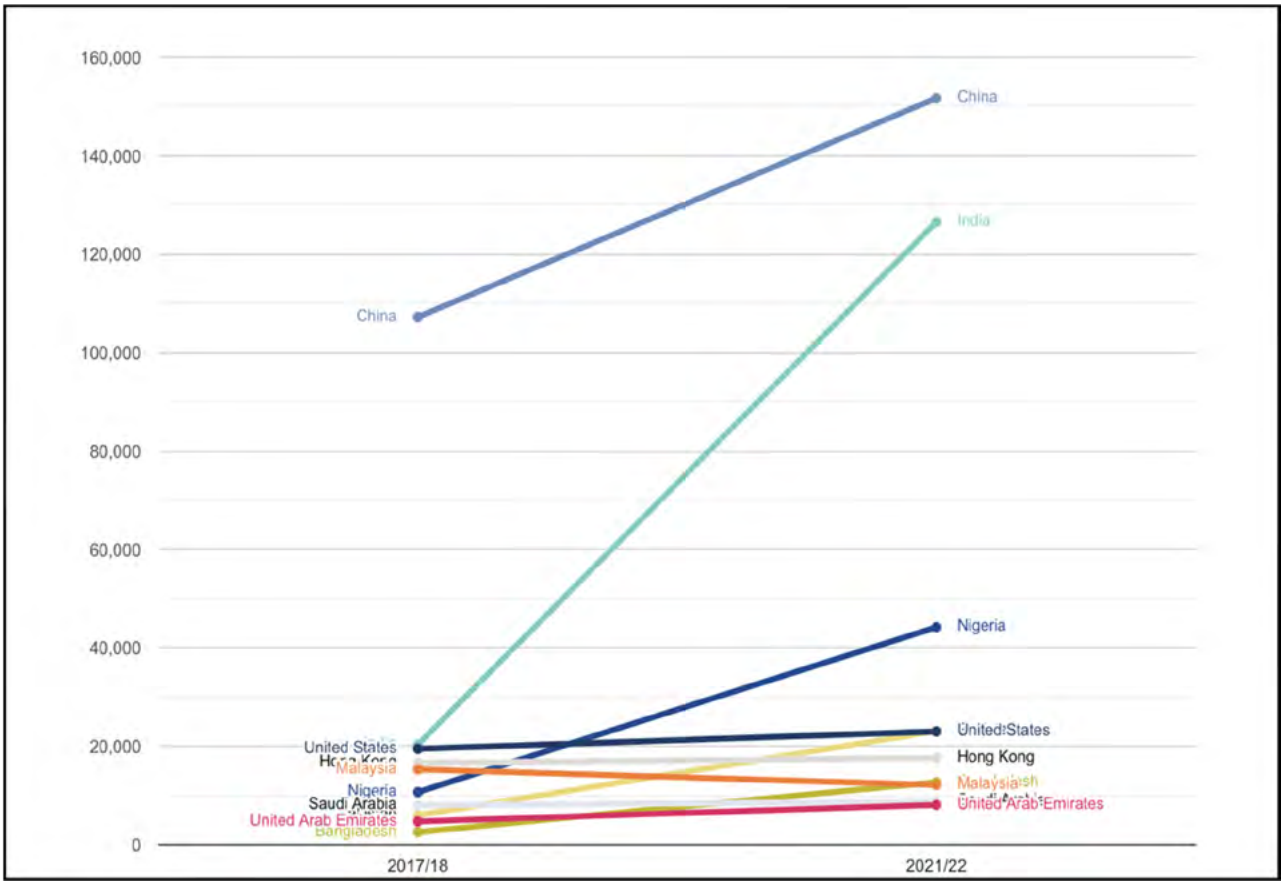


Figure 1. Patterns of growth in Non-EU enrolments in UK HEIs 2017/2019 – 2021/2022, showing a sharp rise in enrolment of Chinese and Indian students (HESA, 2023).

Specialist design universities in the UK have seen a dramatic rise in overseas enrolments in general, and have become reliant on these to fill financial gaps left by government reduction in funding for Higher Education in the public sector or to boost profits (Figure 2). At the Royal College of Art and the University of the Arts, overseas student enrolments have risen from approximately 35% in 2016 to 53% in 2021. Therefore, overseas students represent a significant proportion of the UK student body (Aguilar García et Al, 2023).

Similar patterns of international enrolment appear for EU universities, with 25% of students studying in European countries coming from Asia in 2021, although specific data on enrolments for art and design by nationality was unavailable (Eurostat, 2023).

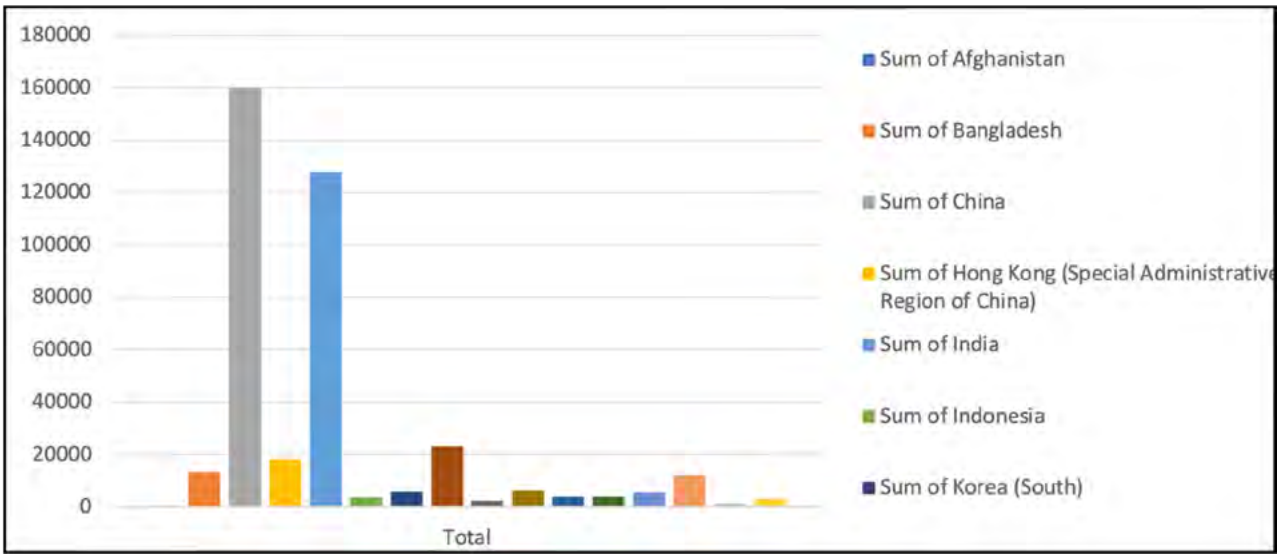


Figure 2. Enrolment data for Asian students in specialist design schools in UK 21/22 (HESA, 2023).

2.2 UK and EU Design Schools Overseas

In addition to the large number of international students that enrol in design schools in the UK and Europe each year (HESA 21/22, Eurostat 2023), one of the enablers of colonialism may be the international expansion of many Western fashion schools. International expansion is here defined as partnerships with overseas institutions (for example, in curriculum development), as project partners or as validating bodies, or through the establishment of an entire school or campus overseas.

Fashion education increasingly is searching for ways to evolve more ethical approaches, while continuing to train young people to join the industry as it is now. While this uneasy compromise fails to drive the urgent systemic change needed for us to live within planetary boundaries and prevent further climate change, students must find employment when they graduate in an industry that has yet to fully comprehend the seismic transformation required of it. It is crucial to critically self-reflect, as Western fashion educators, on our positionality and the values that are implicit in what and how we teach - and to whom (Torretta and Reistma, 2019, Vettorello, 2023). As Haraway reminds us,

> "It matters what stories we tell to tell stories with…it matters what thoughts think thoughts." (Haraway, 2017: 12)

Is there, now, a responsibility for Western fashion schools to actively regenerate the cultural crafts and clothing knowledges – the sacrifice zones - that the global fashion industry and its education system have all but erased? It is of urgent importance to learn from traditional knowledge systems that have existed for centuries, if not millennia, that embody ways to produce clothing in emotionally, environmentally and culturally sustainable ways, which today have all but been erased by Western fashion (Harper, 2018, Chapman, 2015, Niessen, 2020), but how might we do this in a non-extractive way? How, now, might we right the wrongs of a particular form of colonial oppression that has been imposed on non-Western design cultures (Niessen, 2020, Vettorello, 2023)? Are there, in fact, any specific advantages that Western design schools might bring to supporting endangered traditions, if they will work humbly in non-Western settings (Torretta and Reitsma, 2019)?

2.3 Western Fashion Education in India

As indicated previously, Indian students represent a significant proportion of overseas students studying in design the UK and EU today. In recent years, a number of Western universities and design schools have become closely linked with Indian design schools and some have established their own schools.

Istituto Marangoni Mumbai (IMM) was opened in 2017 to bring the values of Italian design to fashion education in India (Istituto Marangoni, no date). The School Director is Indian, the Director of Education of Indian heritage, and approximately 70% of the tutors Indian, with some 30% from other countries. Students may study for two years in Mumbai before completing an undergraduate qualification at one of the European IM schools, or complete a shorter programme after two years.
The teaching philosophy of IMM is one of locally-contextualised learning that is evolving a distinctive identity across all courses. This includes collaborative projects with local designers that promote local heritage, skills and knowledge systems; visits to and collaborations with local artisan communities and textile producers; recruiting inspiring Indian designer-mentors for students; and the promotion of local cultural crafts, which are characterised as true luxury in a counter-narrative to the conventional concepts of luxury in Western fashion.

Fashion students at IMM come from all over the incredibly diverse Indian sub-continent. They are encouraged to research in depth, to look inwards, experiment, and to find new inspiration in their own local crafts. This approach provides students with an opportunity to discover and refine a unique design identity, that is simultaneously rooted in tradition and authenticity, and to construct a culturally sustainable value system that will guide them in their future careers. Multiple workshops and studio visits enable students to work closely with artisans, in their own language, to develop and co-design together. This process equips the artisans with new ideas that may support their livelihoods and enables the students to develop vital skills in innovating with local crafts for local and global markets. Social and environmental responsibility is reinforced by encouragement to use only local, natural, and sustainable materials, through which students build a network of local artisans, suppliers and manufacturers that are invaluable for their future careers. Final-year collections are distinctive in their use of local materials and the application of embellishment techniques created in partnership with local artisans. Graduating students eventually will work with local designers, who require a good knowledge of local and global. Furthermore, affluent urban consumers in India now actively seek out and appreciate the value and beauty of local textile crafts and enjoy wearing modern interpretations of these. Recent praise of and publicity for international designers that use extraordinary Indian expertise and materials in their collections, including the Dior Fall 2023 show that took place in Mumbai, has stimulated a further sense of pride in Indian craftsmanship.

A common challenge encountered by the school is that some artisans struggle to independently innovate for new markets and many cannot afford to experiment with new ideas because of the financial risks attached. Experimentation may require new materials, dyes, equipment and time, and may not result in success and sales. The school is now deepening its localisation approach by attempting to support a hard-to-reach artisan community that faces particular challenges, including through the experimentation and sampling processes required to innovate for new markets.

2.4 Nothing Comes Without Its Worlds

The negative impacts of colonialism, Western modernity and globalisation on India's cultural textile sector have been well-documented (Jena, 2019, Bannerjee and Mazzarella, 2022, Roy, 2020). Europeans have a problematic history in the region, and the British in particular. Until Indian independence in 1947, the British systematically undermined local textile traditions, reducing India to a source of raw materials for industrialised British mills whose fabrics were then exported back to India (Bannerjee and Mazzarella, 2022, Roy, 2020).

India is an example of a country where cultural craft has fought back, where some traditions have been maintained and even successfully recovered. However, in spite of many initiatives designed to support or revive traditional textile knowledge systems by Indian governments over the years, many remain in decline and are at risk of being lost (Tarai, 2022, Jena, 2019). The reasons for this are complex, manifold and to some extent locally specific, however some recurring factors may be identified: the competition to local handwoven textiles from cheaper, synthetic, industrially produced fabric (including sarees, kurta and dhoti); the influence of globalised clothing styles that undermine local identity and influence tastes, particularly in urban areas; the subsequent reduction in market for traditional crafts; the inability of artisans to adapt their designs to contemporary markets that might afford labour-intensive craft; the reluctance of youth to learn time-consuming and highly-skilled crafts, when the market for these is too small to provide a sustainable income; the crafts being associated with the past, rather than representing modernity; a lack of entrepreneurial and IT skills; and other social or environmental factors that may affect the value chain (Tarai, 2022, Jena, 2019, Roy, 2020).

3. The Kotpad Project

At the request of the artisan community of Kotpad, Odisha, mediated by Bina Rao, project partner and founder of Creative Bee, Hyderabad, and guided by ongoing dialogue, a holistic research and design project has been created with IMM and IML to deliver a series of staged interventions that may assist the Kotpad artisan community in negotiating change and in helping to preserve, promote and ultimately regenerate an at-risk Indian textile tradition. The team members from IML, IMM, and Creative Bee hold positions of privilege and power relative to the Kotpad artisans. As much as possible, our activities have been guided by the artisans: by their wishes, their ambitions, their ideas, their skills, and by the limits and possibilities they decide. However, we acknowledge the precarious nature of this intervention, that has at times lapsed into the prescriptive, and have attempted to hold space for the listening that reinstates balance and facilitates cultural sensitivity (Torretta and Reistma, 2019). Bina Rao has a long-standing relationship with the community and has therefore been an invaluable in assisting understanding of local culture, gender and other social politics, religion and environment.

3.1 Plan

This research offers a case study of stage one of a collaborative project between IMM, IML, Creative Bee, and the artisan community of Kotpad. The project offers a lens through which to examine the ways that situated, negotiated and humble research and design activities might articulate a new, deeply localised role for Western fashion education today. It draws on field work that took place in January and November 2023, which included interviews with the dyers and weavers, local youth, and with designers that have worked with the artisans for many years. A review of existing literature revealed that previous initiatives from local government, designers, educational institutions and organisations have not resulted in sufficient long-term benefits (Jena, 2019, Dutta and Maulik, 2021, Tarai, 2022). Analysis of the project activities and findings (to date) identifies the interactions and impacts of diverse ecologies of knowledge (de Sousa Santos, 2014), the potential benefits and difficulties of the collaboration, the challenges that have been encountered along the way, and are foreseen in future.

3.2 Plan/Design

Figure 3 presents the project plan, adapted from Yin (2018), which outlines the processes used for this research. We consider this to be a flexible framework rather than a cage, however, and are responsive to the dynamic and generative nature of collaborative research may be marked by serendipity. Therefore, the sub-headings in the sections below indicate where more than one part of the process has taken place simultaneously.

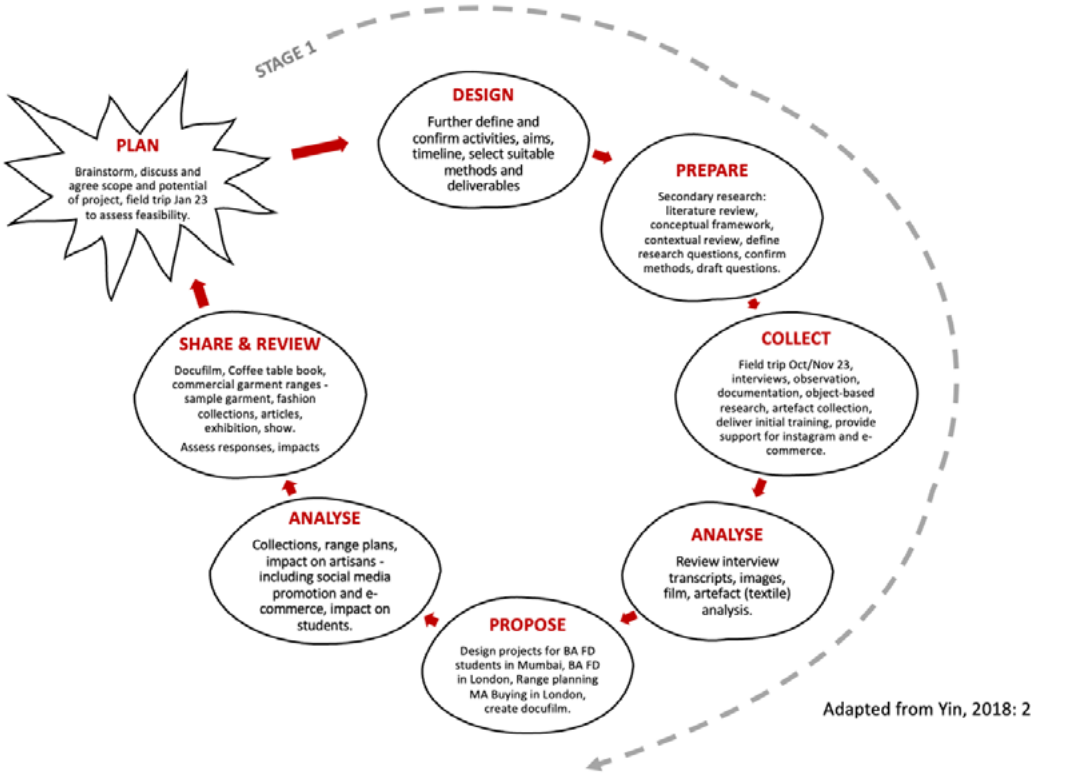


Figure 3. The Kotpad case study process plan.

3.3 Design

The Kotpad artisans wanted to learn how to promote their textiles online in order to reach new markets. They were open to developing new textile designs (within the strict parameters they set on fibre, colour range and weaving technique). For this project, they would like enough work to keep their looms busy for three to six months or longer and to raise awareness of the contemporary potential of their cultural craft more widely in the region and even internationally. They want customers to appreciate the time and skill required by the complex, ancient processes that achieve the deep red of the aal dye and the distinctiveness of their woven textiles, and who would be willing to pay what their work is really worth. Ultimately, they are hoping for an improved market that will enable their craft to continue for generations to come. Creative Bee asked IMM and IML to carefully document all the techniques, processes and products created by the Kotpad artisans so that there is a detailed record of these.

The schools will offer a holistic package that includes documentation of the craft and its skilled artisan community, support with product development for contemporary markets, branding, online promotion and e-commerce. In addition, they will showcase the outcomes in exhibitions and shows that improve regional and international awareness of the potential of Kotpad textiles in fashion that is simultaneously rooted in place and authenticity.

The initial scoping visit to Kotpad by representatives from IMM, IML, and Creative Bee took place in January 2023, after which a plan was developed in consultation with Creative Bee and the Kotpad artisans.

3.4 Prepare/Collect/Analyse

A second visit to Kotpad took place in November 2023, to conduct interviews, document histories, materials, techniques and value chains, to identify the challenges and opportunities that confront this artisan community today. A researcher from IML conducted a series of semi-structured interviews with

weavers, dyers, and youth in the community, as well as with Bina and Kesav Rao, while observing and documenting all processes, investigating local and personal histories, material culture, customs, gender-politics, environmental issues, and their concerns, in order to develop a deeper understanding of the specific local context and the wishes of the community. The interviews with individual aal-dyers and weavers used a similar questionnaire as a starting point, enabling interview data to be triangulated. The group was accompanied by an Indian film and photography crew from IMM to capture local context, people, tools, materials, techniques and processes (Figures 4, 5, 6). Saloni Lakhia, a representative from the United Nations Institute of Training and Research (UNITAR), joined us to conduct a needs assessment for more holistic training that might benefit the Kotpad community, particularly to support women and the local youth. Initial training was delivered in packaging, promotion on social media and an introduction to e-commerce. Bina and Kesav Rao acted as invaluable intermediaries and interpreters with the artisans – some of who spoke their tribal language rather than the more common Hindi.

3.5 Collect/Analyse

Kotpad tribal textiles represent many centuries of situated knowledge of how to produce materials for clothing that are emotionally and environmentally sustainable (Chapman, 2015). However, these precious textiles are no longer economically sustainable. The Kotpad artisan community face the mounting suffocation of their tribal identity, culture, craft and knowledge by intersecting external factors that are outside of their control and by internal cultural factors that are constricting opportunity (Figure 6). Today this community comprises approximately 10-12 female aal dyers and a similar number of male weavers from families that have passed down their knowledge for at least six generations of the Panika tribal group. They trace their craft back to the sixth century, when they claim it was introduced by Kabir, considered a patron saint of weavers.

The techniques used to create Kotpad textiles comprise many labour-intensive, repeated processes and stages (Figures 4, 5, 6). The characteristic deep red, cotton yarn in their weaving takes approximately three weeks to perfect. Women learn aal-dyeing from their mothers or mothers-in-law using the ground root bark of the aal tree (morinda citrifolia) and the dye confers natural, anti-bacterial properties on the yarn. The aal traditionally is harvested and sold by the Alkudu tribal people that gather this sustainably without damage to the tree. They source their cotton yarn from bigger centres in Odisha or in Andhra Pradesh, and tussar silk yarn from Jagdalpur. Other essential ingredients to their complex dyeing process are castor oil, ash water, and cow dung. In addition, they make a deep, warm black dye by mixing jaggery and iron, and have begun to use indigo for dark blue, which was introduced to them by Creative Bee.

Young men and boys learn weaving on pit-looms from their fathers when they are considered old enough – normally at fifteen or sixteen – and the oldest male child is still expected to continue the craft (Figure 5). The traditional motifs in the textiles are created by using a floating weft technique in a contrasting colour (normally red), where additional yarn is woven separately into the warp in an intricate process that requires lifting individual warp threads by hand. There are commonly used motifs, such as fish, but each weaver will create these in their own design (Figure 5). Today there is some government-supported training for girls too, taking place at a small pit-loom centre in Kotpad, and a daily allowance is paid to those undergoing training. Interviews with local people suggest that some attend training for the allowance, rather than a desire to learn the craft and find a future in it. Some men in the community were not happy that women might become weavers, and one woman who mentioned she could weave was quickly silenced by her brother. Regardless of who weaves, there is reduced demand for their culturally-significant textiles, including large shawls that customarily were worn for local weddings (Figure 8), sold in their Sunday markets and further afield in Odisha, Chhattisgarh, and beyond. The market has shifted to a preference for cheaper, synthetic textiles, although the aal-dyers themselves all wore cotton sarees which they find much more comfortable to wear in the heat. Climate change is an additional factor affecting local preferences too, as temperatures have risen in the last few decades; therefore, a lighter, industrially-produced fabric is preferred over slightly thicker, firmer Kotpad textiles. From a thriving craft with more than fifty artisans in Kotpad village alone, the number of practising aal dyers and weavers has declined as a consequence of the factors outlined earlier.



Figure 4. Purnima Samrat, a sixth generation aal-dyer, coating cotton yarn with aal and ash water solution in the dyeing process in Kotpad, 2023. (Vora, T., November 2023).

Interviews with youth in the community suggested that there was great interest in continuing the craft amongst them but they could see no future for it, in current market conditions, so were turning to other forms of employment. The ancient dyeing and weaving processes require great skill, patience and are extremely time-consuming – their local customers can no longer afford these textiles and purchase cheap synthetics instead.



Figure 5. The floating weft technique, used to create motifs and pattern in Kotpad textiles, is extremely time-consuming and requires great skill, Kotpad 2023. (Vora, T., November 2023).

In addition, local development and pollution affect the availability of natural resources. For example, the aal harvesters used to collect the root bark near or even within Kotpad village, but due to deforestation the trees are now around 200 miles away in a forested region controlled by Naxalite rebels. From fluid, local and accessible transactions, sourcing aal root bark now relies on traders coming to Kotpad and thus higher costs. Local government has planted an aal tree nursery a few miles from Kotpad and this should, in time, become a reliable source of dye if the tradition survives that long. The lake near the village where the aal-dyers historically washed the yarn between phases of the dye process is now too polluted with rubbish to use, so they must travel further afield to a river, incurring additional travel costs (Figure 6).



Figure 6. IMM film crew recording the rinsing process that is part of aal-dyeing and repeated at various stages, at a river 15 minutes' drive from Kotpad, 2023. (Scott, K., November 2023).

3.6 Analyse

The Figure 7 diagram summarises the most significant factors that are impacting Kotpad artisans in continuing their craft, providing a sense of the suffocation they experience. Analysis of these factors suggests that there are measures that can be taken in the short term that will improve the resilience of the craft and the livelihoods of the artisans, and which may help to preserve knowledge of the craft before it is lost. The need to preserve this knowledge before it is too late was identified as paramount, followed by support in raising awareness of the craft and finding new markets.

In the short to medium term there are opportunities to promote Kotpad textiles through social media, using visual storytelling with compelling imagery, as well as through design projects that showcase the potential of their work in contemporary luxury clothing. The patterns used in the textiles can be adapted in multiple ways, without changing the technique used. Exhibiting the outcomes online and physically may support the artisans in finding new markets that are able to afford their highly specialised, time-consuming, natural, wholly sustainable textiles.

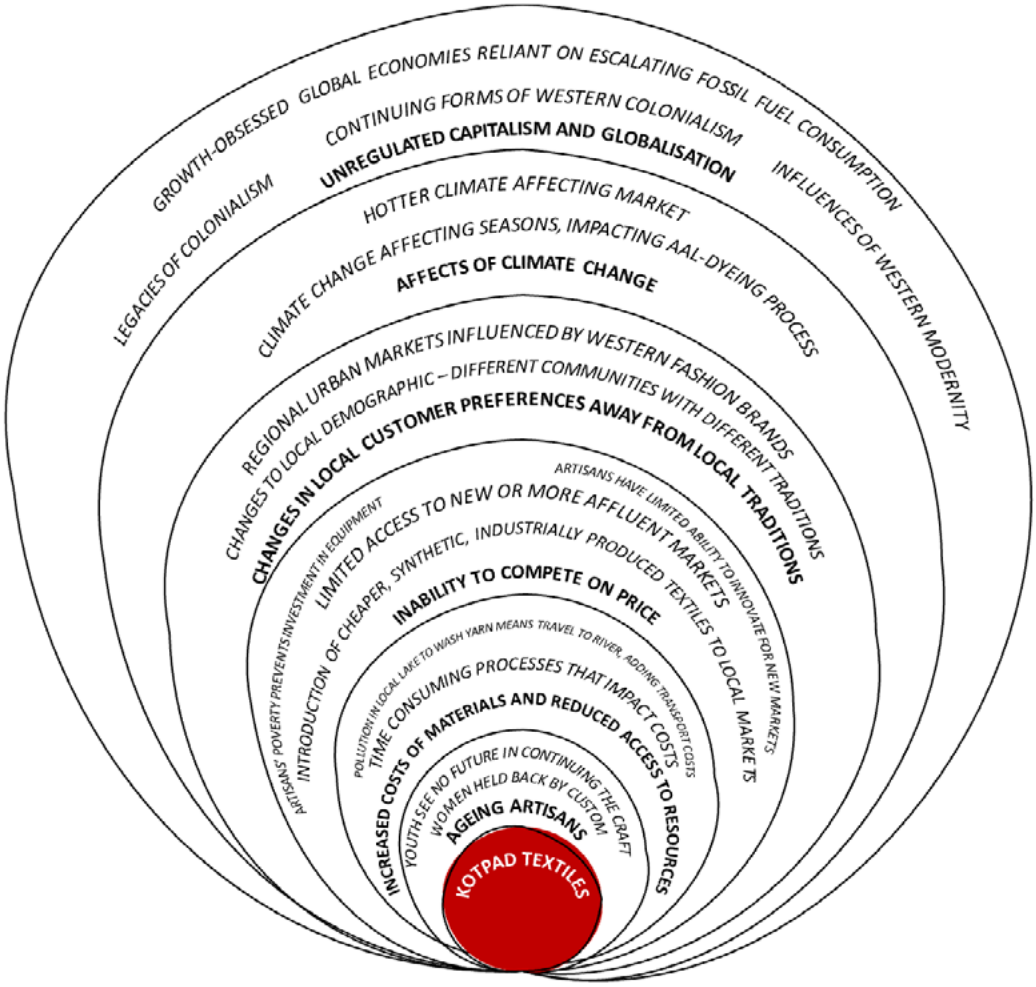


Figure 7. A summary of factors impacting the Kotpad textile artisans, showing the complex macro and micro obstacles that they face.

3.7 Propose

In the short term, a docufilm has been created to capture the lives, environment, histories, culture, skills, materials, techniques, processes and textiles of the Kotpad artisans by a team of film makers from IMM (Figures 4, 5, 6, 8). This film provides an important record of unique people and their situated craft practices for posterity. In addition, an illustrated book will be published that includes more detailed information.

Mevin Murden, Director of Education at IMM, gave some initial training to the younger artisans on how to photograph their stock in the most attractive way, including the important practicalities, such as ironing the products first, how to curate a photoshoot, best lighting, background etc. Mevin's background in luxury branding enabled him to support the artisans with ideas for non-verbal communication (such as packaging, initial logo ideas) that may help to elevate the status of this textile and reach a more affluent customer. IMM fashion business students have since created a brand logo (Figure 9) and an Instagram page for master weaver Purushottam Samrat, who represents his fellow artisans at #purushottam_kotpad. The page is administered by his oldest son Baskar, and will showcase Kotpad textiles to sell directly to consumers rather than to businesses, gaining a better financial return and reaching a wider market locally and internationally. Crucial to this strategy is the powerful visual storytelling that connects community to brand, and repositions Kotpad textiles as a premium product that is socially, aesthetically, emotionally and environmentally sustainable (Harper, 2018, Chapman, 2015).



Figure 8. A traditional style of Kotpad wedding shawl showing some motifs and patterns commonly incorporated in these, Kotpad, 2023 (Scott, K. 2023).



Figure 9. Branding created for the Kotpad artisans by Istituto Marangoni Mumbai Fashion Business students.

Further training will be provided to the artisans on marketing, branding and e-commerce, so that their work can reach other customers in the region. Reciprocity is considered key to the success of this project, where mutual learning is made possible in ways that may help to right the wrongs of Western fashion. This approach reflects aspects of humble design in the co-creation of products and services that is led by local actors (Torretta and Reistma, 2019).

In the medium term (stage 2), IMM and IML students and faculty will offer textile development ideas (within parameters set by the artisans) and fashion designs, commercial range planning, and product development for the luxury sector. Selected small collections and products will be produced as sample garments that demonstrate the enormous potential of Kotpad textiles as contemporary, sustainable fabrics. Some initial orders for existing fabrics have now been placed, while IMM students develop new motifs to be trialled.

It is important to be clear about what is and what is not within our scope to change, as fashion schools and as fashion practitioners. The inequalities and sacrifice zones engendered by capitalism and colonisation are formidable challenges that we are all compelled to address. The complex, structural disadvantages experienced by the Kotpad artisan community require a more systemic intervention than IMM, IML and Creative Bee are able to engineer alone. What we can do – first and foremost – is to listen, then to exchange and develop ideas in collaboration with the Kotpad artisans, and to offer support in specific, design and business-related areas within our expertise that may improve the market and encourage the youth to find a future in an ancient craft. Within our curricula, we can continue to emphasise the value of traditional crafts in ways that may inspire young designers and business students with an appreciation of their own cultural heritage, and of slow and local, place-based systems that challenge Western fashion colonialism. We are able to use our skills, our resources, and our networks (our privilege) to amplify these materials, techniques and processes that embody sustainable collaboration with nature, in ways which may attract others to work with endangered textile knowledge systems. In addition, Kesav (from Creative Bee) has already delivered natural dye training using locally available plants, to increase the range of colours that Kotpad fabrics can sustainably be made in, as well as finding alternative natural mordants. The UNITAR representative that accompanied the team in November 2023 will raise funding for a holistic training in IT, entrepreneurial skills, literacy and numeracy, and empowerment for women and girls that builds the community's resilience in a changing world. In these ways, we may affect longer-term change.

4. In summary

This research reveals how deeply-localised, design-led learning and teaching activities might advance a now crucial role for international fashion schools in preserving, promoting and regenerating traditions that Western design cultures have previously de-futured. It identifies specific challenges that negatively affect the Kotpad artisans, including the impacts of western modernity; it outlines potential benefits that a bespoke designed intervention of this type might offer to all parties; and finally, it suggests that (if they get it right) this role may even be framed as international fashion schools' responsibility today.

IMM and IML were invited into this project by Creative Bee and the Kotpad artisans. Although the project has been designed together, we acknowledge the problematics of a Western fashion school descending on an artisan community in India to offer solutions to the complex challenges they face. While our proposed solutions have been co-created, they may ultimately turn out to be temporary or even ineffective. We ask ourselves whether we are merely re-enacting practices that reflect unequal privilege and power: to some extent we are. However, we believe that we may now have something specific to contribute to a transition away from extraction and over-production in fashion, which advocates for traditions that hold vital clues to how we might live in collaboration with - rather than in opposition to - nature. The benefits of the collaboration to the Kotpad artisans include training and support that may improve their resilience and equip them to reach new markets that can afford the higher costs that slow textiles demand, in the face of competition from low cost, low quality, industrially-produced fabrics. Istituto Marangoni's Italian design roots reflect a historic appreciation for high quality local textiles and the values of craft, legacy and innovation. The school works closely with the luxury sector and is therefore particularly well-placed to

support artisans in developing new ideas and innovation for those contemporary markets that can pay the premium that slow, handcrafted materials require; to provide guidance with branding, packaging and promotion that amplify the luxury of their craft; in developing e-commerce capabilities; in the documentation of their craft for posterity, through a docufilm and a significant publication; and with shorter-term financial support in the forms of orders for project sampling and experimentation.

The students and tutors at IMM and IML benefit enormously by learning how to work pragmatically and creatively within boundaries dictated by the artisans themselves; being able to see the textiles developed in collaboration with the artisans realised and showcased in small fashion collections; by learning to define implementable range plans and create sample garments suitable for small-scale production that amplify the local; and by increasing their knowledge of and appreciation for the value of craft traditions today. The design process is naturally constrained by the seasonal availability and sustainable supply of the raw materials required for Kotpad textiles, and by lead times that must accommodate fluctuating weather conditions that impact dye processes. Such restrictions are rare in an industry built on exponential growth, and resource use. Today it is crucial to re-learn how to work within natural limits in the face of enormous environmental and climate challenges. This deeply-localised approach reveals how we might reconnect with limits and begin to hospice and transition away from the mainstream, while regenerating traditions that have sustainably been performed for centuries, to re-materialise a pluriversal fashion system that is characterised by less and better. On completion of stage two of this project, completed collections will be analysed to measure the ways that students have responded, comparing outcomes in Mumbai and in London, interpreting the meanings of this, and gathering feedback from the artisans, Creative Bee, potential customers, and the press. We will reflect on this analysis, learn from it, and may need to adapt our strategy accordingly. We will evaluate the success of the Kotpad Instagram account in raising awareness of the endangered craft and increasing sales.

As a global community of fashion and design educators, we have the privilege (and responsibility) to shape the values that will best serve people and planet, by training young designers to be able to challenge the hegemony of mainstream fashion. By consistently embedding localisation deeply in learning and teaching practices – and by privileging local traditions and skills over dominant fashion mores – international fashion schools may decolonise design teaching to support cultural resilience, while developing curricula and activities that offer multiple benefits to students, faculty and the wider community. If collaboration is formed with artisans that have suffered as a result of colonisation and globalisation – and is led by their voices rather than imposed in an unequal power dynamic - there may be opportunity to redress (in part) violence committed by the global fashion system. This research, while focuses on fashion and textiles, may be significant to all other design disciplines emanating from the West.

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CIRCULAR DESIGN THROUGH TRADITION: A TRANSFORMATIVE APPROACH TO PROMOTE THE MEDITERRANEAN CULTURAL IDENTITY AND SUSTAINABLE ARCHITECTURAL INNOVATION.

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KEYWORDS | CIRCULAR DESIGN, MEDITERRANEAN CULTURE, CLADDING BUILDING SURFACES

ABSTRACT | The Mediterranean region, renowned for its diverse cultural heritage, faces challenges posed by globalization and environmental factors. Circular Design, rooted in sustainability principles, emerges as a solution to preserve its unique identity. This study explores Circular Design's role in safeguarding Mediterranean cultural heritage amidst global changes.

Circular Design promotes sustainable practices and materials, revitalizing traditional crafts while aligning them with modern environmental standards. It addresses environmental issues like climate change and resource depletion, reducing ecological footprints and enhancing resilience.

This research integrates Mediterranean architectural culture, developing modular ceramic-based products with solar functionalities for construction. These modules, encompassing passive and active solar features, offer innovative solutions for cladding building surfaces. They integrate elements such as solar thermal collectors and photovoltaic systems, utilizing materials like cork, ceramics, glass, copper, and composites.

The resulting system allows versatile applications, demonstrating the fusion of sustainability, aesthetics, and technological innovation. Circular Design fosters a harmonious blend of Mediterranean architectural identity and solar functionality.

In conclusion, Circular Design bridges tradition and progress, ensuring the preservation of Mediterranean cultural heritage. By embracing circular principles, the region navigates towards a balanced coexistence of tradition and modernity, safeguarding its vibrant cultural legacy amid contemporary complexities.

1. Introduction

The project offers us the opportunity to reflect on the evolution of our design practice and our most relevant concerns. Over the last twenty years we have witnessed the new paradigms of cultural globalization. Architecture needs to use mechanisms, forms and materials that link it to its local culture and identity.The growing interest in sustainable architecture is causing an evolution in design processes and project strategies.

> "Solar radiation is the main source of renewable energy. As well as providing a direct source of energy, it regulates the Earth's climate and gives us the opportunity to obtain energy from wind, waves, tides and a host of biological sources [...] As all aspects of the climate depend on the sun, it is logical to define the techniques adopted in buildings to take advantage of this action as 'solar design'." (SMITH, 2001, p.12.)

Our ancestors used simple and ingenious strategies to build their homes, neighborhoods, public spaces, villages and even advanced solar cities. (GUZOWSKI, 2010) The sun and the wind inspired every aspect of Mediterranean architectural development, from construction to layout, from materials to details. Both were always there to cover lighting, heating and cooling needs.

Vernacular architecture that truly utilizes the sun and the wind is more than a sum of passive strategies, technological systems and ecological engineering. Buildings whose forms are defined by these forces of nature reveal how we can utilize renewable resources, promote social, cultural and ecological values and also offer aesthetic values by creating relationships with the place and surrounding environment, supported by references and poetic and modeling attributes of these forces.

Ceramics have a lot of potential as a creative and constructive material for sustainable architecture in a new scenario where the environment in which the city is immersed, the scarcity of resources and the well-being of the community have to be taken into account. Ceramics is a universal material that has been present in architecture for centuries as an ornamental and structural element. Its innovative and avant-garde capacity has led it to become a recurring and prominent material in sustainable architectural projects. Its advantages are increasingly greater than those of other alternative materials. The aesthetic characteristics and customizability of ceramic tiles make it possible to multiply the creative possibilities of architectural projects. In addition to its technical performance and properties, it meets the requirements and assumptions of responsible and ecological construction, minimizing its environmental impact on the environment and its inhabitants.

2. Project Background

> "Ecodesign is the art that reconnects us as sensitive beings who have evolved over millions of years in a marvelous world. We don't need to remake this world, we need to reveal it. To achieve this, we don't need to do more research, we need to rediscover old and forgotten things." (ORR, 2002, p.34)

In the 1990s, sustainability was a matter for specialists, but today it has become a generalized and paramount awareness. Climate change and the scarcity of resources have become the center of discussion. Western societies must reduce carbon emissions by 50 per cent. Construction, a sector that contributes around 40 per cent of carbon emissions and consumes 50 per cent of our societies' energy, must obviously contribute to this goal and the most pressing question for architects and designers at the moment is how they can contribute and how their activity can influence their way of thinking and their professional habits. It's worth considering both options: the passive reduction of energy consumption through intelligent design, and the active application of energy development or energy generation technologies. The new paradigm has to affect the way we design new buildings, as well as the understanding and applicability of these new technologies in pre-existing constructions. (HUTTON, 2009).

The new generation of ecological architects and designers has been developing new and effective ways of integrating passive design and active systems into projects that combine the ancient traditions of bioclimatism with the most advanced technologies. By responding to the forces of the sun (and the related dynamics of wind, climate, place and the cycles of the seasons and the rhythms of day and night) these projects address ecological issues and also fulfill our deepest aesthetic aspirations. The great sense of urgency has provoked a new spirit of innovation and design exploration, as well as a greater commitment to redoubling the efforts needed to achieve a-greater ecological response.

> "Architecture that truly utilizes the sun and wind is more than the sum of passive strategies, technological systems and green engineering. The new solar architecture has a slim profile that optimizes light and air; it employs an ecological envelope that is sensitive to site and environmental forces." (GUZOWSKI, 2010, NP)

Solar architecture cannot be reduced to a few isolated measures, such as installing thermal collectors or photovoltaic panels on the roof. The building must be seen as a complete configuration - a total energy concept that makes the best possible use of local natural resources, such as solar, wind and geothermal energy, to fulfill a series of requirements. Passive and active measures complement each other in this approach, from the orientation and division of the building to the integration of systems to produce hot water or electricity. Flexible façades, regulated by intelligent control systems and capable of reacting to changing climatic influences and conditions, offer interesting contributions (SCHITTICH, 2009). In the main examples of the new solar architecture, there is a hybrid approach, which integrates passive and active systems from the earliest stages of design conception. This will be the path towards sustainable and energy-efficient solar architecture.

> "It starts with the use of passive solar energy, which is easy to implement and reliable [...] it can be adjusted using intelligent, self-regulating control technologies. Finally, it combines passive and active solar systems [...]. The key words in this field are hybrid solar systems, micro-climate building envelopes and self-regulating façades. This development of intelligent solar architecture will lead to new technologies and a new architecture that is eagerly awaited." (HEGGER, 2003, NP)

The project presented here is the result of a complex evolutionary process (survey, analysis, proposal and communication). It was not just the manipulation of forms, but the search for a foundation, at the intersection with other design disciplines and other areas of knowledge. Within his operational context, the designer has to bear in mind, on the one hand, all the cultural heritage derived from the memory of a material culture built up and refined over centuries, and on the other, the evolution of socio-cultural models and new social contents. The project thus gains a condition that allows it to intervene in societies and their values. It has the ability to create new functions and forms of use, to change habits, to activate feelings, to modify the relationship we have with the built environment. Architecture is not just functional, it must be intervening, responsible and transform the perception we have of ourselves, our way of socializing. Searching for the archetypal roots of architecture and the habits or uses it conditions through a design activity that is contextualized in the present become necessary tools for building our identity. In this process, the designer interacts as a filter in the dynamics of the group (society), but also imbues the project with his own language, his perception of the world, his emotions, his cultural values, his personality and his individual identity.

2.1 Design References



Figure 1. Detail of BAHÍA PALACE, Marrakech. Photo: Raquel Salomé, 2010.

After deep reflection on Mediterranean geometric patterns, the natural choice of geometry for the project was the hexagon. According to El-Said, it is the most important geometric figure in Islamic art. (BARBOSA, 2007)

The hexagon, like the square or triangle, is able to cover the plane without the participation of another shape. The realization shown here in figure 12 is the application of the star-shaped hexagon. We are thus trying to determine the basic geometries of the complex Islamic patterns (figure 13).
We tried to dismantle all the formal complexity by analyzing the specific characteristics of Islamic art found in each of these ancient creations in gebs (Moroccan sculpted plaster).

The figure of the hexagon is present at the base of almost all geometries, from interlacing to floral decoration, from calligraphy to mougarnas (honeycombs in stucco decorations, wood, on columns and capitals). The hexagon itself functions as a versatile unit of repetition, and is the most common basis for repetition schemes (El-Said & Parman, 1976). Many designs that are apparently very different from each other are drawn from hexagonal networks, as illustrated in figure 2.

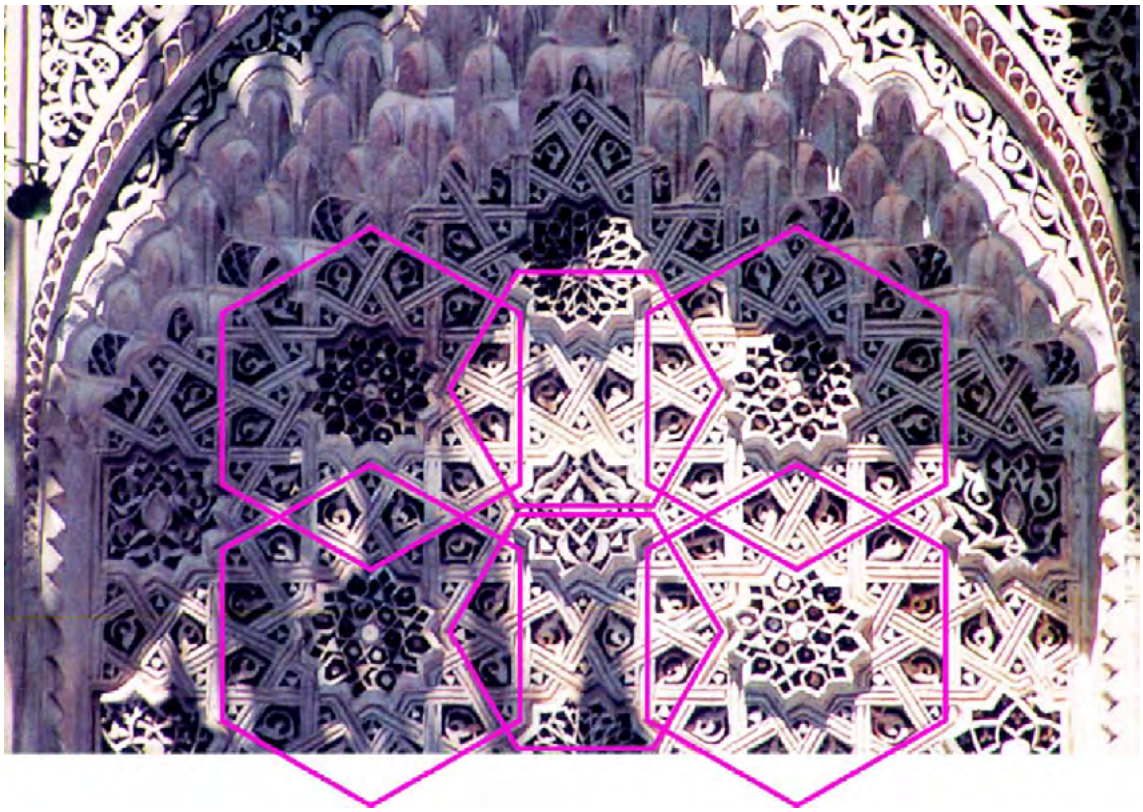


Figure 2. Basic geometries of the complex Islamic patterns. Detail of BAHÍA PALACE, Marrakech. Photo: Raquel Salomé, 2010.

Identification of secret geometries. Here are some of the constructions and properties of the hexagon and the six-pointed star used in geometric drawings.

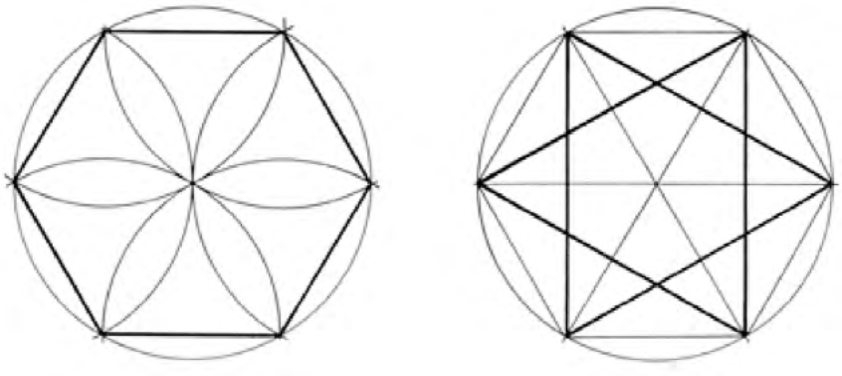


Figure 3. The radius can divide the circumference of a circle into six equal parts. Joining the resulting six points with straight lines creates a hexagon. Joining alternate points with straight lines creates triangles which, in turn, give shape to a six-pointed star.

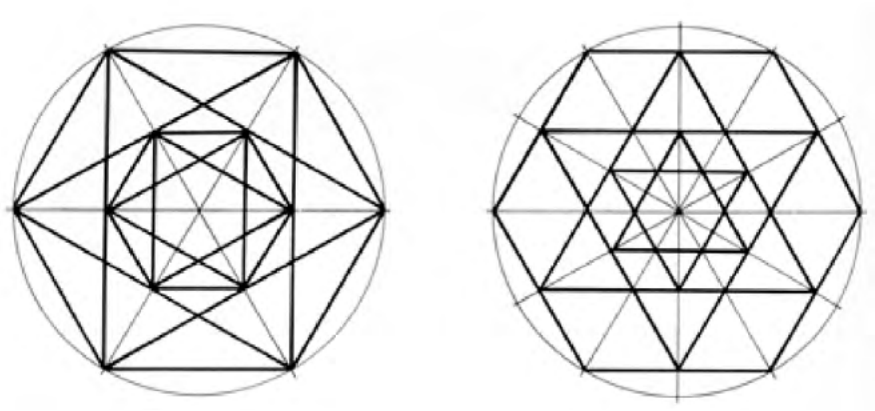


Figure 4. The ratio between the diameters of hexagons based on concentric six-pointed stars drawn from the angles of the hexagon is 1:2.

When the concentric stars are drawn from the midpoints of the hexagons, the ratio between the heights of the hexagons is also 1:2. The ratio between the diameter and height of the hexagons is a root of 3:2.

The repeating unit of the following design was built in two phases: in the top row the double hexagonal frame is based on two hexagons. In the second line, the star is drawn on a grid of three squares (BARBOSA, 2007).

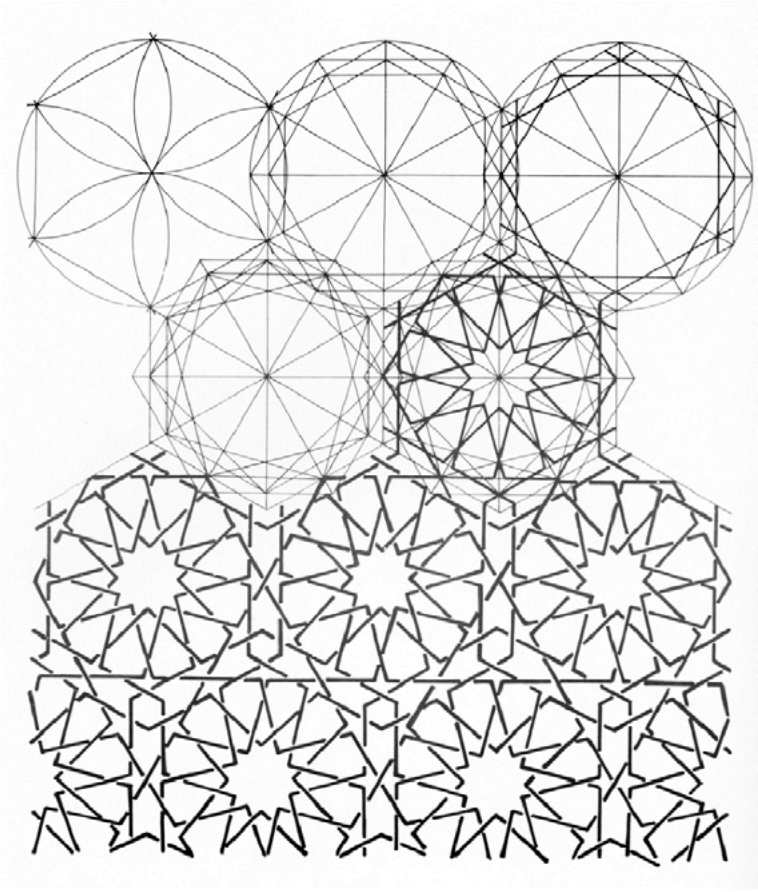


Figure 5. Design created from two overlapping grids (hexagonal and quadrangular).

The motifs were made using a regular weave of hexagons, identical to a weaving. A large-scale hexagonal motif is emphasised above this weave, with a play of more superficially worked areas that act as white dots which, when moving backwards, are read as continuous lines.



Figure 6. Room opening onto the courtyard PALÁCIO BAHÍA, Marrakech, image by Raquel Salomé, 2010.

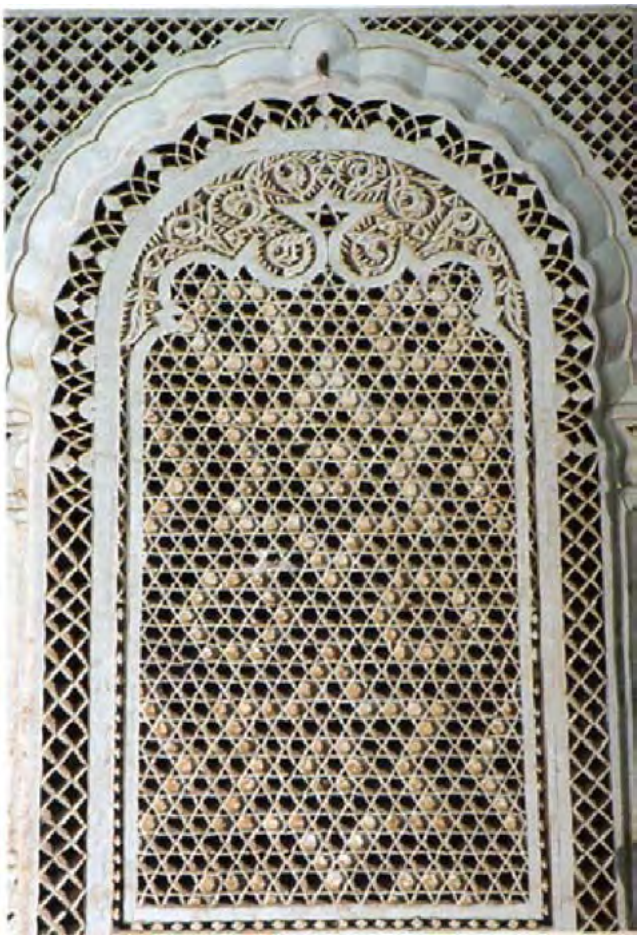


Figure 7. Detail of BAHÍA PALACE, Marrakech. Photo: Raquel Salomé, 2010.

The lacy stucco openings enhance the “venturi effect”. Here are some more magnificent examples of Islamic patterns painted or carved in wood, where the twelve-pointed star inscribed in a hexagonal grid is used (as seen in figure 6 and 7).

2.2 Project Design: Formal/Aesthetic Assumptions

Once the geometry for the construction of the module - the Hexagon - had been found, the process of sketches and drawings that preceded the project began. The aim of the project was not to create a new shape, but to find the essence of the geometrization of Islamic art. The aim was to interpret forms, recreate them and decontextualize them in new contemporary environments.

The advantages and constraints of the chosen shape, the applicability of the selected materials, the support structure and the study of details were identified. Here are some sketches of the preliminary project.

It began as a hexagonal ceramic module, with a glass opening in the centre to let light into the building, an air box to act as a trombe wall, and a copper piping system inside the module for water heating, which ran along the entire façade. The back would be insulated with cork.

The project conceptually resulted in an association of four types of modules with different functions:

1. Ceramic Module (chimney effect)
2. Glass Solar Thermal Module (trombe wall effect)
3. Solar Collector Module for DHW production
4. Brise Module, made of cork (filters natural light)



Figure 8. Ceramic Module (chimney effect).

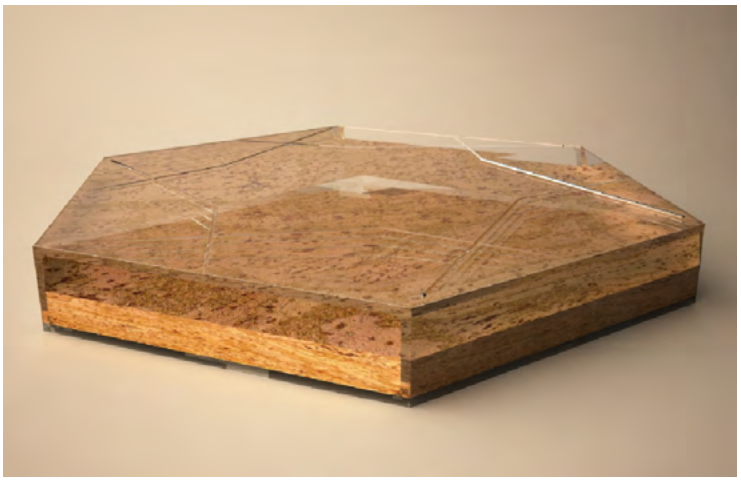


Figura 9. Glass Solar Thermal Module (trombe wall effect).



Figura 10. Solar Collector Module for DHW production.

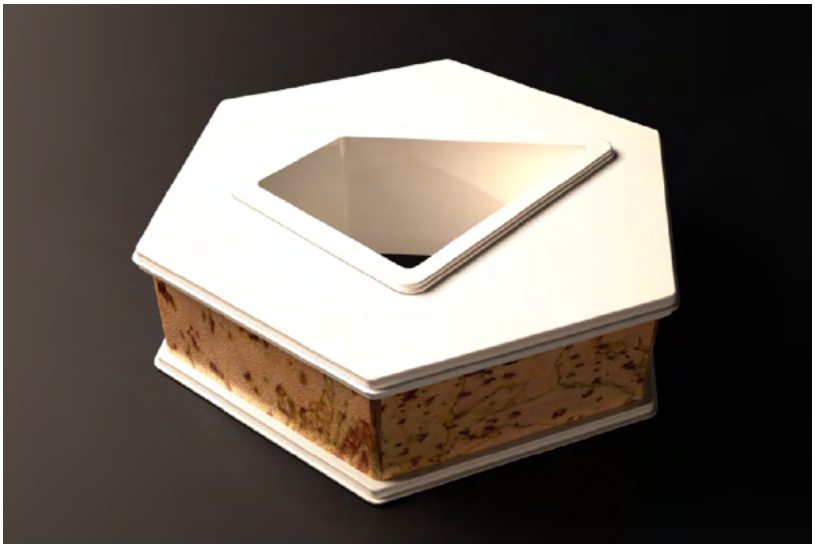


Figure 11. Open BRISE module in cork + ceramic (filters natural light).



Figure 12. Open BRISE module, in cork + ceramic, simulation of the BRISE effect, inside the space. Filters natural light, creates an intimate and introspective atmosphere and protects interiors from direct light.

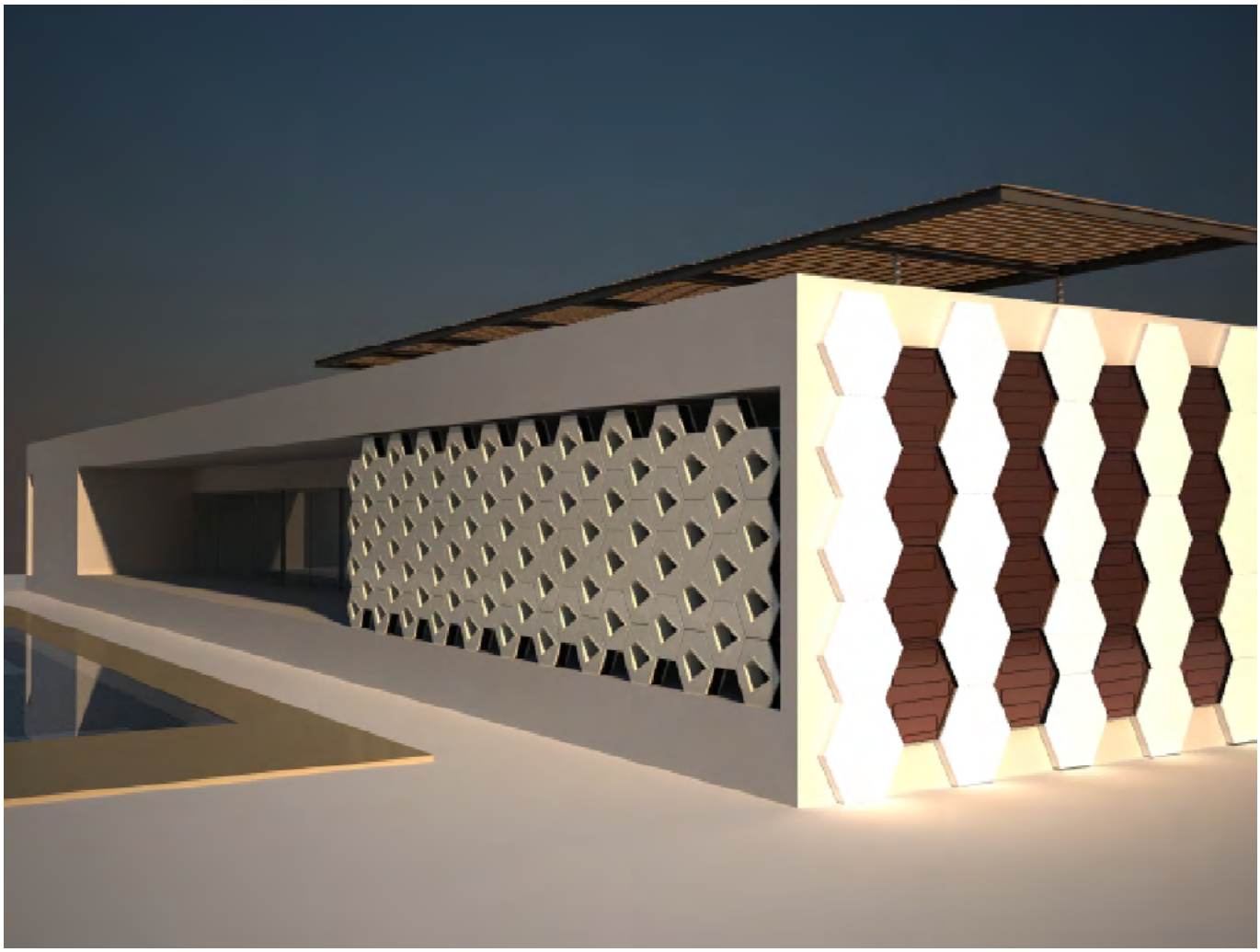


Figure 13. Solar orientation study. The ceramic modules allow cross-ventilation between the north and south façades. Ceramic modules and solar thermal modules, alternating on the south façade. Open BRISE module in cork + ceramic, open on the west façade, adjustable. (All 3D simulation by Nuno Martins).

2.3 Designing Other Geometries

After reflection, we thought about developing a geometry that could be used together with other hexagonal modules that had already been developed. This gave us multiple aesthetic options for architectural cladding.

From a hexagonal grid we can create a new model as shown in figure 12. Module Y (Figure 14) was based on the art of basketry and traditional handicrafts. After a 90º rotation we can combine it with other hexagonal modules, in this case the solar collector module (Figure 13).

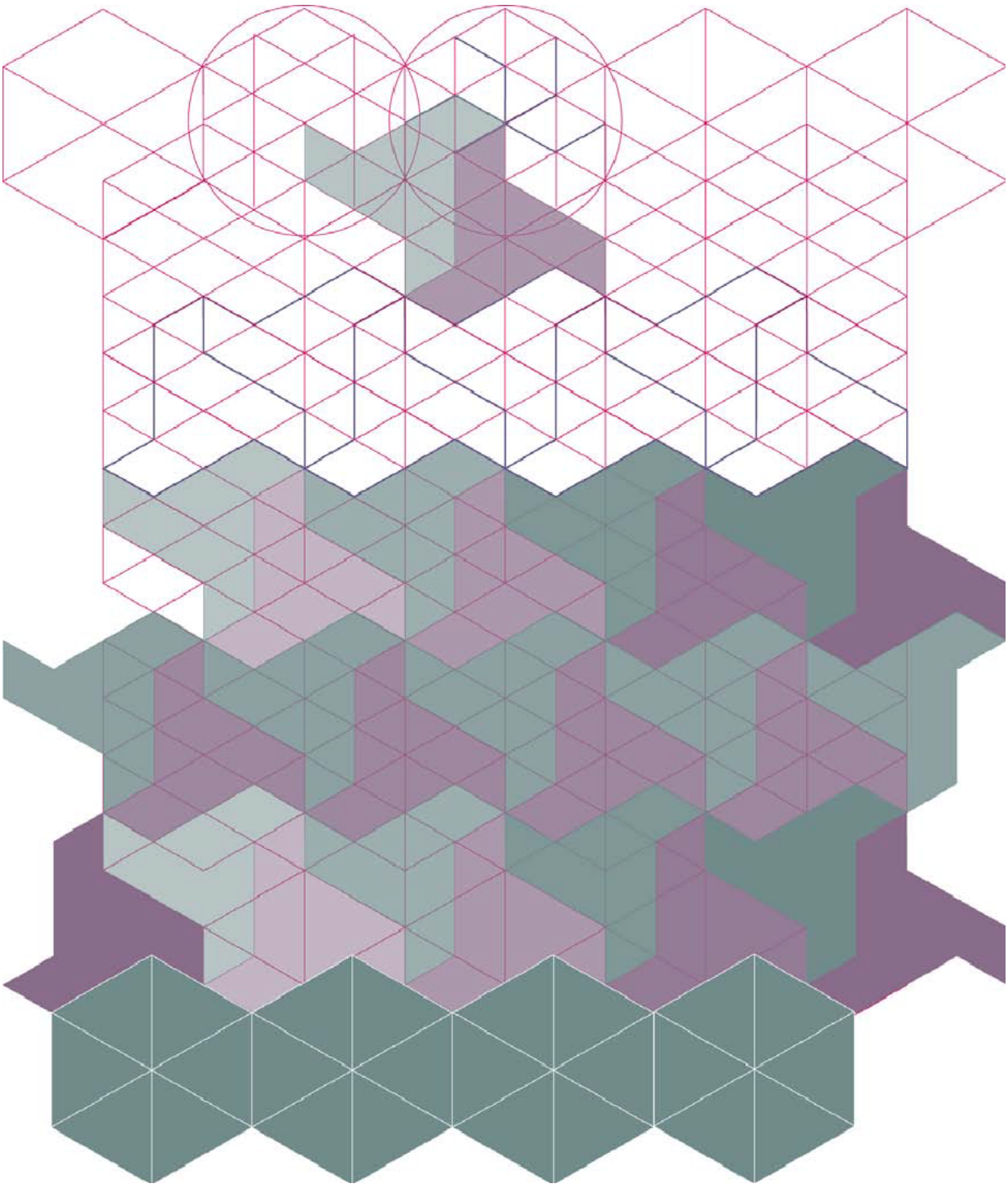


Figure 14. Illustration of the development of the new module Y, using a hexagonal grid as a reference.



Figure 15. Illustration of the combination of the new module Y with the solar collector module, after a 90º rotation.



Figure 16. 3D simulation of the new module Y, based on the art of basketry and traditional handicrafts.

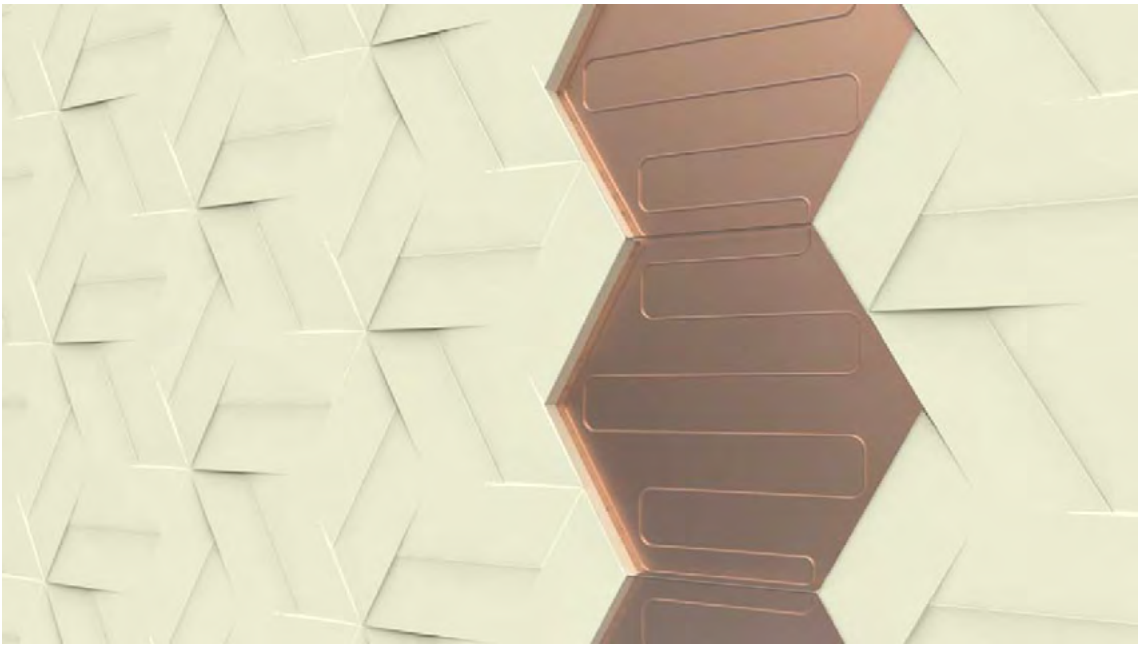


Figure 17. 3D simulation of the combination of the new module and the solar collector module, after a 90º rotation.

The Y-Module applied to the façade harks back to local/traditional references.

We also developed another geometry that allowed us to combine it with other hexagonal modules we had already developed. The conception of new geometry, a design based on a “split dry rope” tile pattern produced in Seville in the second half of the 15th century, with Mudejar geometric motifs known as “crow's feet” (SALOMÉ, 2012), shown in figure 18.

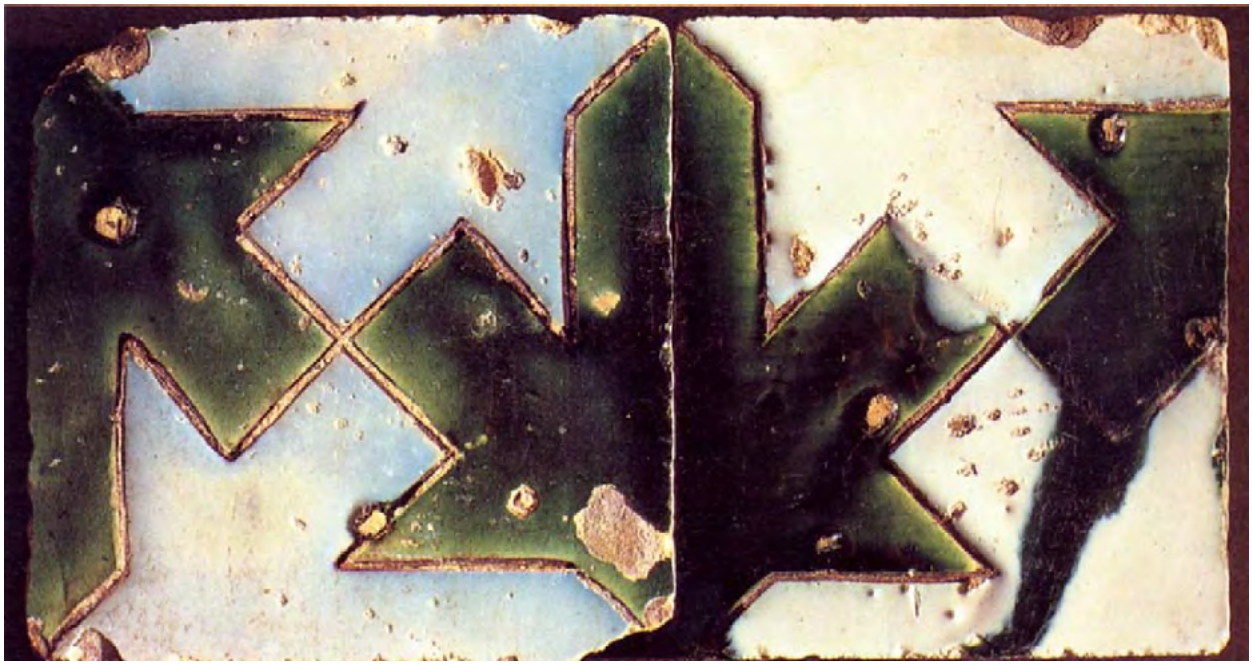


Figure 18. “Cracked dry rope” tile produced in Seville in the second half of the 15th century, with Mudejar geometric motifs known as “crow's feet”. Adapted from (SALOMÉ, 2012).

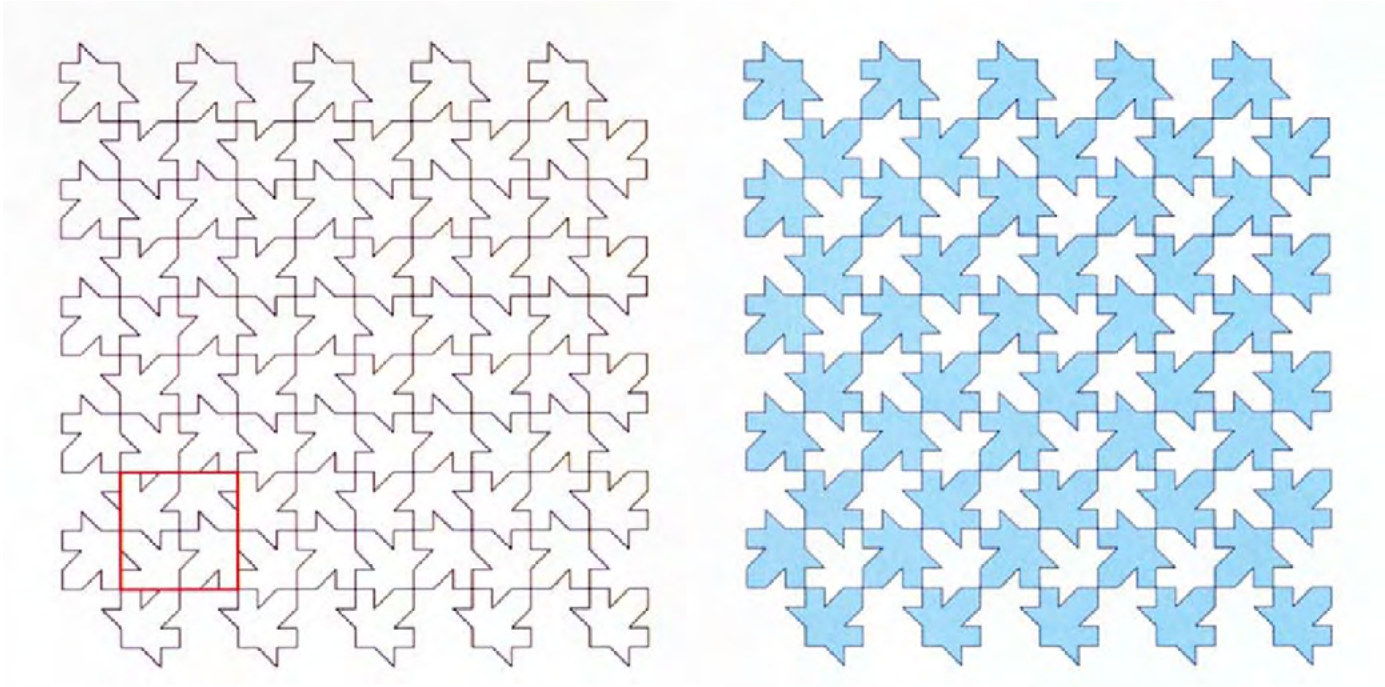


Figure 19. Mudejar geometric. Experiences gained during the design process.

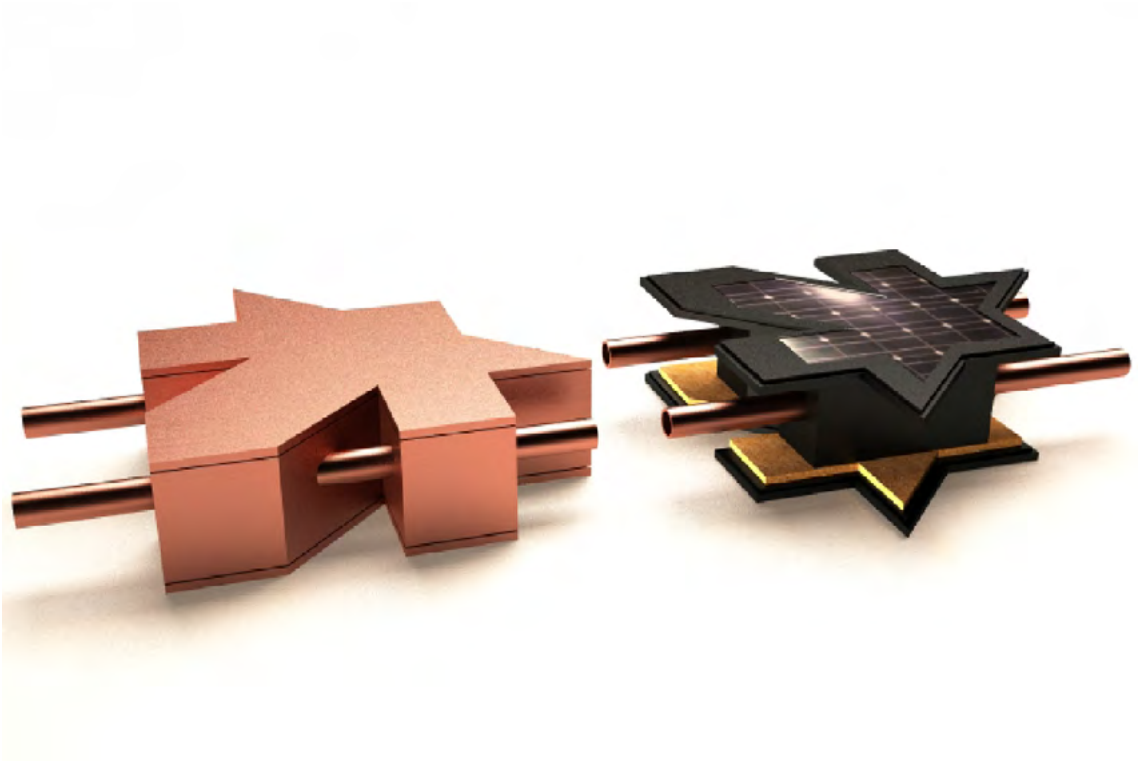


Figure 20. “Cracked dry rope” - 3D illustration of the mudéjare module known as “crow's feet” associated with another incorporating photovoltaic technology.

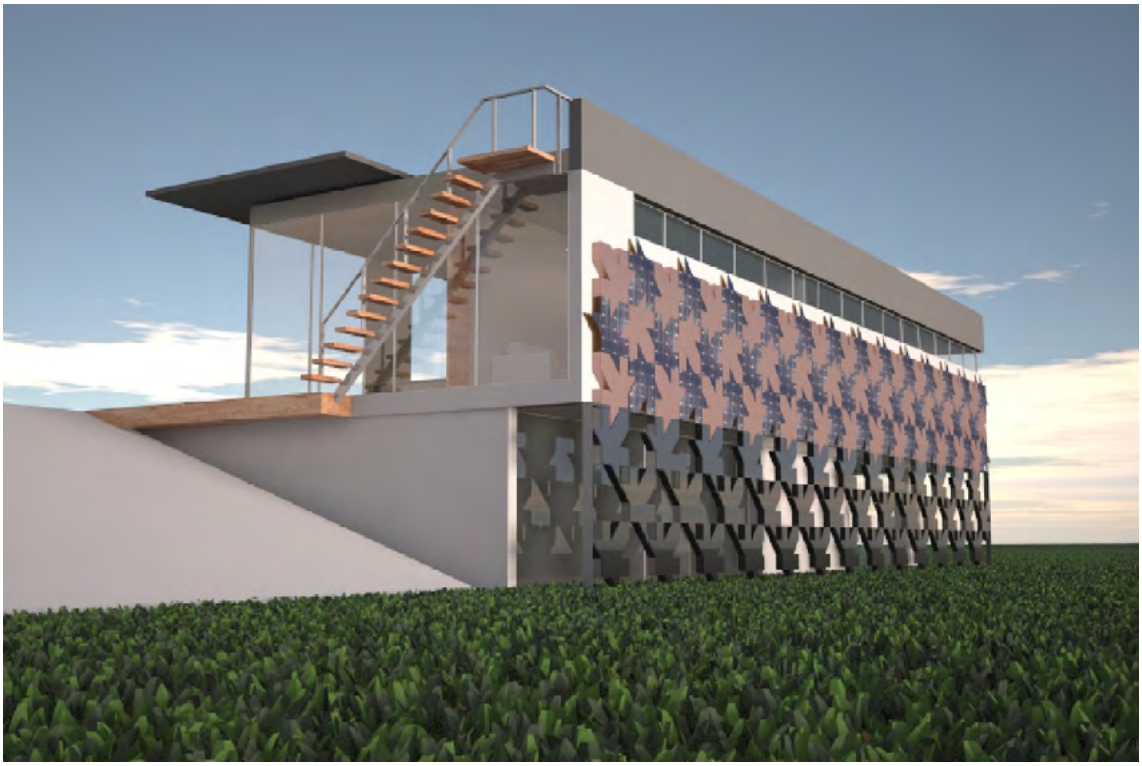


Figure 21. 3D façade simulation of the mudéjare module known as “crow's feet” associated with the photovoltaic energy module.

2.4 Reflection on Results and Literature Review: Mediterranean Cultural Identity and Sustainable Architectural Innovation

The study of the interconnection between materials and sustainability has garnered increasing attention in contemporary academic and practical discussions. Growing environmental awareness and the pressing need to mitigate the negative impacts resulting from unbridled consumption have led to a critical reassessment of the relationship between materials and sustainability. Within this context, two fundamental principles stand out: circularity and efficiency (SALOMÉ, 2012).

Material circularity emerges as a pivotal paradigm to advance sustainable practices by fostering closed production, consumption, and recycling loops. This approach aims to diminish reliance on virgin resources and minimize waste generation. Achieving circular systems necessitates innovative strategies across product design and waste management, facilitating resource regeneration and reducing environmental footprint.

The convergence of renewable energies and agriculture presents a unique opportunity to enhance sustainability and efficiency across both sectors. This synergy not only facilitates the shift towards cleaner energy sources but also optimizes land utilization and encourages sustainable farming practices. The fusion of these domains underscores a promising and mutually beneficial alliance.

Efficiency in material usage stands as a cornerstone in the pursuit of sustainability, involving the optimization of resources, waste reduction, and maximizing material performance throughout their lifecycle. Material selection, considering technical properties, origin, manufacturing processes, and recyclability, plays a vital role in enhancing efficiency and mitigating environmental impacts. So, transitioning towards a more sustainable relationship, between materials and society encounters various challenges, including resistance to change, inadequate legislation, and the necessity for specialized recycling infrastructure. Nonetheless, these hurdles also present opportunities for innovation, research, and the development of new technological and social solutions.

The coexistence of renewable energy installations and agricultural activities is evolving positively, particularly through innovative methods such as agrivoltaics. Through initiatives like the InSPIRE project (2019) which uses solar panel shading to enhance water efficiency and protect crops, tangible benefits are being observed. For instance, a cherry tomato plantation in Arizona has significantly reduced water demand and doubled its yield. Furthermore, advancements in photovoltaic technology, exemplified by Enel Green Power's HJT double-sided panels (2019), are further optimizing land use and increasing efficiency. Debunking myths of excessive land use and conflicts with agriculture, these innovations promise to drive the energy transition while benefiting agricultural practices. Success stories like the photovoltaic-battery hybrid system at St. Luke Hospital in Ethiopia highlight the transformative potential of sustainable energy solutions in enhancing both sustainability and innovation.

Projects aiming to embody Mediterranean cultural identity through design and material selection emphasize the bioclimatic aspects of Mediterranean architecture. By valuing cultural diversity and reconnecting with Mediterranean heritage, such initiatives strive to reintegrate cultural identity through form, materials, and concepts.

Eco design serves as a transformative vehicle for ecological education, prioritizing the cultivation of appreciation and assimilation of ecological principles. By fostering awareness of sustainability's possibilities and limitations, Eco design promotes a harmonious balance between human behavior and nature, amplifying ecological competence and consciousness. Initial tests indicate the potential of tested materials and concepts, underscoring the promise of sustainable practices and innovations in advancing circularity, renewable energy integration, and cultural sustainability. Continued research and implementation efforts are essential to realize the full potential of these transformative approaches in promoting a sustainable future.

The aim is to find a balance between human behavior and respect for nature, promoting awareness of the possibilities and limits of sustainability. Sustainable design thus becomes a way of spreading our awareness of nature and our ecological competence.

After reading and analyzing the results, preliminary tests indicate the potential of the materials and concepts tested. In future work, we intend to continue with the tests, explore new mechanisms, and apply the concepts to new materials and geometries.

The study outlines a comprehensive set of objectives aimed at addressing various aspects related to the promotion and preservation of Mediterranean cultural identity within a global context. These objectives include reflecting on existing methodologies, evaluating the impact of modernity on traditional cultures, bridging industrial production with handicrafts, re-contextualizing traditional materials for contemporary use, analyzing contemporary definitions of design practice, discussing Western material culture, fostering critical thinking for sustainable development, and promoting communication between Product Design and Engineering disciplines. These objectives collectively seek to advance understanding, appreciation, and integration of Mediterranean cultural heritage while fostering sustainable practices and critical discourse in design and engineering fields (RAQUEL, 2014).

This approach not only fosters climate change mitigation but also advances economic and environmental sustainability in rural regions, marking a significant stride towards resilient and ecologically conscious systems. The solution to prevailing challenges is encapsulated in the concept of a “Green Recovery”. This strategy advocates for investments in green technologies, renewable energies, consumption efficiency, sustainable mobility, and the circular economy. Furthermore, it presents an avenue to merge the energy transition with employment generation. Prioritizing social impacts is paramount. Achieving a just transition necessitates dedicated focus on the most marginalized communities, particularly those associated with the coal industry. Mitigating job losses in specific sectors requires concomitant efforts to create new opportunities and implement retraining programs to ensure equitable inclusion for all. In essence, while the energy transition is imperative, meticulous management is indispensable to mitigate disparities. The pursuit of a Green Recovery not only tackles present challenges but also lays the groundwork for cultivating a more sustainable and equitable society.

3. Conclusion: Navigating Towards a Sustainable Future

This comprehensive exploration of the intricate relationship between materials and sustainability underscores the urgency of adopting circular design methodologies. The imperative principles of circularity and efficiency emerge as keystones in the pursuit of a more sustainable and responsible future.

Addressing our immediate challenges, the call for a Green Recovery allows us to identify challenges stemming from unbridled consumption and environmental degradation and necessitates a strategic response. The proposal for a “Green Recovery” stands as a foundational concept, advocating for investments in green technologies, renewable energies, consumption efficiency, sustainable mobility, and the circular economy. (SALOMÉ, 2012) This approach not only addresses the immediate challenges but also presents an opportunity to intertwine the energy transition with job creation, contributing to a holistic and inclusive solution.

Challenges and opportunities in the transition to a more sustainable energy landscape presents challenges that demand careful consideration. A just transition requires a nuanced approach, particularly in supporting vulnerable communities tied to sectors like coal. Mitigating job losses in these sectors necessitates the creation of new opportunities and comprehensive retraining programs to ensure an inclusive and equitable transition. However, that doesn’t mean that energy efficient projects can only be expensive answers to the planet’s problem or first country solutions.

Striking a Balance between energy transition and social justice becomes the overarching goal of a Green Recovery. Not only to build a more sustainable future but also a just society. Balancing the energy transition requires a meticulous management strategy to avoid exacerbating existing inequalities. By addressing social impacts and prioritizing inclusivity, the journey toward a sustainable future becomes a shared responsibility and opportunity.

> "Right now, what's most interesting to me is what we can do to catalyze the most abundant resources we have on the planet, which are our human capabilities. (...) If we consider that we have a very small heavily populated planet, to move to sustainability we have to make best use of all the resources we have." (MANZINI, 2011, NP)

Synergies between circularity and efficiency can represent the future of the relationship between materials and sustainability. In a way it lies in creating synergies between circularity and efficiency. Advocating for a circular economy, where materials are continually reused and enhancing efficiency in production and consumption are imperative steps toward achieving a harmonious environmental and social equilibrium.

Collaborative Engagement for a Sustainable Future The complexity of the intersection between materials and sustainability demands collaborative engagement. The synergy between academia, industry, and governments becomes essential in driving this transition. Through collaborative efforts, society can be empowered to confront emerging challenges, fostering a collective commitment to a more sustainable and responsible future.

A Vision for Tomorrow: Beyond Consumed Resources In essence, this exploration underscores the dynamic and complex nature of the materials and sustainability landscape. Circularity and efficiency emerge as fundamental principles in crafting a future where materials transcend being mere consumed resources. Instead, they become integral elements in a sustainable and responsible vision for the well-being of future generations.

In the words of Tom Dixon,

> "We want to know everything about the materials. Where they come from, how to work with them, how far they can go, what else we can do. And we like them to be as dense, generous, and simple as possible." (2007, NP)

This ethos encapsulates the essence of the journey toward sustainable design, where a profound understanding of materials guides us toward a more conscious and responsible coexistence with our environment.

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P/REFERENCES OF DESIGN

REDEFINING GEOGRAPHICAL BOUNDARIES: MAPS AS COMMUNICATION DESIGN TOOLS FOR PURSUING SOCIOPOLITICAL GOALS.

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KEYWORDS | GEOGRAPHIC BOUNDARIES, MAPS, ATLASES, VISUAL COMMUNICATION, SOCIOPOLITICAL ARTIFACTS

ABSTRACT | The paper focuses on the crucial role played by visual design artifacts in reconfiguring the relationship between the so-called first and third worlds, between centers and peripheral or semi-peripheral cultures and territories, overtaking the societal structures perpetuating a cycle of subjugation and dependency that still affects several regions in the contemporary geography of the world. The aim is to contribute within the international debate about maps as cultural artifacts through a comparative exploration of two artistic experiences coming from different regions of the world. The case studies examined are the work of the South African draftsman Titus Matiyane and the one of the American maps and books artist Doug Beube, whose cartographic representations will be investigated as visual communication artifacts to overcome the "borders" of the map. Aspects under analysis, therefore, will be the ways in which they employ visual elements, symbolic motifs, cartographic conventions and narrative structures for suggesting the construction of an imaginary transnational identity.

The experimental approaches described denounce sociopolitical phenomena that seem viscerally imbued with the history of civilizations and nations by redesigning visually and implicitly metaphorically the cartographic representation of the world. Imaginary, alternative and utopistic forms of maps destroying, and then rewriting and redesigning the boundaries between territories are the object of analysis, addressed as media for creating new perspectives for a more equal geographic shape of the world in which otherness and multiculturalism are values to be preserved.

1. Introduction

Maps are powerful instruments of knowledge. Since the dawn of civilization, territories have been mapped to allow to cross them without getting lost, providing a graphic abstraction and therefore experimenting translating approaches necessary to synthesize a large amount of information in a single image. These graphic visualizations reflect the perception and the knowledge of the world in different historical periods and reveal aesthetic trends and technical abilities of mapmakers and their evolutions through time (Thrower, 2008). According to Norman Thrower, indeed, maps are "excellent indicator of culture and civilization" (Ibid., p.1) and as such they have been performing several functions over time, going beyond the necessary knowledge of the spatial characteristics of a territory.

Over the last decades the act of mapping has evolved and has taken on different purposes, 'alternative' forms and a multidimensional and thematic connotation, overcoming any desire to schematize the world, in favor of a subjective representation of the same (Jacob 1992). The science of cartography [1] has been replaced by a hermeneutics of cartography (Quaggiotto 2016), and mapping has become the prerogative not only of geographers, cartographers, paleoclimatologists, seismologists, but also of chemists, biologists, astronomers involved in mapping the human genome, the universe, the cells, and then philosophers, sociologists, theologians, anthropologists, who began to build "atlases" that describe cultures, migrations, rituals, journeys into interior worlds, spiritual phenomena and topographies of existence. Added to these are the information maps, which have the arduous task of acquiring, decoding and returning complex data, knowledge, processes, physical phenomena and thoughts [2]. The paper explores particular design experiences in which maps are used for rediscovering the territory through an imaginary rewriting of the same, and through the creation of 'other' spaces compared to the measurable ones: spaces of encounters, of transit and emotional crossing, spaces imagined by the sensitivity of the individual.

By observing the transition from the geographic scientific maps to imaginary maps as cultural artefacts, this paper aims at investigating the ability of a map to reinterpret physical spaces, deconstructing and reconstructing them, thus to become a tool for rewriting the territory with cultural and sociopolitical objectives. In this perspective maps can become showcases on imaginary scenarios that demolish boundaries and shorten distances – thus differences – between faraway places, between topographic ontologies seemingly unattainable, between centers and peripheries, and – in a sociopolitical perspective – between the so-called Third and First Worlds. Maps therefore can strategically deconstruct and interpret the world, or a portion of it, conveying choices of a political, social and economic nature.

After outlining critical analyses, and primary sources collected for establishing a comprehensive understanding of the concept of maps as spatial agents for rewriting and remodeling territories and boundaries, the paper will undertake a comparative examination of the work of two artists: Titus Matiyane and Doug Beube. Special attention will be paid to the ways in which the artists employ visual elements, symbolic motifs, cartographic conventions and narrative structures for suggesting the construction of an utopistic transnational identity.

2. Maps as Relational Sociopolitical Artifacts

> "Those who drew the maps controlled the destiny of nations through the very power of delineating space. The graphic impact of maps of exploration, invasion, and rebellion is more memorable and vivid than the long explanatory texts accompanying them." (Envisioning Maps, 2008)

With this sentence the Hebrew Union College-Jewish Institute of Religion Museum Curator, Laura Kruger, on the occasion of the inauguration of the *Envisioning Maps* exhibition (2008) highlighted the power of maps to reflect "the state of cultural activity, as well as the perception of the world, in different periods" (Thrower, 2008, p.1). 'Primitive' civilizations' early maps were attempts to visually represent earth distributions in order to improve its visualization and knowledge. When examined across time these maps

not just demonstrate their power to fulfilled certain purposes, but they illustrate how human cognition has evolved. As previously stated, a map serves many important purposes in the modern world: It is an essential tool for understanding spatial phenomena, an effective way to store data, and a research tool that helps uncover distributions and relationships that would not otherwise be known. In this multifaced scenario maps have been a compelling theme for contemporary designers and artists throughout the twentieth century as these visual artefacts represent any kind of relationships, and not necessarily spatial ones, occurring at or near the surface of the Earth: social, political, cultural, historical and help humans to read and understand them according to the context of investigation. That is why today we are able to give a historical-political justification to compositional aspects of cartographic artefacts of colonial travelers such as Thomas Baines (1820–1875) and Thomas Bowler (1812–1869), whose restitutions of the South African territory mainly concerned the geography of the country and people were excluded or they were represented proportionally on a smaller scale compared to the overwhelming scale of the landscape, like those in David Livingstone's travelogues (Huigen, 2009, p. 209). These representations focused on panoramas of desolate landscapes, as if in preparation for colonial expansion and capitalist exploitation, deliberately excluding indigenous populations considered an obstacle to expansion (Pratt, 2008, p. 51).

This finding corroborates the arguments discussed by Nicholas Gliserman in the article *Unpacking the Meaning of Maps, Power, and Boundaries* (2021) in which the author claims that we must ask ourselves not what a map *is* but what a map *does* to arrive at an all-encompassing definition, and – in perspective – what a map *can do* in the future: by "navigating an environment or visually representing information […] the map can help reconstruct mental and physical […] processes" (Griserman, 2021, p.2) but they can also utopistically and optimistically act as agents that influence the relationship between territories and cultures, thus changing the geography of the world in a reciprocal relationship in which "maps shape a world that in turn shapes its maps" (Matthew 2005, 12). The agency of map as recursive and relational tool can affect and influence different cultural aspects and mapping becomes occasion for territorial rewriting. These performing visual texts break down boundaries and suggest a utopian, imaginary and subjective reconfiguration of the world without inequality, thus becoming a vehicle of social denunciation.

Several non-mapmakers have approached this form of expression for narrating stories asking the viewer to navigate into imaginary spaces that – by altering the representational conventions and the geography of a territory – demonstrate that mapping is a continuous process that relate different aspects of society and reshape identities, relationship, and the idea of the world itself (Kitchin and Dodge 2007).

Map-artists such as Saul Steinberg, Stephen Wiltshire, Dannielle Tegeder, Wopo Holup, Titus Matiyane and Doug Beube are generally considered outsiders that do not follow a precise style and do not have conventional artistic training, but operate within and for the society starting from a personal vision and technique. The works of these artists have relational sociopolitical purposes, as their maps, in any shape they have been designed, flat or tridimensional, with altered scales or faithful to the real proportional relationships between the territories represented, drawn or obtained by assembling elements, tell stories aimed at defining, reconstructing, administering polities and territories, and so at developing national identities and "establishing places in the Community of nations" (Akerman, 2017, p. 2).

3. New Views of the World in Titus Matiyane and Doug Beube's Maps

The work of two map artists will be following examined: the imaginary territorial representations of the South African draftsman Titus Matiyane and the collages and altered atlas of the American artist Doug Beube. Since the late 90's Matiyane has designed imaginary geo-mappings by deconstructing and reconstructing transnational spaces that connect numerous cities of the Western world and South Africa - not by chance an environment with a postcolonial history harassed by the contrast between centers of power and peripheries (Dreyer, 2017, p. 126). Doug Beube between 2003 and 2015 created physical artefacts in which he manipulated the structure of geographical atlases, dissecting them and altering the organization and relationship between the territories represented on the existing maps (Masuga, 2016).

The two artists have been selected - among those previously mentioned - because in both of them the idea of rewriting national borders and transforming the geographic configurations of places which still today shows the consequences of processes of colonization and decolonization strongly emerges. Both in Matiayne's drawings and in Beube's collages and recomposed atlases the imaginary juxtapositions between political geographies and anthropic landscapes seem to produce territories and – as suggested by Kitchin Rob e Martin Dodge (2007, p. 21) – create constructive and not merely descriptive maps. In their works, the choice to show a city or a specific place is not random but strategic and demonstrates a precise desire to translate into graphic visualizations the criticism towards the destruction of the history of entire cities, ethnic groups or nations, also conducted through cartographic representations. An example is the history of road mapping in *apartheid* and *post-apartheid* South Africa described by Thomas Bassett as a clear case of racialized organization of space, and so persistence of racial prejudices (Bassett, 2017, p. 373). Matiyane and Beube denounce – by de-structuring it – classical cartography as it is recognized as a powerful tool of racial discrimination and colonial politics, probably among the most dangerous, "because the eye and mind of the map user are likely to be quite unaware of them" (Akerman, 2017, p. 7). By redesigning borders, distances and hierarchical relationships between cities and nations, therefore, the cartographic act of Matiyane and Beube is strongly politicized, and the following analysis will try to identify the visual codes and the graphic choices adopted to achieve this objective, and then it will compare the emerging overarching trends, and implications.

3.1 The Imaginary and Transnational Maps of Titus Matiyane

The maps of the South African cartographer Titus Matiyane ask the viewer to broaden their physical and ideological horizons towards an imaginary and transnational geographical space that enhances the identities of African territories and cultures (Ekpo, 1995; Adichie, 2020). Matiyane deconstructs the Afrocentric idea of a solitary Africa and a shared system of values and stories (Sidogi, 2018, p. 129), placing in his imaginary views urban contexts that belong to different continents, but which seem to dialogue as they are integrated into scenarios in which individuality and difference coexist as values.

Titus Matiyane began his work as a cartographer in the 1990s, in a decade that saw South Africa recovering from a historical moment of "cruel dehumanization" (Kruger, 2022, p. 199), drawing his monumental panoramas on a small coffee table of 40 x 60 cm outside a house of approximately 25 square meters in which he still lives today with his family (Figure 1). His first panoramic drawings depicted local cities, metropolitan districts and provinces, including Durban, Pretoria and Pietersburg, before moving on, at the end of the decade, to drawing telescopic scenery of foreign cities such as New York, London, Amsterdam and Hong Kong. Matiyane Maps are long strips of paper whose size varies from 6 (as in *Panorama of Hong Kong*) to 46 meters wide (this is the case of *Panorama Pietersburg-Sasolburg*) for approximately 1.5 meters in height (Figure 2). Here the artist reconstructs scenarios created with colored pencils and markers and characterized by strange proportions based on intuition and an admirable attention to detail. Matiyane, in fact, graphically transposes what he pictures in his head, and the visual references of his work are the commercial maps donated by sponsors or purchased from local stationery shops and Google Maps. These images are often his only source of knowledge of the cities of which he then proposes monumental panoramic representations based on his vision of places that, in most cases, he has never visited. Through his imagination, writes Elfriede Dreyer (2017, p. 128), Matiyane "becomes a transnational traveler who produces representations of the geo-history of the most famous cities in the world". Matiyane works as a sort of archivist and produces documents that tell a local history that can't be captured by photography because it is not contingent, but extended over time, in a dimension of intrinsic dynamism and continuous evolution. Matiyane's concern for functioning from the city justifies the cartographer's singular process: he draws what he knows, not what he sees, and this makes his panoramas more like maps than impressionist views (Silverman, 2007, p. 23).

In this new vision of the world, it is possible, indeed prescriptive, that large cities such as New York and London relate to peripheral places such as Soweto and Atteridgeville in a utopian and imaginary geographical restitution. As Dreyer writes:

> "By including less important South African cities and towns in his canon of famous cities, the artist suggests an intervention strategy that deconstructs the paradigmatic perception of the world that associates African cities like Pretoria and Johannesburg with a Marginalized Third World." (Dreyer, 2017, p. 135)

The South African cities designed by Matiyane overcome the social and cultural confinement that emerged with the advent of post-apartheid political regimes and establish a fair dialogue with the territories, architecture and urban planning of that First World seen from the eyes of an African, and therefore perhaps more authentic (de Kler, 2007, p. 17). By operating this hybridization between panoramas belonging to apparently irreconcilable social, cultural and geographical contexts, Matiyane makes graphic choices that convey a very specific sociopolitical communication project. Most of his panoramas include powerful and fast vehicles, planes, trains and boats that can easily cover long distances. The lines and connecting paths are marked - to the detriment of proportion - as to form a global and transnational network. The representation of the buildings becomes homologous, attenuating the aesthetic differences between the so-called Third and First Worlds to the point of almost disappearing. The border lines between towns and cities are invisible and the distinction between territories relies on topography and toponymy: large green areas, endless blue horizons and warm colors to make the anthropic areas recognizable. These panoramas are actually glimpses of a broader reality, of a world without hierarchies, differences or contrasts between those who have and those who have not, therefore between poverty and prosperity, and, above all, of a world free of racial discrimination. To confirm this prospective, Matiyane's cartographic representations lack – As Melinda Silverman writes (2007, pp. 32-33) – specific elements of a decadentism typical of the postmodern condition of third world countries: the settlements of shacks, the dense system of ropes from which linen dangles to "decorate" the skyscrapers of the 1960s, the numerous street vendors who gather on the freeway ramps to sell their products. Of particular importance in the cartographer's drawings is, then, the almost total absence of human figures, except for the symbolic use of the faces of some well-known personalities which strengthen the identity of the places portrayed, for example Princess Diana in *Panorama of London* (1998), Nelson Mandela in *Panorama Pietersburg-Sasolburg* (2004) and Queen Beatrix in *Panorama of the Netherlands* (2000). This aspect, together with the simplified style, the use of color and the inclusion of considerable toponymy, reinforces the ideological, imaginary and transcendent nature of his work.

Another relevant graphic character of Matiyane's cartographies is the erasure of borders. This choice can be interpreted as a further action of deconstruction of the political barriers of South Africa and the world, which is, in fact, transcribed and reconfigured in such a way as to communicate a utopia of depoliticization. The graphic space imagined by Matiyane in his panoramas terminates oppositions and deconstructs the traces of colonialism, apartheid, the hierarchies of national states and the great differences between the First and Third Worlds (Kruger, 2022, pp. 199-200). The cancellation of borders in favor of a geographical, economic and cultural re-mapping does not mean the absence of references to the history and specific characteristics of the territories that are protagonists of the panoramas. The cartographer, in fact, portrays a precise historical moment in his panoramas, a specific event that inextricably and unequivocally characterizes a city or a state, as if his map crystallized on paper a moment of local importance and global resonance. And so, for example, in the 46-meter-wide *Pietersburg-Sasolbourg Panorama*, the cartographer refers several times to the 2010 World Cup; in the 2019 *Panorama of Italy*, the portrait of Pope Francis overlooks the city of Rome; and again, in *Panorama of New York* (1999) the Twin Towers are on fire (Figure 3) (See Hobbs, 2007, p.39).

Matiyane's work is therefore part of a phenomenon that has seen contemporary African artists generally considered outsiders - including the sculptors Helen Martins and Jackson Hlungwani - becoming spokespersons for an authentic, honest and free testimony of decolonial processes.



Figure 1. Titus Matiyane at work on *Panorama of Cape Town* (2005). Mixed media on paper, 7m Photo: ©Titus Matiyane.



Figure 2. Titus Matiyane (Atteridgeville, 1964). Panorama Pietersburg-Sasolburg, 2004. Mixed media on paper, 46m. Photograph taken on the occasion of the exhibition Cities of the World (2008). Photo: © Titus Matiyane.



Figure 3. Titus Matiyane (Atteridgeville, 1964). *Panorama of New York* (detail, 1999) [drawing modified after 09/11/2001]. Mixed media on paper, 12m. Photo: © Titus Matiyane.

3.2 The Altered Atlases of Doug Beube

With a very different approach than Matiyane, the American mix-media artist Doug Beube undertakes the deconstruction of maps not through a graphic rewriting, but by physically dissecting and reassembling maps' paper material, thereby engendering the creation of unique territories characterized by altered borders and amalgamating political and geographic identities (cfr. Hoeltzel and Villalonga, 2013)). In the last three decades Doug Beube has produced bookwork, collages, installations, and sculptures and has forged a new source for cultural and artistic understanding of the world trying to rewrite social conventions in a creative way (Masuga, 2016, p. 181).

Since the beginning of his artistic experiments Beube has demonstrated a particular attention to books and, in many artworks, he manipulates, destroys and transforms these objects into cultural artifacts of different nature that provide a new image of the world and asks the viewer to experience "the dichotomy of the physical object and its conceptual status" (Ibid., p. 194), and yet of course to explore the new significances carried on with this process of transformation. Many of the books altered by Beube are, not randomly, geographical atlases, which he reorganizes and transforms into new bodies with and of new images. Beube's mapworks' premises, indeed, stand from the assumption that "maps are not to be understood or trusted as firm markers of meaning. Rather, Beube's works illuminate that maps are often markers of the meaning we seek in them" (Mullin, 2011, p. 55). Diane Mullin in the article *Illuminated maps: the World unzipped but not uncut* argued that Doug Beube's collages question our beliefs about the world in which we live and can be considered:

> "Explorations into nameless territories of our consciousness where the rationalistic and nationalistic zeal that underlies the western enlightenment has become, in and of itself, an almost blind faith in our worldview, no matter how unbearable it is for the planet at large." (Ibid.)

Mullin focused especially on the "Erosions Series" (2004) in which Beube sanded the pages of atlases so that the familiar images of territories disappear and new images of mountain ranges emerging from the center of oceans are created and so he built new elements on the maps such as islands and rain forests

appearing like oases in the middle of deserts. If the images or objects (atlases and books) are artefacts with a big cultural meaning, in a certain way – according to Thomas Mitchell and Katy Masuga – by destroying and restructuring them automatically their transformation questions and suggests the need of a similar rewriting for the cultural aspects that these objects are representations of. In other words, these alterations redesign the boundaries – thus the relationships – between spaces and places that bring with them a stratified tradition of social and cultural conventions (Mitchell, 1996; Masuga, 2016).

Beube concentrated on mapworks and bookworks especially in the first decades of the new century, when he creates a jumbled and practically unintelligible world's geography by dissecting and layering actual vintage maps, insinuating the emergence of a global community that blurs social and political frontiers (cfr. Mallonee, 2013). As revealed by the artists in an interview release in 2018 on the occasion of the exhibition *Books Undone: the art of altered books (2018),* in these pieces, he physically manipulates the obsolete cartographic configuration by cutting, crushing, sketching, drilling, gouging, and sewing maps, pushing their physical ontology until they nearly collapse. By converting a map from its original purpose, Beube suggests reading it non-linearly and transferring decades of devotion for a pervasive object into a challenging shape with new levels of meaning (Beube, 2018, p.6).

This approach is clear especially in five artworks produced between 2003 and 2015: *Fault lines* (2003), the *Erosion Series* (2004), *Border Crossing* (2006), *Fallen Borders* (2014), and *Shifting Borders* (2015) [3].
The first experiments involving atlases and printed maps date back to the artwork *Fault Lines* of 2003 (Figure 4). In this work Beube cut all pages of the atlas into one-inch strips which however remain sewn to the spine of the volume. The book's start and finish are interwoven with the chopped rows "in an arbitrary geopolitical braiding" (Bright, 2011, p. 17) that enables the spectator to examine various topographical perspectives and, in turn, reinterpret the globe. This artwork inaugurated a path of conceptual experimentation that has focused on maps – and in particular borders – as flexible entities that can be deconstructed and reconstructed, thus allowing to re-read the relationship between territorial, geographical, historical, political and cultural identities.

In the *Erosion Series* of 2004 (Figure 5) Beube kept questioning the fluidity of international relations by manipulating pages extracted from world atlases. Moved by the notion of geopolitical adaptability, Beube's process involved a meticulous exploration of color-field relationships and compositional elements within a bunch of chosen maps. With a belt sander on the verso of the pages, he deliberately carved out irregular forms, akin to the erosive actions of insects, thereby redefining the geographical shapes of numerous nations.

When overlapped to underlying pages these irregularly perforated maps lead to unexpected juxtapositions, expanse seas and oceans, and intersect terrestrial masses. This intervention interrogates cartographic conventions, thereby challenging socially-embedded assumptions regarding the representation of physical and cultural boundaries, and so global alliances and political sovereignty.
The resultant artifacts disrupt the reader's accustomed navigation through territorial boundaries, prompting a reconsideration of the inherent complexities underlying border delineations.

By halving atlases pages and affixing separator zippers along the incised edges, in *Border Crossing* (2006) (Figure 6) Beube focused again and reimagined new, dynamic and malleable boundaries as segments of disparate maps can be seamlessly joined, mimicking an analogue version of "cutting" and "pasting". These resultant sheets offer a kaleidoscope of possibilities as they allow to be interchanged and recombined, defying conventional perceptions of geographical demarcations. Whether laid out flat or fashioned into multidimensional shapes such as prisms, these compositions imbue the spatial plane with an illusion of depth, thereby subverting conventional understandings of geographic representation. The integration of a zipper-based system confers a newfound openness, facilitating the addition, removal, or interchangeability of pages at the user's discretion, thus redefining the boundaries between places, people and cultures.
In the bookwork *Fallen Borders* of 2014 the focus of reshaping boundaries gains more and more importance as each page undergoes a transformative process, involving techniques such as cutting, drilling, or sanding, which serve to disrupt and reshape the traditional boundaries of national, geographical, and cultural

identity. The project is conceptualized as a metaphorical battleground, wherein the physical alteration of the book's pages symbolizes the clash and fluidity inherent in the construction and dissolution of borders between nations. Notably, no external elements are introduced to the book; rather, the manipulation of existing materials accentuates the organic evolution of boundaries. The exposed layers of the book's covers, revealing the juxtaposition of green leather and yellow foam cushioning, evoke imagery reminiscent of spilled spaghetti squash, metaphorically suggesting the porous and malleable nature of territorial demarcations. A similar piece to *Fallen Borders* is *Shifting Borders* (2015) (Figure 7), but here every page is altered only by meticulously cutting elements from the overlapping maps of the atlas, thus leaving elements that strengthen the concepts of connection and confusion. Both the works *Fallen Borders* and *Shifting Borders* metaphorically reference the tumultuous process of restructuring national, geographical, and cultural delineations driven by political regimes and authoritarian leadership. They delve into the inherent ambiguity and uncertainty surrounding the establishment and recognition of territorial boundaries, wherein the exercise of power by political entities often results in arbitrary rearrangements of land and property ownership. Consequently, the reliability and clarity of delineating where boundaries precisely commence and cease become subjects of doubt and skepticism. Maps, rather than serving as definitive representations, are portrayed as imperfect approximations, further emphasizing the fluid and contested nature of boundary delineation in the geopolitical landscape.



Figure 4. Doug Beube (Hamilton). *Fault Lines* (2003). Altered Atlas. Photo: © Doug Beube.



Figure 5. Doug Beube (Hamilton). *Erosion* (2004). Collage. Photo: © Doug Beube.



Figure 6. Doug Beube (Hamilton). *Border Crossing* (2006). Altered atlas, collage, thread, zipper. Photo: © Doug Beube.



Figure 7. Doug Beube (Hamilton). *Shifting Borders* (2015). Altered atlas, collage, gouache. Photo: © Doug Beube.

4. Conclusions: Maps as Sociopolitical Visual Communication Projects

Matiyane's territorial representations and Beube's physical cartographic compositions provide imaginary but conceptually possible geographical configurations. Their visual action provokes new 'deterritorializing' desires as it premediates an a-territorial or a-bordered world (see Deleuze and Guattari, 1987). However, as Gilles Deleuze and Felix Guattari argued in their book *A Thousand Plateaus* (1987), 'deterritorialization' is just a preparatory phase that anticipates the transformative and creative moment of making new connections, reconfigurations and assemblages; and they named this moment 'reterritorialization'. The simultaneously destructive and constructive action of deterritorialization and reterritorialization theorized by the Philosopher and the Psychiatrist is not spatial rather social and cultural in a constant changing scenario. By transcending geographical, material and cultural boundaries the work of the two artists analyzed in this paper follows the same idea of spatial estrangement formulated by Deleuze and Guattari, and intersects spatial and sociopolitical discourse, engaging with issues of power, identity, and representation. Their borderless imaginary worlds, indeed, cause a profound upheaval and reconciliation between the spatial/representational and the social/communicative dimensions of chartography. Matiyane's imaginary maps and Beube's altered atlases can be considered, therefore, powerful visual communication projects, unique utopian panoramas that invite the viewer to experience new places in which spatial relationships are altered, destroyed and then reconstructed, and thus convey sociopolitical messages that underlie the fragility of strategies of transnational abuse and the search for social and economic equality. The described artefacts are indeed messages that "invite us to see and think about what is neither seen nor thought when observing real spaces" (Jacob, 1992, p. 50), but with a different approach, which – to simplify – we could define optimistic, utopian and naive in the case of Matyiane's imaginary maps, more critical, hermetic, apparently destructive in the case of Beube's altered atlases. The articulated structure of graphic elements and compositional criteria described, paraphrasing the words of Maria Linda Falcidieno, makes the manipulation of the representations of the territory conducted by the two designers a privileged form of expression that mediates between objectivity and subjectivity and which, taking advantage of the rich tradition of historical cartography, offers graphic-linguistic and physical-experiential solutions intermediate between a symbolic and iconic representation (Falcidieno, 2009, pp. 115-121). The reading and design of the territory – and above all its rereading and redesign –, therefore, open up to the development of a specific visual language in which the design components dialogue in an unusual but recurring and recognizable way. These works become a manifesto of a new form of pseudoscientific communication of the world, a multicultural simulacrum with a strong sociopolitical meaning. Their maps create new connections and paths, they are visions of a transactional identity ideologically close to a global dimension, they are projects of graphic-visual representation in which otherness and multiculturalism are values to be preserved, they are forms of visual communication of the territory which give "access to otherwise unattainable cultural and human spaces" (Quaggiotto, 2016, p. 228).

The analysis undertaken underscores an additional aspect intricately interwoven with the use of Matiyane's cartographic transformations and Beube's multi-dimensional collages: namely, the maps crafted by these two artists can be interpreted as expressions of a transnational identity within contemporary culture, rooted in the consumption of technology, each emphasizing distinct components. Matiyane's portrayal of cities invites users to traverse and enjoy the magnificence of panoramic vistas, thus navigating "virtual" spatial realms. This immersive experience disregards conventional metrics of dimension, proportion, and distance, fostering subjective and individualized exploration. Implicitly, Matiyane advocates for participatory engagement, facilitating an authentic analogical encounter marked by deliberate attention to localized identity details. Beube's altered maps and atlases, on the other hand, demand active involvement and interaction from viewers, enabling them to manipulate and overlay depictions of diverse terrains and landforms, stitching them together or substituting paper strips to create new configurations. Users are thus prompted to engage directly with the installation, assuming the role of virtual nomads navigating an idealized and imaginary landscape.

Notes

[1] Cartography is a science whose object is the graphic restitution of physical space on flat supports (geographical maps) through the symbolic representation of geographical, statistical, demographic, economic, political and cultural information (Tracanni Encyclopedia, 2010).
[2] The definition of mapping here provided and the listed different uses and graphic configurations that affect the production of maps today, come from the re-elaboration of the reflections conducted by Jerry Brotton (Le Grandi Mappe 2015, p.7), Lorenza Pignatti (Mind the Map 2011, pp.5-7; Cartografie Radicali 2023, pp.7-12), Katharine Harmon (YOU ARE HERE. Personal Geographies 2004, pp.15-19).
[3] Beube's bookworks descriptions written in this paper paraphrase and expand the explanations provided by the artists on his personal website: https://dougbeube.com/home.html.

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P/REFERENCES OF DESIGN

DOWNTOWN BERLIN AFTER THE REUNIFICATION AS AN EXAMPLE OF GLOBALISED DESIGN.

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KEYWORDS | BERLIN, REUNIFICATION, REVITALISATION, PUBLIC SPACE, URBAN DESIGN

ABSTRACT | After the fall of the wall in 1989, the revitalization of the city centre of Berlin, that is located in the former eastern part of the city, became one of the most important directions of the urban planning in Berlin. The leading model of the new planning was called “Critical Reconstruction” of the “European City”. That meant reconstruction and maintenance of the street pattern of the 19th century, of the block structure, of the height of the buildings, of stone facades, and of the open spaces. The structure and function of a vivid downtown, that implies mixed-use neighbourhoods, was not rebuilt. There are many similarities between the planning for American downtown areas and Friedrichstraße in Berlin. This is remarkable, because the official directing ideas of the German planning were the “Critical Reconstruction” and the “European City”. The reconstruction was not critical. The new downtown does not represent a European city, rather it has many components of American central business districts. Strategies to make our cities more livable have to be developed from the actual social, cultural, and economical situation of the city. In the case of post-wall Berlin, local Stakeholders, architects and citizens had very limited possibilities to influence, improve or even change this globalised design. Therefore, the center of Berlin has led to a mainstream design ignoring present local cultures and needs.

1. Revitalization in American City Centers

Modern city planning replaced networks of multi-use neighbourhoods with a model that separated living, working, production, and leisure within the city. The city was fragmented through this reduction of specialized areas to technical functions. This development started between the world wars. After the second world war there was an even bigger flight from downtown with large numbers of apartments and single-family homes being built in the suburbs. In some parts, this also meant racialized transformations of inner cities, including the white flight from downtown areas. Places of work partly persisted in the downtown areas, but offices were also built outside of downtown, following the idea of the decentralized concentration.



Figure 1. New York City Revitalization Project, Promotion. Photo: by the author.

1.1 Malls and Mixed-Use Developments

Shopping centers were constructed extensively in the countryside near the suburbs. They were autonomous compounds surrounded by parking lots, that had given up on the street concept. Leisure activities were directed towards theme parks also located away from the city. These fragments were connected through highways.

After this development downtown areas could only be used as tourists' attractions, if they had an attractive, historic core, which concentrated monostructurally and seasonally on visitors' activities. If they did not have an interesting heritage, they were ruined by neglect and often became ghettoized areas. This is the reason for the density of the city center to decrease while the density of the suburbs increases. In many cities in the USA, the suburbs have de-colonized the city. The suburbanites do not even come downtown to work, to go to the cinema or theatre, or to shop. They find all these amenities in their own or in a neighboring suburb. This flight from downtown has led to a deurbanization of downtown areas. Important attributes of city cores such as density, mixture of functions, and public transport were lost.

Following the decline and destruction of many buildings, the downtown was no longer a place with central functions and central importance, no longer a place of identification with the city. The centers have been deurbanized, and the downtown areas themselves have become suburbs of their own suburbs.



Figure 2. Car-Oriented City Centre Memphis, Tennessee. Photo: by the author.

Because of this development city officials and developers thought of two attempts of revitalization:

- Malls and mixed-use developments with own circulation systems in the sixties and seventies;
- Revitalization of the historic Main Street in the eighties.

In the sixties and seventies mega structures were developed to try to save the dying North American downtown areas. Mainly office towers, some shops, and few apartment buildings were built in city centers. These huge autonomous compounds also contain shops, hotels, conference rooms, and restaurants. They were frequently linked through skywalks. In cities with hot climate tunnels were constructed.



Figure 3. Inward-Oriented Shopping Center Eaton Plaza Toronto, Main Street Revitalization Atlanta, Georgia. Photo: by the author.

The mixture of types of buildings and of functions was given up in the center. Variety was only achieved by esthetic means through use of different materials, form or color of the buildings, rather than through different functions or variety in use.

Urban life was concentrated in certain locations, certain hours, and certain categories of 'acceptable' activities. After working hours and on weekends, the center is devitalized through the functional monostructure.



Figure 4. Downtown by Car in Boston, Massachusetts, Driveway New York City. Photo: by the author.

The main entrances are directly from the underground parking. Blank walls homogenize the streets. The compounds do not animate the surrounding streets and sidewalks. They are self-centered, and lack direct street relation. Their inner circulation systems inverse indoor and outdoor space. Public streets are

emptied through parallel circulation systems as passages or skywalks. Moreover, streets become more and more dangerous, because they are not observed and controlled by passers-by anymore.

Originally passages were thoroughfares or shortcuts between streets. However, they were developed as systems that attract their own population and divide it from the ordinary person on the street. The mixture of the urban population to be observed on public streets is hardly possible in malls and indoor plazas, and it is not wanted. The indoor worlds are realms with special regulations. Users have to be willing to follow the rules, e. g. to consume, or they are excluded. Groups of people are thereby segregated. “The public” is divided into several “publics” of populations of the same descent, education, income, and way of thinking.

The indoor worlds such as shopping malls, arcades, atriums, underground cities, and skywalk systems want to substitute for the lost public space in streets or on plazas. These spaces are nearly always privately controlled, offering privatized versions of the once-public street life. The potential for these plazas to be truly public is highly dependent on the owner’s attitude. Therefore, the result is privatization and control of open space and public life.

Therefore, the construction of huge, autonomous mega structures did not lead to a livable city center. These compounds did not animate their surrounding open spaces. The cities’ physical appearance became similar throughout the continent. The downtown areas therefore lack individual character.

1.2 Simulated Main Streets as Revitalization Strategy

In the eighties and nineties, the disadvantages of this development were taken into account by planners and politicians. They looked for a new strategy to revitalize the deserted and unsafe downtown areas, and they wanted to give their cities a new identity. Preservation of the historical heritage of small-scale buildings directed towards the streets, emphasis on walking instead of driving, and a vital street life, became the new guidelines for the restoration and creation of the American downtown areas. Where historical complexes were already destroyed, new buildings with historical appearance were erected. Naturally grown cities were simulated.



Figure 5. Atlantic City Building Type Simulation. Photo: by the author.

2. Revitalization in a European City Center: Friedrichstraße in Berlin

From an urban design point of view, the situation in the city center of Berlin after the fall of the wall in 1989 can be compared to the situation in some American city centers in the sixties. The reasons for this and the history are very different, obviously, but the situation of the central area in Berlin in the year 1989 resembled many American downtown areas. A disperse building structure with many voids was prevalent, there was no vital street life but many deserted open spaces.

2.1 “Critical Reconstruction” as Urban Planning Goal

After the fall of the wall, the revitalization of the city center, that is located in the former eastern part of the city, became one of the most important directions of the urban planning in Berlin, mainly for political reasons. The political situation was very different from the one in North America, evidently, but the dynamics and intentions for the revitalization were similar.

The leading model of the new planning in Berlin’s center was called “Critical Reconstruction” of the “European City”. That meant reconstruction and maintenance of the street pattern of the 19th century, of the block structure, of the height of the buildings, of stone facades, and of the open spaces. It was developed by the municipal city planning office with very little influence of the local people or by local architects. The main driving factors of this development were commercial ones.

Besides Potsdamer Platz and Alexanderplatz the Friedrichstadt with the central Friedrichstraße was one of the main revitalization areas. It was based on a street concept. The building type that was introduced to fill the street was called a “mixed-use commercial building”. It consists of nine stories above ground and four below ground. The first and second floors as well as the first basement floor were filled with shops and restaurants. From the third to the seventh floor offices were planned. The eighth and the ninth story were reserved for apartments, and the remaining three underground floors contained parking.

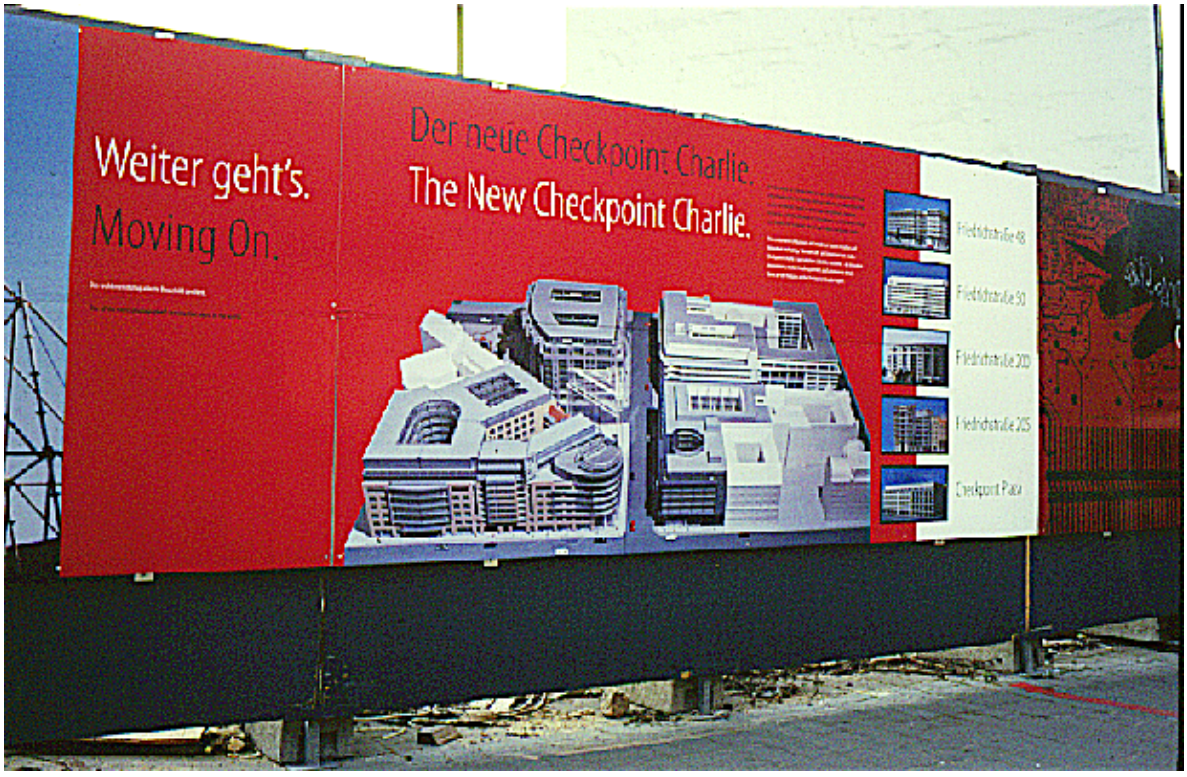


Figure 6. Berlin, Checkpoint Charlie at Friedrichstraße Revitalization Project. Photo: by the author.





Figure 7. Friedrichstraße Building Type. Photo: by the author.

2.2 Simulation of Historic City Patterns

These “historical downtowns” can be interpreted as theme parks of history. The functions in these new, pseudo-revitalized city centers and in the renovated areas were directed towards tourism and shopping, not towards living and working in an urban environment. Downtown areas were transformed into museums or into drive-in shows.

The simulation of city life did not lead to a revitalization of the downtown areas based on real and diverse urban life, but it intensified the negative tendencies that were already introduced in the sixties: monostructure of functions, commercialization, segregation of the urban population, privatization and control of open space. Malls and revitalized Main Streets are similar concepts. Housing had to be 20 per cent in this building type.
This was achieved with small luxury apartments on top of the buildings as well as apartment hotels. In comparison to other city centers in Germany this figure is very low. Housing occupancy in the center normally is 50 to 80 per cent.



Figure 8. Is Berlin Located in the USA and Only Accessible by Car?. Photo: by the author.

The most prestigious project in these areas is the Friedrichstadt Gallerias (“Friedrichstadt Passagen”). They form three blocks in the center of the Friedrichstrasse, near the legendary boulevard “Unter den Linden”. (Block 207: architect Jean Nouvel, investor: Roland Ernst; block 206: architect Henry N. Cobb, investor: Tishman Speyer Properties; block 205: architect Oswald Mathias Ungers, investor: Arc Union/Bouyues).

1400 million DM was invested for a brut floor area of 99600 square meters, containing 35 per cent shops and restaurants, 59 per cent offices, 5 per cent apartments and 1 per cent cultural functions. The floor area ratio is 6.5. The three complexes are connected by an underground passage.



Figure 9. Friedrichstadt Gallerias Shopping Mall, Block 205, Block 205. Photo: by the author.

2.3 Similarities in City Planning – Globalised Design

Comparing this German strategy of downtown revitalization with the one in North American city centers, several similarities are notable. What both have in common is the reevaluation of the city center. But this return to the center is mainly a geographical one. The structure and function of a vivid downtown, that implies mixed-use neighborhoods, was not rebuilt.

Historically, the city of Berlin consisted of many similar mixed-use neighborhoods. The center is now directed towards service and business, whereas huge housing areas are built as suburbs outside of the city. Berlin is fragmented by this specialization.
The displacement of housing towards the suburbs leads to a deurbanization of the center by means of depopulation. The center is only frequented during rush hours and lunch breaks. At night and on weekends, it is becoming a deserted area. In Germany, there is a high demand for housing in the city center. Therefore, this planning means mismanagement.

The regulation of street width (22 meters) and the height of new buildings (22 meters) was set up to create a homogeneous streetscape. However, homogeneity in a negative way results from monostructures. The new buildings in the Friedrichstrasse contain shops, banks, automobile showrooms, offices, and hotels. The center now is a central business district displaying multi-national chain stores and not an individual city center. Moreover, this one-dimensional monostructure of functions can hardly adapt to changing needs of different uses.

The banks and car showrooms of the Friedrichstraße do not encourage window shopping and strolling along the sidewalk. The shopping compounds and indoor galleries do not attract street life, in fact they lack a direct street relation. The autonomous complexes of the Friedrichstadt Gallerias are directed towards their interior rather than towards the street. Private indoor plazas like the “Place Voltaire” in block 206 want to substitute for outdoor public streets and plazas. These commercial buildings have direct access from the parking garage. This leads to a social devaluation of the street.



Figure 10. Inward-Oriented Building Type and Simulation of Building Type in Berlin. Photo: by the author.

The tendency of gentrification is also obvious in the Friedrichstraße. Small shops and little trade and craft businesses, families and subcultures were expelled through demolition of old buildings or high rents. The new trade spaces and luxury apartments are directed towards high-class shops, high-profile businesses, and high-income professionals.

The regulations, which have directed the design of Friedrichstraße, originate in the late 19th century city (street pattern, block structure, height of the buildings, stone facades). In some places this also led to a simulation of a naturally grown neighborhood in blocks that were divided into pieces simulating different architectural styles and ages, and to the construction of new buildings that pretend to be old.

The historical tradition of Friedrichstraße as a nightlife area, as it was in the twenties, with many bars, clubs, and theaters is an image which the new builders want to promote in their advertising, to give the street back its historical value as an address. But they did not supply the street with the functions that make a street vivid.

There are many similarities between the planning for American downtown areas and Friedrichstraße in Berlin. This is remarkable, because the official direction of the German planning was a regional one: the “Critical Reconstruction” and the “European City”. There were inhabitants, researchers, planners and architects who raised their voice against this development. This only had a minor effect. The public discussion and the economical promotion of Friedrichstraße were hypocritical. The new downtown does not represent a European city, rather it has many components of American central business districts and therefore is an example of globalization in architecture and urban design.



Figure 11. You are leaving the American Sector, Friedrichstraße at Checkpoint Charlie, Berlin. Photo: by the author.

3. Conclusion and Outlook

If we want our cities and their public spaces to be open, human, accessible, and adaptable to changing causes and fashions, how can we achieve it?

Developing general guidelines for city planning is not the right direction. Efforts that are made to solve the city through developing general city patterns are questionable as revealed above concerning the recent development in Berlin. Strict guidelines often become recipe books that contain overall proposals for urban planning. They are based on the wrong assumption that common design guidelines can fit every city and every town. But every city has its own language, pattern, history, and requirements, and thus it has to be analyzed and designed individually. But some points should always be taken into account concerning planning and revitalizing cities:

The downtown area has an important role for the whole city. In economic terms, constructing in the center is desirable, because the technical infrastructure already exists, whereas in a new suburb it has to be constructed newly. Public transport often serves the center, if it has not already been dismounted. For ecological reasons, a city should be planned and built in a dense and urban manner in order to stop the urban sprawl.

City planning has to direct towards the urban population. Each city and each business are dependent on their users, consumers, and passers-by. A city center that is not planned according to the residents' needs and desires will not survive, neither in an economical, nor in a social way.

The planning process has to become more democratic. City planning may not be dominated by speculation. Local community groups and local architects should be involved in the planning.

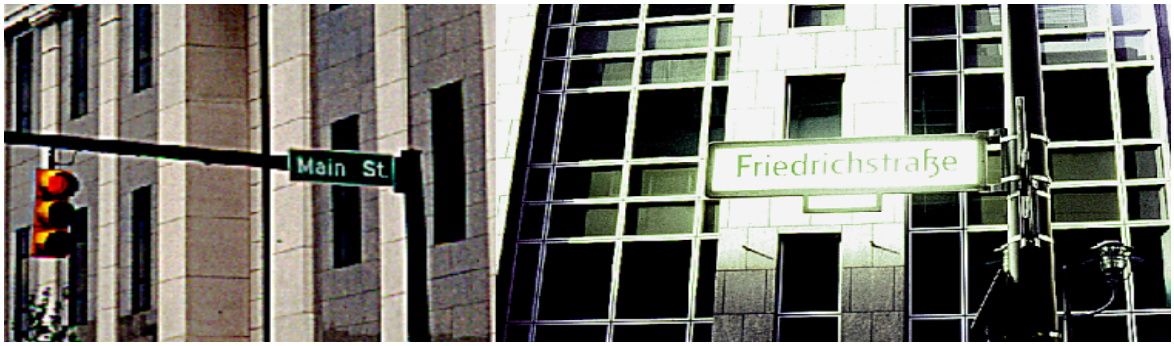


Figure 12. Similarities between US Main Streets and Friedrichstraße in Berlin. Photo: by the author.

Adaptability and flexibility are key words in city planning. Historical cities have survived because they are based on flexibility. Monostructures and the creation of a final situation of a city, as it was done in the Friedrichstrasse in Berlin, contradict the adaptability of the city to changing needs.

One essential quality of the open spaces is accessibility and multifunctional use. Plazas and streets, that are only accessible to a limited part of the population, and that are only serving one function, are not truly public.

There are, however many examples of successful revitalizations in Berlin and elsewhere. Strategies to make our cities more livable have to be developed from the actual social, cultural, and economical situation of the city. For every planner concerned with the urban environment, this presents a tremendous challenge.

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P/REFERENCES OF DESIGN

DESIGN RESEARCH INCUBATION: REFLECTIONS ON HOW TO FOSTER DESIGN RESEARCH.

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KEYWORDS | DESIGN EDUCATION, SUPERVISION, REFLECTION, COURSE BOOK

ABSTRACT | The contribution outlines a research project exploring the supervision of design research. ‘Design Research Incubation’ aimed to foster exchange between different perspectives on design research from regional and disciplinary contexts. It also searches to contextualize design research within more expansive geographical environments of centres and peripheries. These goals were motivated by our observations that the nature of design research in relation to design practice and research in other subjects often confuses students, supervisors, and colleagues. Additionally, interpreting research findings requires an understanding of cultural, demographic, socio-economic and geographical contexts.

The research was a collaboration between the German University in Cairo (GUC) and Anhalt University of Applied Sciences in Dessau (HSA). Both institutions have diverse student and faculty populations. At GUC, design students from various backgrounds in Egypt study with an internationally diverse faculty. Anhalt University offers two English-language design master programs and has research centres in architecture and design.

1. Introduction

The project brought together six design master students from the German University in Cairo (GUC) and their peers at Anhalt University of Applied Sciences in Dessau Germany to discuss their design research projects. Workshops focused on critical reflection, including clarifying research questions and projects, relating theoretical and practical research, and visualising topics and processes.

Observations from these discussions prompted the development of a 'speculative course book' compiling sources to support design research supervision. It includes five modules: 1) Design Research as an ethical position, 2) Design Research as an expedition, 3) Design Research as knowledge circulation, 4) Design Research as context, and 5) Design Research as supervision. The modules are not finalised course descriptions but provide conceptual and practical guidance on engaging with different phases when supervising a design research project. The defined modules may help to enrich environments and processes for conducting and supervising academic design research in most settings, such as master or PhD programs in other regions of the world. At the same time, these modules aim to encourage attention to contextually specific characteristics in different cultural, demographic, socio-economic and geographical environments.

One of the main challenges deals with uncertainty student researchers experience in the design research process. In their studies students have come to rely on following the rulebook and applying design methods, e.g. design thinking, often in a top-down process, which makes them feel safe. As design researchers however they have to resist the urge of applying this top-down rationality, but instead remain open to new findings and emergence. For many this resilience to insecurity is a challenge and needs to be learned (Hall & Hohl, 2023).

The course book invites others to contribute ideas and join ongoing discourse and experimentation in the field. It is a starting point for collecting a broader range of supervision materials and further exploring design research's nature, scope, and methodologies of design practice and research relating to other disciplines. Therefore, we invite interested parties to join us in expanding this peer-to-peer exchange and developing frameworks, strategies, and practices for further design research supervision in different regional and institutional settings.

2. Course Book as a Sourcebook: A Critical and Speculative Compilation of Ideas, Concepts and Tools to Support Design Researchers

During our research project, each of us was supervising design researchers. Anhalt University offers three design master programs. One is the Master of Arts in Integrated Design (MAID), and the other is the more cultural history-oriented Master of Sciences COOP Design Research in cooperation with the Bauhaus Dessau Foundation and Humboldt University in Berlin. Both are conducted in English, while the Master of Arts in Intermedial Design (MID) is mainly in German. Anhalt University also has specialised research centres, such as the Centre for Doctoral Research in Architecture and Design and the Materiability Lab. Most master students in Dessau pursue their postgraduate studies as full-time students. At the GUC, students pursue their Master of Sciences in Design individually under supervision by one of the faculty members. Prior, they complete the so-called premaster year, consisting of semesters nine and ten of their bachelor studies. In Egypt, a bachelor degree requires ten semesters of study, but the curriculum at the GUC adapts a typical German bachelor curriculum of eight semesters. In these semesters nine and ten students complete compulsory studio and theory courses, required for obtaining a bachelor degree. However, those students who wish to can use those courses, which they share with the whole bachelor batch, to prepare for a potential master thesis. These two semesters then become also the first two semesters of a three-semester-long master program. However, in reality, those students who are interested in a master degree usually begin a new research project after the premaster year and spend longer than one semester on completing a thesis. Most of them are also teaching assistants and conduct their research part-time.

Despite the differing formats and conditions of the master programs at Anhalt University in Dessau and the GUC in Cairo, as supervisors of young design researchers, we found that our experiences overlap. Thematic areas or challenging phases in the research process, e.g. identifying research interests while new design concerns continue to emerge do not differ much for design researchers and supervisors in Cairo and Dessau. Therefore, we defined five modules, which form the basic structure of the publication 'Design Research Incubation'. The modules take the style of speculative course folders. They are not finalised course descriptions with defined learning outcomes, readings, tools and other materials but try to provide food for thought for engaging conceptually and practically with a design research project during different phases. We extracted the following five modules from our discussions during the project:

1. Design research as ethical position: How to identify values, mindset and principles
2. Design research as expedition: How to immerse into an unknown voyage
3. Design research as knowledge circulation: How to structure, express and communicate research in a thesis
4. Design research as context: How to embrace diverse circumstances in research
5. Design research as supervision: How to be accompanied in the design research process

The book also briefly documents our research visits to Dessau and Cairo because many of the ideas for the modules emerged during the conversations with the master students who participated in this research project. They made us realise that our initially anticipated goal to formulate guidelines for supervising design research was probably not the most helpful outcome due to the manifold topics and their different research requirements.

The modules are a starting point for collecting more helpful material for design research supervision. Moreover, they aim to foster a broader discourse on design research relating to design practice and research in other subjects. What are the nature and the scope of design research projects? How do they differ from the research inherent to every design project regarding users, target groups, market surveys, resources and the like? What implications do such differences have on methodological approaches? How can we debate and explore design research with students embarking on this journey? Other researchers have already discussed these questions (Findeli, et al, 2008). We consider our course book as speculative because we speculate about how to foster design research conceptually and practically in the five modules, which are briefly outlined in the following section.

3. Course Book Modules

3.1 Module 1 – Design Research as an Ethical Position: How to Identify Values, Mindset and Principles

In the design realm, practicality, ingenuity, and empathy guide the process alongside skills acquired during education (Cross, 2006, p.3). However, for emerging academic design researchers, additional emphasis is placed on ethics, critical thinking, and meticulousness. This transition challenges the conviction of designers with the scepticism of academic researchers. The mindset of a researcher calls for critical thinking, self-awareness and humility in order to navigate ambiguity and diverse perspectives. Therefore the following aspects gain importance:

Posture and mindset: Terry Irwin (2015, p.235) argues that "Living in and through transitional times requires a mindset and posture of openness, mindfulness, self-reflection, a willingness to collaborate, and 'optimistic grumpiness'." As designers we might be experts, but as academic researchers we are becoming learners again. We might be wrong, and we might make errors. Our perspective is one among many different perspectives.

Practice-based design theory: Design research discussions aim to engage with practice and theory equally, integrating theoretical knowledge into practical contexts and vice-versa. The goal is to foster knowledge of practices within academic institutions while ensuring discussions reflect the diverse domains and communities represented (Hohl et al, 2020).

Ethics and aesthetics: Balancing efficiency and effectiveness by acknowledging the impossibility of perfect objectivity. Second-order cybernetics views the observer as a part of the observed system, where he influences the design and research process. Reflective practitioners consider both efficiency and effectiveness as important, weighted by the values of the ends achieved. They recognise the impact of their values, postures and mindset on expectations and interpretations (von Foerster, 2003).

Gatherings: These encounters provide inclusive spaces for diverse perspectives on design research, encouraging reflection and challenge. Regardless of background or experience level, participants contribute insights from lived experiences. The following rules of engagement in gatherings guide the ethical position of design research, promoting critical reflection, inclusive dialogue, and ethical conduct in academic discourse:

- Gatherings as spaces where teaching, learning, and research intersect, inviting all references and insights from all parts of lived experiences of people with diverse backgrounds and experience levels who participate;
- Respectful disagreement with a generous attitude towards all present;
- Use straightforward language to make the forum accessible to everyone, never assuming that other people know what we know, always avoiding name-dropping, unsubstantiated references to unexplained arguments, and explaining the meaning of jargon if it is necessary;
- Use English as the language of communication while welcoming comments and questions in the language the participants feel comfortable with which experienced members will help to translate;
- Inclusivity, where in case of specific accessibility needs, the organisers will find solutions;
- Respectful treatment of everyone (in presence and online) and the creation of a welcoming environment, for which everyone takes care that the behaviour meets these standards;
- Empathy to the vulnerabilities of others and avoidance of violence through words or images, discussing with experienced members and organisers if there is a need to share potentially disturbing material.

3.2 Module 2 – Design Research as Expedition: How to Immerse into an Unknown Voyage

Aspiring design researchers, such as master students, often enter their projects with preconceived notions of the outcome – a product, a campaign, or even an app. However, this assumption highlights a common misunderstanding: the belief that the research result is predetermined. However, design research diverges from traditional design practice as it involves exploring abstract concepts through practical experimentation and theoretical reflection alike.

Design research encompasses diverse approaches, including investigations about design historical and contemporary practices as well as practice-led inquiry where design work is used as a research method to explore the concerns and questions at hand, e.g. how to bring innovative practice in different design disciplines forward. Research results may not necessarily be final design projects but critical analyses, speculative concepts, or frameworks guiding future design practices. Challenging the notion that design researchers must solely solve problems, the process is more about embracing open-ended exploration. Practice-led research involves continuously asking and expanding the canon of questions, experimenting and offering valuable learning opportunities through successes and failures alike. Embracing the uncertainty and serendipitous discoveries enriches the research journey, leading to novel insights.

In fostering rigour, honesty, and values in research, doctoral-level and master-level inquiry demands critical, reflective, thorough, exhaustive, accurate, systematic, and honest approaches. This rigour emphasises both breadth and depth of understanding and a commitment to questioning assumptions and scrutinising every facet of the research process.

A proposed course on critical thinking in design research aims to equip students with theoretical and practical competencies. Students develop critical thinking skills for innovative design research by exploring diverse research methodologies, perspectives, imagination and storytelling, and engagement with diverse cultural knowledge systems (Escobar, 2017). The course shall encourage students to apply design research methodologies to real-world challenges with a critically reflective mindset. The preliminary syllabus covers fundamental concepts of design research, practical research methodologies, and the application of critical thinking to design projects. Students will engage in critique sessions and presentations, fostering intellectual growth and creative problem-solving skills. The course syllabus serves as a framework, adaptable to meet students' and instructors' evolving needs and interests by facilitating a dynamic learning environment. Three relationships we found to be vital for developing a researcher mindset in design (Fig.1):

1. Making and practice through ideas that are developed and refined;
2. Research questions that emerge from design problems in design practice;
3. Importance of embracing failure and error in practical experimentation for research insights.

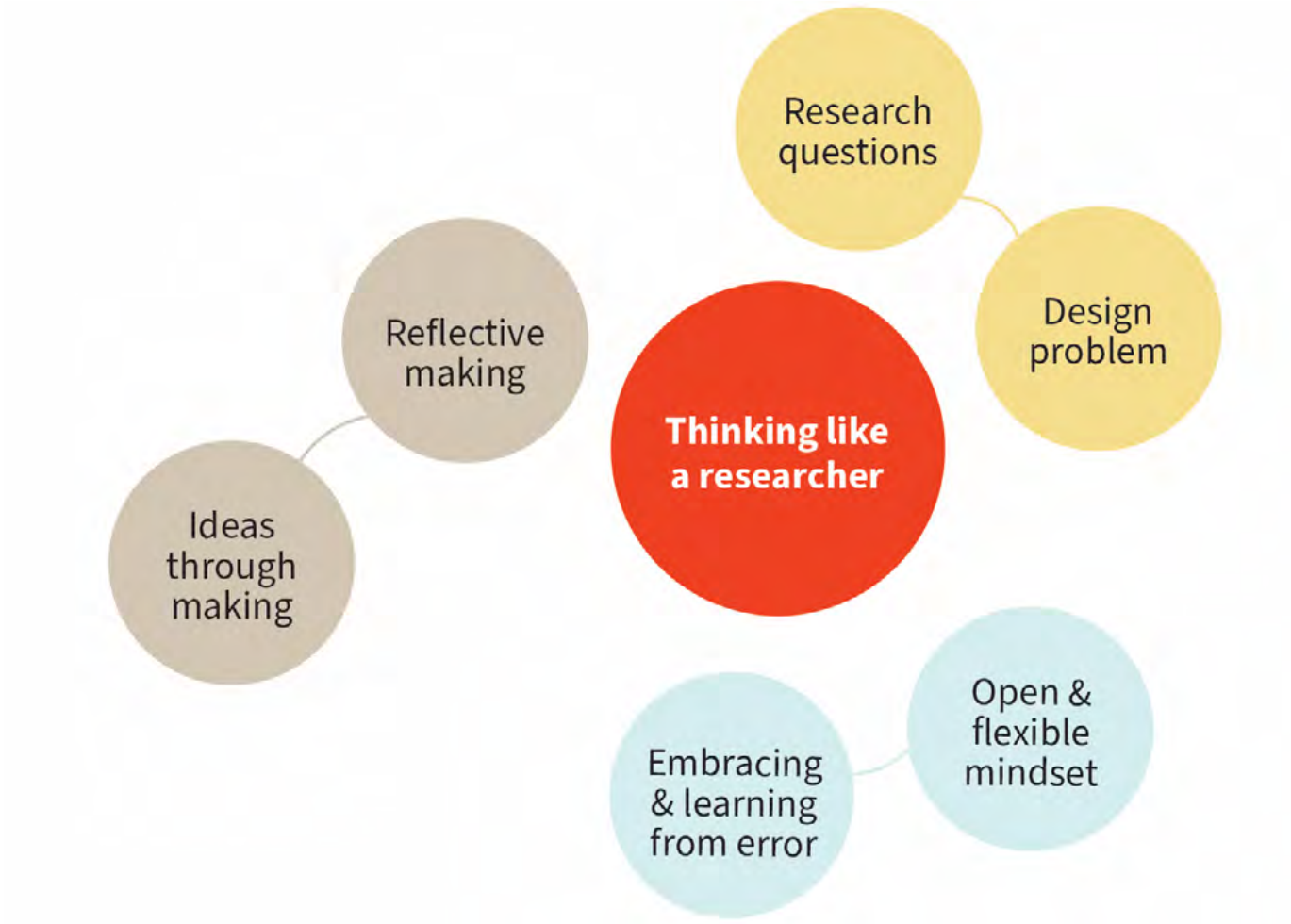


Figure 1. Mindset of a researcher. Developed by the authors during the research project.

3.3 Module 3 – Design Research as Knowledge Circulation: How to Structure, Express and Communicate Your Research in a Thesis

Design researchers, especially new ones, often conduct their research with much consideration. They define a research methodology, collect data accordingly, and try to make sense of their insights. They experience the highs (when making exciting discoveries) and lows (when being lost and confronted with more questions than answers) like many other researchers.

Writing a thesis about their research process and results is challenging for most design researchers. They never got used to writing. Structuring and writing texts have usually not been at the core of their previous studies. Unlike students and professionals of other academic disciplines, designers do not usually write much apart from small descriptions in project presentations and documentations.

However, the ability to communicate design research projects is vital (Fig. 2). We think it would be beneficial to design a course that focuses mainly on academic writing skills for designers, including hands-on exercises and developing competencies in using up-to-date digital tools. A course description could look like this:

> **Course description: Reflective writing and communication**
> Effective communication is vital for design researchers to share their insights and findings. However, many designers face difficulties structuring and expressing their research in a thesis format. This course addresses this gap by equipping students with practical knowledge and insights in reflective writing and communication. Students will learn how to apply language effectively, ensuring correctness, clarity, engagement, and delivery. Additionally, they will gain proficiency in standard academic writing rules, language styles, and citation formats. Emphasis is placed on utilising digital tools for writing, particularly for non-native English speakers.



Figure 2. Impression from the workshop in Dessau, 2023: gatherings and discussions on communicating design research projects.

3.4 Module 4 – Design Research as Context: How to Embrace Diverse Circumstances in Your Research

Design research necessitates understanding context, which we define as the circumstances surrounding an event or idea. This contextual awareness is crucial as it influences the thematic focus, research methodology, and outcomes of design research endeavours. Various factors, such as geographical

location, cultural norms, and socio-economic conditions, significantly impact research processes and conclusions.

Design topics may initially appear universal but require consideration of diverse contextual factors. For example, waste management strategies differ between Cairo and Berlin, Egypt and Germany, and other places, or between rural and urban areas. Similarly, cultural attitudes towards consent and data collection methods vary. For example, Egyptian students face problems when they ask informants to sign consent agreements as informants become suspicious of the researcher and less willing to share information freely. Accessibility to research locations and power imbalances caused by demographic and socio-economic differences between researchers and participants affect many research processes. Moreover, context extends beyond tangible factors to encompass differing worldviews and knowledge systems. Clarifying understandings and avoiding assumptions are vital when engaging with participants from diverse backgrounds. In feminist theory, context is an intrinsic component of situated practice, highlighting the interconnectedness of circumstances within a specific situation:

> "We do need an earthwide network of connections, including the ability partially to translate knowledges among very different – and power-differentiated – communities. We need the power of modern critical theories of how meanings and bodies get made, not in order to deny meanings and bodies but in order to build meanings and bodies that have a chance for life." (Haraway, 1988, p.580)

On a different level, looking at feminist theory also offers a valuable perspective on the 'context' of young design researchers. Following Donna Haraway, only "situations" exist, including the circumstances creating the situated practice. According to feminist sociologist Adele Clarke, context does not exist outside the actual situation but is a component of a specifically situated world: "The conditions of the situation are in the situation. There is no such thing as 'context'" (Clarke, 2005, p.72). The diagram of a situation mapping presents all conditions influencing a master student's situation besides the thesis project (Fig. 3).

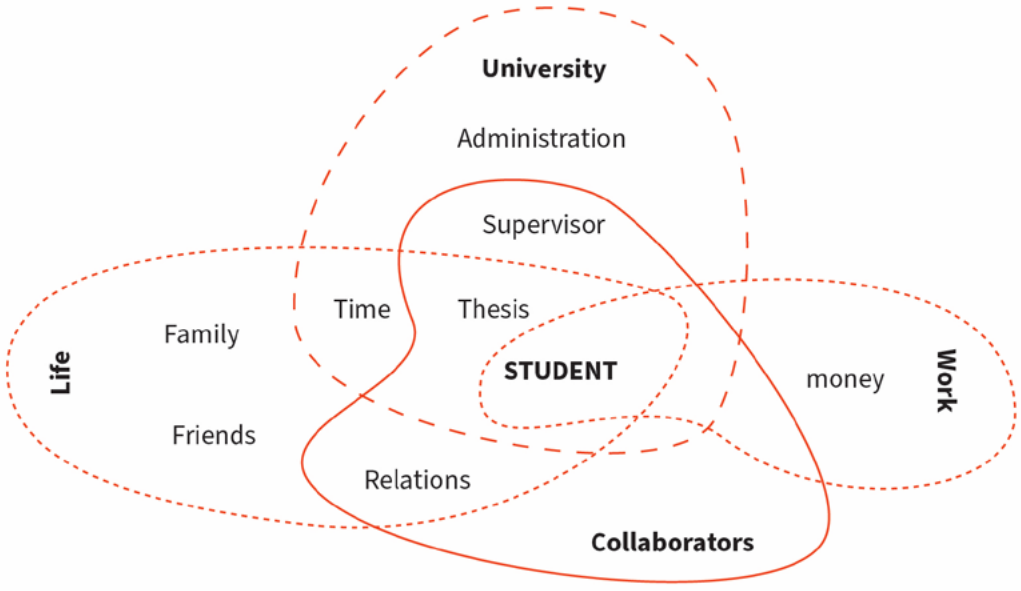


Figure 3. Situation mapping of doing a thesis.

Transitioning from design practice to academic research can evoke vulnerability and uncertainty. Accustomed to confidence in the creative process, designers may struggle with doubt and scepticism in research. Furthermore, designing is a research-driven process, blurring the distinction between the role of the designer and the researcher. In conclusion, embracing diverse circumstances is integral to effective design research. By acknowledging and navigating contextual complexities, researchers can generate nuanced insights and contribute meaningfully to their different fields of interest.

3.5 Module 5 – Design Research as Supervision: How to Accompany a Design Research Process

This module briefly outlines our view of design research supervision at the master and doctoral levels. We discuss the roles and responsibilities of the supervised learner and the supervisor.

Supervisor: In our view, a supervisor is a 'guide on the side'. It is not the supervisor's thesis project. He or she tries to support the learners in finding their way, thus taking ownership of their research and learning process. Supervisors guide through recommendations, giving information, and communicating reliably, regularly, constructively, and clearly. We also strongly support the idea that those who supervise thesis projects have regular exchanges with other supervisors, sharing their observations, knowledge and experiences and recommend offering workshops for supervisors about supervision responsibilities.

Learner: What can the supervised student expect from their supervisor?

At the first meeting:

- Information about roles, expectations and timescale, the relationship between project work and written thesis, theory and practice, assessment criteria, ethics, honesty, and consequences of cheating and plagiarism;
- Agreement on the frequency of meetings, possibly more frequent in the early research stages.

During the process:

- Time for regular meetings and tutorials;
- Relevant and constructive feedback;
- Timely responses to email enquiries.

From the supervised design researcher/learner the following is expected:

- Responsibility for their research process;
- Honest communication with their supervisor;
- Motivation and reliability;
- Preparation for tutorial meetings;
- Reaction to feedback from supervisors;
- Own decisions regarding the research project and discussions about those decisions;
- Establishment of practical and theoretical knowledge to build on;
- Management of own work plan, including goals and pace of work;
- Clear communication that includes worries and doubts;
- Acceptance of advice;
- Proactivity in sending agreed outputs on time.

One critical message supervisors can communicate to young design researchers is that finding answers to questions can be limiting. Research that opens up more questions and hence inspires further research can be classified as successful research (Fig. 4).

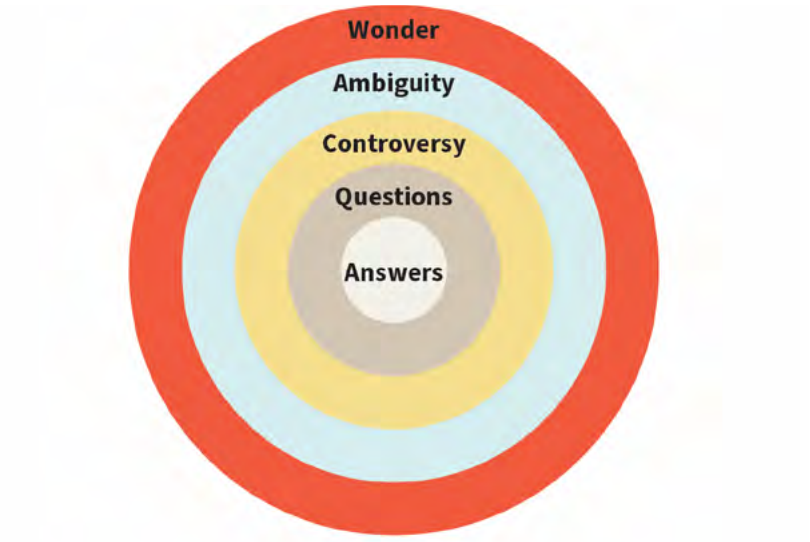


Figure 4. From answers to questions to wonder and curiosity in research (adapted from Wesch, M., 2014).

In school, students learn that knowledge is about how to answer correctly. In graduate studies, young researchers might learn how to ask questions, have discussions and realise that beyond the syllabus, knowledge is steeped in ambiguity and controversy, that there are different perspectives, and that there may be many possible answers, perhaps none of them entirely satisfying.

As reflective practitioners (Schön, 1984) and researchers, those researchers also learn how to reflect, question and be sceptical. As researchers, it is here where they might find new avenues for research worth exploring. However, they must suspend their desire for certainty and learn to embrace ambiguity, uncertainty, and curiosity, and as such trust that through the research process new insights will emerge. They must become more interested in questions than answers, as questions, observations, and critical thinking may drive their research and learning. It may conflict with their learned stance of seeking answers instead of seeking questions. Sometimes, unlearning is the most promising road forward.

At the beginning of an academic design research expedition usually comes the proposal that outlines the research interest and its methodological approach, which is not an easy task. In order to support design researchers at the starting point of their expedition, the following worksheets have provided supportive guidance since they were first introduced to prospective GUC master students (Table 1).

Table 1. Support for framing a design research topic.

01. What design research topic do you propose?		
Guiding questions:		Open questions and comments:
What is it that you are interested in?	How did you become interested?	
What do you want to investigate?	From your personal experiences?	What are you still insecure about?
What are your questions?	From your academic experiences?	
What challenges do you observe?	From your professional experiences?	
02. What is the character of your research?		
What makes your research design research?		Open questions and comments:
What distinguishes your research from research in other disciplines?		
Are you researching design practice, historical or philosophical design aspects or design by others?		What are you still insecure about?
Are you researching through design by exploring through practical design experiments)?		
Are you researching for design (improved design practices)?		

03. What is the story of your topic?	
Problem statement: Tell a story of how and why you became interested in exploring this topic.	Open questions and comments: What are you still insecure about?
04. What are your research questions and your purpose statement?	
Narrow down your primary research question(s): Based on your responses above, state what you want to explore in question form here! Try to make it as focused and specific as you can. What are your questions?	Purpose statement: Turn your question into a purpose statement, which conveys the same information as the research question(s)Example: 'The purpose of the study is to …' State why your research is significant and to whom?
	Open questions and comments: What are you still insecure about?
05. What is your methodological research approach?	
Anticipate your research Research changes in the process, but it is good to anticipate how you will find out what you are interested in — even if you might not implement it exactly like this. Describe how you think of conducting your research! Which research methods do you have in mind?	Open questions and comments: What are you still insecure about?
06. How would you visualise your research process?	
Sketch and map different aspects of your research: Interest Methods Involved research partners Locations	Open questions and comments: What are you still insecure about?
07. Which terminology do you need to familiarise yourself with and define?	
Clarify terminology: Which terms belonging to the field of your research interest are unclear to you? Which ones are ambiguous? Define them for your research based on dictionary definitions or literature specifications!	Open questions and comments: What are you still insecure about?

(Based on worksheets prepared in 2022 by G. Kulick using a preliminary worksheet set developed by R. Sadik in 2013)

4. Reflections: What We Think is Needed for a Better Design Research Supervision Ecosystem

So, what can we do as supervisors to mitigate the confusing situation experienced by practitioner-researchers, pay attention to cultural, socio-economic and other differences and as such also negotiate the tension between centre–periphery when it comes to applying research methods and ethics in design? Summarising this paper, our common experiences across different cultural and institutional environments regarding design research and the supervision of design research include (but are not limited to):

For the young design researchers:

- The difficulty of trusting an open-ended research process instead of pretending to already know the outcome at the beginning of the research process, which would feel safer;
- The confusion about the role of design practice in design research and the resulting negotiations of this relationship in each design research project;
- The challenge of writing an academic thesis while not being familiar with this process from undergraduate studies.

For the supervisors:

- The difficulty of defining a supervision structure that delegates responsibility to the researcher while assuring him or her that they can get guidance from their supervisor when needed;
- The situation that research topics are so diverse that a supervisor cannot always have detailed knowledge about each topic.

There were also differing experiences: while at Anhalt University master students study in one of three structured master programs, at the GUC the master students study on their own and consult individually with their supervisor.

What both young researchers at master and PhD levels as well as supervisors experience as fruitful is a regular exchange, sharing their research progress and receiving and providing input from and to each other.

Through our exercises with the GUC and Anhalt University master students, and the exchange with them, our colleagues, and ourselves, we identified a few points that require attention when supervising design research projects. The following list is not static but an invitation to develop a 'community of practice' (Wenger et al., 2002) between design research supervisors and design researchers in more institutions. As a side note, a 'community of practice' requires 1) a domain consisting of shared particular expertise and interest areas (not just any loose network of people), 2) a community sharing activities related to the domain regularly, and c) a practice, which is more than sharing viewpoints and theories, but means to work together actively (Wenger, et al, 2002; Wenger-Trayner & Wenger-Trayner, 2015).

What do we need then to develop such a community of practice around design research supervision?

1. An understanding that the knowledge of what design research comprises is not a static knowledge base but changes alongside the emergence of topics, theories, research methods, tools and methodologies;
2. Opportunities through collaboration and exchange with fellow supervisors and researchers inside our institutions and other institutions, for developing and creating access to resources that support design researchers and their supervisors;
3. A culture of critical reflection and exchange with colleagues that we must continue to research, supervise and foster;
4. The ability and the will to learn how to listen with the intent to understand and communicate often and with clarity;
5. Curriculum strategies at the undergraduate level, that convey the essential role of critical reflection in successfully learning how to design for current and contextual design concerns;
6. Prerequisites that enable us to implement our ideas for such a more dynamic research environment, including the creation of programs, extracurricular platforms and events such as conferences and symposia, focusing on supervision strategies for design research.

What we find important is to mention that this need for a community of practice of design research supervision differs from other design research communities, of which already many exist, insofar as the focus is on supervision strategies.

Some of these strategies or parts of them have already been attempted. For example at the GUC a master course is currently not part of the curriculum but a master colloquium has been implemented in fall 2022 and spring 2023 informally for those students who participated in this project. Much of the learnings discussed in this paper stem from this experiment, which is currently on hold but will continue following the positive feedback, possibly as a formal integration into the curriculum. Within this colloquium, some of the suggestions above will be implemented. What has worked well so far were the regular presentations of the master students to their peers and for those who just joined and identified topics questions in were helpful (Table 1).

At Anhalt University master students already experience assignments and research tasks that focus on a critically reflective practice in their regular theory courses. Students, among others, are encouraged to keep a reflective journal that is used at the end of every seminar. In it, they reflect on their learning and role in the seminar, and how they could have acted differently. This allows them, over time, to realise the value of reflective practice and this record creates an awareness of their emerging skills, confidence and growth.

However, to foster design research and design research supervision further, in our daily work at our institutions and in transcultural networks, we must stay curious and updated and actively participate in shaping the field with fellow supervisors and research candidates. Therefore, we hope that we will be able to continue with our shared project, try out some of our modules, refine them and develop more tools, methods and supervision strategies, ideally with fellow design research supervisors from other universities joining us.

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P/REFERENCES OF DESIGN

AN ENQUIRY INTO SPATIAL ATTRIBUTES OF THE URBAN: RURAL TRANSIENTS IN INDIA.

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KEYWORDS | URBAN JUGAAD, CONSTRUCTION WORKERS, AHMEDABAD

ABSTRACT | The developing world is currently undergoing a great rural to urban migration. It is a necessary and inevitable trend, yet failures of urban planning and political consideration result in diminishing opportunities for the rural migrants. Activist architecture that attempts to deal with these problems is often focused on the physical manifestation of the failures of this arrival process: the urban slum. This paper explores the lived experiences and practices of seasonal migrants who come from the tribal borderlands of central India to work as construction workers in the city of Ahmedabad. The case study attempts to understand the factors and dynamics that shape these seasonal migrants' housing experiences, practices, choices, and constraints in Ahmedabad. These migrant colonies generate a Kinetic City[1]; an incremental city in motion, characterized by reusing easily available construction materials on and around the worksites, bursting with constant modification and reinvention through the practice of Jugaad Urbanism. These quick fix colonies are highly suffering from a lack of any basic infrastructure. Access to basic services like water and sanitation is lacking or profoundly inadequate in most instances while access to social infrastructures of health and education for their children is a major challenge. With interventions in Indian cities being driven by exclusive imaginations of "global cities" and "world-class infrastructure," and more recently of "smart cities," these urban migrants have often been thrown by the wayside. The root of the problem lies in social and political acceptance and interventions. The onsite living conditions of the migrants are mapped taking in consideration 5 representative construction sites in Ahmedabad. Here the documentation communicates the spatial configurations, fundamental materials and structure used in these colonies and throughout the Kinetic City. The mapping documents the struggle to employ architecture as a means of achieving a desired standard of dignity for the migrants. The study concludes stating a need for solutions which anticipate and make room for the innovations of Jugaad Urbanism[2], employing local techniques and incremental improvements, rather than by imposing a one-off, technologically advanced solution not forgetting that addressing basic necessities of accommodation and sanitation is of utmost importance. The research emphasizes the need to address both on-site living conditions and housing arrangements made by workers at labor "Nakas"[3] in cities. It builds upon earlier recommendations emphasizing the essential role of political and administrative commitment as well as advocacy and mobilization of migrant workers.

[1] Kinetic City - The Kinetic City is not perceived as architecture, but in terms of spaces, which hold associative values and supportive lives. Patterns of occupation determine its form and perception. It is an indigenous urbanism that has its particular 'local' logic. It is not necessarily the city of the poor, as most images might suggest; rather it is a temporal articulation and occupation of space that not only creates a richer sensibility of spatial occupation, but also suggests how spatial limits are expanded to include formally unimagined uses in dense urban conditions. (Mehrotra, 2018)

[2] Jugaad Urbanism - The spirit of jugaad urbanism, is defined by Argawal as a "resourceful and innovative bringing together of disparate parts." The strategies go beyond "making do" and improve and reveal new possibilities within the existing realities of urban life. Jugaad "thinks beyond the object," stated Argawal. They engage with the surrounding "urban milieu" to harness the energy of the street, which is perhaps the most critical resource of all. (Argawal, 2011)

[3] Nakas – (India) A place where workers assemble to seek employment. (Wikipedia, n.d.)

1. Introduction

India is one of the most populous countries in the world consisting almost one-sixth of the world's population. According to UN estimates, India overtook China in having the largest population in the world with a population of 1,425,775,850 at the end of April 2023. (Metrics, 2023) Indian cities are also growing at an exceedingly fast rate; in the period from 2001 – 2011 the urban population grew from 286 million to 377 million, and is expected to rise to 600 million by 2030. (UNDESA, 2023) With this rapid urbanization, comes the demand for mass housing to cater to the growth of a new middle class[4]. This has resulted in an abundance of large-scale gated communities situated around the outskirts of cities throughout India. The rate at which these developments are being built comes at a cost; the construction industry thrives on exploitation of migrant construction workers and maintains a low standard of building construction. Construction workers constitute one of the largest segments within the service provider community in urban areas, yet their significant contribution to the economy often goes unnoticed, mirroring the plight of many informal sector workers. In Ahmedabad alone, there exists an estimated population of 100,000 construction workers, more than half of whom are seasonal migrants from both intra-state and inter-state regions (Homeless, 2013). Originating from tribal districts of Gujarat, Rajasthan, and Madhya Pradesh, as well as other states such as Maharashtra, Uttar Pradesh, Bihar, and Jharkhand (Desai, 2020). Many of these workers have been integral part of the city's construction landscape for over a decade. Typically, they spend anywhere from 6 to 10 months in the city, periodically returning to their villages for short durations ranging from 15 days to a couple of months during festive seasons and the period of agricultural activities (Homeless, 2013). Despite the essential role of these migrant construction workers in shaping the urban environment, the intricate dynamics of their employment, migration patterns, and their housing needs within the city remain poorly understood.

Although laws exist for the rights of construction workers, systemic corruption impedes enforcement for these laws (Homeless, 2013). These workers will move with the contractors not only within Ahmedabad, but also to other cities. The workers belong to the most poor and disadvantaged sections of Indian society, the majority from poorer states, such as Uttar Pradesh and Bihar as well as bordering states such as Rajasthan and Maharashtra. (Desai, 2020) Migration provides survival to these workers and their families, but also exposes them to a cruel and vulnerable existence. As these workers are in a setting far from their place of origin, they stay at the construction sites in labor colonies. The labor colonies are made up of individual Jhuggis[5], where living conditions are so poor that they deprive the workers of basic human dignity. The living conditions these workers are subjected to are harsh and require architectural interventions.

[4] New middle class - The ‘new middle class’ in India refers to the socio-economic group that emerged in the post-liberalization era of the 1990s, characterized by rapid economic growth, globalization, and the rise of the service sector. This group has experienced significant upward social mobility and has become an influential force in shaping the social, cultural, and political landscape of India. (Fernandese, 2016)

[5] Jhuggis - a house, usually made from mud and or sheets of iron, that is dirty and in bad condition, and located in a very poor area of a city. (Oxford Learners' Dictionary , n.d.)



Figure 1. Accommodation built by one of the RCC – Masonry – Contractors in Ahmedabad for a project duration – 3 years.

2. The Documentation of Conditions at the Construction Sites

2.1 Mapping the Scenario of Construction Sites in Ahmedabad

There is no reliable data to estimate the scale of construction activity in Ahmedabad and its peri-urban area, finding the actual the number of construction sites is also difficult in comparison with the number of sites registered.

I draw upon the following dataset to provide a picture of the number of construction sites in Ahmedabad:

This data-set consists of construction sites registered in Ahmedabad district under the BOCW Act 1996 6 (see Table 1). Construction sites which employ ten or more building workers for any building or construction work and where the total cost of construction is more than INR 1,000,000 are required to be registered under the BOCW Act. (bocw-act, 1996). The registrations under the BOCW Act are done district-wise and the data is not available at the city level, therefore, the data is presented for entire Ahmedabad district, which covers an area of 8107 sq.km.

Table 1. Construction sites registered in Ahmedabad district under the BOCW Act 1996.

Year	Sites Registered	No. of Workers declared by registered sites		
		> = 100	100 - 500	< 500
2017 (Jan-Mar)	45	34	10	1
2017-18	237	192	43	2
2018-19	485	392	84	9

* There is a possibility that the numbers of workers are often under-reported. (Desai, 2020)

[6] BOCW Act, 1996 - The building and other construction workers (regulation of employment and conditions of service) act, An Act to regulate the employment and conditions of service of building and other construction workers and to provide for their safety, health and welfare measures and for other matters connected therewith or incidental thereto. established on the 19th of August, 1996. (bocw-act, 1996)

2.2 Field-Visits and Questionnaire at Construction Sites

This paper consists of data form 5 construction sites to document the housing and basic services provision to construction workers (see Table 1). The details of all the construction sites, their developers, contractors, etc. are kept confidential in this report. These 5 sites cover projects such as a residential, a commercial, a hotel, a university building and a road development project. These 5 sites included 2 projects in which different medium and small-scale contractors had been hired for almost each of the construction activities such as excavation, RCC, masonry-plastering, flooring, painting, waterproofing, aluminum windows, grill fabrication, plumbing, electricals, etc. When the project consisted of multiple buildings, often more than one contractor was hired for each of the activities. The remaining 3 projects out of 5 projects were executed by 3 different large construction companies – the large construction company had been hired for the civil work (excavation, RCC and masonry-plastering) and in most cases, for a few other construction activities as well.

A questionnaire was filled at each of these sites to document the following details of the construction project:

1. The number of construction workers employed for various construction activities;
2. Who among them lived at the worksite;
3. Who provides the accommodation other facilities for the workers living at the worksite;
4. The nature of these facilities (Annexure 1).

The questionnaire was filled through a combination of personal observations and detailed discussions with the relevant on-site staff of the developer / contractor (e.g. project manager, safety officer, admin manager, admin in-charge, etc). In a few cases, the questionnaire could not be filled comprehensively due to various reasons. Nonetheless, substantial data could be collected.

Annexure 1.
With regard to the mode of provision and nature of provision, the following aspects were documented:

1. Provision of land for the labor colony;
2. The building of labor accommodation;
3. Creche for the workers' children;
4. Provision of water infrastructure - for drinking and other uses such as bore-well, water pipeline, water tankers, water storage tank, water filter;
5. The building of sanitation infrastructure - toilets, bathing spaces, spaces for washing clothes and utensils, sewage disposal and drainage;
6. Provision of electricity.

Note – Details regarding the provision of health services for the workers and their families, tie-ups with medical clinics or hospitals could not be documented. Provisions of the housing and basic services were documented through photographs.

2.3 Interviews with Developers and Contractors

Interviews with developers and contractors of construction companies were an important part of this study, in order to understand how they view their workers' housing question and how this housing can be improved.

Surprisingly there is a very little systematic information available about the current practices in the construction sector vis-à-vis the provisions made for worker accommodation and other facilities for workers at construction sites. In fact, one developer, when asked about these practices across Ahmedabad, reflected on the lack of information about these aspects within the developer community itself:

> "We never discuss it. We discuss FSI when we meet with other developers or in public forums or in conferences. Nobody – not one topic, not even 15 minutes are spent on discussions pertaining to these aspects and what one should do for them. Which is really a reflection on some people [pause]… actually it is a reflection on us, that we don't think of these things. That we don't consider them worthy of discussion. We don't ask each other what are you doing at your site; who is providing housing to the worker. We may be doing something for worker at our site, but we don't discuss this when we meet other developers. We don't give this importance enough for it to figure in the conversation." (Pavan Bakeri, Bakeri Group, discussion in 2018)

2.4 Study of Regulatory Framework for Housing and Basic Services for Workers

In the 2017, CIRA7, the existing regulatory framework was studied to understand the mandated responsibilities of developers and contractors with respect to housing and basic services provision for migrant construction workers (Desai 2017). The study included worker legislation, along with the follow-ups done in the present study to understand the implementation of the provisions of BOCW Act for registering construction sites and regulating housing and basic services provision for workers at the construction sites. The 2017 study by Renu Desai also noted that, though ambiguous, the development permission (DP) has a provision for regulating housing and basic services for these workers. The RERA, 2016 8 – which is part of the regulatory framework for real-estate construction projects and requires registration of these projects before project launch – was also briefly examined to see if it could play any role in regulating housing and basic services provision for these workers. These regulatory frameworks were studied through discussions with government officials as well as relevant documents/data obtained using Right to Information (RTI). The data obtained was also used to estimate the number of construction sites in Ahmedabad in the recent years.

2.5 Labor Legislation and Governance

Based on a previous study on the entitlements of migrant construction workers (Desai 2017), and follow-up research on the implementation of the BOCW Act, this section outlines aspects which shape how worker legislation and its implementation impact provisions by employers for housing and other facilities for workers at construction sites.

Besides the question as to whether or not a construction site is registered under the multiple worker laws that are applicable to it, the provisions vis-à-vis housing and other facilities to be provided by the employers for workers vary across these laws. While the ISMW Act9 and related central rules have some of the strongest and least ambiguous provisions on housing and other facilities, the enforcement of this law in general is weak due to various reasons. Enforcement of the BOCW Act and related Central and Gujarat State rules is deficient but better than the ISMW Act, but BOCW Act has ambiguous provisions for housing and other facilities for workers (Desai, 2014). Different regulatory actors to enforce the different worker laws applicable to construction sites The CL Act10 and the ISMW Act are to be implemented by the Worker Commissioner wing of the Labor and Employment department of Gujarat government, while the BOCW Act is to be implemented by the Directorate for Industrial Safety and Health (DISH) wing of the department. The BOC inspectors, who were recruited in 2017 under DISH to enforce the BOCW Act most of the times do not

[7] CIRA - The Contract Labour Regulation and Abolition Act, 1970, An Act to regulate the employment of contract labour in certain establishments and to provide for its abolition in certain circumstances and for matters connected therewith. (CIRA, 1970)
[8]RERA - Real Estate (Regulation and Development) Act 2016 - An Act to establish the Real Estate Regulatory Authority for regulation and promotion of the real estate sector and to ensure sale of plot, apartment or building, as the case may be, or sale of real estate project, in an efficient and transparent manner and to protect the interest of consumers in the real estate sector and to establish an adjudicating mechanism for speedy dispute redressal and also, to establish the Appellate Tribunal to hear appeals from the decisions, directions or orders of the Real Estate Regulatory Authority and the adjudicating officer and for matters connected therewith or incidental thereto. (RERA, 2016)
[9] ISMW Act - INTER-STATE MIGRANT WORKMEN Act, 1979, Is an Act to regulate the employment of inter-State migrant workmen and to provide for their conditions of service and for matters connected therewith (ISMW, 1979)
[10] CL Act - Contract Labour Act, 1970 - Chief Labour Commissioner (Central) - This act has been enacted to regulate the employment of contract labour in certain establishments and to provide for its abolition in certain circumstances and for matters connected therewith.

know, and are not responsible for enforcing, the provisions in the CL Act and ISMW Act at the construction sites they visit. It is unclear how frequently inspectors from the Worker Commissioner wing visits the construction sites to enforce the CL Act and ISMW Act. During discussions on construction sites in the Labor Commissioner's office for a previous study, the officials often declared that they did not have much to do with construction sites and that one should go to the DISH wing since the BOCW Act was under their purview (Desai 2017). These reasons include, but are not limited to, lack of policies.

3. Current Practices of Providing Housing and Services for Workers Living at Worksites

The RCC and masonry-plastering workers, who form the largest proportion of the workforce in any project, predominantly lived at the worksite in all the 5 projects covered in the study. These workers were circular migrants[11]. On a few projects, there were also a few RCC and masonry-plastering workers who were locals or settled and lived off-site; while some of them were Naka workers brought in intermittently, some were also attached to contractors on a regular basis. With respect to the workers engaged in other construction activities in the 5 projects, there were variations across the projects in terms of whether and how many workers engaged in each activity lived on the worksite and off-site in their own arrangements.

This seems to depend on a combination of factors such as:

1. Migrant's status of the workers engaged in a specific construction activity (see Table 2);
2. Duration of work for that activity;
3. Scale of the project;
4. Kind of accommodation;
5. Services provided for them at the worksite;
6. Off-site accommodations provided by contractors (seems to be very rare);
7. Workers' preferences between offsite / onsite.

[11] Circular migration - Circular Migration can be understood as "the temporary, recurrent movement of people between two or more cities / countries, mainly for purposes of work or study" (UNECE, 2016) For the migrant worker, however, circular migration is a survival strategy when economic opportunities do not respond favorably at home. Moving between the host and the sending economies offers an opportunity of social and economic mobility for the migrant. But the rhetoric of an all-benefit situation arising out of circular migration, nevertheless, stops short in face of labour rights and well-being. Circular migration strikes a high personal cost for the migrant, which is for most of the time unnoticed and the labour invested in earning a bare living, unprotected.
[12] Saliya Kaam - Bar bending work (In Gujarati language - a colloquial term) is the process of making and bending steel reinforcing bars and beams, also called "rebar," which are used to strengthen concrete in buildings.
[13] Bharai - Filling Work - A filling refers to a quantity of earthen material such as soil, rock, aggregate, shingle, and sand that is placed and compacted in trenches, foundation, and under floors for the purpose of filling in a hole or depression.

Table 2. Type of work and workforce at the construction sites registered in Ahmedabad district under the BOCW Act 1996.

Type of Labors	**Family type description**	**Place of living**
RCC – centering & saliya kaam [i]	Single male migrants	Worksite
RCC - Masonry-plastering	bharai [ii]	Worksite
	Local / settled workers	Off-site
	Mostly migrant families but also single males (women work as unskilled helpers)	Worksite
Flooring	Local / settled workers	Off-site
	Single male migrant	Worksite or Off-site (shared rental rooms where workers pay the rent)
	Migrant families (women work as unskilled flooring workers)	
Painting	Single male migrants (majority of the painting workers)	Worksite or Off-site (shared rental rooms where workers pay the rent)
	Migrant families (women do not working in painting)	Worksite (rental rooms were workers pay the rent)
Waterproofing/China mosaic	Mostly migrant families	Worksite
	Local / settled workers families (women work as unskilled workers)	Off-site
Electrical work	Local / settled workers	Off-site
	Single male migrants	Worksite
Depart workers	Often migrant families	Worksite

The accommodation for all workers living at the worksite was built by the developer at all of the 3 projects. The nature of accommodation varied across the projects. At Site 1, rooms with verandahs and walls made from pre-cast concrete panels were built by a contractor specifically hired for making these rooms.

Additional rooms, made during peak construction time when the above-mentioned rooms were inadequate for the number of workers, were built from corrugated metal sheets – it was unclear if these were built by the developer's depart workers or the RCC contractor's workers. At Site 2, room-like enclosures were built with corrugated metal sheets by the developer's depart workers in the basement of an under-construction building. At Site 3, the developer hired a contractor to specifically build the worker colony which was intended to be a "model colony"; here, the rooms were arranged around communal verandahs and were made from a combination of materials like corrugated metal sheets, PVC plastic sheets and agronets. In the remaining 2 projects, the contractors were involved in building some of the or all of the workers' accommodations.



Figure 2. Overview of the 5 construction sites in Ahmedabad.

As explained later, the nature of accommodation built by the contractors varies, with large construction companies often building relatively better rooms than the medium/small-scale contractors. Furthermore, a contractor will generally build rooms only for his own workers. Therefore, in a project with multiple contractors, often more than one entity builds rooms for the workers, leading to variations in the worker accommodation built for a single project. Thus, in 5 projects involving multiple contractors, one or more contractors-built accommodations, each for their own workers; whereas the developer-built rooms for it depart workers and the workers of the remaining contractors.

Corrugated tin sheets act as both wall and roof, they are tied with wire and nails to odd pieces of metal scaffolding and occasionally bamboo poles. Wooden off cuts provide a frame for an opening. The roof is held down with rocks, branches, shoes, helmets etc. These things are also kept here for storage. A stiff plastic tensions cable wraps around the front of the houses keeping things in places as well as providing a clothes rack for drying laundry. A day bed rests on its side against the front of a house to allow room for the laundry above to dry on the tension cable. When the cable is not being used for laundry, it acts as support for cloth to drape over for shade while occupants rest below. The concrete poured on the ground in front of the houses claims an area used as an outdoor social space.

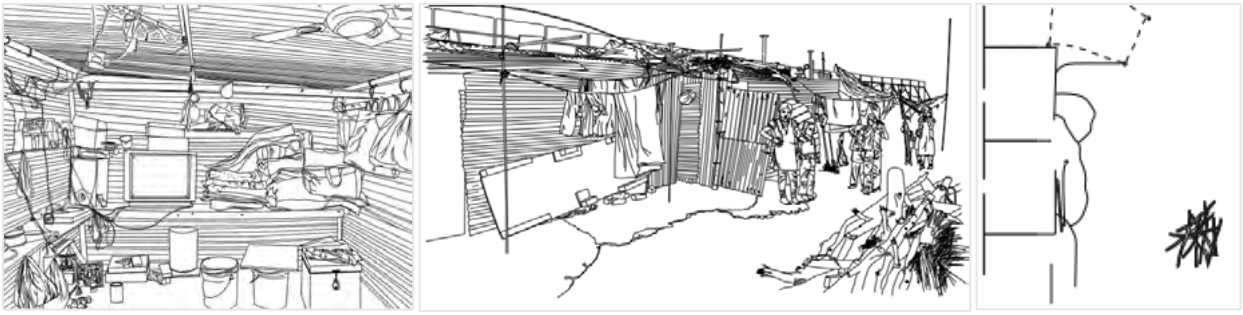


Figure 3, 4. Interior of construction worker's house and a typical construction worker's housing.

Figure 4 shows a one room house, shared by a family of seven, at the construction site. During the day all of the bedding is folded and stacked on a shelf which also act as structural bracing. The beams all have nails and hooks attached to provide storage. The cables providing electricity come in through small gaps where the corrugated tin sheets meet and are hung from the beams.



Figure 5. Frame structure made by fabrication onto which corrugated metal sheets are bolted, also a single storied structure is seen built with the same assembly.



Figure 6, 7, 8. Rooms made from Aerocon panels (Aerocon sheets are cement sandwich panels, made of two fibre reinforced cement facing sheets on either side of a light-weight concrete core).



Figure 9. Workers living in an under-construction building.



Figure 10. Makeshift bathing enclosure seen to the left of the room, below the plastic sheet or cloth.



Figure 11. Hanging electrical wires to make arrangements for a bulb, extension board and fan.

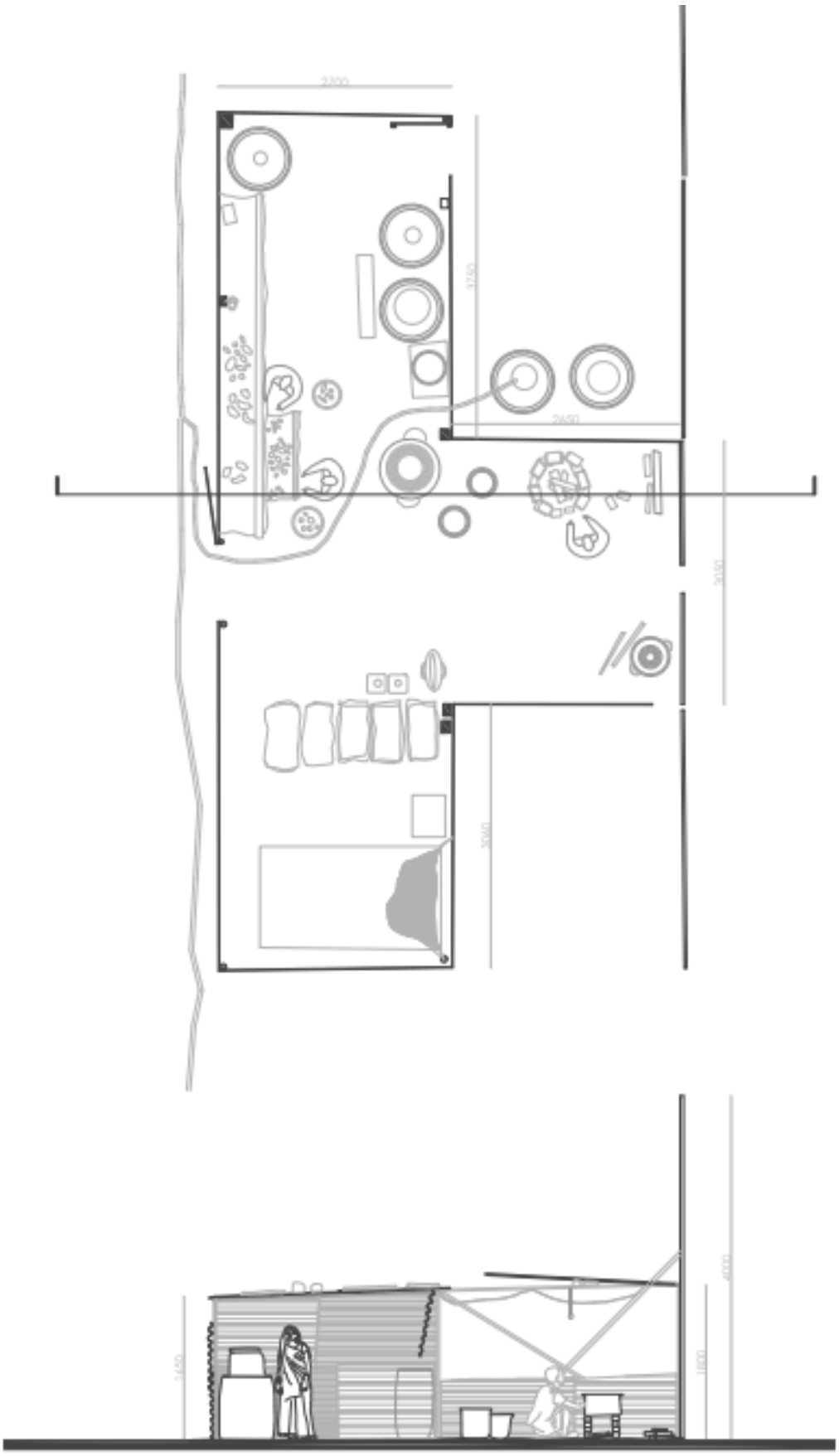


Figure 12. Communal Kitchen.



Figure 13. Children's Creche.

Overall, with regard to the mode and nature of provision, the field visits and discussions across the projects revealed that corrugated metal sheets were widely used to build the rooms – by large construction companies, most medium/small-scale contractors and developers – but there was a variation in the quality of the rooms. The worker accommodation made by many of the medium/small-scale contractors was poorly built with recycled materials that were in very poor shape and with no proper flooring. However, some of these contractors had built better rooms using concrete blocks with relatively better flooring. In general, rooms made from corrugated metal sheets created harsh spaces to live in during summers. There were no windows and the doors, leading to inadequate natural light and ventilation. The aspect of environmental comfort was rarely a consideration.

Let's focus on the rationale of large construction companies for using an insitu fabrication system for the structure is that this allows for quick erection, dismantling and re-erection. The rationale behind the wide use of corrugated metal sheets for the walls / roofing – whether they are roughly erected or erected through in-situ fabrication system – is its low cost. It is not only cheaper than using other materials like Aerocon panels or pre-cast concrete panels but also easy to handle, possible to re-use several times across different worker colonies, and furthermore fetches a price in the scrap market when finally discarded. Among all the different kinds of rooms built across the 5 sites, there were however a few cases where an attempt was made to address light and ventilation for the rooms and use more climatically appropriate materials and design. While there were still limitations in the materials / design / cluster-layout, it may be possible to learn from and build on these "better practices." Rooms meant for a family or a group of 4-5 single males were generally 8 feet x 10 feet (7.5 sq.m) or 10 feet x 10 feet (9.3 sq.m). At some sites, bigger rooms were made to accommodate large groups of single male migrants. At one such site, groups of 10 male workers were accommodated in rooms of 20x20 feet (37 sq.m). Compare this to the ISMW Act which mandates a norm of 10 sq.m. room for a family, and a norm of 6.5 sq.m. per person in barracks for 10 workers.



Figure 14. The image displays a 800 mm X 2030 mm corrugated sheet commonly used for the worker housing.



Figure 15. Use of commonly available materials and impromptu joinery details.



Figure 16. The toilet areas covered with tarpaulin sheets with improper drainage left to run along the site peripheries.



Figure 17. Use of commonly available materials and impromptu joinery details.

4. Research Findings

4.1 Tenure Security

On-site settlements have high tenure security for the duration of the construction work. Among off-site settlements, rental housing in the city's recognized slums have highest tenure security even though the rental agreement with the landlord, who is an informal occupier of the land, is undocumented. The other two off-site typologies have low tenure security despite residents having lived at the same location for many years. The most vulnerable are the shelters / settlements on pavements and street edges, under flyovers and bridges, where residents often face violence in the form of evictions and harassment, leading to losses of belongings and investments they have made in their housing as well as an everyday experience of uncertainty and insecurity about their shelter and belongings. This is also true of some shelters / settlements on government or private lands which are non-recognized slums, especially those on railway lands and government lands being reclaimed by the local authority. This low tenure security is a direct result of the state's attitude towards informality and the urban poor, compounded by its attitude towards recent and non-permanent migrants from lower-income backgrounds. These tenure conditions deny large numbers of construction workers a secure space in the city and access to basic services.

4.2 Housing Quality

Four main types of shelters were found in construction workers' settlements in Ahmedabad:

1. The first is potla type shelters which are arrangements where residents tie up their belongings with tarpaulin during the day when away for work and open the potla in the evenings to set up a sleeping and cooking area. This is found in the off-site settlements with very low tenure security. These shelters are extremely vulnerable to weather conditions, rodent and mosquito infestation and theft of belongings.
2. The second type is kutccha shelters made from tarpaulin, and is found in off-site settlements with low tenure security as well as on-site settlements of smaller construction sites. They are unstable structures vulnerable to weather conditions, rodent and mosquito infestation, theft of belongings and flooding in case of waterlogging in the settlement.

3. The third type is kutccha shelters made entirely from tin sheets. These are found in on-site settlements of small to medium-size construction sites. They are susceptible to over-heating and have little or no ventilation, leading to extreme discomfort for its residents and posing health risks.
4. The fourth type is the semi-pucca shelter consisting of brick walls and tin sheet roofing. They are found in on-site settlements of larger construction sites, and off-site settlements of rental housing and the more consolidated and secure settlements on government land. These are less vulnerable to weather compared to the other three types, although the tin roofs still lead to heating up of the shelters. Rodent and mosquito infestation can be controlled and the structure provides security of belongings.

In off-site settlements, residents choose to build a particular shelter type depending on the tenure security, migration pattern which shapes their willingness to invest in housing, and affordability. In on-site settlements, there is an absence of government enforcement of existing regulatory frameworks (Interstate Migrant Workmen Act 1979, The Building and Other Construction Workers Act 1996, PWD and CPWD guidelines, etc) to provide proper housing to construction workers as well as inadequate provisions in these frameworks. As a result, shelter type is linked to the size of the construction site and duration of work, since currently, it is the scale of the project which determines whether a developer / contractor thinks it is worthwhile to invest in better shelters or not.

4.3 Basic Services and Amenities

Off-site settlements:

Generally, do not have any basic services like water, sanitation and electricity. Residents often have to pay or do some worker to get access to water. Most lack toilet facilities, nearby pay-and-use facilities are not affordable, and most residents resort to open defecation as a result. Bathing facilities do not exist and many residents have built temporary enclosures for bathing, however, women face privacy issues in these, requiring them to bathe early morning or at night when it is dark. Rental housing may have access to water but sanitation and provision of electricity is usually inadequate or nil. Most settlements are prone to waterlogging due to lack of drainage.

On-site settlements:

These are often provided with water, however, at the smaller private-sector construction sites and public-sector flyover construction sites, potable water is not always provided and water storage facilities are often unhygienic. Toilet facilities were not provided as per the case-study of public-sector flyover construction site, and while toilet facilities were provided in the other on-site settlements, they were not well-maintained, leading to open defecation. The public-sector construction site of IIT Gandhinagar was found to have the best facilities of water, toilets and bathing facilities, and electricity, as well as a crèche and regular health camp. This was due to the keen interest of the IIT Gandhinagar administration in the issues faced by construction workers and their families.

4.4 Documents for Rights in the City

Documents showing proof of residence in the city such as ration card, election card, property tax receipts, and electricity bill are important for the urban poor to build claims to their informal housing spaces and basic urban services as well as realize entitlements to government schemes, including housing programs. Almost all the seasonal migrants in the study were found to have these documents only for their villages and were not willing to give up these to get new ones at their city address since their migration patterns require them to keep their village documents. However, the lack of documents for entitlements in the city

leads to high vulnerability. Alternate documents for such migrants could be obtained through registration with the Building and Other Construction Workers' Welfare Board, however, registration with the Board is currently difficult. Therefore, construction workers cannot avail the Board's schemes, including housing scheme, let alone access housing schemes of the local urban authority. Any policy intervention to improve the housing conditions of construction workers will have to take this into account in its design and implementation so that city-based documentary requirements do not lead to exclusions.

4.5 Construction Work, Migration and Housing

The typology of settlement in which construction workers find shelter, the mode of obtaining construction work (finding work at a Naka, or by being part of a worker gang, or by getting regular contract work through contacts one has built up over time) and the dynamics of migration (which include type of migrant household and migration pattern) are interlinked aspects which need to be understood to propose housing interventions that are viable for construction workers. Naka workers and regular contract workers live in off-site settlements. Local and permanent migrant Naka workers are found across the off-site typologies, depending on the individual family's socioeconomic condition. Local and permanent migrant regular contract workers are relatively better-off and thus do not live in the most vulnerable off-site settlements, that is, pavements and street edges, under flyovers and bridges. Seasonal migrant Naka workers are found across the off-site typologies, depending on the individual family's socio-economic condition and also the migrant household type. Thus, only the single males among them live in rental housing. Significantly, the rental housing is affordable to them not only because they share the rent with other single male migrants, but also because arrangements with the landlord and their sharers to pay rent only for when they are living in the city. This rental housing is not affordable to the seasonal migrant Naka workers who come to the city along with families (with children or couples) and it is this group that lives in the most vulnerable off-site settlements. Construction workers who find work through worker gangs are mostly seasonal migrants and live in onsite settlements as they are provided housing for the duration of the work. However, among this group, those who work in public-sector or private-sector infrastructure-laying work such as road-building or pipeline-laying are not provided housing and they live in off-site settlements on government or private lands, access to which may be informally negotiated by the contractors. The study also found that kinship and community ties play a central role in determining the settlements that seasonal migrant workers choose to live in. Another important finding was that Naka workers, especially the seasonal migrants, walked a maximum distance of 15-20 minutes to reach a Naka. This is important since they do not have to incur transport costs to reach a Naka where there is no guarantee that they will obtain work every single day. Majority of Naka workers obtain work for 10-15 days a month. Housing interventions would have to be sensitive to these aspects.

4.6 Household Income and Housing Expenditure

Monthly household income amongst construction workers depends on number of earning members, their skill levels and mode of obtaining work which determines daily wage rates and the number of days for which they get work in a month. The study calculates that for Naka workers who have a single earning member household, monthly income is Rs.3000-4500 if he is unskilled and Rs.5000-7500 if he is skilled. For two earning member households, monthly income is Rs.6000-9000 if they are unskilled and Rs.8000- 12000 if the male is skilled. (Naik, 2015.)

The study found that construction workers live in rental housing with monthly rents in the range of Rs.800-2500, often with additional charges for basic services. (Desai, 2020) Single male migrants share a room, each incurring Rs.300-500 per month for rent and basic services. This is 7-15 per cent of an unskilled single male migrant's monthly income and 4-10 per cent of a skilled single male migrant's monthly income. Thus, rental housing is affordable for single male migrants when they share amongst 4-6 males, and each is paying no more than 4-15 per cent of their income on rent and basic services. (Desai, 2020) Those who live on pavements and street edges, under flyovers and bridges, or on government or private lands which are not recognized slums, incur expenses on building / repair of shelter but this is difficult to estimate. Some of

them spend around Rs.300 per month for buying water. For families who live in these types of settlements, rental housing would entail higher expenses of Rs.900-2500 per month, which would be 16- 25 per cent of their income. (Desai, 2020) Such a regular expense is unaffordable to them, due to which they do not choose rental housing.

5. Summarizing the Argument

Seasonal migration stands as the primary mode of economic mobility for the impoverished, particularly amongst the economically weaker sections of the society. This migration tends to be circular, driven by the need to maintain ties with hometowns during the agricultural season and hindered by barriers to permanent settlement in urban areas due to a lack of social security. Addressing the housing and basic service needs of these marginalized urban poor is imperative for inclusive city development. Urban planners and policymakers must grasp the dynamics influencing the lives of seasonal migrants to effectively accommodate them in the cities. Urban governance significantly impacts migrants' housing conditions through informal settlements and rentals. Current urban policies largely exclude seasonal migrants due to eligibility criteria reliant on city residency documentation (Desai, 2020). Housing programs primarily focus on homeownership, neglecting rental options favored by migrants. Although some efforts, like the Shelter for Urban Homeless (SUH) scheme exists, inadequacies persist in shelter availability and suitability for migrant families. To address these challenges, policymakers must integrate seasonal migrants into urban planning and housing policies. Collaboration between construction workers' welfare boards, municipal governments, and housing departments is crucial. Informal settlements should be viewed as viable habitats and upgraded rather than eradicated. Investments in basic services and sanitation are necessary, alongside measures to ensure affordable access, such as subsidizing pay-and-use facilities. Systematic mapping of worker markets, such as construction worker Nakas, is vital for designing inclusive urban spaces. Understanding migrants' specific needs and their adaptation of inadequate spaces is essential for effective policy formulation. Ultimately, building inclusive cities necessitates recognizing migrants' rights to a decent and dignified urban life. Efforts must prioritize enhancing housing options, providing basic services, and integrating seasonal migrants into urban planning processes. By acknowledging their presence and needs, policymakers can pave the way for more inclusive and equitable cities.

6. Initiatives in and Around

In recent years, there have been some initiatives that address the housing of migrant workers in the cities. These include interventions and proposals for homeless shelters, some under the national-level Shelter for the Urban Homeless (SUH) scheme, in Ahmedabad, Surat and Bhuj; the Apna Ghar projects by the Kerala State government; migrant hostels in few cities by the NGO Pratham under its Project RISE program; and the Garima initiative in Kozhikode, Kerala (SUH, 2018). Following section outlines the initiatives in Ahmedabad and other cities for migrant construction workers – those who live at worksites as well as those who go to worker Nakas and arrange for their own housing. Following section further discusses interventions on migrant workers' housing in countries like China, South Africa and Singapore.

6.1 Night Shelters or Ren Baseras

Night shelters, also known as Ren Baseras, have been established in numerous Indian cities following directives from the Supreme Court in 2010. While initial implementations faced challenges related to location, design, and management, there have been notable improvements in some cities over time, often driven by pressures from the Supreme Court and civil society organizations. These shelters have played a crucial role in providing better housing options for migrant workers who would otherwise be homeless or living in extremely vulnerable conditions. Many of the enhancements have been facilitated by the national-level Shelter for the Urban Homeless (SUH) scheme, launched in 2014. (Desai, 2020). The SUH scheme's guidelines envision these shelters as 24-hour facilities offering a range of services, ultimately serving as a space to connect the homeless with various entitlements.

6.2 EWS Site Converted into Family Shelter in Ahmedabad

In Ahmedabad, the AMC converted an EWS housing site which had been lying vacant into a family homeless shelter in 2019. It consisted of 36 four-storey buildings (about 1150 flats). The AMC has begun allotting these flats to homeless families who had been shifted to one of the other homeless shelters in the city and had lived there for several months or more. The families who have shifted to this family shelter have been verbally told by AMC that they will have to pay Rs.500 as monthly rent, however, there has so far not been any rent collection even from families living here since 2-4 months (Desai, 2020).

6.3 Apna Ghar Initiative, Kanjikode, Kerala

In Kanjikode, approximately 5000-6000 inter-state migrant workers are employed across various industries including metal works, ice-cream manufacturing, packaging material manufacturing, mattress-making, aluminum works, and lamination. The majority of these workers hail from states such as Orissa, West Bengal, Assam, Chattisgarh, Jharkhand, Bihar, Uttar Pradesh, and Madhya Pradesh. To accommodate these workers, Apna Ghar provides housing facilities with a capacity to accommodate 620 individuals. The infrastructure includes a four-storied building with 64 rooms, out of which 62 rooms are allocated for worker accommodation, 1 room serves as lodging for the hostel warden, and 1 room functions as an office. Each of the 62 rooms designed for workers' accommodation houses 10 individuals and is equipped with 5 bunk-beds and 10 lockable storage units. Additionally, the facility features 32 community kitchens and 8 dining halls arranged in kitchen-dining blocks. Each block comprises 4 kitchens, each furnished with a gas stove featuring two burners and an LPG connection. These kitchens are shared between 2 rooms or 20 persons, providing one burner per room or 10 persons. Furthermore, each dining hall within the block is equipped with amenities such as a television, filtered drinking water, and wash basins, catering to the needs of 8 rooms or 80 individuals. Other amenities include 96 toilets, urinals, washbasins, bathing spaces, and areas for clothes washing and drying. Additionally, communal seating areas, a lawn, and a volleyball court are provided for recreational purposes.

6.4 Initiatives in Other Countries: South Africa, China, Singapore

South Africa

The migrant hostels in South Africa have a deeply rooted history stemming from the colonial era, particularly during apartheid (1948-1994), when they were established as single-sex institutions to accommodate African migrant workers in white urban areas. These hostels were tools of racial discrimination and economic exploitation, embodying the apartheid regime's strict controls over the movement and living conditions of black workers. Despite being intended solely for labor containment, families began inhabiting these hostels over time, leading to severe overcrowding and deteriorating living conditions. Around 1997, there were approximately 604,000 hostel beds in South Africa, with many accommodating whole families, totaling about 1 million people. The hostels varied in ownership and location, with public and "grey sector" hostels typically situated in segregated black townships, often on city peripheries. The conditions within these hostels were often appalling, with overcrowding, inadequate facilities, and neglect contributing to a dehumanizing environment for residents. Efforts to improve hostel conditions gained momentum in the early 1990s, driven by mounting criticisms and community advocacy groups like the Western Cape Hostel Dwellers' Association. The National Hostels Redevelopment Program aimed to convert hostels into family units, but the extent of its implementation and outcomes remains unclear. Some redevelopment projects have shown promising improvements in living conditions, but sustainability concerns persist, particularly regarding long-term management and rental revenue. Additionally, the experiences of rural-urban migrants and migrants from other African countries living in informal settlements warrant further research to understand the broader impact of urban policies on migrant tenants in South African cities.

China

Since approximately 2008, the Chinese national government has embarked on an expansion of public rental housing and relaxed the hukou[12]-related distribution system, aiming to facilitate migrants' access to housing. This shift was notably influenced by the "New Urbanization Plan" (2014-2020), which gradually prioritized migrant benefits in destination urban areas. Zhou (2018) particularly focuses on Chongqing's public rental housing program, which, despite preceding the New Urbanization Plan, served as a significant model for national housing development and migrant welfare improvement. By 2011, Chongqing had constructed public rental housing equivalent to 10% of the nation's total output, reaching 670,000 units by 2013 (Knowles, 2016). The program also aimed for eventual ownership by allowing eligible tenants to purchase units after a five-year rental period. Additionally, Wang, Li, and Zhang (2015) introduce an integrated prefab accommodation system designed for construction workers residing on worksites. This system, utilizing modular construction technology, was experimented at a prominent developer's project in Xuzhou.

The accommodation units, made of colored steel plates meeting national fire-protection standards, featured 8.4 m^2 rooms shared by two occupants, each equipped with private amenities such as toilets, bathrooms with water heaters, and air conditioning. Smart-card locks ensured security, and on-site facilities included storage rooms, dining areas, kitchens, convenience stores, and recreation/training rooms. Management was proposed to be handled by a professional agency, with developers or investors procuring accommodation and services based on contractors' and subcontractors' requirements. Despite the higher cost (1639 Yuan per worker per year compared to 1165 Yuan), the additional expense (474 Yuan) was offset by charging migrant workers a fee, representing 1-1.5% of their daily wage. Alternatively, developers or investors could cover the increased cost, adding less than 1% to project expenses.

Singapore

In Singapore, there are over 1.3 million transnational migrant workers, predominantly from Malaysia, China, Bangladesh, India, and other Asian countries, including domestic and construction workers (Kirk, 2015). Singapore's temporary contract labor migration system confines foreign workers to transient statuses, restricting job mobility and bargaining power. Employers, responsible for housing, often avoid public housing estates due to citizen opposition, leading to migrant workers primarily residing in dormitories, often converted industrial spaces or unregistered accommodations. The Ministry of Manpower enforces housing regulations, but inspections reveal persistent overcrowding and inadequate ventilation in registered dorms. Purpose-built dormitories (PBDs) offer better conditions, exemplified by Tuas View, accommodating up to 16,800 workers (Lee, 2016). While PBDs provide amenities and spacious accommodations, concerns arise regarding surveillance measures and social isolation, prompting comparisons to apartheid-like segregation. Worker advocacy groups praise improved living conditions but critique the isolation fostered by PBDs, suggesting they serve as containment strategies following a 2013 riot involving migrant workers. Brenda Yeoh highlights the state's dual approach of control and care, immobilizing workers within isolated spaces away from mainstream society. Despite government incentives for PBDs, many employers persist in substandard housing practices, facilitating worker exploitation and coercion. Overall, while PBDs offer improved living conditions, concerns persist regarding social isolation and surveillance, reflecting broader tensions between labor control, migrant welfare, and urban development in Singapore.

[12] Hukou - 'Hukou' refers to a household registration system in China that is inherited from one's parents and can be moved based on certain criteria such as income, education, and property ownership, impacting individuals' economic status.

7.Way Forward

The rural-to-urban migration trend necessitates addressing failures in urban planning, particularly in providing opportunities to migrants. This study explores migrant housing experiences, emphasizing the Kinetic City concept marked by Jugaad Urbanism, especially when these colonies lack the basic infrastructure such as access to clean water, sanitation, etc., highlighting the need for social and political interventions. Even though there are legislations protecting the interests of the rural migrants at central and state level, lack of synchronization between the concerned bodies executing these legislations, defeat the basic purpose of these regulations. At present, the impact of the increasing number of non-governmental organizations, which strive to strike a co-ordination between the various functioning bodies and end-users, is felt only at a local scale. The accommodations provided by the government agencies to the construction workers is a positive step but these facilities do not comprehensively address the daily needs of the workers. Hence, a deeper investigation is needed to go beyond addressing basic needs to improve migrants' quality of living, incorporating local techniques and incremental improvements. Policies, such as the National Urban Rental Housing Policy 2017, propose interventions with respect to social rental housing and worker hostels. However, translating policies into action requires detailed guidelines, budget allocation, and state-level initiatives. Other challenges include land availability, affordability, and regulation of the informal rental sector in the city, etc. The study highlights the dire need to investigate this topic in details to map the complex interactions between the various actors, identify the systemic loop holes and bridge them to establish a comprehensive solution to the woes of the rural migrants.

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P/REFERENCES OF DESIGN

ENABLING CROSS-CULTURAL DIALOGUES AS A TOOL FOR CO-DESIGN: BUILDING EQUITABLE KNOWLEDGE EXCHANGE THROUGH CREATIVE TEXTILE CONNECTIVITY.

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ABSTRACT | In May 2022 rural women weavers from the Jaipur Rug Foundation and BA Textile Design students from CSM, embarked on a design project exploring new channels of knowledge exchange and remote co-creation.

This paper reflects on the project's aim to facilitate non-hierarchical creative dialogues between international design students and artisan-weavers from the Global South to co-design a collection of handwoven rugs. Participants challenged existing stereotypes and hierarchies, through a process of mapping textile skills and design methods as well as inviting storytelling, gaining a richer understanding of the material and social networks afforded by their diverse contexts. Together they negotiated different cultural starting points towards the development of twelve co-designed rugs using visual, material-based and digital communication methods.

The authors discuss future skill sets for designers and artisans to effectively navigate a rapidly changing global design culture, to reposition themselves within complex power dynamics. Challenges and opportunities for cross-cultural co-design and creative dialogues are identified as connected to existing Western-centric design school thinking such as individual authorship and a linear generic design development process. If textiles can become a tool for social connectivity, how can design educators enable their students to learn non-hierarchical communication and design facilitation methods to develop inclusive and diverse design mindsets?

The paper concludes by proposing new evolved pedagogies including the ethics of design collaborations, visual storytelling, empathy building as well as connecting local heritage to post-colonial contemporary global design culture as key considerations to move towards more inclusive teaching approaches.

1. Introduction

In 2022 artisan-weavers from the Jaipur Rug Foundation [JRF] and BA Textile Design students from Central Saint Martins [CSM], part of the University of the Arts London [UAL] embarked on a design project exploring knowledge exchange and co-creation. The project was funded by the British Council Crafting Futures India programme.

JRF is an NGO, adjunct to the Jaipur Rugs design company, working with over 40,000 artisan rug weavers across 660 villages in five Indian states. They aim to revive hand-weaving techniques and provide access to social and financial support. Over two-thirds of the JRF artisan-weavers are female, collectively weaving rugs from home. Central Saint Martins is a renowned art and design college with a creative community of over 5000 British and international students.

The intention of the collaboration was to provide artisan-weavers with design tools, access to international knowledge resources and opportunities to translate their creative capabilities into economic potential. The project addresses the skill gaps experienced in marginalised communities in rural Rajasthan, India, where 90% of the artisan-weavers live below the poverty line. For CSM students, the focus was to explore different approaches to global design communication through a diverse and intersectional experience.

The JRF team recruited 25 artisan-weavers and set up a community learning space including digital access and a translator. CSM academics co-delivered 12 lectures, ranging from ethics of intercultural collaboration to sustainable design practices and regenerative leadership. Through online workshops students and artisan-weavers learnt together, exchanging design insights, technical expertise and personal stories. The collaboration led to a collection of co-designed hand knotted rugs which encapsulate the multi-facetted journey of this project (Figure 1).



Figure 1. Two female JRF artisan-weavers with several co-designed rugs from the final JRF X CSM collection.

2. Background

2.1 Global Design Context

Globalisation of the textile industry has led to a decline in manual labour in the West, a gap filled by the exploitation of cheap labour in the global South. With this structural shift the artisan is losing direct connection to their customer and market, and subsequently adopts the role of the invisible maker, whilst the designer is, in many cases, increasingly detached from the process of hands on making. Dr Kevin Murray, World Craft Council Asia Pacific Region, states that:

> "Globalisation has impacted negatively on traditional crafts... this has left many traditional crafts in an unsustainable position." (2010, p.5)

This detachment and change in working structure have led to a hierarchical situation whereby the designer, holding the market knowledge, strongly influences both the power dynamics and economics. This power inequity is particularly felt by female artisans, often invisible in craft production, who work in craft production largely because it offers them flexibility in terms of both schedule and work location. Readdressing the power imbalance between artisan and designer is a means to tackle the issues of gender equality and women's empowerment.

A shift in the craft landscape is emerging, with a new breed of designers looking to rebalance the hierarchical dynamic between artisan through equitable knowledge exchange. Digital platforms such as that created by The Anou Cooperative offer opportunities for direct market access connecting artisans to potential clients. These new platforms allow artisans to navigate the complexity of global commerce and gain market insights resulting in increased economic opportunity. These platforms of democratisation give the artisan greater agency, positioning them to initiate external design collaborations. Artisans, together with designers, are now addressing the systems through and by which products are developed, skills exchanged, and communities and knowledge systems regenerated and shared.

Educators have a key role in equipping students with the skills needed to navigate these new territories of collaboration as future designers. Building new skills of empathy, knowledge exchange and equity. Textiles are now being used as a tool for connectivity and as a catalyst to changing ideas and system innovations.

Over recent years, driven by global environmental challenges, we have seen the emergence of a more politicised ethical consumerism and consequently a renewed interest in global artisanship and transparency in supply chains. Fashion Revolution, established in 2013, is a key player in this field with a belief "in a global fashion industry that conserves and restores the environment and values people overgrowth and profit." (Fashion Revolution Website, n.d.).

Advocating for citizens everywhere to demand greater transparency in the supply chain and enabling the consumer to connect more closely with the people who produce the fabrics and raw materials used in textiles has led to artisans becoming more central to this conversation. Whilst this movement goes a long way in promoting greater transparency, these narratives highlight technical, material and making skills rather than focus on "design" or other knowledge bases. Digital platforms are increasingly used to reinforce the role of the artisan as maker, whilst increasing the profile of the artisan these gestures frequently mask the deeper inequities.

The project JRF X CSM seeks to challenge this hierarchical narrative and disrupt power dynamics between artisans and designers through a model of learning together and knowledge sharing, challenging the "Designed By" and "Made By" narrative.

Increased market understanding and design confidence through effective partnerships and material knowledge can support the artisan towards more sustainable livelihoods and agency. Through collaborative knowledge sharing new roles for both designer and artisan are evolving. Woven rugs offer an authentic tool for storytelling and collaboration, through materials, images and techniques social stories are played out and diverse world views rooted in culture, place and time are brought together.

> "The rural arts of India are the arts of settled villages and countryside, of people tuned to the rhythm of nature and its laws of cyclical change." (Jayakar,1989 quoted in Chatterjee, 2016)

Design and craft-making have the material power to challenge traditional arrangements of agency and domination and foster empowerment (von Busch, 2022).

2.2 Knowledge Systems

Examination of the knowledge systems held by both artisan and designer offer insights into the potential new working relationships which can be achieved through knowledge sharing and the re-evaluation of existing power dynamics.

Traditionally artisan knowledge draws on skills of making and materiality, these haptic skills offer insights into both sustainability and local economics. The approaches traditionally adopted by artisans whereby materials are sourced locally, used efficiently with minimal waste and products are developed to commission, embody key sustainable approaches. For textile artisans, knowledge is embedded in the system of the artisan community as a whole. Mazzarella, Mitchell and Escobar describe this:

> "The holistic contribution of textile artisan communities can be seen to support sustainable development through social engagement, environmental stewardship, boosting the creative economy and preservation of cultural heritage." (Mazzarella et al., 2017, p.1)

Artisan knowledge includes not only how a material might be selected, sourced and prepared, but how it might be coloured, woven, and repaired. Material innovation and deep technical knowledge of the specific craft are key and applied to all stages of the production process (figure 2). Artisans typically work collectively with organisation taking place at a familial or village level to navigate the various structures and dynamics within a community.



Figure 2. Close-up of an artisan-weaver hand-knotting one of the co-designed wool carpets.

Most frequently the artisan learns through generational, direct knowledge transfer. Approaches to making are held within families and communities. The artisan-weavers working with JRF evidence a specific collective identity through their rugs. This collective identity is known as Manchaha (expression of the heart). Through the approach of Manchaha, artisan-weavers are:

> "Given the opportunity to express themselves through their rugs with a mix of personal stories and elements of their own culture and surroundings." (Jaipur Rugs Website, n.d.)

Both artisan-weavers and textile designers have the knowledge required to facilitate the sustainable development of a product, inputting their knowledge at specific stages of the value chain. Textile Designers evidence a "specific blend of knowledge" (Igoe 2010, p.3) a way of thinking which allows them to assimilate various stimuli. This tacit knowledge which brings together thinking, knowing, and making equips the designer to challenge existing patterns of creation and production.

> "Tacit knowledge can be defined as skills, ideas and experiences that people have in their minds and are, therefore, difficult to access because [they]… may not necessarily be easily expressed." (Chugh, 2015, p. 128)

Textile designers have knowledge in relation to research skills, visualization and communication. Tangible tools are essential for collaboration.
These varied and complementary knowledge systems evidenced by artisans and textile designers, supported by a risk-taking approach from textile students can support effective co-creation. New channels of knowledge exchange and "collective creativity" (referred to as acts of creativity that are experienced jointly by two or more people) are emerging. Sanders identifies a move towards Co-creation rather than individual authorship (Sanders, 2013; Sanders and Stappers, 2014).

2.3 Co-Design

The concept of co-designing has been widely discussed and multiple definitions have been published since the 1960s. Fundamentally creative agency is shared by the involved researchers, designers and participants, which can be consumers (Prahalad and Ramaswamy, 2000), urban stakeholders (de Koning et al., 2016) or medical patients (Vargas et al., 2022). Whilst the principle of participatory design and co-designing is based on knowledge sharing, the understanding of process dominance and empowerment (Wang, 2023) has shifted to question hierarchies and stereotypes of 'non/expertise'.

For this paper the authors aim to focus on the unique context of co-designing with artisan-weavers situating the process in a distinctive area between design and craft, education and industry, digital and physical, and intercultural communities of practice (Wegner, 1998). The following is a glossary of terms relevant to the nuances and differences to the specific context of the JRF x CSM Co-design project.

In *Participatory design* participants are seen as beneficial contributors to the design process by offering their expertise and knowledge as a resource (De Koning et. al., 2016). Ehn describes participatory design as design "with a special focus on people participating in the design process as co-designers" (2008, p.93).

Co-design is defined as the creativity of "designers and people not trained in design working together in the design development process" (Sanders and Strappers, 2008, p.6) whilst Brant, Binder and Sanders outline the three key components of this process as a multi-circular triad of making, telling and enacting (2012).

Co-creation is often seen as a more extensive process ranging from conceptual to spiritual – with Vargas et al. describing it as:

> "The collaborative approach of creative problem solving between diverse stakeholders at all project stages. It emphasises diverse stakeholders at all parts of an initiative process, beginning with determining and defining." (2022, p.2)

Sanders and Strappers see co-creation as the collective creativity of collaborating designers ranging from the physical to the metaphysical and from the material to the spiritual (2008, p.6). In contrast some designers use co-design to describe the process of collaboration in which co-creation can take place, so they see co-creation as subordinate to co-design. (De Koning et al., 2016)

Cross-pollination is a craft community specific term introduced by Dhaundiyal and Pant (2020), who define a more fluid and open process between designers and craftsmen as consisting of four different collaboration stages: Sharing, Connecting, Framing and Cascading.

The concept of 'boundary objects' was first introduced by Star and Griesemer in the zoological museum context and defined as both "abstract and concrete" (1989, p.393) and are used to enhance the interaction with members from different social groups. Zamenopoulos and Alexiou expand on this in relation to co-design and linking different communities:

> "Shared material objects and processes arise at the boundaries across different 'social worlds' defined as the wider contexts as a set of shared practices, ideologies and norms." (2018, p.140)

Whilst the closely related pedagogic practice of object-based learning is defined as multi-sensory experiential learning (Chatterjee and Hannan, 2016) involving collective material culture.

The focus of this paper is therefore on the exploration of intercultural co-designing with artisans as a form of non-transactional creative exchange between design students and artisan-weavers. There is a fine line between design influence which "happens organically" (Altbach, 2013) and employing an outside perspective that is not culturally sensitive (Janzer and Weinstein, 2014, p.338–339) which could at worst become as a form on neo-colonial design intervention. Mamidipudi identifies the following three scenarios for designers co-working with artisans: intervention, in which designers plan while artisans implement to develop a commercially driven outcome; interaction, in which designers "constrain their agency" and involve different craft communities to produce a socially concerned craft outcome; as well as mediation, in which designers:

> "Act as translator and mediator of cultures and leave room for artisans to actively shape culture, exhibiting a cultural concern." (Mamidipudi, 2018, p.44)

In the context of intangible power dynamics between indigenous artisans and art school-trained designers it is helpful to recognise Barcham's (2023) recommendation of using new design approaches involving storytelling as an equitable co-design methodology, which brings Brant, Binder and Sanders' model of "making, telling and enacting" into a different global context. Whilst the "empowerment" of artisans as part of the co-design process has been widely documented the authors aim to amplify and reflect on the powerful creative assets and craft skills of artisan-weavers and how these can inform future design-craft exchanges.

2.4 Educational Perspective

Students taking part in the co-design project were Year 2 students who had specialised in Woven Textile Design. The cohort comprised of 25 students from diverse cultural, class and creed. In the context of teaching international cohorts within a western institution "the world of practise in art and design, higher education in the UK means understanding its western context and traditions," both tutors and students are being asked to

> "Review and interrogate your own culture and values… actively pursuing intercultural engagement (...) seeking opportunities to learn about the national and cultural perspectives of others." (Austerlitz et al., 2008)

The JRF X CSM Co-design project provided a unique opportunity for staff and students to pursue "intercultural engagement" both across the student cohort and with participants in Jaipur.

Within *Art & Design Pedagogy in Higher Education* Orr and Shreeves outline the "pedagogy of the project" (p.109) as an alternative model to traditional academic pedagogies. At CSM the students are often exposed to "brief based or project centred learning" (p107). The JRF X CSM Co-design project tapped into an emerging type of project, an evolution of the "Live Brief" defined by Orr and Shreeves as: "Projects set by, or in conjunction with, an external party" (p.111) where traditional power dynamics between industry and students typically play out. Live briefs aim to improve employability of students through experiencing scenarios aligned to employability credentials within traditional industry models.

Live projects have traditionally been focused on equipping students to work within established sectors and industries. Co-design projects can build on the traditional notions of professionalism but challenge the transactional nature of work live projects (Orr & Shreeves, 2017, p.111). Co-design as defined "a practise where people collaborate or connect their knowledge, skills and resources in order to carry out a design task" (Zamenopoulos and Alexiou, 2018, p.10). Unlike live project, where students work individually to briefs set by external stakeholders, the co-design project seeks to foster engagement between the internal and external stakeholders. If we accept bell hook's notion that:

> "The decentring of the West globally, embracing, multiculturalism, compels educators to focus attention on the issue of voice. Who speaks? Who listens? And Why?" (bell hook, 1994, p.40)

Then the co-design project model encourages both educators, and learners, to question this.
UAL's "Creative Attributes Framework" (UAL, n.d.) was put in place with the aim "develop ethical and wide-ranging qualities, abilities and behaviours" in students with a view to improve their employability. The Creative Attributes Framework is embedded into curriculum at CSM to support the development of key skills, behaviours, and abilities. The JRF X CSM Co-design project developed student knowledge and skills across all three capabilities with a particular focus on Showcasing Abilities and Navigating Change.

3. Methodology

> "People do action research as a way of helping them understand how they can influence social change. This commitment is contained in Marx's idea that it is not enough only to understand the world; the intent is to change it for the better." (McNiff, 2002, p. 25)

We applied an Action Research Project methodology [ARP] as defined by Jean McNiff in Action Research for Professional Development as

> "Identifying a problematic issue, imagining a possible solution, trying it out, evaluating it (did it work?), and changing practice in the light of the evaluation." (Jean McNiff, 2002, p.7)

Within this framework the JRF X CSM Co-design project identified the problematic issue of traditional artisan/designer collaborations reinforcing colonial mindsets of exploitation and hierarchy. The Co-design project typology provided a possible solution and the JRF X CSM Co-design project provided an opportunity to apply, evaluate and inform future practise. This was a course wide ARP, requiring the authors and members of the wider BA Textile Team to reflect on their own practise with a view to advancing the holistic course practice.

As part of the ARP qualitative research approaches were employed, collecting data from multiple sources including student artisan-weavers and design-student interviews, object analysis, questionnaires, photographs and WhatsApp exchanges. Thematic data analysis was carried out, taking into consideration the authors positionality and aligned to Braun and Clarke's notion that:

> "Themes do not passively 'emerge' from data but are actively produced by the researcher through their systematic engagement with, and all they bring to, the data set." (Braun and Clarke, 2022, p.8)

4. Case Study

The Design intervention was set up to offer a unique and innovative collaborative learning opportunity for both artisan-weavers and design students focusing on the sharing of personal stories, skills and life perspectives. The intention of the collaboration was to build on design skills and creative confidence of rural artisan-weavers and to build on design and communication skills and cultural capacity of design students.

The content of the workshops was co-developed by the CSM BA Textile Design team and JRF team and covered a range of skill building workshops. Over a series of weeks and conducted through online teaching platforms the design workshops covered a range of topics including design and storytelling, market awareness, materials and sustainability and a technical session led by JRF. The focus was on creating non-hierarchical creative dialogues through shared practical workshops and design experiences. The practical design aspects were complimented by an innovative and participatory workshop on female leadership (figure 3). For a meaningful and personal exchange of ideas, artisan-weavers and design students were partnered: 2 design students working with 2 artisan-weavers. This medium group approach intended a more meaningful and personal exchange of ideas and invited storytelling in a safe environment where each participant felt able to contribute.

Both tangible and digital approaches were used to promote connectivity between artisan-weavers and design students throughout the project. Tangible approaches included the exchange of "cultural parcels" - boxes containing inspirational and technical materials, objects, and personal items at the outset of the project and tangible mood boards and design inspiration to support the artisan-weavers in the final stages of design. These boundary objects (Star and Griesemer) formed creative toolkits that were essential for facilitating object-based learning, knowledge sharing and co-design.

An accessible research theme 'everyday journey' was identified. Both artisan-weavers and design students shared personal and cultural stories through the identification and documentation of everyday objects of personal interest from their journey, either around their village or to college.

These images, videos and sounds were shared through WhatsApp groups, each artisan-weavers/student designer group were assigned a specific visual icon to facilitate communication and navigate language and literacy barriers. WhatsApp enabled an easy exchange of content, facilitating a visual dialogue of design inspiration. Through regular weekly online meet-ups artisan-weavers and design students shared and discussed stories relating to the WhatsApp images, videos and sounds (figure 4). Artisan-weavers contextualised the images of village celebrations, harvesting tools, food items and rural landscapes they had shared. Design students shared images and narratives of their commute through urban environments, reflecting the contrasts of the city and differing cultural and material starting points.



Figure 3. Screenshot from one of the online workshops where artisan-weavers are enacting their notion of collective sustainable leadership.

Collaborative visual design resources through the digital platform Padlet were set up to create opportunities for sharing imagery and sound. Artisan-weavers and design students were represented on the Padlet page through profiles and examples of previous work encouraging connection between group members. Design resources were co-created including a glossary of technical words and inspirational images of weave and dye processes.

The environment and wider issues around sustainability including material provenance and life cycle were discussed in workshops where design students and artisan-weavers learnt alongside each other in the digital space. The artisan-weavers shared innovative sustainable approaches to dye techniques and the repurposing and coloration of waste yarns.

Sketchbooks and experimental ideas were developed by design students combining artisan-weavers' images and materials with their own research journeys. Artisan-weavers further develop these sketches through group discussion in collaborative teaching sessions moderated by a translator.

Tangible mood boards offering additional inspiration for final rug development were shared with artisan-weavers to facilitate a collaborative design approach (figure 5). Design "spaces" were created with design students leaving space in their designs to encourage spontaneous design adaptation by the artisan-weavers during the making process. This was a conscious decision between CSM team and JRF to ensure artisan-weavers familiar design approach could be applied, whilst looking to avoid control over methods of designing.

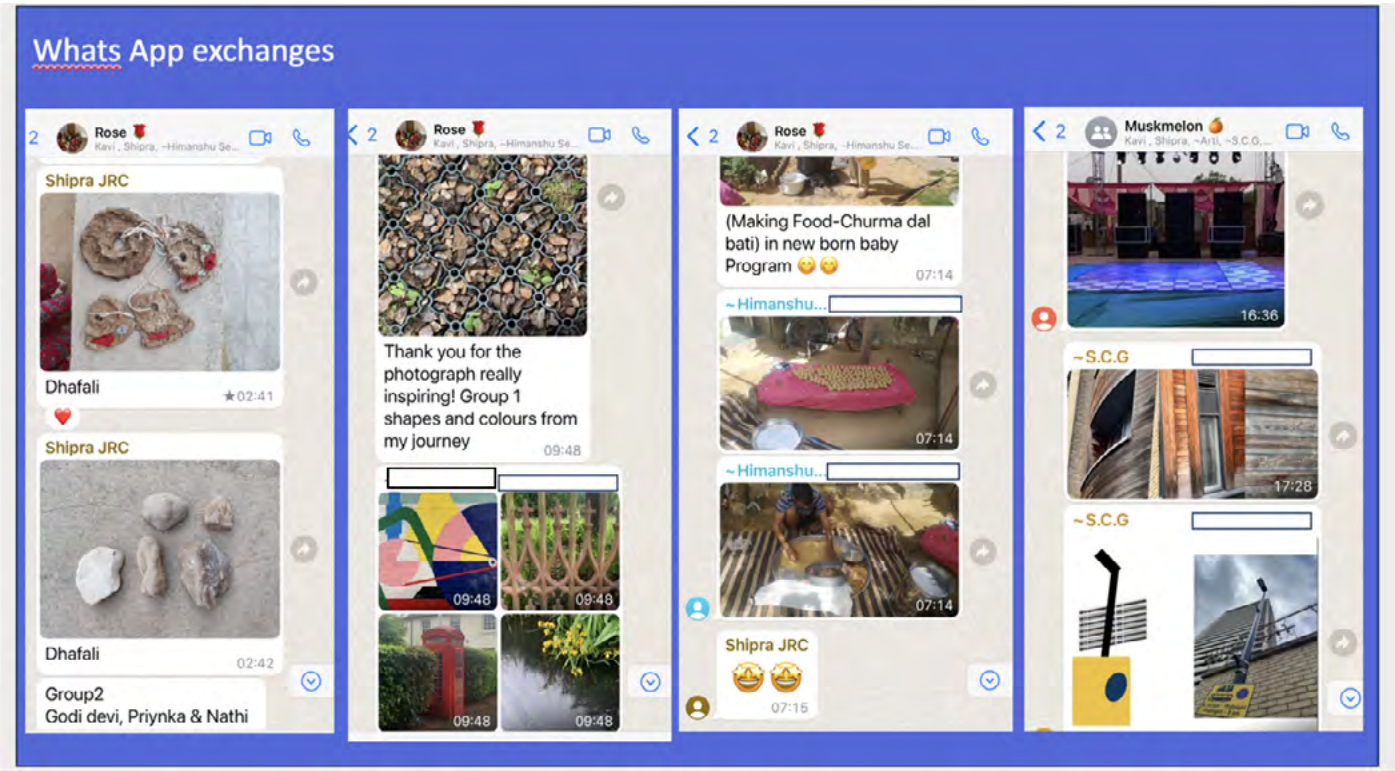


Figure 4. Co-produced Padlet board showing imagery shared by artisan-weavers and student designers through WhatsApp.

The artisan-weavers, whilst tasked with the interpretation of the co-created design, also had the freedom to reinterpret, change and modify the design. In some cases, adding authorship to the final woven pieces through signatures, demonstrating confident ownership of the co-created design. The final outcome, a collection of rugs, was effectively shaped by both the craft skills and deep material knowledge of the artisan-weavers, the risk-taking and image making approach brought to the project by the students and the specific tools built in to facilitate the co-creation/co-design process.

5. Findings

During the JRF X CSM Co-design project there were hidden power dynamics at play such as tutor-students and employer-artisan as well as apparent, noticeable differences between Global West- Global South, rural-urban, educational, gender as well as ethnic and economic differences. The authors acknowledge the limitations of the above findings as they themselves are intrinsically embedded in the power structure of the project's setup, potentially preventing them to fully capture authentic responses from all participants.

Key to the perceived success of the collaboration was the co-development of the programme from the initial funding application stage to making time to understand the different work cultures, physical and economic restrictions, existing expertise, and knowledge gaps to plan meaningful interventions. The starting point of the collaboration was an emphasis on horizontal team structures allowing consensus in decision making through deep listening, inclusive language and clear communication.

Students and artisan-weavers successfully developed a culture of mutual trust and a sense of belonging enabling participants to take micro-risks within a safe online space and embrace the encounter of unfamiliar cultural perspectives and textile approaches. Holley and Steiner propose a safe classroom space which allows students:

> "To feel secure enough to take risks, honestly express their views and share and explore their knowledge, attitudes and behaviours. (…) Being safe is not the same as being comfortable. To grow and learn, students must confront issues that make them uncomfortable." (2005, p.50)

Agreeing on shared ethics and values from the outset of the project helped to set a framework around celebrating unique identities and having an equal voice. JRF artisans-weavers commented in their project feedback: "They [CSM tutors] emphasised the significance of love in collaborative work a principle that became integral to infuse the essence of our carpets".

Many micro-risk steppingstones were built into the project, enabling participants to unlock and mobilise their knowledge and creativity. For example, during the first shared lecture, CSM students and staff were challenged on their preconceptions of female artisans as defined by excellent craft competence, rural lifestyle and raising a family – instead of associations with entrepreneurial or design skills. Highlighting unconscious biases demonstrated to staff and students a need to actively and reflectively engage in the co-design process to ensure equity or ideas and input was maintained. For the students this was a new consideration to their usual curricula but an important skill to take through into all forms of collaborative working.



Figure 5. A co-designed mood board and colour palette for a rug - bringing together visual representations of 'everyday journeys' including photographs of Jaipur artifacts and London shop front textures.

Working towards the same accessible design theme 'everyday journey' worked as a connecting point and led to some inspiring visual storytelling as part of the co-design process. Tutors specifically encouraged personal contributions, valuing differing individual and collective identities. Carefully selected medium size groups fostered a sense of personal responsibility and shared ownership. Knowledge sharing through digital Show & Tell workshops expanded the "telling" component of co-design. Working within a group context, through digital mediums, pushed students to be accountable, both to their group members, but also to the wider participatory process, turning on their cameras and engaging visually when unable to communicate verbally.

Building connections through digital platforms and shared learning resources was important to bridge varying levels of language, digital and material literacy. The authors' model of co-designing between artisan-weavers and design-students (figure 6) identifies the access to shared digital and physical tools as

vital to navigate different learning environments and enabling an equitable creative process. The WhatsApp groups were successful as an accessible tool to share visual storytelling through images and films. The glossary of design terms and the session on local rug weaving approaches helped spark further co-creativity and understanding. Artisan-weavers stated, “This was the first time we have seen such design references” whilst students had not heard “knot counts” and other rugmaking vocabulary before.

The exchange of boundary objects such as yarn samples, cultural objects, everyday snacks and gifts was a pivotal moment in the project, creating tangible representation of both design cultures. CSM students enjoyed the personable, joyous aspect stating: “It is very exciting to work with artisans with such knowledge and to work with a community that experience things in such a different way, to laugh and learn together”.

Each group of students collaboratively developed collaged textile design outcomes which represented collected ‘everyday journey’ references from Jaipur and London. These were presented on paper by the students who learnt how to negotiate different elements and to be less precious about a preconceived design language. Artisan-weavers were confident in expressing themselves further as part of the co-design making process, specifically when adding spontaneous motifs to the blank ‘design spaces’ as an open invitation to add a final layer of dialogue into the physical rug design. Each maker added their signatures to the rugs to amplify their role as both co-designer and weaver.

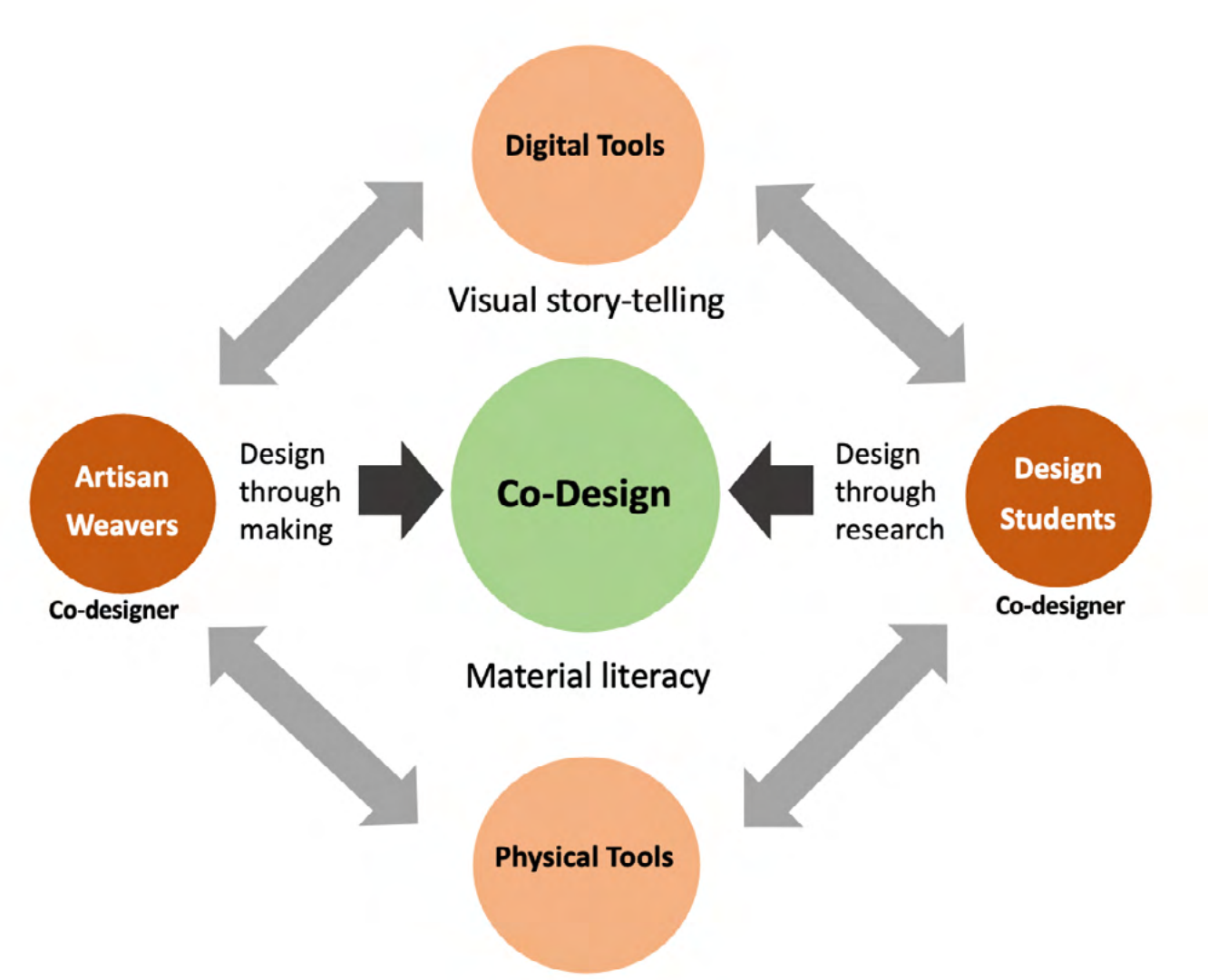


Figure 6. Co-designing between artisan-weavers and design students.

Alongside the practical skills such as active listening and empathy building the students also expressed a wider impact of the project was their engagement in the topic of equitable design systems. For a predominantly white student cohort, asked to actively engage in challenging and deconstructing traditional hierarchies, this project enabled students to engage in de-colonial conversations around their work. The feedback evidences new threshold levels in learning, as one of the design students' comments: “This project gives us the opportunity of discovering what is really design and designing in the real world – how it works, working with other people, collaboration.”

Challenges were inevitably numerous. Logistical hurdles in bringing together artisan-weavers from distant villages had to be overcome. Practical challenges included time difference, translation, communication and internet connectivity. Wider challenges related to the learning experience and the realities of the differences in life situations. Both artisan-weavers and design students had different expectations and motivations; the artisan-weavers were salaried as part of their engagement and the design students were being assessed, the fact that the collaboration activities were non transactional between artisan-weavers and design students facilitated a more open, safe place. Additionally, ownership of Intellectual property [IP] presented a challenge due to the collaborative nature of the outcomes. For the purpose of this project a collective decision was made to assign all IP rights to the charitable foundation (JRF).

CSM Staff were challenged as to how best to accommodate intercultural collaborative experience within the constraints of an already loaded curriculum and industry expectations. Initial concerns around how to create equitable environments of shared learning and co-creation were dispelled once design students and artisan-weavers became unified in their aims and personal connections formed between group members. A lack of a shared spoken language, whilst initially perceived as a hurdle, soon became the catalyst for a more visual and in turn richer learning experience. The cultural unfamiliarity as experienced by both design students and artisan-weavers became a tool to facilitate engagement and curiosity, the navigation of cultural unfamiliarity contributed to the interest, humour, and shared learning on all sides.

6. Discussion

When we establish an enabling environment and materials to support and provoke collective creativity (Sanders 2013) we create a design studio space that supports the exploration of innovative ideas, even in wicked problem situations Sanders (2015). Mazzarella et. al proposes that designers have the ability to trigger micro-transformations (2016), the authors extend this notion to say that artisans can equally trigger micro-transformations in designers. The project’s embedded co-creation process enabled micro-transformations in the design and making approaches of both artisans and design students and their tutors.

Collaborative making through the telling, making and enacting process supports an understanding of potential power dynamics at play whilst micro risk-taking by both designers and artisans create confidence to navigate diverse voices. A shared textile co-design mindset can break down cultural boundaries and explore new intercultural outcomes.

Barriers such as language and digital literacy have less impact on co-designing textiles, as a significant part of the process is through visual materials and thinking through making. Noticeably design students apply a more controlled design lens to the process rooted in Western Bauhaus and Arts and Crafts education, which puts individual authorship at the centre. In contrast artisan-weavers have usually been generationally trained by family and operate in a local community context. Interestingly artisan-weavers do not use sketch books to draw their layout ideas before weaving, following a more intuitive, spontaneous, design process developed from within the hand knotting process, often resulting in a series of linear figurative motifs on small scale.

With the artisan-weavers as creative partners in the development process the design students were positively challenged to find new methods to communicate design intentions– such as leaving open blank

layout spaces to be filled in during the making process as well as negotiating collective design ownership (figure 7). At the same time the initial co-research phase was new to the artisan-weavers, this encouraged them to establish colour palettes, sketchbooks and small material samples. Zooming out and creating a large-scale layout meant that the co-designed rugs displayed a mix of macro abstract textures and micro motif patterns.

The navigation of unfamiliar scenarios approaches led to increased confidence and a more effective co-design process. Design students and artisan-weavers were supported to develop 'listening' and 'sharing' skills through specific storytelling sessions and open-ended questions. Digital literacy and accessibility limited the possibility of synchronous designing through online platforms. In future scenarios this could be overcome.

Collaborative textile making between artisan-weavers and designers offers the possibility to share stories and create new sustainable material solutions through collective inter-cultural narratives. Where students are active players in their learning experience and step outside their comfort zone, the learning experience is more transformative.



Figure 7. One of the co-design rugs with a 'free-style' artisan-weavers motif strip was added into one of the blank layout spaces during the final making process.

7. Conclusion and Recommendations

What could artisan knowledge and designer approaches look like in the future?
How best to build equitable knowledge exchange and creative connectivity into the curriculum?

The authors propose evolving new pedagogies including the ethics of design collaborations, visual storytelling skills, recalibrating creative attributes such as empathy as well as understanding local heritage and how this relates to post-colonial contemporary design culture as key considerations to move towards globally inclusive teaching approaches.

Western art schools should actively engage with local and global communities to permeate teaching silos and reconnect with the making process, supply chain and materials. Much can be learnt from other global

educational practices around reversing power dynamics by employing artisans as design tutors. At the same time, it is important to develop resilient future design knowledge to go beyond craftsmanship and amplify the cross-pollination of local knowledge and traditional making skills with critical design thinking, digital literacy, and open-ended research approaches:

> "to activate craft communities to gain critical insights into local contexts, collaboratively develop a sustainable mindset to envision alternative futures, and reframe craft sustainability into actual actions." (Wang et al., 2023, p.65)

Future designers will be playing a broader role requiring collaborative, communication and facilitation skills. What will the essential design knowledge for future students be?

At a personal level, the authors recognise the benefits to their own skills and knowledge in intercultural facilitation, through the engagement, planning and delivery of the co-design workshops. A future design curriculum should support students in understanding the ethics of collaboration as well as how to effectively facilitate co-creation and connectivity. Developing workshopping skills alongside active listening and observation skills will support both the artisan and design student to navigate these new roles within a changing global design culture.

Future artisans, designers and educators will require intercultural communication skills to build confidence and agency to establish effective and sustainable partnerships. The role and value of future artisan and craft practices is shifting, and the global artisan will play a key role in rebalancing the dynamic between design, artisanship, and market. This paper concludes that through co-creation and non-hierarchical design dialogues artisans and designers can positively challenge the top-down power dynamics towards a more equitable future.

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P/REFERENCES OF DESIGN

IM/POSSIBILITIES FOR PLURIVERSAL DESIGN EDUCATION: A FIELD GUIDE FOR NOTICING INSTITUTIONAL LIFE.

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KEYWORDS | DESIGN EDUCATION, PLURIVERSAL DESIGN, ACADEMIC INSTITUTIONS, HIGHER-EDUCATION, FIELD GUIDE

ABSTRACT | A growing body of scholarship supports the development of pluriversal curricula towards healthier ways of being, knowing, and designing. At the same time, the notion of the pluriverse raises thorny questions for the dominant university-based model of design education. Pluriversality challenges us to consider how institutional arrangements, disciplinary habits, and cultural norms privilege certain ways of learning over others and then begin reworking—or making new—ways to practice design education. Yet, despite growing interest in pluriversal design education, we lack references of how people grapple with practicing design education differently on the ground. As an invitation to enrich conversations that transform design education, this exploratory paper sketches a variety of components at play in the institutional machinations and day-to-day experiences of educators and students. The sketch is presented in the form of an ecological field guide to institutions. The field guide aims to support educators in noticing how the interconnectedness among the day-to-day tasks, positions, relationships, agreements, infrastructures, and risks of a particular context can constrain and expand possibilities for transforming institutions of design education toward pluriversality. By making public the everyday practices of educators, we can keep critical reflection on design education futures grounded—resisting the pull to standardize while informing local, pluriversal, action toward healthier ways of knowing and being.

1. Introduction

> *"Are you excited by budgeting? Do you love scheduling courses? What about caring for your favorite learning management system? For many design educators, such activities represent what it means to work with an institution. But what if, rather than approaching our institutions as bureaucratic task masters, we engaged them as living ecologies, full of change and possibility?*
>
> *In this field guide, we invite you to explore the rich institutional life you take part in as a design educator. By taking more notice of our institutions, we believe you'll find new and unexpected possibilities to practice education that are in tune with the myriad ways of living, being, and knowing in the world. Perhaps there are events or projects already happening that—when noticed differently or more fully—hold potential for fostering pluriversality wherever you practice design education.*
>
> *As you go about noticing, you will likely realize that the various features of institutions do not have distinct boundaries. We agree! Nothing in our institutions exists in isolation. As such, we encourage readers to pay particular attention to the relations among the things you notice and what nourishes, sustains, and interrupts them."*
>
> — Draft Introduction to A Field Guide for Noticing Institutional Life

Take a moment to consider the faculty meeting. At first, the event seems relatively mundane: a routine occurrence where you and your colleagues walk through a list of administrative updates, committee reports, and new issues affecting your design department. Pay more attention, however, and you might discover that these meetings play a vital role in how education happens. Colleagues engage in chit-chat that builds bonds or reveals unexpected insights about why things in the school work the way they do. Ideas emerge for new initiatives. People nominate each other for task forces to set standards or review applications of incoming faculty and students. A volunteer records meeting notes and sends them out afterwards, turning the conversation into a textual object that contributes to further meaning-making and action. All of this plays out in an hour, maybe two, once a month over the course of the semester.

The future of design education is a perennial topic in design academia, but discussions of it rarely delve into things like faculty meetings. Yet, such moments can have a profound effect on the way we educate designers. And, of course, meetings represent just one aspect of the rich ecology of institutional life where so much formal design education takes place. There are also scheduling calls, cloud-storage platforms, learning outcomes, contractual obligations, accreditation reviews, and mandatory trainings—the list goes on. For those of us in the thick of it, it can be difficult to step back and identify just what we have to work with as we participate in designing our institutions. However, as we confront strong arguments that our dominant model of design education falls short in its ability to prepare students to engage with on complex socioecological issues (Davis & Dubberly, 2023), we need to question not just what we teach design students, but how we conduct design education itself.

Questioning the institution of design education may feel like a daunting task. How many times have we expressed resignation over the stifling bureaucracy of our universities and colleges? Despite the situation, design educators may still find ways to operate at different speeds, engaging values that seem to run counter to the prevailing winds of their institutions. These small instances of educators working "otherwise" (Nicholls et al., 2021) within the system offer hope for transitioning to a model of design education that honors the diverse ways of living and being necessary for shared flourishing. The educators who figure out how to support pluriversal education from an insider position have noticed potentialities in the life of their institutions; they connect, leverage, or reconfigure practices to make space and time for pluriverse-supporting activities that do not fit dominant standards.

This article seeks to expand and enhance how design educators notice institutional life. Presented as an ecological field guide to institutions, the content serves as an invitation to examine how we can work within academic institutions to put pluriversality into practice. This sketch of the field guide is partial, developed largely from the position and perspective of an early stage faculty member at a large public research university in the USA. As such, publishing this sketch of the field guide to the wider academic community is an effort to subject it to critique and dialogue as a tool and orientation to change. Inspired by work such as Rob Walker's *The Art of Noticing* (Walker, 2019) and the popular genre of environmental field guides (Izaguirre, 2021), the guide provides a variety of prompts meant to hone the reader's attention to easily overlooked things around us. In the following pages, we provide a brief rationale for why it is worth considering institutions when exploring potential to make pluriversity happen in design education. After that, we move on to present the initial fragments of a "field guide" that explore a few propositional features of institutions to notice, and how, through attending to them in our everyday practices as educators, we might find possibilities—and likely impossibilities—for pluriversality.

2. Why Does (Not) Noticing Institutions Matter?

The ways we practice design education are not merely a matter of leadership decision-making or organizational designing. The practice of education is entangled with complex economic, political, and technological developments (Berman & Paradeise, 2016; Perkin, 2007). Even the ambitious projects of design education, such as the Bauhaus and The New Bauhaus were products of their time (Cross, 1983; Findeli, 2001; Findeli & Benton, 1991), and through various social practices—for instance, replicating curricula—such projects continue to exert influence on our time (Davis & Dubberly, 2023). As such, it behooves us as educators to focus not only on the content we teach, but also the social forces that affect the shape and focus of our activities. Yet, to look at design education through institutional and organizational lenses, it helps to clarify just what we mean by those terms and how they might be helpful in exploring potentials for pluriversality.

Institutional Theory has a rich history of scholarship, albeit potentially too rich. As Alvesson and his colleagues point out, the concept of institutions has become so expansive that it can be hard to identify what it cannot explain (Alvesson & Spicer, 2019). Not only that, scholars have discussed institutions and organizations using overlapping or conflicting concepts. We follow Charlotte Linde's (2008) distinction of "institution" as a broader category identified primarily through established and recognizable practices, while organizations represent primarily formal and legal structures. For the purposes of the field guide, we consider "design education" as an institution and specific "design programs"—whether embedded in universities or colleges—as distinct organizations. The institutional lens on design education highlights practices that commonly extend across design programs, such as project-based learning, studios, and critiques. Yet, despite sharing many characteristics, these practices play out differently depending on the particular organization of a design program. Class sizes, content, and number of faculty per section may be different from program to program. With this in mind, we see the potential for both lenses to orient our attention to aspects of design education that extend beyond—but are also enacted in—pedagogy and curricula.

2.1 Institutional Influences and Design Education

To understand the relationship between institutional forces and design education, we can consider an example related to design-at-large. For the past century, design has had an intimate relationship with modernity and capitalism. Design researcher Yoko Akama presents the notion of "Dominant Design" and argues that it "has accompanied modern world-making practices to be useful, effective, functional, durable, seductive, convenient, original and innovative, and has been used to solve problems for others, grow market share and increase customer satisfaction" (Akama, 2021, p. 107). In many ways, Dominant Design represents a powerful institution, one that is instilled and reinforced in practice. Frameworks such as IDEO's Feasibility, Desirability, and Viability position design's value firmly in service to solving problems and contributing to success in the marketplace. Following this logic, many design professionals have adopted design

ethnography and user research as ways to identify “unmet” needs and problems for (potential) customer segments. With the problems of others found and framed, Dominant Design practice moves on to prototyping to arrive at an optimally pleasing final product. This approach, Akama highlights, has deep connections to European philosophical traditions of the 20th century that privilege rationality (ibid). Indeed, prevailing conceptions of who designs, what gets designed, how we determine value in design, come from a legacy of the “one-world” reality from the global North (Law, 2015) that has overpowered so many other ways of being, knowing, and valuing—many of which are more in tune with the health of the planet.

The relationship among modernity, capitalism, and design, highlights the importance of attending to ourselves, our practices and the worlds we create or deny through design. This is no easy task. It requires confronting our personal habits and our relations with institutions. When it comes to education, we see the power of these institutional forces first hand. Wrapped up in the relationship between design and marketplace success, many design programs have launched initiatives that position design in service to this dominant paradigm. In such cases, educators gain recognition for working with industry. Students feel engaged by working on “real world” projects. The program positions itself as innovative. Industry partners feel invigorated by the breadth of new ideas generated in just a few weeks or months. These institutional forces work together, play out in practices—full of embodied understandings, habits, rules, and material arrangements—that make certain activities for educating easier, or even possible, while constraining or inhibiting others (Schatzki, 2019). This becomes especially important to recognize for design educators seeking to work with pluriversality.

Drawing on the work of anthropologist Arturo Escobar, Lesley-Ann Noel and colleagues —writing for The Future of Design Education working group on pluriversal design—advocate for a richer framework for design education based on the recognition that diverse worlds can—and should—fit. In support of this effort, they recommend focusing on relationality in design education, which “values trust-building, long-term commitments, and dedication to understanding constituents and their future prosperity” (Noel et al., 2023, p.183). The authors also highlight the importance of approaching design education through locally rooted knowledge and radical participation with, through, and by people affected by design. Yet, how do design educators proceed in fulfilling these aspirations when our daily practices are wrapped up in institutional life that pulls our actions toward productivity, universalization, and return-on-investment?

The pervasiveness of dominant institutional forces makes it daunting to imagine alternatives. To support pluriversality design educators need to face our institutional entanglements, recognizing that our universities and colleges enable and restrict certain courses of action. Additionally, as individuals often trained via the dominant system that limits pluriversality, there is undoubtedly a fair bit of “unlearning” (Akama, 2017) for us to undertake ourselves. We find hope for alternatives by approaching institutions on the ground, where everyday actions afford opportunities for creative maneuvers that redirect and resist dominant forces to support pluriversality. Our lives are full of potential ways for acting otherwise, but sometimes we could use a little help finding them.

3. Ways of Noticing Institutional Life

Our attempt with the field guide is to offer a humble starting point for our work toward pluriverality in design education. To some, noticing may seem like just another way to say “ethnographic research,” however, our proposition is much less formal. Our field guide is informed by an ethnographic attitude, but we do not suggest that design educators conduct ethnographies of their programs. The intention of this field guide is not to analyze design education as an institutional phenomenon. That said, our orientation shares much in common with what Sara Ahmed describes as a “phenomenological approach” to studying institutions (Ahmed, 2012): the field guide suggests a “thick” approach to institutions in an effort to “attend to what is looked over, to allow what is ‘‘overed’’ to surface” (ibid). Importantly, this perspective invites us to look at how everyday practice—activities, affectations, agencies, materials, norms, and understandings—create a sense of stability that we recognize as an institutional force, as well as “generative potentials” (Simpson & den Hond, 2022) for change.

To enrich our guide to noticing institutions, we find inspiration in theories of practice (Reckwitz, 2002; Schatzki, 2021; Shove, 2016). The power of looking at worlds through practices "lies in its capacity to describe important features of the world we inhabit as something that is routinely made and re-made in practice using tools, discourse, and our bodies" (Nicolini, 2012, p. 2). Institutions, according to this view, are not static, deterministic, entities, but "combinations and configurations that are regularly *reproduced* [emphasis added]" (Blue, 2019, p. 931). Looking closely at how people's actions are bound up with institutional life through everyday material engagements has led scholars to identify how such things as commitments (Kanter, 1968), rhythms (Blue, 2019), narratives (Linde, 2008), and infrastructures (Star, 1999) play a role in how work and change happen. This is the orientation we aim to support with our field guide: a search for relations among the everyday stuff of muddling through our work as educators and the pathways, ruts, openings, and dead-ends of institutional life.

3.1 A Caveat About Field Guides

Presenting this sketch in the genre of the field guide might imply a certain amount of stability and objectivity to institutions. Indeed, popular field guides for birds or plants may communicate about the world through matter-of-fact descriptions associated with the natural sciences. As Izaguirre highlights, even field guides to birds have presented different orientations and expressions of "nature" over the years (Izaguirre, 2021). Our articulations of nature are tied to countless everyday cultural practices—there are many modes of naturing (Swanson et al., 2018). As such, what readers are invited to "see" via natural field guides depends on the context, and thereby perspective, from which the guide was written. Just as the articulation of nature used in field guides and policies depends on sociotechnical traditions, our field guide frames design education in a particular way, namely in terms of institutional life.

As such, this field guide relies on a sociomaterial understanding of institutions, where elements are not fixed, but are dynamic and context-specific. There are many modes of institutioning (Huybrechts et al., 2017). Thus, we do not provide a list of places to look or things to look for, where one can consistently expect to find specific things that support pluriversality. Just like the ways in which practice theory seeks to stimulate "research capable of rendering visible phenomena and contexts that were previously off the radar" (Reckwitz, 2016, p. 115), this field guide aims to prompt design educators to attend to their practices in hopes of discovering opportunities for pluriversality in their particular contexts. As such, readers of the field guide will not find an exhaustive list of aspects of an institution. Instead, the guide calls each reader's attention to characteristics that appear relatively common to institutional life in design education.

4. Sketching a Guide to Institutional Life

> *Our field guide introduces four features of institutions for design educators to explore and make discoveries: Accessing, Evaluating, Planning, and Knowing. Bound up in these features you'll likely find all sorts of bodies, feelings, materials, processes, tools, rules, spaces, and values. Working together, these common, everyday aspects of our lives carry potential for courses of action that can support or suppress the various realities we touch through design education.*

This brief overview frames the orientation of the field guide. As presented in the introduction, the four features are not meant to classify separate aspects within an institution. Rather, they are connected, overlapping, and entangled. Articulating these four features is a way to provide starting points for noticing. From these starting points we invite noticers to explore the rich complexity of connections that make up the practices of design education. In the following paragraph, we provide a brief description and an example exercise for each of the four features, Accessing, Evaluating, Planning, and Knowing. The examples are provisional, meant to show how the field guide might support design educators in paying attention to their everyday sociomaterial practices and discover potentials for pluriversality. Even in taken-for-granted, background activities, like preparing for a critique or structuring class time we act in ways that make some realities im/possible for design education.

Accessing

Many design programs have dedicated teams, or at least work streams in the administrative team, focused on admissions. However, if we start attending to the entrances and exits of our programs, we confront the realities of access: certain things—credentials, metrics, evidence—restrict or grant passage; rules make it easier for some people to fit than others; pathways are more or less visible depending on your location.

An Exercise to Notice Accessing: Doors

Take a moment to consider, perhaps, the simplest starting point for attending to access: doors. Who walks through the doors of our institutions of design education? Do different people walk through physical doors compared to virtual ones? How do people find their way to our doors? When do doorways begin and end? When are doors locked or open? Who (or what) opens and locks our doors? What is allowed to come in, or out of, doorways? How do we feel as we approach the doors of a particular building or room?

By noticing doors, we might also attend to the spaces and locations where they exist. The doors we notice might lead into buildings just off a pristine courtyard on a college campus or from a bustling urban sidewalk. Doors also invite us to notice how we relate to others through control of spaces. We tell students we have an "open door" policy for our office hours or to "lock the studio door" to protect their projects and things. Take a moment to map out the "doors" of your program, where they're positioned, and how they shape access to design education.

When we attend to the humble door as an entry point for noticing access, we may start noticing the positions and attitudes that our sites of design education present towards others. When it comes to pluriversality, we can identify how the position of doors imply who design education is for, under what terms, and in what capacity. Primarily, the doors of design education reside in schools, places for formally approved students and faculty. At the same time, design programs are rarely confined to a single building. Studios, galleries, and classrooms often extend out into our surrounding neighborhoods. These extensions may afford different forms of access at different times. What made these extensions possible? How are they related to the communities in which they are embedded? Reflecting on the power of doors to include and exclude, Carol A. Taylor invites us to image, "What possibilities grow out of doors left ajar, doors unhinged, doors kept open by door wedges, softly closing doors" (Taylor et al., 2024, p. 17) This example exercise shows just one prompt of how to explore access from the relatively mundane starting point of an everyday object.

Evaluating

Design educators thrive on judging quality. Whether through design contests or final reviews that feature industry professionals we engage any number of practices that assess the aesthetic, functional, and economic value of design work. We rely on all manner of tools and materials for making these judgments, many of which themselves are wrapped up in systems of economics and politics. Our evaluation practices influence what counts as positive impact, for whom, and with what consequences.

An Exercise to Notice Evaluating: Critiques

Let's see what we can notice about evaluating through the example of a classroom critique. On the day of a critique, pause for a moment and sense the atmosphere of the room. How is the room arranged and how did it get that way? Where are you positioned in relation to the others in the room? Are there guests in the space? If so, who invited them and how did they get there? What about non-human guests, such as video cameras and microphones? In what format is work being shown? How long will this assembly last?

For many design educators, critique plays a central role in our practice, but there are different flavors; they vary in scale, pressure, orientation. Critiques are events where we bring to bear and reinforce expectations of what constitutes "good work" in design. They also put on display certain roles or positions for the participants. If we shift attention away from the work, and the student presenting it, we can notice the factors shaping the judgment of value in critiques. Approaching critique as an event in time, we find that our evaluations do not have a clear beginning and end; histories and habits infuse the evaluating that happens in the moment.

As one example of the evaluating—or "valuation"—that happens in design, critique can tell us much about potentials for pluriversality in design education. On a very basic level, the evaluating that happens in a critique is wrapped up in norms of communication (Coughlan, 2023). Critiques set expectations for quality not just through execution of craft, but also through their use of language (García-Sánchez, 2015). Students exercise storytelling, articulateness, and verve as they take their turn in the spotlight, developing the type of communication they need to succeed in the professional community. Critique can easily turn evaluation into a means of narrowing what we celebrate and promote as good design. When it comes to pluriversality, therefore, we might challenge ourselves to notice how critique values and devalues aspects of design. Rather than focusing on the relative loudness of style and utility (Ober, 2022), what about the subtler expressions of solidarity, way-finding, curiosity, and personality? Upon noticing these expressions we might look for the aspects of our practice that elevate them. Do they come forward in certain formats more than others? How does location, tone, or time influence the potential for other—typically marginalized or even erased—values to enter our evaluation of good design?

Planning

Design education is a social affair. As educators, we come together in various constellations and tempos to discuss how things are going and what, if anything, we might want to do differently. Visions and performance indicators come from within our department and also beyond it, handed down (notice direction and the power it implies) from the office of a Dean or Provost. From a Planning perspective, it is tempting to see pluriversality as a desired outcome. However, the very organization of Planning activities makes certain realities more possible than others. Let's tune in to investigate how.

An Exercise to Notice Planning: Faculty Meetings

Take a moment to list out the things that make up a faculty meeting. What technologies participate in the meeting? What tools are people using? What about spaces? What impact do those tools have on the way people interact? What items are on the agenda and how did they get there? Where do the items direct the energy of the meeting? Where do agenda items travel after the meeting? What role do they play in your future activities and engagements?

Among other various administrative activities, faculty meetings represent events for coordination, dialogue, and keeping track. Tools and technologies undoubtedly play a role. We glance at clocks to stay on schedule because we have classes to teach or other meetings to attend. We type up "action items," or materialize documents to bear on the conversation. At the same time, these meetings present moments to express care for each other, to be together in a particular place, nurture and relationships. Attending to the subtleties of faculty meetings can surface possibilities for acting in congruence with, or in resistance to, the gravitational pull of our institutions.

The mass of institutional things creates gravity that pulls activity to not only maintain the current institution, but also make progress according to the dominant narratives of our programs. Through the above example exercise, we invite readers to focus on how routine events like faculty meetings can reinforce prevailing activities or plant seeds for potential disruption. Rather than fixed instances of going through the motions to support institutional order, these organizational routines exist as fluid moments full of change in the interplay of habit, thought, and emotion (Simpson & den Hond, 2022). Faculty

meetings represent moments where dominant institutional forces can pull our attention to things like competing for funding, meeting enrollment objectives, or defining measurable outcomes. At the same time, they hold opportunities for bringing other things into the mix: concerns for each other, for our place, and those who reside there with us. As a step toward supporting pluriversality we notice how, within our existing efforts at Planning, there are spaces for relating otherwise, which may be strengthened through the materials, tools, arrangements, etc. at play in our matters of care (de la Bellacasa, 2011).

> ***Knowing***
>
> *As educators, we work with knowledge. Over the years, we learn through making, reading, modeling, imitating, and discussing various aspects of designing. We leverage that expertise in our classes. During these interactions, it's easy to slip into a sense that we are guides: we have the knowledge of how to design and we lead students to it. In such cases, we adopt a position and attitude that perpetuates certain expectations of design education, many of which promote a narrow range of ways to know, be, and make worlds.*
>
> *An Exercise to Notice Knowing: The Project*
>
> *When was the last time you didn't structure a design studio around projects? We often default to the project as our go-to format for teaching design. But how does engaging with the world through a project lens influence what students learn? Look carefully at the tools and approaches that emerge alongside projects. How do these frame possible ways of knowing compared to times when you didn't work with a project? What do the artifacts that are produced from projects say about the student's relationship with different worlds?*
>
> *The "project" is one of the defining characteristics of design education. Wrapped up in institutional life, we find ourselves shaping design education around predetermined quantities of time (semesters, credit hours, four-year degrees). To fit these constraints, we also begin packaging knowledge. The objectives of this project are to deliver X, Y, and Z. The project format also nudges us toward a problem-solving approach. We ask students to identify user pain points to address or to design an objective that is effective. The project is just one way of organizing design. Things move in and out of projects, extending before, during and after. Take time to notice these flows and you might also find ways of knowing that projects obscure or render insignificant.*

In this example, noticing "The Project" is a way to explore how design education knows and relates to issues that are complex and evolving. Design is infused with social, technological, political, and environmental factors that projects need to "freeze" in order to manage. This freezing-based approach lends itself to conceptualizing knowledge as something out there that we can gather, compartmentalize, and bestow (Freire, 2000). Common design tools and activities also contribute to this understanding. Problem statements, system maps, user personas are inherently reductive. And while we might recognize their limitations and myths, their connection with other institutional forces often lends itself to educational practices that privilege rational, exclusionary engagement with worlds. The power in taking notice of Knowing lies in our orientation to change. By attending to those moments when our programs support knowing as open-ended, emergent, and embodied, we might find how they relate to our attachments or commitments to each other and the local sites where we practice design education.

5. Conclusion and Invitation

Today, most formal design education happens in programs of higher education. Whether private or public universities, the dominant model of design education—faculty, organized by discipline, teaching cohorts of students according to explicitly defined curricula—is entangled in all manner of systems that influence what counts as knowledge, quality, and impact for students and faculty. It is also in these contexts that many design educators find themselves striving to respond to theoretical developments that emphasize

the importance of diverse ways of knowing and being for design. Indeed, design education must confront the "information revolution," and adjust perspective from a focus on discrete artifacts to complex evolving, interconnected systems (Davis & Dubberly, 2023).

Unfortunately, shifting vantage points can reveal things you might rather not see. Looking at design in relation to systems highlights the dangerous relationship that our practices have with unsustainable and unjust economic and ontological models. In response, scholars have recommended the development of curricula to move design education "toward a relational, ontological, and pluralistic perspective" (Noel et al., 2023, p. 182). Despite the orientation toward systems in the development of curricula and pedagogies, design educators have little to go on if they want to act on the implications of pluriversality, especially when it comes to the ways we organize and manage our programs. With this initial sketch of The Field Guide for Noticing Institutional Life, we hope to prompt more engagement and experimentation with the practices of organizing our design programs in specific, and design education at large.

Is it reasonable to expect design educators to engage with noticing institutional life? After all, many of us are experts in our discipline, not management or organizational studies. And as practice theorist Andreas Reckwitz reminds us, there may be little affective motivation to dedicate attention to areas outside our cultivated interests and skills (Reckwitz, 2016). Facing this situation, we have modest aspirations for the Field Guide. We do not expect the guide to unleash a sea change in the practice of design education. Rather, we see the guide as a prompt—or perhaps a probe—to generate critical discussion and reflection about the forces that shape design education and how we might find ways to start shaping it otherwise. It is our small effort to invite exploration of tools, interactions, contexts, and languages to change "the ways in which we deal with ourselves and things so that futuring is enabled" (Escobar, 2018, p. 168).

In no small part, this effort departs from our own moments feeling trapped and helpless in the face of institutional bureaucracy. At times it can feel like there are only two paths ahead: accept the institution or leave it. Indeed, we are keenly aware that the most popular tools for managing organizations evolved within a paradigm we seek to disrupt. Our aim, therefore, is to support design educators by developing alternatives to "the master's tools" (Lorde, 2003). Yet, in confronting our entanglements with established institutions, we recognize that we need to find ways to work with new tools in relation to our everyday realities. Therefore, we close our call to notice with a reminder from Paolo Freire that education is constantly remade in praxis: "in order to be, it must become" (Freire, 2000, p. 84).

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P/REFERENCES OF DESIGN

LOCAL TRADITION AND GLOBAL FUTURE: NEW PARADIGMS OF THE MADE IN ITALY CULTURAL DESIGN.

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KEYWORDS | PRODUCT DESIGN, MADE IN ITALY, CULTURAL VALUE CHAIN, CIRCULAR SUPPLY CHAIN, LOCAL PRODUCTION DISTRICTS

ABSTRACT | This paper proposal, which is part of a wider interdisciplinary research called MICS (Circular and Sustainable Made in Italy), intends to reflect on the new contours of the contemporary idea of 'Made in Italy', exploring its cultural value chain and the user engagement's new paradigms as well as the companies' current narrative strategies and the role played by the product-service systems within the Italian production framework.

The paper will focus on the new and consumer-driven business models for resilient and circular supply chains analyzing how Italian design supply companies today address the public (visitors, buyers, customers, users, etc.) in the framework of an approach in which the ethical components prevail over the aesthetic ones.

Furthermore, the research will study the narrative forms, both physical and virtual, through which companies present, to an increasingly sensitive and attentive audience to environmental issues, not their products but their strategies related to sustainability, inclusion, respect for the environment, and control of their products' life cycle, as well as how they pursue the objectives of product, process and social innovation.

1. Introduction

The paper represents a reflection on the contemporary contours of the Made in Italy design production in its relationship with the new social requirements, to lay a groundwork for further research steps aimed at defining and experimenting with a new country of origin effect based on circularity and sustainability, models and methods for technology-based branding, communication, customer engagement and experience.

As a first step of the research (view the acknowledgments below), the paper has the form of an essay rather than a traditional paper because due to the complexity and the multiple directions that a topic like this can take, in this phase the investigation needs to be anticipated by the definition of a general framework in which to move.

Considering the definition of a new competitive paradigm for the companies in the Made in Italy sectors and the development of models, approaches, methods and tools for design as main final objectives of the research, the paper is based on a methodology structured in three parts: in the first one (chapters 2 and 3) the text offers an overview on the contemporary interpretation of the concept of Made in Italy, underlying the relationship with its historical identity and actual external references and interpretations; in the second part (chapter 4) the essay moves from this relationship towards the detection of the main specific elements which characterizes the new Italian production showing their ethical, sustainable and innovative components; in the third part (chapter 5 and 6) the paper uses these elements to draw the contours of the contemporary Made in Italy paradigm, its strengths and its possible future implementations in cultural terms.

The conclusions, far from being final, try to get out from the complexity of the argumentations through the definition of some simple questions to whom it tries to give a first system of answers in the mark of starting building a bridge between design and consumer-driven business models for resilient and circular supply chains.

2. The Concept of Made in Italy

Italy has a long history of excellence in design, which ranges from ‘anonymous’ objects of its historical material culture to innovative products born in various historical periods, especially between the 1950s and the 1980s. The concept of Made in Italy traditionally evokes images of high-quality craftsmanship, sophisticated style and innovation in continuity with cultural tradition and, in more recent years, it has continued to evolve by adapting its productions to the global cultural, technological and economic changes which have led to a significant transformation in the so-called ‘Made in Italy’ design paradigm. Amongst other things, an aspect that characterizes this paradigm shift is certainly linked to environmental and social sustainability: Italian companies and designers are increasingly trying to integrate eco-friendly practices into their production processes, using recycled or recyclable materials and adopting design solutions to reduce environmental impact; moreover, sustainability itself acquires a social dimension through processes of ‘democratization’ which aim to improve people's lives through conditions that become inclusive and accessible to all.

A second important aspect of the contemporary Made in Italy is represented by the renewed dialogue between design and technology: being Italy renowned for its artisanal and manufacturing heritage, the access to information and digital technologies (Internet of Things, Artificial Intelligence, 3D printing systems, etc.), if at first it seemed to be a threat to its identity and productive culture’s authenticity, today it seems to reveal itself as a precious ally precisely because it defenses the small productive realities offering them fundamental tools to enhance and innovate their productions, remaining competitive on the global market.

Thirdly, another aspect is represented by the ability of the new Made in Italy to adapt to changes in the needs and expectations of global consumers: Italian companies are increasingly looking beyond national borders and trying to meet the needs of an increasingly diversified international market and this means not only offering products and services that reflect universal values of civilization but also and above all demonstrating sensitivity and responsibility towards major environmental, social and economic issues.

3. Made in Italy Between Local Tradition and Global Future

In a condition of liquidity such as that of our contemporary age, uncertain instead of certain, temporary instead of definitive, flexible instead of solid (Bauman, 2000), it's not easy, and perhaps it doesn't make reasonably much sense, to establish a universal definition of 'Made in Italy', at least for a couple of reasons: first of all because it's original meaning was defined ex-post, that is only after having observed the results of a very complex process in which creativity, social sensibility, artisan know-how and industrial technologies built an unrepeatable historic conjuncture which produced design artifacts with a very high (aesthetical and ethical) quality level (Fortis, 2005). Secondly, because it's evidently anachronistic to refer to a national context intended as a closed territorial unit in a moment in which the match is played between the local context (sub-national dimension) and the global market (trans-national dimension).

What can today probably have an interest, beyond the speculations about the origin of this phenomenon, is considering the Made in Italy in terms of a more general idea of excellence, in which the objects always have not only a function but also a 'soul' (Branzi, 2004), transferable to other cultural contexts, filtered through the actual contemporary social and economic situation; on the other hand, the importance of reaffirming the Made in Italy brand can be seen as the possibility to detect the cultural elements that it produced (also independently from the original socio-economic framework) anticipating the times and the forms through which it now flows into the idea of sustainability first and of 'country of origin effect' then (Pellegrini, 2016).

With the aim of making a new reading matrix, considering 'traditional' the idea of Made in Italy as a complex and heterogeneous industrial archipelago of local clusters with deep roots in artisan tradition, human capital and territorial culture able to produce always new high-quality objects within strong physical interactions and interpersonal relationships (Becattini, 1998; Sennett, 2008), the detailed analysis of this complexity leads us to detect some elements that, without claiming to be exhaustive, can be summarized as follow: Synthesis between art, tradition and material culture; Unicity in the product's character and identity; Strong relationship between row materials, transformation techniques and supply chain; Propensity for innovation in the mark of a historically sedimented know-how; Capacity of finding out solution using the latest technologies, always seen as a means and not as end; Confluence of the artisanal manufacturing production into high quality design objects through industrial productive processes; Social attention, communication and interaction with the final users' needs and requirements, those intended both as individuals and as members of cultural communities; Production based on cooperation, intercultural dialogue and sharing; Aesthetical aspects based on semantic and semiotic elements. Even if these elements, still visible today, shall be considered as constant and temporally stable characteristics of Made in Italy, their relationship with the global scenario in which they are inserted has significantly changed: this means that the traditional dynamism of the Made in Italy system turns it into a constantly evolving paradigm in which it rediscovers and reinvents itself aiming at building a new system of values in the framework of the so-called 'New Normal', starting from the valorization of the local production districts so to give a contribution in creating a new country of origin effect extendable at international level (Lotti et al., 2015).

Starting from the valorization of the local production districts, what is happening is that the (so-called) Made in Italy tends to build a new system of values to produce a new country of origin effect extendable at the international level: beyond the 'traditional' 4A (*Alimentari, Abbigliamento, Arredo, Automazione*), in all the sector in which is nowadays possible to recognize the abovementioned characters of the new Made in Italy brand (automotive, fashion, craftmanship, furniture, graphics-communication, urban spaces,

enhancement of cultural heritage, new digital technology) the companies that mainly belong to small local productive context with little chance of emerging in the global market, are increasingly moving towards the definition of social innovation strategies, sustainability and customization as well as on the offered user experience possibilities and usability.

In Europe, the relationship between local traditions and global future is nowadays crucial in design's field of action because the necessity of defining new ethical values that follow the contemporary social senses and sensibilities of each local community has become fundamental to reach the objectives defined by the New European Bauhaus initiative, as promoted by the many platforms created for the cooperation of art, architecture, design, science, circular economy and AI, to build a sustainable, inclusive and innovative future (i.e. the Triennale of Milan in 2021, the MAXXI in Rome in 2022 and the *Biennale di Venezia* in 2023); otherwise, the challenges coming from the global dimension of things cannot be tackled any more by deleting or restricting the local traditions and this is true both in the dimension of production processes and consumer awareness (Ceconello, 2022). Furthermore, sustainability, innovation and identity as never before are now parts of a more general 'cultural dimension' which can be considered as a bridge between different backgrounds and as a *fil rouge* connecting all the local contexts with their specific relationships between industrial design and manufacturing knowledge (Dellapiana, 2022).

While the European Union identifies the productive factor of the manufacturing sector as fundamental for future sustainable economic development, in 2017 the Italian Government promoted and presented the Industry Plan 4.0 (*Piano Industria 4.0*) aimed at improving the digital innovation for the manufacturing sector (advanced craftsmanship), but the crisis has slowed down in approaching the new possibilities offered by the latest technologies.

In 2015 the Italian Government answered to the European guidelines also in terms of sustainability when, following the goals of the Agenda 2030 for sustainable development, it arranged the national scheme called 'Made Green in Italy' to integrate the Made in Italy brand with the dimension of sustainability: this led to a very positive outcome in terms of product's environmental sustainability (as evidenced by the report '*Italia Sostenibile*' by Cerved Italy), even if to yet excellent under the social and economic point of view. Nevertheless, all the sectors are now showing signs of recovery both at the productive and management level: which is leading to an important contribution, as we have seen, to the construction of a new paradigm of Made in Italy, made of the innovative supply chain, technology transfer, preservation of the artisanal dimension besides the acquisition of computer tools (hardware and software), clear traceability and authenticity of products, equilibrium between productive responsibility and necessity of quickly placing on the market, new ethical relationship between specific user requirements and mass customization (Goretti et al., 2019).

As a consequence, downstream of these processes, after the global transition to industry 4.0 with its four components (cyber-physical production system, internet of things, smart factory and internet of service), it's now that Made in Italy is trying to re-invent its identity updating its historical relationship between technology and craftsmanship, overcoming stereotypes and misrepresentations on behalf of its real social, economic and cultural characteristics, reconstructing the relationship between 'image' and 'information on it', taking advantage of the opportunities offered by the new digital technologies (Bettiol, 2015).

The companies are now asked to design their products differently, better explaining their philosophy, integrating sustainable strategies, strengthening customer services to be close to buyers as consultants and assistants; furthermore, the 'content' becomes fundamental for the future production in the local contexts: with which to communicate, inspire and bring the target audience closer by creating suggestions of living lifestyles through the product, as well as sustainability and circular economy are increasingly concrete resources and challenges for all the actors involved in the design processes.

4. Sustainability and Innovation of the Italian Production

Sense and aesthetical sensibility, empathy and adaptive flexibility, humanistic mode, meticulousness and attention to detail, thinkering, and enjoyable modernity (Amatulli et al., 2017) are keywords related to the concept of Made in Italy that can help us to reach the specific dimension of sustainability of its brand: an ante-litteram social and environmental sustainability strongly connected to a cultural context, with a central role of design that becomes an active subject in managing innovation processes, communication systems, cultural meaning of the functional solutions.

Furthermore, this extended interpretative perspective of the concept of sustainability is a key to changing our point of view on the actual idea of 'consumption' which tends to become a critical action done by the users/buyers that, without passively suffering choices 'from above', on one hand actively ask the company to demonstrate them their strategies in terms of environmental respect and resource-saving, on the other hand, claim to 'communicate' with products that recognize their values and their identity instead of (only) that of the productive company (Micelli, 2017). As already underlined, this is certainly a form of sustainability, on one hand considered in its social aspects, on the other hand as a fundamental ingredient in the search for innovation: the increase in the number of actors involved, the extension to the intangible dimension of things and the open character of the manufacturing processes create the conditions for maintaining a constant updating independent from the companies' push and more and more related to the encounter of a large number of contributions at any level.

In the ambit of this new sustainability paradigm, the Italian design supply companies have accepted new consumer-driven business models, welcoming the opportunities offered by the new information technologies and systems of interaction that allow buyers and users to participate in the design decisions through individual experiences, collective interpretations and definition of new meanings, symbols and rituals: new narrative approaches that make possible to share knowledge and offer to the public the possibility to become active creators, co-designing and sometimes co-producing, starting the product development process from the bottom and not anymore from above (Micelli & Di Maria, 2000); but also living real experiences in specific real contexts or virtual spaces as a sublimation of the sharing of cultural meanings and ethical values with the companies, in a socially and economically sustainable way.
In other words, through the new models of interactions, consumers have now tools to get out from individuality and build social relationships with companies and with other consumers, so that the manufacturing systems, in this case of Made in Italy, cannot live anymore on the old image of its brand, but it's now asked to redesign not only its productive framework but also its context of consumption to allow participation and definition of new significances.
In terms of innovation, as already mentioned, the Made in Italy design tradition has always been characterized by a condition of flexibility, mutability, creativity and intuition: then, not products intended as reiterations of static and dogmatic aspects, but future-oriented solutions open to a multitude of productive outputs (Mancini, 2018). Now, the evolution of this concept can be the idea of innovation as an expression of an equilibrium between art, technology and the human factor, based on relentless experimentation which always starts from the reinvention of the past and never by its denial, also in absence of the highest technological tools (Dellapiana, 2022). Moreover, an innovation that is not radical but 'incremental', produced by a sequence of small contributions that can be added over time, from generation to generation, without an explicit boost but, in a way, spontaneously, as a natural consequence of a working methodology and ritual.

5. New Paradigms of the Made in Italy Design

Currently, the narrative dimension of Made in Italy in the international context is characterized by some shortcomings which are mainly attributable to the following aspects: absence of a common strategy for the entire industrial network; not always clear definition of the common values that link the specificities of the different local production contexts beyond their differences (among themselves and with those of other countries); a certain reticence of the small companies to make their know-how available; confusion between the

communicative dimension and that of marketing, that is, between narration and marketing of products; limited acceptance of the information and digital technology contributions, including those relating to online sales (Micelli, 2018).

This situation clashes with the increasingly active role required by users who focus less and less on the products' functional aspects and more and more on the symbolic and cultural ones, attributing to the concept of 'quality' a connotation more in line with an idea of continuity with history, identity of the cultural contexts and authenticity of the production processes.

It is therefore clear that in Made in Italy, the relationship between production, storytelling and user experience must necessarily be generated starting from the ethical comparison with the material culture and cultural heritage of the territorial contexts, with their tangible and intangible elements, and must also be freed from traditional marketing mechanisms aimed at mere commercialization and move closer to build open, participatory and ultimately 'cultural' dialogue with users.

Therefore, the possibilities offered by the new business models and their relationship with the Made in Italy brand, as well as the necessity now socially shared to build a condition of circular economy, brings us to overcome the concept of 'made in' and arrive, as anticipated by the previous reflections, at that of 'country of origin' (Lotti & Trivellin, 2017).

The country-of-origin effect is the impact of the idea of quality associated to a specific cultural context on the users/buyers' purchasing processes. In the case of the Made in Italy products, the COOE can be defined as the trust people place on the objects whose design and production have been developed in Italy, due to the positive image they have of this country, with its abilities, experiences, knowledge and capacities (Bertoli & Resciniti, 2013; Bettiol & Micelli, 2005).

Being related to the buyers' perception and behavior (especially foreigners), downstream of the processes of market integration, standardization and trend for delocalization, the COOE is now taken into account by the companies through strategic systems of communication, interaction and participation, to rebuild their identity. Hence, the companies start addressing the shopping experiences of their clients but, as we have said before, is not possible anymore to consider the users/buyers as passive consumers, so becomes important the respect their consciousness and awareness about the products' cultural values.
But actually, the problem is that, due to the difficulty of a product to be designed, manufactured and assembled in one unique country, the COOE has become fragmented at least into three main constitutive elements: the overall image of a country, the image of a country and its products, images of products from a country (Bertoli & Resciniti, 2013).

Considering the stark imbalance in company size, typical of the contemporary Made in Italy productive system, it should be considered that the fragmentation which characterizes it very often tends to becomes an opportunity to transform the signs of recognition into a system of socio-cultural distinctive values; when these values take on a certain strength, they are intercepted by the contemporary scenario that, once accepted, it translate them into possible directions for design, productive and marketing strategies with a greater awareness. With no ambitions of being exhaustive, these directions can be: interoperability between objects, machines and people; virtualization as a function of the productive, economic, environmental and social sustainability; modularity of adaptable and open products, services and processes; decentralization as organizational form of the processes (Celaschi et al., 2017).
As a consequence, the user experience is therefore fundamental in the dialogue between companies and buyers, but it must be intended not as something added to the ordinary objects with the mere objective of selling a product, but, on the contrary, as an occasion made of specific spatiality, temporalities and rituals when companies and buyers can share a common ground of iconographic repertories, ethical values, bonds with tradition, socially eligible degrees of innovation, forms of customization (Rinaldi, 2015).

Today, communicating one's impact and sustainability by informing the consumer about the creation of green products, use of natural and recycled materials, etc., is a fundamental competitiveness factor for local companies: the attention to quality of life becomes an issue to be addressed through the new business strategies to make people understand the new directions that the more careful design actions are going to take, rediscovering an approach that in our modernity has as a founder in the person of Adriano Olivetti which, ahead of his time, investigated the problem of interaction already between the Fifties and the beginning of the Sixties working with designers like Sottsass and Maldonado (Riccini, 2010).

6. Towards a New Cultural System of Values

The new contours of the contemporary Made in Italy, its cultural value chain and the user engagement's new paradigms of the companies, as we have seen, are nowadays interested in a process of transformation in which a fundamental role is represented by the strategies used by the product-service systems and by the new consumer-driven business models. The resilient and circular supply chain is now fully recognized as a necessary condition, as well as the fact that the ethical components of products and processes prevail over the aesthetic ones is not an option anymore but a widely recognized fact.

The way Italian design supply companies today address the public (visitors, buyers, customers, users, etc.) and the narrative forms, both physical and virtual, through which companies present, to an increasingly sensitive and attentive audience to environmental issues, not their products but their strategies related to sustainability, inclusion, respect for the environment and control of their product's life cycle, as well as how they pursue the objectives of product, process and social innovation, are all elements that the new design approach must consider in its background research (Dalla Mura, 2015).

Although the level of awareness, as often pointed out, is higher than in the recent past both in companies and consumers, what seems to be by no means certain is first of all the fact that the Made in Italy design with its many local cultures could build automatically a relationship with the global design landscape; secondly, that the entity of the social and emotional level of communication, its natural modalities, as well as the dimension of time (temporality of experience) defines always compatibility with the physical context, its social acceptance and its eco-sustainability (Giovannella, 2008); thirdly, the fact that all the forces involved in the new product development process (designers, engineers, marketing experts, etc.) easily reach a balance between them without cultural coordination (Bettiol & Micelli, 2005).

This is the reason why the designer is still fundamental in its capacity to mediate between different knowledge, activate interdisciplinary contributions, give sense to innovation, improve the cultural dimension of objects, humanize technology, promoting eco-efficient behaviors (Lotti & Trivellin, 2017). Furthermore, as well as we put the word 'new' beside the concept of Made in Italy and that of country-of-origin effect, the same should be done for the idea of 'authenticity': also, in this case, design can be a privileged actor in detecting and managing the forms of expression of all the possible new authenticities which can come out from any local context, productive territory, social community and innovative reality at a different scale. Thus, to link them together in a unique (even if diversified) cultural common ground within a new multiverse geography of productive systems able to improve, through good objects and services, the environment and the people's everyday lives (Norman, 2013; Scalera, 2020).

More specifically, the power of cultural renewal that the Made in Italy design is interested in, belongs to its narrative power and the possibilities offered by the digital and/or virtual storytelling, whose impact is not measured on a generic final user but on a 'social capital' made of people belonging to a specific cultural context with strong and dynamic relationships between them, sharing a common system of ethical and aesthetical values, rituals and behaviors and open to the global world (Bertola & Colombi, 2014).

This aspect has a deep impact on the conception of the new products because changes, on one hand, the ways of consumption and customer expectations, on the other hand, the companies' approach to production which becomes more and more customized and personalized: this encounter produces a

dimension called ‘cultural manufacturing’, that in the cases of territories characterized by strong cultural roots, such as Italy, is transformed into a cultural experience closely linked to a specific physical and social context of use (Ceconello, 2022).

Regarding the relationship with digital technology, if Stefano Micelli, paraphrasing the work of Maholo Uchida, says that empathy is the key through which design can make the digital world acceptable, preventing technology from reducing the role of human dimension and, in the meanwhile, building new forms of co-habitation for reality and virtuality based on innovative aesthetics and new forms of interaction (Micelli, 2018), trusting technology seems to be now a more easily accessible street.

In the case of the Made in Italy districts, this change of behavior undoubtedly leads to a real and diffused cultural change, as well as to a concrete opportunity to raise and increase competitiveness in the global market. Certainly, but not only that, because this perspective re-activates an artisanal dimension made of small productive archipelagos, auto-production systems, etc., in those territories in which the big industry is physically too far away: economy, simplicity, clarity and beauty but also awareness, privacy, context, experience, synergy, emotions, participation, identity and cultural meaning are the main ingredients for the cultural framework of the new relationship between digital technologies, design and Made in Italy brand. But the very big power of this new dialogue goes at least in four main directions: the possibility for products to be manufactured locally; the facility in preserving over time the cultural manufacturing know-how; the capacity of joining together the humanistic aspects of production with the technologic-scientific ones; sensibility in combining virtuality and reality in the user’s interaction and participation processes.
On a productive level, the new possibilities offered by the dialogue between Made in Italy design and digital technologies improve the potentialities of the products in terms of customization and non-standardization through the sharing of information and participation in making decisions, as well as expand the design freedom of movement already in the concept phase where many possible final product proposals can be created in a digital environment. This means that design and production build an innovative relationship that is very similar to that of a traditional craftsmanship activity: what happens, then, is first of all that design and production are not sequential steps anymore but become synchronic and simultaneous activities, secondly, that artisanal creativity and rational management of the processes are no longer in opposition, thirdly that self-manufacturing becomes increasingly available (Ramoglu & Coskun, 2017).

As already happened in the past, also in this case the technological innovation flows into a radical social and economic innovation, thanks to the strong union between products (with its components of design, production, and put on market), productive systems, territories, natural environment and people, so that the digital transition is accepted for its power to produce democratic and socially virtuous processes that can be returned to the creative dimension of the craftmanship (Sbordone & Turrini, 2020).

7. Conclusions

This paper, which aims to be an essay, must be considered as a starting point of an investigation which, more in detail, in the next step of the research will focus on specific local contexts within the Made in Italy productive system, to analyze the impact of the aspects above illustrated and regarding their matching with the contemporary paradigm, in its evolution to the cultural country-of-origin effect.

In any case, as a conclusion, we can try to answer the following questions, according to the general objective of exploring the future perspectives of the Made in Italy design culture within the global design landscape: How do customers and users attribute value and significance to the products? How do companies manage the relationship between brand identity and (mass) customization? How do companies declare and show their way of being inclusive, sustainable, and innovative? Which is in general the relationship between cultural dimension and marketing?

First of all, we can say that customers and users can give value and significance to the products considering a variety of factors, which depend on individual expectations, needs and personal social background, as well as criteria that come from their relationship with one or more cultural contexts. Besides the traditional evaluation elements like quality, functionality, aesthetics, durability, prize, etc., the main aspects that now seem to be fundamental are the emotional factors (aspiration, references to individual memories, social identity, etc.), the active involvement in the user experience, the reference to cultural and social factors and the forms of flexibility in terms of customization.

As a consequence, companies are now asked to manage the relationship between brand identity and customization first of all building an identity that must be shared with the clients and not imposed from above: is not possible anymore to speak of 'company's identity', against which the users don't feel like sharing it, but, on the contrary, the identity becomes a value with many different interpretative declinations with a unique cultural common ground. Even the word 'mass' is going to disappear, not in favor of extreme individualism, but for a more human material culture open to diversity and contrary to the cultural leveling.

Then, companies are nowadays obliged to declare and show their way of being exclusive, sustainable and innovative: this happens in all contexts, physical and virtual, such as shops, temporary expositions, fairs, museums, online platforms, etc. The traditional distribution ways, selling and commercialization are outdated, as well as the products (or the services) cannot be sold if they don't show their 'ethics' in terms of environmental respect, resource-saving, and productive sustainability.

Last but not least, the relationship between cultural dimension and marketing appears now profound and multifaceted. The cultural dimension of products and services provides insights into the values and priorities of a target market; therefore, marketing efforts must align with these cultural values to resonate with users and we must consider that the cultural dimension has an influence also on language, communication, symbols that are meaningful to the users (semantic and semiotic dimension of things), hence, companies must take into account the necessity to be always dialogic in their marketing strategies, building trust and credibility, not only in the small contexts but also in the global market. No doubt, these first general answers to the questions above detected, have many possible declinations according to the specificities of each local social context. But as another fact to be highlighted, each productive context is ultimately a social entity and it relates to the market (local or global) always in social terms, and this awareness constitutes the quintessence of the renewal of the Made in Italy circular and sustainable contemporary brand.

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P/REFERENCES OF DESIGN

THE LIBRARY AS THRESHOLD: LIMINALITY IN THE CONTEXT OF FASHION RESEARCH.

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ABSTRACT | The academic field of Fashion Studies is a relatively new one and has been traditionally defined by its scholars as a mixed, hybrid and layered area of study. Merging various and sometimes unexpected disciplines, methods, and approaches; Fashion Studies have therefore been the protagonist of a long-lasting debate on their positioning within academia. With this paper, I argue that the state of in-between-ness which distinguishes this area of study permeates not only its identity as a discipline, but also as a research practice, ultimately characterizing the spaces in which it is carried out as well. The contribution employs key concepts such as liminality and thresholding to investigate the spatial qualities of fashion research and of the fashion library, with the objective of defining them as fundamentally intermediary, 'entre-deux' and transgressive. These theoretical premises find their actualization in the analysis of International Library of Fashion Research (ILFR), a public library dedicated to fashion printed matter founded in 2020 by editor and curator Elise By Olsen and hosted since November 2022 by the National Museum of Art, Architecture and Design of Oslo (NAM). Observing the intertwining of the digital ramifications of the project and its physical space, the peculiar positioning in fashion's geographies and the proximity to an established cultural institution, as well as the heterogeneity of the collection and the multidisciplinary team that guides it; ILFR can be identified as inherently decentralized, capillary and in-becoming, and therefore the ideal site-of-passage for fashion research.

1. Introduction

The research intends to contribute to a recent momentum of interest towards fashion archives and repositories, and their role within the study of fashion cultures. This study investigates the practice of fashion research and the space in which it is conducted, namely the fashion library, through the theoretical framework of liminality. The aim is to uncover the spatial, symbolical and practical qualities that, I argue, facilitate and inspire the use of multimethodological approaches and decentralized perspectives on fashion research.

In the first chapter, I will focus on the definition of liminality by engaging with a solid theoretical framework, with the scope of applying this notion to the context of fashion research. To do so, I will start by tracing an overview of Fashion Studies to sketch a portrait of its disseminated and cross-disciplinary positioning within the academic disciplines' landscape. From these theoretical premises, it will then be possible to investigate the practice of fashion research and the space of the fashion library as composite, capillary, and liminal thresholds.

The second part of the paper will apply the theoretical web introduced in the first chapter to a specific case study, that of International Library of Fashion Research, a repository for fashion printed matter founded in 2020 by editor and curator Elise By Olsen and open to the public since November 2022. The features of this specific library, I claim, encapsulate at best the state of becoming and in-between-ness shared by Fashion Studies, fashion research and the fashion library, establishing itself as an ideal space for research in the field.

What I offer here is by no means an exhaustive or complete investigation on the topic, but a mere introduction which I hope can inspire further explorations on fashion repositories and their role on fashion research.

2. Liminality and Fashion

2.1 Fashion Studies: A Decentralized Discipline

In 1991 fashion historian and curator Valerie Steele famously published an article titled "The F Word" on the American magazine *Lingua Franca*, highlighting the status that fashion had among the academic lineages at that moment in time. Nameless and utterly unmentionable, fashion as a discipline for critical reasoning made its debut on a media outlet officially dedicated to intellectual discourse in the form of a cut-off word, a highly symbolical letter which ironically played with the concepts of censorship and academic propriety. More than twenty years later, scholars operating in the field still participate in a heated debate on the positioning of fashion within the realm of research, successfully unveiling both the criticalities of imposing fixed categories in academia and the struggle of navigating this landscape to gain proper recognition.

Foremothers of the discipline are figures such as independent researcher Elizabeth Wilson, who through her seminal book *Adorned in Dreams* (1985) gave a first contextualization of fashion within theoretical frameworks; or cultural studies scholar Agnès Rocamora and visual culture theorist Anneke Smelik, whose anthology *Thinking Through Fashion: A Guide to Key Theorists* (2016) offers a compendium of theoretical interventions on the concept of fashion. In the introduction to the book, the editors define Fashion Studies as "an interdisciplinary field that refers to the understanding of fashion in its broad meaning, including influences from history, philosophy, sociology, anthropology," (Rocamora & Smelik, 2016, p.3) a view also shared by art historian Christopher Breward (1995), cultural theorist Efrat Tseëlon (2001), and cultural anthropologist Heike Jenss (2016). The names here cited are just a few of the personalities who feed the discussion around the topic, nevertheless, they effectively demonstrate the heterogenous plethora of backgrounds that forged leading voices of the field before the advent of specialized educational career paths, which are also a relatively recent phenomenon.

The diverse scenario of fashion researchers is well exemplified in “A Fashion Studies Manifesto: Toward an (Inter)disciplinary Field” (2023), a contribution signed by Dean of Fashion at Parsons School of Design in New York Ben Barry and Graduate Program Director of the School of Fashion at Metropolitan University of Toronto Alison Matthews David. In the paper, the academic duo employs an autoethnographical methodology to comment on the state of the art of Fashion Studies, recounting their personal parabola towards fashion as former PhD students in Management and Art History. In their recounts, both strongly agree that the mixed methodologies applied to their work as researchers, theorists, and educators of Fashion Studies "opened up new possibilities of research” (Barry & Matthews David, 2023, p.11) and stimulated a productive dialogue between seemingly antipodal specialisations. Directly quoting the words of authors Eugenia Paulicelli, Veronica Manlow, and Elizabeth Wissinger (2021), Barry and Matthews David concur that “if ever a subject both called for inquiry and resisted classification in a single field or method of inquiry, fashion would be it,” (Barry & Matthews David, 2023, p. 2) concluding that the study of fashion should not be a prerogative of few experts. Distancing from a sectorial and fixed division of specialties, the authors therefore identify Fashion Studies as an ideal arena for academic convergence and overlapping: “Fashion Studies is about fostering community, collaboration, and inclusion, not about disciplinary boundaries.” (Barry & Matthews David, 2023, p.17).

Another example that clearly highlights the composite nature of this field is the investigation conducted in 2012 by author and Associate Professor of Fashion Studies Francesca Granata, which unravels the methodology adopted for her Doctorate thesis. Her project, which applied Bakhtin’s theories of the Grotesque within the framework of fashion practices, “needed a range of methodological approaches, poached from a variety of fields and disciplines, including material culture, visual culture, as well as performance and film studies” (Granata, 2012, p. 68). Expanding Rocamora and Smelik’s definition of fashion from interdisciplinary to “multi-methodological” and “inter-media” (Granata, 2012, p.75), Granata reasserts the state of in-between-ness of Fashion Studies within the realm of research. From an object-based approach to qualitative research, passing through philosophy, cultural memory, and ethnography; the author unpacks the complexities of conducting research in this area and concludes that a mixed-method approach is beneficial to the study of fashion due to its natural hybrid identity.

From this brief introduction to Fashion Studies, it is clear how this discipline is fundamentally decentralized, and privileges contamination, if not a total hybridization, between areas of specialization. Moreover, it is significant to underline how both the “Fashion Studies Manifesto” and Granata’s investigation make use of a specific terminology, that of spatiality. In the first reference, the writers define Fashion Studies as “both bordered and borderless in practice,” (Barry & Matthews David, 2023, p. 3) introducing the words ‘in’ and ‘out’ to communicate their fluctuating posture within the academic sectors and the propensity to blend areas of study by activating different disciplines and practices. Granata, instead, traces conceptual parallels between the theories applied for her research and fashion practices in general, finding a common ground in the idea of liminality and threshold. By acknowledging the heterogeneity of Bakhtin’s theories, which supported her Doctoral thesis, she concludes that this mixture of references and backgrounds “remains particularly apt for a study of a ‘discipline’ (such as fashion) that exists itself at the borders.” (Granata, 2012, p. 79).

2.2 Fashion Research as a Liminal Practice

To better understand the spatial features that denote Fashion Studies and apply them to fashion research at large, it is fundamental to define the concept of liminality. One of the seminal publications that contextualized this notion in the realm of research is *Landscapes of Liminality: Between Space and Place* edited by Dara Downey, Ian Kinane, and Elizabeth Parker; a compendium of articles that present possible implementations of the concept within Humanities. In the introduction to the book, the editors retrace the history of the term starting from the Latin etymology *limen*, which suggests “a ‘harbor’, […] a ‘threshold’ or ‘passage’ to be crossed.” (Downey et al., p. 10).

The volume then cites anthropologist Arnold van Gennep as the first figure to use liminality as a concept, applied to the process of becoming that every individual experience while participating in sacred rites of passage. But it was Victor W. Turner, through his cultural studies approach, that popularized the term

within the academic sphere, speaking of the spatio-temporal, symbolic and transformational passages of becoming that distinguish the process of community-formation. Since the 70s, the concept of liminality has been a constant presence in theoretical experimentations, to the point that the authors criticize the widespread misuse of the concept yet embrace the fact that the term cherishes a natural "malleability," as well as the "ability to signify in multiple, even contradictory ways" (Downey et al., p. 4). These elements are ultimately the features that make this specific notion so pervasive and appliable to any study subject.

In the volume, professor of English Robert T. Tally Jr quotes German philosopher Martin Heidegger through the association of liminality to the concept of the uncanny and their intrinsic "sense of homelessness" (Downey et al., p. x), while the editors echo Eric Prieto by stating that liminality can be referred to as "the 'entre-deux', or the 'in-between' that occurs between certain 'established categories' (Downey et al., p. 5). The spatial and metaphorical imagery of liminality could therefore easily be associated that of Fashion Studies, whose positioning in the academic realm is essentially 'entre-more-than-deux', simultaneously implying "some sense of boundaries, borders, or limits" (Downey et al., p. xi) and a fluid transgression of such. Moreover, the image of the "anteroom" (Downey et al., p. xii), of a cushion-space between a 'here' and a 'there' clearly resonates with the situation of being both 'in' and 'out' described by Berry and Matthews David in reviewing the background of fashion scholars.

I argue that if Fashion Studies share fundamental features with the concept of liminality, fashion research should undoubtedly be considered a liminal practice too, as it implies that fashion is itself a terrain for fluid hybridizations. In her review of the seminal book *Fashion Studies. Research Methods, Sites and Practices* (2016) by Heike Jenss, Anneke Smelik frames fashion research as a necessarily open and layered practice based on a multiplicity of perspectives.

> "As fashion is made of both material things and symbolic signs, produced by individual and collective agents, which all merge through practices of production, consumption, distribution and representation, the study of dress and fashion necessarily covers a wide range of research issues." (Smelik, 2017, p. 618)

Thus, whether for academic purposes, design processes or marketing manoeuvres; researching fashion necessarily implies the merging of disciplines, themes, methodologies, and approaches; taking into consideration both theoretical reasoning and practice-based attitudes. The fashion researcher could therefore be considered a transgressive figure, one who recalls "the form of the Deleuzian nomad, living in the intermezzo, ever deterritorialising without reterritorialisation, occupying smooth spaces subject to intense striation, over and over again." (Downey et al., p. xi). Porous and decentralized, the fashion researcher therefore moves in a flux between structures and categories and occupies a space where "a boundary or border might become a threshold, but only when it is transgressed" (Downey et al., p. xi). In tracing the portrait of the fashion researcher, it could be remiss not to mention once again Granata, who in her article aptly quotes Mitchell's definition of inter-disciplinarity: a practice which "causes moments of 'rupture' and/or 'turbulence' within established disciplines" (Granata, 2012, p. 79).

Furthermore, directly quoting fashion theorist Susan Kaiser, professor of Integrated Design Otto von Busch claims that "studying fashion is a both/and, rather than either/or" activity, as "fashion thrives on contradiction (conflicting truth claims) and ambivalence (conflicting emotions)" (Jenss, 2016, p.181). It is then clear how the inclusive and contradicting nature of fashion naturally guides its research methods too, which abandon all hierarchies or divisions in the process of acquiring references and sources. Von Busch then offers a visual representation of fashion research applied to the context of design, taking inspiration from Donna Haraway's theory of diffraction based on an "approach to complex fields, which include both/and perspectives and contradictions" (Jenss, 2016, p.185).

Dwelling in the interstices between disciplines and methods, thriving in an abundance of sources and inputs; the fashion researcher can therefore employ diffractive modes of observation to stimulate intermediate, comprehensive, cross-cultural, and decentralized studies. If liminality "is itself an in-between space of potentiality," (Downey et al., p. xi) researching fashion then mirrors this state of becoming by

edging the borders of the disciplines it encounters. In the next chapter, I will argue that since the practice of fashion research shares qualities with the concept of liminality, then the spaces in which it is conducted are ever more effective if they feature liminal qualities as well.

2.3 Thresholding the Fashion Library

From study collections to museums, from the ateliers to university workrooms, the spaces in which fashion research is conducted are varied and not standardized. For the purpose of this article, I will focus on the space of the library, as I argue it tunes in with the state of in-between-ness and the definition of liminality sketched in the previous chapters. Going back to Granata's contribution, the author traces a revealing outline of the difficulties faced when researching fashion by recounting her experience of the library.

> "[…] one of the easiest ways for me to visualize the difference in disciplinary status between film and fashion studies was by observing how works on film studies were spatially self-contained within large research libraries compared with those on fashion studies. […] retrieving books on fashion had me scouring between floors and wings, which gave a more exploratory dimension to the physical act of research, but it certainly made it more time-consuming!"
> (Granata, 2012, p. 75)

Not only this image is exemplary in portraying the positioning of Fashion Studies within academia, but it also effectively illustrates the idea of 'passage' that fashion research implies, as well as expressing the urgency of creating spaces which could enhance—yet facilitate—this liminal practice. A specialized library of fashion therefore faces a crucial contradiction: it should unify its collection under the umbrella-term of fashion, yet it must also be broad enough to stimulate cross-disciplinary encounters.

In her MA thesis *Beyond the Library: A Study of Fashion Documents' Archival Spaces,* fashion scholar Ilaria Trame unpacks the terminological and phenomenological complexities of the fashion library, disclosing the state of in-between-ness proper of this institution. In particular, the author acknowledges that the identity of a fashion library necessarily flirts with that of other existing repositories such as centers of documentation and archives, especially for what it concerns the contents of its collection. The fashion library, in fact, can host multiple forms of materials: magazines, fanzines, exhibition catalogues, books, documents, photographs; but could also expand its collection to ephemera—a concept I will analyze more in detail in the next chapters—or textile samples. To define a library of fashion therefore means to evermore engage with a liminal perspective, starting from its positioning at the borders of established centers of conservation and authentication.

> "The margins of the term 'library' need to be broadened in order to become a comprehensive device to gather these variety of identities. I argue that its identity is strictly related to the types of materials that it preserves, and to the ways in which these objects are stored and put in communication with one another. It is specifically for this reason that the definition of a fashion library is still so blurred and multifaceted: there is an urge to acknowledge this heterogeneity and the multiple singularities in order to be able to define the main features and characteristics that compose a library of fashion." (Trame, 2022, p. 8)

Similarly to documentation centers, the fashion library can host materials (such as ephemera) which are not canonically fostered by traditional libraries. It also mirrors the objectives of the archive by becoming a repository of objects and participate in what French philosopher Michel Foucault names "the creation of a system of statements" (Foucault, 1969, p. 34) by actively legitimizing its collection. Nevertheless, the fashion library differentiates from the museums' documentation centers for the materials included in its physical as well as digital walls are not apt merely to sustain a collection of artworks or garments. Simultaneously, it challenges the institutionalized heritage-making of the archive as its collection can be contaminated with unofficial knowledge as well, that is materials which stem from the everyday, the under-represented and the personal spheres.

The broadness of the term is evermore enhanced by its digital iterations, which continuously challenge the definition of what a fashion library should or could be. Trame mentions for instance the phenomenon of university libraries' Instagram accounts such as @bibliotecaiuav—the official social media of IUAV University of Venice's library—which display their collection echoing hyper-popular profiles dedicated to sharing images or videos related to fashion printed matter—which not coincidentally use the word 'library' and 'archive' interchangeably. It is also noteworthy to mention the proliferation of online guerrilla libraries, which offer complete scans of rare materials without considering copyright or distribution policies and regulations. From these examples it is clear how the concept of fashion library itself, as well as its actual collection, is then subject to multiple mutations and transformations. In Trame's words:

> "The library can be seen as a device to reorient an understanding of fashion beyond the garment itself […] and to redefine certain hierarchies of material typologies […] that can speak for another, additional and parallel history of fashion, oftentimes complementary to the one written by the study of garments." (Trame, 2022, p. 12)

Another feature proper of the library, is that it "demands a daily relation with the system of fashion in order to keep being relevant in contemporary times," (Trame, 2022, p. 10) something that, I argue, is not necessarily required by documentation centers and archives. Emblems of this permanent dialogue between the library and the outer world are two specific genres of materials: ephemera and magazines. If the second object is quite self-explanatory, the first can be described in the context of fashion as "all those objects, documents, invitations, press releases, catalogues, lookbooks and flimsy materials that survive their original function" (Trame, 2022, p. 10). These objects are highly reactive to the cultural zeitgeist, as their production by the fast-paced industry of fashion grows steadily and consistently. Through their presence, both magazines and ephemera expand the idea of the library and are manifestation of the multiple identities, definitions and practices proper of the institution. Ultimately, the fashion library could be seen as an intermediate space of constant negotiation between the fashion industry and fashion research; an ever-changing threshold charged of interpretative possibilities.

Based on these premises, it is interesting to analyze the act of researching within the fashion library through the practice of thresholding as described by artist and lecturer Ally Bisshop. In her Doctorate thesis, based on practice-based research and sustained by Henri Bergson's theories of the threshold, Bisshop coins this term to describe a set of techniques that stimulate more-than-human relationships between artist and art. Without getting into the specifics of the single techniques, it is interesting to notice a resonance between her definition of thresholding and the act of researching within the fashion library.

> "In its openness to indeterminacy, thresholding puts into question what we think we already know […] when we enter into compositional relation with material. Instead, it provides the conditions for new knowledge and new techniques to emerge in the making, in the process of engaging and attuning to material forces." (Bisshop, 2018, p. 9)

If we were to apply Bisshop's definition to the fashion library, thresholding the library would mean to engage in a relational and open-ended process of questioning with the objects of the collection, a dialogue which aim is to produce new knowledge and stimulate new kinds of research. I argue that this practice is innate to the fashion researcher when in dialogue with the library, as they are both rooted in the concept of liminality. As a practice of rupture and creative invention, states Bisshop (2018, p. 54-55), thresholding aligns both with the transgressive nature of the fashion researcher and of the fashion library. To conclude, it is clear how Fashion Studies, fashion research and the space where both meet—the fashion library—all share liminal qualities and are instances of decentralized practices, methods and spaces which stimulate a constant thresholding of their specific relations.

3. International Library of Fashion Research (ILFR)

3.1 The Foundation Process

The primordial state of International Library of Fashion Research can be pinpointed at the moment of encounter between Norwegian editor and curator Elise By Olsen and New Yorker cultural theorist Steven Mark Klein. In 2015, By Olsen's work as editor and curator was already well-renowned in the European publishing industry and overseas. One day, Klein contacted By Olsen through a three-word email that recited: "who are you?" (By Olsen, 2022, p. 58). Curious to meet the person that started her first blog at eight years old and founded her first magazine *Recens Paper* at thirteen, Klein initiated an epistolary exchange with By Olsen, which led to multiple encounters, conversations and exchanges of ideas and perspectives. Sharing a profound appreciation of printed culture, the duo found a common ground in discussing practices of publishing, collecting, and archiving fashion printed matter. In the 80s, 90s and 00s, Klein had in fact been a hungry hoarder of anything that was fashion-print-related and fed his personal archive accumulating brands' in-store catalogues, stealing discarded weeklies from his neighbor's doorstep (By Olsen, 2023, p.37), and acquiring now rare fashion publications and ephemera. In three decades, Klein generated a collection of more than 5000 objects, crammed in his Lower East Side apartment. Then, in 2020, during a call between the two, Klein nonchalantly asked By Olsen if she would have been interested in inheriting his whole collection.

In a matter of just few months, the collection was shipped, relocated, and established in the renovated building and former train station opposite the brand-new National Museum of Art, Architecture and Design of Oslo (NAM), the Stasjonsmesterboligen (Fig. 1 & 2), which agreed to host the library-to-be on its premises. This passage of the baton couldn't have been more symbolical: an entire collection was quite literally navigating across the ocean to become the foundation of an international institution. Going back to the theories on liminality, the repositioning of the collection could be associated to what Van Gennep identified as "preliminal rites," that is the ceremonial passage "that incorporates the individual(s) within the new symbolic-spatial state." (Downey et al., 2016, p. 7). I argue that Walter Benjamin's essay "Unpacking My Library" (1931) could be a suitable reference for this process. In the text, in fact, Benjamin describes the state of in-between-ness of his library, at a time in which it found itself amid a relocation in his new house. Evoked by the author's words are in fact a precise sense of transition, as well as the tactile-like notion of presence and persistence.

> "Inheritance is the soundest way of acquiring a collection. […] the attitude of an heir, and the most distinguished trait of a collection will always be its transmissibility." (Benjamin, p. 66)

The threshold that a book trespasses in the moment of acquisition, when it ultimately becomes part of one's possessions, is emulated in that of the inheritance process, which is described as the natural course of a collection: being passed on to other possessors. For Benjamin, "ownership is the most intimate relationship that one can have to objects," (Benjamin, p.67) and the materials purchased become secretly bounded to the acquiree, and vice versa. In his conclusion, the author offers an image which symbolizes the total union of object and collector, when he states that the collector 'disappears' inside the library. For the author, the presence of the original collector isn't lost in the process, it is hosted instead by the objects of the collection. This process, which lays in the foundation of a library, triggers questions related to the concepts of memory, identity, and temporality within the space, charging these concepts with a sense of becomingness and transition.

Shortly after the donation, in the fall of 2021, Steven Mark Klein ended his life. After learning the news, By Olsen stopped the process of relocation before slowly re-introducing her presence and that of her collaborators in Spring 2022. The library finally opened its doors in November 2022, and has since grown steadily gathering many private collections through donation process only. By Olsen not only considers the library as the physical and spiritual legacy of her mentor, but also as an entity in constant transformation, a malleable body that reacts through the contact of those who touch it, though "memory, symbiosis, sharing

and conversation." (By Olsen, 2023, p.38). It is evident how the process of foundation and the subsequent establishing of ILFR is embedded in a state of liminality, it is the incarnation of a threshold in constant negotiation between the boundaries of "privacy, autonomy, and public access." (By Olsen, 2023, p.38); as well as of memory, history, and heritage.





Figure 1, 2. The process of transportation of the seed donation of Steven Mark Klein to the library's premises. Photographs by Einar Fuglem, courtesy of International Library of Fashion Research.

3.2 From Digital to Physical, and Back

Before its physical opening in 2022, ILFR had already launched in 2020 as an Instagram profile and website, which became the first visual manifestations of the project. Alongside the fundamental information of the project—such as the mission, the team and board members, and the history of the library—the website hosts the collection's catalogue, which is constantly updated through the process of classification and indexing of donations. The front and back cover, as well as a spread of every object of the collection are also photographed and uploaded to the site, supported by essential data such as material typology, location of production, names of practitioners and date of publishing. This process aligns with the investigation conducted by fashion scholar and curator Marta Franceschini in her 2019 paper "Navigating fashion: On the role of digital fashion archives in the preservation, classification and dissemination of fashion heritage." In the contribution, the author stresses that, when digitalized, the materiality of the fashion object is lost and is replaced instead by its data.

> "Digitizing museum objects means reproducing them as a set of information that defines them. Information can be easily isolated, perhaps shaping research paths and establishing commonalities that different objects may, or may not, have." (Franceschini, 2019, p.72)

A point that Franceschini makes in her contribution is that the data stored in digital archives can offer "the opportunity for researchers and enthusiasts to widen their knowledge and wander into an incredible number of items from different disciplines," (Franceschini, 2019, p.72) especially through the implementation of thematic pathways or curated selections of materials that gather seemingly unrelated objects under shared data. In the case of the ILFR, this is achieved on the website through the aforementioned sets of information—Brand, Publisher, Year, Location, Language, Material, Category, Practitioners, Collection—that can be filled and accessed transversally for each object. The library's site also offers a series of curated pathways, such as the Homage to Donors series—which gathers the materials of a specific donation—, selections compiled by guest practitioners, groupings of the objects displayed in in-house exhibitions, and general thematic collections on designers, art directors or photographers. These thematic compositions offer additional object-led tracks, inspiring the act of 'wandering' throughout the digital platform and the subsequent trespassing of the same data sets that define each object. In this sense, the library's website acts as a liminal terrain of dialogue between the physical boundaries of the objects and the openness of their metadata. Especially for what concerns the curating the digital space, the processes implemented by ILFR seem to tackle the theories introduced by professor Yrjö Engeström, which pinpoint in the object the node of interpersonal communication, unveiling new perspectives on the digital ramifications of such shared relations and shifting them from the canonical 'object' of fashion—the clothing or textiles—to other objects such as printed matter and their digital doppelgängers.

The Instagram page of ILFR, @fashionresearchlibrary, is also an interesting incarnation of the liminal properties of the project. In particular, the digital debut of the project—a post of the animated acronym ILFR—encapsulates the identity and essence of the whole project. The name itself name of "International Library of Fashion Research represents an incredibly broad definition that opens to multiple interpretations," (Trame, p. 130) observes Trame in her research. The name in fact implies and suggests the natural state if in-between-ness of the project, which stems from a collection originally based in the United States, but which is now hosted in Oslo and is fueled by a network of international and multidisciplinary practitioners. The Library's collection grows steadily as is the repository of world-wide donations. Antecedent to the physical space of the library, the digital tentacles of the project can therefore be interpreted as its visual manifesto, informing and subsequently representing the physicality of the space (Fig. 3 & 4).



Figure 3, 4. Left: rare materials and ephemera part of the library's permanent collection. Right: publications from the seed donation of Steven Mark Klein. Photographs by Magnus Gulliksen and Akram Shah, courtesy of International Library of Fashion Research.

3.3 Between Location, Site, Place and Metaspace

Even if the site for the library had been allocated by NAM in 2020 and its digital iterations had been up and running since 2021, the library officially opened its doors only on 29th November 2022, occupying the mezzanine and top floor of Stasjonsmesterboligen. For an analysis of the physical space of the library, it is crucial to apply the definitions of 'location,' 'site,' 'place,' and 'metaspace,' theorized and contextualized to the realm of fashion by professor and architect Vésma Kontere McQuillan, which in fall 2021 was also appointed as Head of Spatial Design of ILFR. In the volume *Fashion Spaces: A Theoretical View* (2020), the author addresses in fact these definitions from a theoretical and fashion-focused perspective. Through these concepts, I argue it is possible to unpack the decentralist stance and the liminal posture of the physical library.

The location of the library would be its "coordinates of a real-worlds geographic position," (McQuillan, 2020, p.22) therefore its position in the urban landscape of Oslo and outside of the canonical European fashion epicenters. The site is instead the Stasjonsmesterboligen building, an ex-train station which is now part of NAM. Defined as "both the context for the object to be designed, and also the design of that object," (McQuillan, 2020, p. 24) I claim that the site could also be interpreted as the context for fashion printed matter, collecting and ultimately fashion research. Finally, the place can be defined as the ultimate thresholding status of the library, as it embodies the proximity to the NAM's archive and library and the fact itself of being hosted by a cultural institution—a feature that plays a central role in influencing continuous responses and dialogues between the collections of both the ILFR and the museum. This fluid relationship is also fed by shared experiences, such as the Fashion Research Symposium, a conference and cultural gathering organized by ILFR and hosted in the NAM's conference rooms every year in September since 2022. The first edition of the symposium was fittingly centered on the topic of *Decentralizing Fashion* (2022).

This brief introduction to the physical features of ILFR highlight even more the in-between-ness of this institution, which finds itself between the borders and boundaries of fashion geographies, cultural landscapes and institutional collections. Moreover, the concept of 'metaspace' becomes relevant to this analysis as it had played an instrumental role in the design process of the library's physical space. Inspired by cultural theorist Alicia Kühl, who defines the metaspace as an "imagined space," one which "cannot be localized, as it is abstract," (McQuillan, 2020, p. 25) McQuillan pinpoints fashion's current metaspaces in the digital realm. This concept was therefore crucial for the design process of ILFR, as at that point the only manifestation of the project was solely digital. Through an act of translation, McQuillan and her students of the Brandscapes courses she holds at Kristiania University of Oslo created the interior design of the library effectively blurring the boundaries between its site, place, location and metaspace (Fig. 5 & 6).



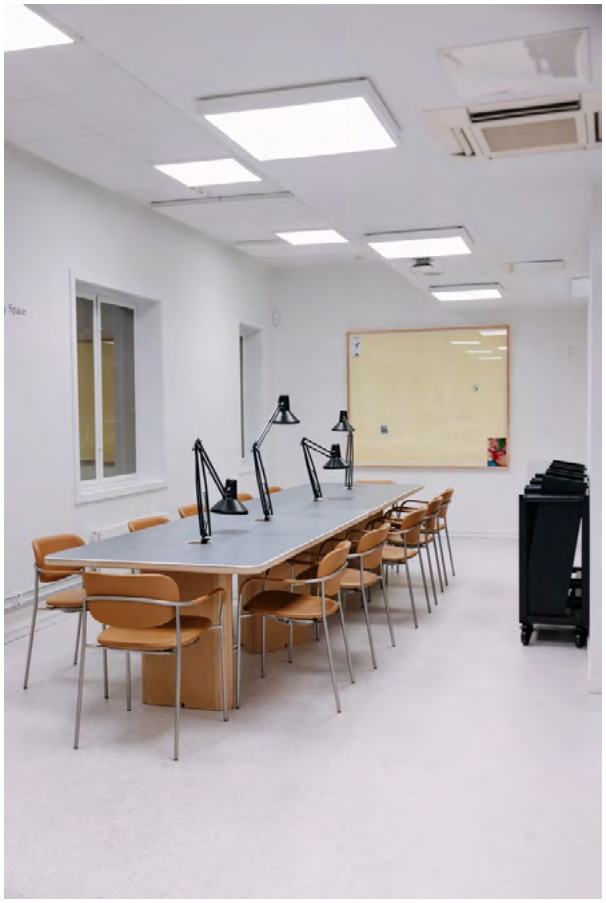


Figure 5, 6. Views of the library's shelves and study space. Photographs by Magnus Gulliksen, courtesy of International Library of Fashion Research.

3.4 A Mediatic Collection

Focused on fashion printed matter and ephemera, the composition of ILFR's collection is undoubtedly a fundamental interpretative key to disclose other liminal qualities of the institution. In By Olsen's words, the library "aims to mediate the gap between the academic world and the spectators of fashion" by fostering objects which are "framed around the whole system of mediation and communication of fashion." (Trame, 2021, p. 125) If fashion communication and promotion are fundamentally mediational disciplines of the fashion system, occupying the interstices between clothing and its cultural impact, designers and their buyers, crafts and their visual manifestations; then the objects resulting from this process can be considered inherently liminal.

Thus, magazines, lookbooks, exhibition catalogues, fanzines and publications of all sorts can be seen as highly relational materials, establishing thresholds between the players and spectators of the fashion's industry, system and culture. As mentioned, the library finds itself in constant conversation with the

external world of fashion, endlessly updating its collection to host the products of these mediational dialogues. The collection therefore seems to resonate with the interests of design director of ILFR and multidisciplinary designer Morteza Vaseghi, who pinpoints his focus on "everything that comes before and after clothes" (Vaseghi, 2023) offering an effective definition of the liminal features of fashion research, repositioning again the gaze of the researcher towards non-textile-based objects.

Introduced previously, the concept itself of ephemera is also deeply rooted in a state of in-between-ness. In the words of fashion scholar and Director of the MA Fashion Studies at Parsons Paris Marco Pecorari, who dedicated its Doctoral thesis and subsequent book *Fashion Remains: Rethinking Ephemera in the Archive* (2020) to the phenomenology and ontology of ephemera within the context of fashion museums and repositories, this term describes "flimsy, printed artefacts produced not intended to survive beyond their initial purpose," namely, in fashion, "fashion plates, commercial receipts, invitations, fanzines, commercial photographs, gadgets, catalogues, posters and much more" (Pecorari, 2020, p.4). Living in a paradoxical state of subversion of their temporality and value, ephemera are in a way the incarnation of a threshold between their original function and their current place within a collection (Fig. 7 & 8).

An interesting and extremely rare example of the role of ephemera within ILFR is the case of calendars, usually created by brands as New-Year's gifts for clients. A calendar, of course, expires the 31st of December of that specific year. But what happens when time passes, and the current year shares the same weeks and dates of a previous calendar? This is what happened for instance with the 16th issue of the experimental fashion publication VISIONAIRE, which took the form of a calendar of the year 1996. Sharing 1996 and 2024 the same dates, that issue of VISIONAIRE could be reactivated as a functioning calendar for the library guests and team. Sometimes, then, the ILFR also becomes a space of liminality for ephemera and publications, in a limbo between intermittent reenactments of their original purpose.



Figure 7, 8. Images of donated materials. Photographs by Amedeo Abello, courtesy of International Library of Fashion Research.

3.5 An “Indisciplinary” Team

The last feature of ILFR I intend to analyze to unveil the liminal properties of the institution, is its team and board members. The board is constituted by 24 members from different nationalities and backgrounds, a compound of expertise and knowledge that includes art critics and creative consultants, publishers and editors, curators and entrepreneurs, designers and photographers, professors, and graphic designers, as well as some of the most prominent figures of the fashion landscape. Moreover, the network of the library expands beyond the board into the Director’s Circle, a web of some of the leading names of the fashion’s system, industry and academia which actively participate in the growth and evolution of the project. Cross-generational, decentralized, inclusive, hybrid and global, the ILFR’s network tackles all aspects of fashion, celebrating its interstices, layerings, and margins.

Finally, I argue that the portrait of the fashion researcher sketched beforehand, characterized by transgressive approach to research and an anti-heirarchical scouting of sources, can be effectively associated with that of the team members of ILFR. Originating from disparate backgrounds and bringing each a specific expertise on fashion, the collective fuels the space of vivacious interpretations of fashion printed matter and its cultural and practical implications. Aforementioned Elise By Olsen, founder of ILFR, is an editor and curator; Else Skålvoll Thorenfeldt, co-founder and head of communications of ILFR, which is a former member of the original team at Maison Martin Margiela; Morteza Vaseghi, director of design of ILFR and multidisciplinary designer; Vésma Kontere McQuillan, head of spatial design of ILFR and architect and interior designer; and Ilaria Trame, head librarian of ILFR who is also a fashion researcher and scholar. Ultimately, one could define the ILFR (Fig. 9) as a co-design-driven project led by the collective work of various fashion practitioners, which paradoxically are often seen as ancillary figures (or the subject matter) to the field of fashion research, and less as its key agents and promoters.

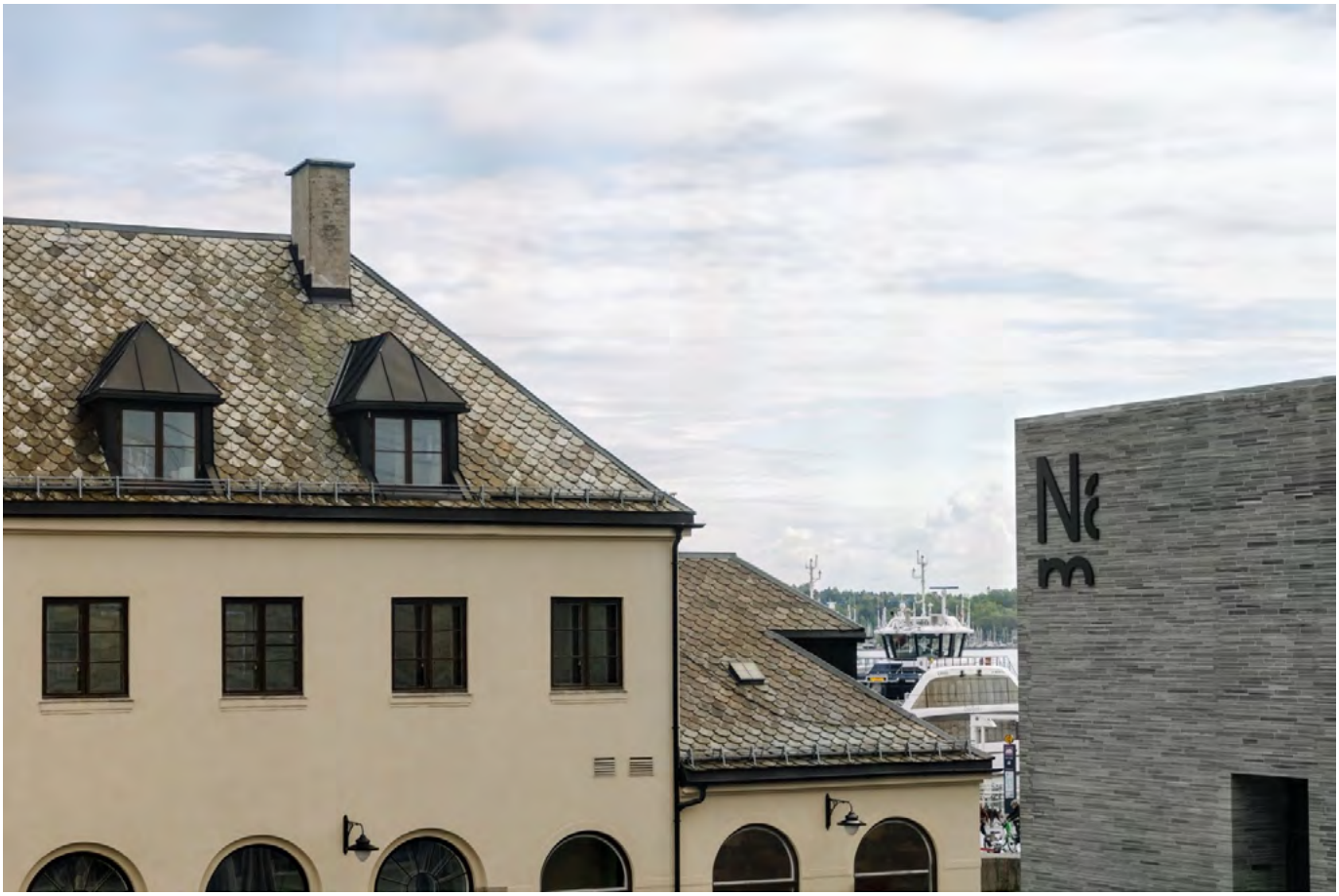


Figure 9. On the left: Stasjonsmesterboligen, the building that hosts the International Library of Fashion Research. On the right: the National Museum of Art, Architecture and Design of Oslo. Photograph by Magnus Gulliksen, courtesy of International Library of Fashion Research.

4. Conclusions

This paper defined Fashion Studies as an inherently decentralized and liminal discipline, characterized by a state of in-between-ness and 'entre-deux'. Then, it made use of the definition of liminality and thresholding to investigate the spatial qualities of the practice of fashion research and that of the space in which it is conducted: the fashion library. These theoretical premises found their application in the case study of International Library of Fashion Research, whose spatial, conceptual and constituent properties express the fundamentally intermediary, interstitial and transgressive nature of the project. In conclusion, ILFR can be identified as inherently center-less, capillary and in-becoming, and therefore the ideal site-of-passage for fashion research.

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P/REFERENCES OF DESIGN

EPI-CENTRES OF THE WORLD WIDE WEB: 30 YEARS OF ITALIAN WEB INTERFACE DESIGN HISTORY, A CRITICAL INVESTIGATION.

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ABSTRACT | When we think of the third industrial revolution, namely the digital one, we have Silicon Valley in mind. The southern area of the San Francisco Bay is where, back in 1969, Stanford University launched the ARPANET, the first seed of the Internet revolution, and many of the pioneering and contemporary companies driving the digital turn, as well as most of the innovation in the field comes from California. Nevertheless, the WWW backbone and the globalisation brought up by the Internet have declined in the different regions according to a glocal perspective, creating a relationship between the centre and the peripheries that should be critically investigated.

Although in a borderline position, Italy was among the "early adopters" thanks to a technological infrastructure that created favourable conditions to establish a context for the flourishing of website design communities of practitioners and experimentation in the field. Besides, some of the Italian protagonists of the 90s and early 2000s gained visibility on the international scene and established original trends in the Italian community.

The paper proposes, drafts, and discusses a possible Italian historiography of the last 30 years, treating web interface design as a contemporary digital artefact at the crossroads of transdisciplinary approaches: graphic design, computer science, and Human-Computer Interaction. In doing that, it also faces aspects of research in the fields of contemporary design history able to propose different perspectives and trace down different stories compared to the "official" mythology of the Information Age. The historical approach, in fact, questions the relationship between global and local actors, decolonising the "vulgate" in order to include decentralised experiences enriching with points of view a complex, articulated, interconnected, but not monolithic evolutionary process as narrated so far.

1. Centre and Peripheries: Different Perspectives

It has been thirty years since the web protocol created by Berners-Lee was made available royalty-free and led to the birth of the World Wide Web as a (future) mass medium that we are all familiar with today. Although in a peripheral position, Italy was among the "early adopters" of the digital revolution thanks to a strong infrastructure innovation creating favourable conditions to establish a technological context for the flourishing of websites as communication artefacts and an intriguing experimental field of design. Besides, some of the Italian protagonists in the 90s and early 2000s gained visibility on the international scene. It is helpful to name some of them, such as Mirko Pasqualini, an Italian 'enfant-prodige' of web design based in New York and co-founder of WXO, who tragically passed away in 2020; Luigi De Aloisio, currently working on the 'nostatic' explorations; Simone Legno, mentioned in New Masters of Flash (Baumann et al., 2003); SuperTotto.com aka Totto Renna. In the late 1990s and early 2000s, several local community events and awards also created leadership in terms of languages and approaches intimately connected with the rest of the Italian design scene.

More recently, others have set specific trends in the Italian digital design community, such as Claudia Molinari, internationally awarded narrative-game designer of the duo WeAreMüesli.

By opening the perspective to experimentation beyond the bi-dimensionality of a display, Studio Azzurro and its intellectual offspring represented a turning point towards a more transversal way of conceiving and conceptualising communication and experience projects mediated, enabled or augmented by digital technologies. If, in the latter case, the architectural and exhibition scale, as well as the intellectual presence of the late Paolo Rosa (Balzola & Rosa, 2019), have made it possible to trace these design experiences in a structured manner, vice versa in the case of what has populated the web and the digital world over the past 30 years, it hardly leaves footprints and traceable paths. Therefore, reconstructing and telling a coherent, documented and articulated story of ephemeral, emerging and complex phenomena seems to be the real challenge in terms of methods rather than content.

The historiographical issue becomes all the more necessary and urgent for those phenomena that belong to the contemporaneity and to contexts that are eccentric with respect to the disciplinary centre of innovation and experimentation in terms of geographical and cultural spaces.

It is indeed paradoxical that a global phenomenon such as the advent of the World Wide Web, in terms of its revolutionary scope and planetary pervasiveness, should be perceived in terms of approaches, models, aesthetics and stylistic features as a single, unifying and unified corpus. The role played by the big players in the digital information market, the "four horsemen of the [digital] apocalypse" (Galloway, 2015) is undeniably homologating, as in the case, for example, of the aesthetics of Apple's products and interfaces or the design system (material design) of Google/Android, which impose patterns and guidelines that are universally received and adopted, just to name two of the leaders in the hardware/software/cloud/service sector.

Even within equally international phenomena, in fact, as in the case of rationalism and modernist architecture, it was possible to identify local schools, currents, interpretations, as in the case of the Bauhaus or Scandinavian interpretation or individual personalities active between and after the two world wars. This was also the case in the field of visual communication and graphic design, where the variations of the Swiss style or of the so-called 'Milanese School' or, within the same tradition, the more recent Dutch "wave", have been contrasted with a modern language, it seems more difficult to define as many variations, paths and personalities in the field of digital design.

The relationship between the epicentre of emerging phenomena and the successive waves that spread from it to more distant territories often defines a leadership role and a subordinate terrain. If this progression is particularly visible in certain historical processes, the time lag becomes the space for mediation with local material culture, taste and aesthetics or for original elaboration.

In their emergence and evolution, innovations often transcend the context and purpose for which they were conceived to spill over into other domains and respond to other needs implicit in the social fabric. However, this dynamic relationship moves asynchronously. Technology dictates the rules by making itself accepted, indeed often becoming indispensable (Bucchi, 2020).

However, recent and contemporary phenomena, such as the electronic and then digital revolution, show a rapidity in which these different planes collapse. The web has become a worldwide mass communication platform in less than a decade. Although it is a polycentric phenomenon that sees the American way (first the military and then the Silicon Valley) and the European communities (from the academic-scientific spheres to the open source model) converge, the Bay Area soon takes over thanks to the concentration of entrepreneurial realities that manage to ride the "momentum" in commercial terms gaining the leadership. The United States, specifically California, formulates the rules governing innovation and design processes in political, financial and commercial terms. These are rules to which the rest of the world has inevitably adhered because of the monopolies that have been created, i.e., the dominant role of platforms such as Amazon or Meta or software such as Adobe or Microsoft. As Gui Bonsiepe (1993) already pointed out,

> "the imbalance in international trade relations [...] may represent a type of power that should supersede traditional forms of 'making history'. [...] without lapsing into the idea that the industrial design of the periphery is merely a belated and shoddy repetition of the process through which the industrialised countries have gone through in the last ninety years when the d.i. was transformed into a social reality." (Bonsiepe, 1993, pp.78-79)

In particular, in some of the essays dating from 1987, Bonsiepe analyses and discusses the ambiguity of this relationship in industrial design in the broadest sense, but especially in the transition to the electronic and then digital world in which design itself becomes an interface and interpretative model of asymmetrical social, economic and political relations. Among the themes that emerge as characterising this relationship between centre and periphery, Bonsiepe identifies the question of autonomy and a partially hetero-directed development of the processes of adoption and acquisition of innovation and its languages with respect to internal capacities, i.e. the production of a "material" culture with its own identity with respect to the external culture and the world trade scene.

At the basis of these processes, design didactics, not only professional practice or critical-academic reflection, play a significant role, especially in a tradition of teaching design culture still deeply rooted in the unifying lesson of the Bauhaus first and the Hochschule für Gestaltung in Ulm later. In the former case, the reference is to the model of basic design, the Grundkurs and the philosophical, conceptual and language-based founding elements of rationalism and modernity, and in the latter to the interdisciplinary approach of the post-World War II period, which is on the way to the crisis of this 'fideistic' vision of the rational and progressive and to the post-whatever. The shift from industrial design to a society of image (Sinclair, 1988) and communication (McLuhan, 1989) and web 2.0 and social platforms (DiNucci, 1999) that dematerialises production and fruition processes and practices in favour of a continuous flux – infinite, like the scroll of social media walls – further collapses and flattens identities, aesthetics and languages on the epi-centres.

2. Mapping the Italian Scenario: for a Research Methodology

The research project presented is in its preliminary phase. It deals with the research of recent history in the field of web design, i.e. that part of digital design predominantly oriented towards interface design of interactive artefacts and websites between 1993 and 2023.

The project has been divided into several concentric waves covering different sources to map and create a puzzle of fragments able to recreate a bigger picture of the phenomenon investigated, the last 30 years of (Italian) web design history.

1) The first of the five planned waves aims to explore and scan printed documentation – i.e. a) theory and statement books; b) edited books and curated projects' catalogues; c) journals and professional magazines; d) indexes and annuals; and e) publishers, which we could call the "cold" sources (for a more in-depth discussion on "cold" and "hot" sources compare Gunetti, 2017). Documents that can reflect crystallised knowledge or image of a specific period often limited and partial but stable and fixed.
Even if working with analog materials, it seems counter-intuitive when it comes to the history of digital design. However, these primary sources show us a precise picture of a given period. Their potential is also their limit: much of the information presented is not valid anymore (URLs of websites, emails and other references), making it very difficult to trace back presences, styles, and phenomena though presented and secured in time.

The first recognition, partially presented but discussed in this paper, maps the aforementioned categories of direct sources.

2) The second wave, on the other hand, explores digital references as primary documentation, e.g. a) websites; b) the Internet Archive; and c) directories, databases and repositories. We can label those "hot" sources because they are still evolving and producing entropic energy and dissipation. Accessing URLs, in fact, often implies finding new versions of a website, updated information and news, partially or completely shadowing and erasing previous releases (Bollini & Guida, 2022; Bollini & Guida, 2023)

3) Moving from the more stable to the living sources, the scope of the third wave is to explore oral documentation and first-hand memories, for instance, thanks to oral stories, interviews, personal archives and so on. This wave embraces the micro-historical approach (Ginzburg, 2023; Parikka, 2011) in order to gather documents, traces, and glimpses from the protagonists, fixing the memories in possible further sources documenting the past in the future, scraping and digging archive primary and secondary sources, preserving existing and otherwise perishable testimonies and legacies. It is also the context in which historical research tools, methods and practices face the need to rethink the idea of documentation, access and sources.

4) The fourth one investigates live documentation, i.e. a) awards such as the Bardi Web Award, Italian Web Award, DonnaèWeb, AWDA (the AIAP Women in Design Award) and/or awards with a digital section like Media Key Awards, already partially mapped, presented and discussed in this essay; b) associations' activities, community meetings as in the case of Architecta, Web Master Italia, International Web Association (IWA) Italy, the Italian Association of Visual Communication Design (AIAP), AccentiRosa, the Ux Book Club, Ux/UI Designer Italia; c) professional conferences and events, for instance: the Kerning Conference, ePublisign Rimini, Webbit, Ux Book Clubs, Italian Information Architecture Summit, WUD (World Usability Days), WIAD (World Information Architecture Days), Pane, Web & Salame, Accessibility Days, that is periodical as well as 'una tantum' events; and d) more ephemeral experiences often taking place thanks to people gathering together. In this case, we can include several categories and sub-events.

5) Finally, the last wave is mainly focused on digital design education, i.e. mapping the a) Universities, private schools and academies, and courses teaching web/UX/UI design; b) the profile of professors and lecturers, their academic background and scientific sectors; c) the disciplinary areas of Bachelor and Major Degrees and of the courses.

The research approaches the investigation by adopting complementary and convergent strategies. The common ground of the first wave has been to map through "cold" sources the existing printed documentation about the last 30 years of web design, namely digital, interface, experience design and information architecture.

In order to do that, the publishers specialised in the digital technologies, design and user research disciplines have been listed, and the catalogues analysed.

Reilly, New Riders, Peachpit Press, A Book Apart, Rosenfeld Media, and Friends Of have been catalogued on

the international scene. The following have been considered significant at a national level: Hops Libri, Tecniche Nuove, Hoepli, Pearsons, and Apogeo, together with Happy Books and Logos. Other players such as A Book Apart, Peachpit Press, O'Reilly, Rosenfeld Media, Taschen, Rockport, AVA, and Pepin Press, for instance, have been included as significant references, although not expressly specialists in the field but covering the project's culture macro-area (architecture, product/industrial design, graphic design, illustration and so on).

If the publisher and consequently the monographs or edited books, catalogues, annuals and indexes have been considered at the international level because of the presence of Italian protagonists in the World Wide Web scene, in the case of journals and magazines, the spectrum has been restricted to the national one. In particular, LineaGrafica e Progetto Grafico, i.e. two communication/visual/graphic design periodicals linked to the academic scenario and professional magazines such as Internet News, Neural, Wired Italia, and Jump.

Looking at the Italian scenario, it is possible to trace down a local historiography of the last 30 years when treating web (interface) design as a contemporary digital artefact at the crossroads of transdisciplinary approaches between communication and graphic design, computer science and Human-Computer Interaction. Doing that also means facing aspects of research in the fields of contemporary design history. It questions from a methodological perspective the difficulties in researching digital sources in an ongoing environment and proposes a systematisation and critical mapping derived from the analysis of publications, curated books, international indexes and annuals published between the mid-90s and the 2010s, scientific journals and digital archives and repositories. Furthermore, it aims to discuss the consequences of switching from the canonical approach to historical research – based on archives, primary sources and documentation mainly in the form of written, printed, and sketched materials – to digitised, digitalised or digital-native sources. For their very nature, the latest ones appear to be subject to obsolescence, manipulation and disappearance, forcing researchers to interpret and write design history based on non-traditional sources and approaches.

Another issue to discuss is the supposed peripheral role of Italy in the evolution of digital visual languages and its participation in the international scene. In communication design, the presence of Italian designers in the global discussion and discipline advancements is underestimated. The research project aims to establish the dignity of some protagonists to be mentioned in the still-to-be-written histories of digital design.

3. Italian Historiography: A Tentative Summary

"By the end of 1993, there were still fewer than 650 websites online" (Ford & Wiedemann, 2019, p. 22). One of the first was Italian: the CRS4, a research centre based in Cagliari (Sardinia) and effectively an extension of CERN. Its website was published in August 1993. The opportunity came from a late 1992 meeting that Maurizio Davini, from the University of Pisa, had with Berners-Lee, who shared a copy of the source code of the web (UniPiNews, 2023). The CRS4 Research Centre was directed in a couple of periods by Nobel Physician Carlo Rubbia: first in 1990-1999 and then in 2003-2006.

In its history, CRS4 has distinguished itself for some milestones related to the development and dissemination of the Internet, not only in Italy: as already mentioned, it created the first Italian website in 1993 (www.crs4.it), contributed to the creation of the first European web-based newspaper in March 1994 (L'Unione Sarda) (Bettini, 2006), and to one of the first Internet Service Providers (Video On Line, December 1994). These milestones also suggest that in the early 1990s, there was a growing need for technicians and designers not only of protocols but also of the first interfaces.



Figure 1. a) “Il progetto delle interfacce” book cover, 1993; b) “Web Design in Italy 01” book cover, 2004; c) LineaGrafica, n. 299, 1995.

3.1 Theory and Manuals

In 1993, Giovanni Anceschi, the most important Italian theorist in the fields of graphic and communication design at the time, published “Il Progetto delle interfacce” (Interfaces Design) (Figure 1a). At that time, he was the scientific coordinator of the Special Course in “Interface Design: Interactive Communication Design” at Domus Academy in Milan. In his seminal volume, Anceschi defines the roles and competencies of the interface designer, consciously not confined to the fields of the then-emerging web design.

In particular, in the essay “The Domain of Interaction. Protheses and Anaphora for Interface Design”, Anceschi (1993, pp. 9-41) discusses the disciplinary approaches to interface design, dividing them into theoretical, analytical and descriptive, on the one hand, and pragmatic operational disciplines on the other. He opened the perspective of a transdisciplinary approach to digital design, including ergonomics and cognitive psychology, information theory, and theories of notation and graphic notation, to name but a few. The book itself represents the variety of disciplinary contributions thanks to the participation of authors – scholars, practitioners and researchers – such as Daniele Marini (professor in the Information Science department at the University of Milan and founder of the Eidomatic Laboratory), Sebastiano Bagnara (full professor in ergonomics and psychology at the University of Siena), Marco Susani (an architect who has been collaborating with Olivetti and Sottsass Associati), Roberto Polillo (founder of the company Etnoteam, specialised in software engineering, author of several publications in the field of usability and design and then professor of Computer Science), Gui Bonsiepe, previously mentioned, and Stefana Broadbent (research fellow at the Centre de Recherche en Epistémologie Appliquée de l’Ecole Polytechnique in Paris). The list demonstrates the variety of contributions converging in interface design and interaction.

In 2006, Anceschi will also edit, with Massimo Botta and Maria Amata Garito, the book “L’ambiente dell’apprendimento. Web Design e processi cognitivi” (The Learning Environment. Web Design and Cognitive Processes). The collective volume provides an insight into the experience of one of the first Master’s courses delivered online in Web Design, which proposed a cross-disciplinary approach based on the expertise and experience of academics and professionals. Some of the authors were the above-mentioned Roberto Polillo and Daniele Marini. With them, Anceschi involved Giovanni Lussu (one of the most relevant theorists in graphic design), Carlo Branzaglia (theorist and teacher), Dina Riccò who wrote: “Sinestesie per il design” (1999) (associate professor at Politecnico di Milano), Letizia Bollini (2004), Maurizio Gnot (at that time at Politecnico di Milano), and others.

Among the various contributions, Anceschi specifies in his introductory essay that the book was conceived mainly by designers. Asserting a fundamental role for designers, in terms of skills and sensitivity, in the project of web interfaces. He proposed a map organising the knowledge of web design and then the figure of the web designer (Anceschi, 2006, pp. 29–39). He organised the knowledge map into two main layers: Methodologies and Artefacts. The design methodologies are articulated in 'instances' (indispensable operations: data collection, analysis, solution research and development, executive design, ...), 'notation systems' (all those methods useful for representing the new objects of the web, which are kinetic and temporal objects), and 'semi-finished products' (i.e., the elements that will constitute the website: typographic text, images, icons, ...).

The second layer, the one of the Artefacts, is divided into two main categories: Tool Sites (those websites that allow for concrete activities) and Database Sites (websites that allow access to a variety of sources of information). This synthesis is useful to support one of the hypotheses of the present research. Namely, the contributions of Italian design culture fully deserve reappraisal at a level that is not solely local. Indeed, some of these references have contributed to the institutionalisation of Communication Design disciplines and the training of digital design professionals.

3.2 Magazines: LineaGrafica

In the early 90s in Italy, only a few magazines were dedicated to graphic design. Alongside them, the Italian publishing market offered various opportunities such as publications, some of which were more oriented towards the technical and design aspects of the web, e.g. Internet News, Wired Italia, and others towards artistic developments and the search for new aesthetics and language, like Neural.

LineaGrafica, founded in 1946, was the main one specifically dedicated to graphic and communication design in all its aspects, reserving its pages to theory and technical aspects and showing case studies. Giovanni Baule (already a full professor at Politecnico di Milano) directed it from 1980 until it ended in 2007. The magazine published during the 80s some articles on digital arts, movie design, and computer arts, and it was an obvious consequence of giving exposure to the first interesting cases of web interface design in the early 90s. It is of some interest that one of the first editorials dedicated to the Digital Revolution was published in 1993, and it was a sort of warning about the changes that it was bringing in the professional world:

> "The computer revolution has already changed the manner in which printed graphic artefacts are produced and is beginning to create its own where electronic graphics are inside the writing and reading mechanism itself. The extension of the graphic design project from desktop publishing to all forms of electronic media brings into question the already debatable confines of an area that had precise limits within the typographical sector but one that was able to extend its vision beyond the world.
>
> The fact that a profound transformation is already taking place is evident. An unequivocal disorientation has hit the culture of graphic design [...]. It is necessary to renew, as soon as possible, the awareness of historical background, capable, as always, of articulate direction, new forms, intelligent products and balanced formal solutions." (Baule, 1993a)

In essence, with his words, Baule emphasises the need for a culture of design and its centrality. It should be noted that just a few years earlier, in 1989, Baule, Anceschi and Torri drafted the "Carta del Progetto Grafico" (Charter of Graphic Design). This was a sort of manifesto in which the centrality of communication design in contemporary systems was advocated (Baule, 2015).

In one of the subsequent issues of the magazine, he identifies an initial response regarding the role of the visual communication designer and its needs:

> "Faced with these new technologies, graphic design finds itself less "armed" with a design theory and guide-less. [...] However, if graphic design is also able to propose itself as a construction of the new media, where each writing and compositional operation of the "new page-settings" can be relocated, where the graphical form of the interaction is invented, it will then discover a precise task. One that will also involve the design of new systems, typologies and formats. One that will encourage, as a first act, a move towards the verification of traditional methods." (Baule, 1993b)

It is of particular interest to revisit some of these editorials that, on one hand, accompany the developments of the web and, more broadly, the digital domains and, on the other hand, those of the profession. Especially how, particularly in Italy, professionals were adapting to them. The editorial titled "Routes", from 1995 (Figure 1c), is probably more optimistic in tone as it begins to clarify the tasks of the graphic designer:

> "The communication visual project has always been designed as a way to accompany and take in hand the message receiver. If we consider graphic design [...] [as] a general project of information system, indicating different routes, even the most complicated.
> This continuous project of route tracing, map drawing and verifications is applied in various fields. [...]
>
> In the net of the hypertexts or, more generally, in the digital systems of writings, graphic design is not any different: controls – cursors and buttons – although metaphorically illustrated as electromechanical, are actually symbols, writings, operative signs: all graphic systems for active directions.
>
> In a virtual library, the system connecting the texts, which can be immediately consulted, is organised on a communicative level. Today, interconnected computer systems are metaphorically called the information superhighway because they are true international communication routes, the faster they advance and broaden through new links and nodes, the more they need adequate sign systems, maps and faster ways to identify directions." (Baule, 1995)

In essence, within the Italian disciplinary literature, there was a need to emphasise the role of the graphic designer on one hand and to build a more solid and updated theoretical foundation on the other. Baule's reflections and considerations indeed find a perfect counterpart in the publication of the first reference texts from a theoretical perspective, as mentioned in the previous paragraph. Also, the first repertories with collections of case studies emerged, which were useful for mapping and monitoring production.

3.3 Repertories: The First Collections of Case Studies

"NewMedia Italian Design" (Bergamini, 1997) was the first book that aimed to give an overview of the production of websites and multimedia products in Italy, as affirmed by Anceschi (in Bergamini, 1997, pp. 8-9). The first impression was that online and offline digital production in Italy was at the international level. Referring to the evolution of web design and to the role of the visual designer, Anceschi states:

> "Perhaps the most pioneering phase is coming to an end when there is already a lot to do. Now begins the phase of focusing on how to do it. [...] we are perhaps moving from a phase of technical naivety to a phase of rhetorical awareness or rather [...] direction. So it once again claims for the designer the ability to govern the limits and potential of hardware and software and to know how to exploit them in the function of an effective and efficient visual translation. [...] the designer, the web-designer, must know how to be a designer of the invisible, or rather of hypostructures, i.e. info-designer and service-designer, but must also be a designer of the visible, i.e. of the graphosphere, and of the video-sphere [...], i.e. graphic- and visual-designer. He must be a logistical planner, a director and choreographer of interaction, but also a tactician and strategist of communication."

Commenting on the collected case studies in the book, Anceschi defines Italy's pioneering web production as free-range in its adaptation to the hard constraints of technology and what Daniele Marini called eidomatic friction, i.e. the excessive number of clicks needed to reach a destination. He also notes how the phenomenon of website production has already taken on a sociological dimension by involving all spheres of life on the web. The book thus provides an important overview of the sectors and realities active at the time.

It is also to note that in the same year, in September 1997, the first website of the Presidency of the Council was presented to the public for the first time. It was the first online presence of the Italian government. It was configured as the typical showcase site, with the images mounted on the classic grey background of the early days of HTML. It is a bit poor, considering that in 1998, Macromedia Flash went mainstream, but it certainly testifies to how the presence of institutions on the web would have constituted another area of application (Ruggeri & Sinni, 2022).

In 2004, another collection of case studies was published: "Web Design in Italy 01" (Galli & Nannini, 2004) (Figure 1b). The intention was to introduce the first book series specifically dedicated to web design in Italy. The initiative was launched through a call on the web magazine yo-yoll.net, which was dedicated to graphic design initiatives and news.

Although the project did not continue, it also represents an interesting case for some of the considerations that the curators report in the introductory text. One initial issue emerged, linked to the transience of the web and the need to document its transformations:

It might apparently seem a contradiction to presenting websites in print, therefore, losing those multimedia and non-linear characteristics offered in websites. When this book is published, several of the websites will have already undergone modifications or will be restyling. This is why paper allows for the permanency of the projects involved, which would, on the other hand, become lost.

In offering a useful instrument of consultation and inspiration for those who worked in this field, it collected websites created on assignment:

> "[...] which affront problems related to communications and positioning, usability and accessibility, supported by an overall project of great dimensions.
>
> From the beginning, the idea was not only to present several frames taken from the web but to, above all, highlight the planning elements that define each specific website.
>
> The creators of the website selected were asked for information regarding the project and the material used, which led to their final creation. Reading through this volume, one can find work drafts, logos, flow charts, photos, and illustrations so that it seems more similar to a book on graphics than a simple home page catalogue.
>
> The presentation structure of the websites, along with the URL and the frames copied from the web, provide several notes relating to the project, information on the author and on the structure that followed the planning and programming stages, and, if available, iconographic project material. At the end of each page, a summary was added that lists the technology and software used, excluding the obvious." (Galli & Nannini, 2004, p.5)

So, there was a clear intention to present at least some case studies in a documented manner, complete with the process or information that could account for the 'instances' and 'notation systems' adopted. The selection of case studies was based on four evaluative parameters: 1) graphic design; 2) Contents and communication capability; 3) Usability and navigability; 4) Accessibility (this parameter was only applied to Public Administration websites or to those with public interest).

The two editors conclude their introduction, affirming that, a few years after the publication of the first repertoire (Bergamini, 1997), “the web has definitely left behind the pioneering phase ever more to become an instrument of daily use for those who work or require information, using the world wide web” (Galli & Nannini, 2004, p. 5).

3.4 Awards

Awards are possibly another source, although most of them disappeared over time, and nowadays, it is difficult to reconstruct the rankings, being most of them promoted online starting from the early 2000s. The only exceptions are the Compasso d’Oro and the EDAwards (the European Design Awards).

Established in 1954 and promoted by ADI, the Italian Industrial Design Association, the Compasso d’Oro is renowned as Italy’s oldest and most prestigious design award. Over sixty years, the award has recognised more than 350 projects, with nearly two thousand receiving Honorable Mention archived in the Historical Collection, established in 2001. The award selection process involves a pre-selection conducted by ADI’s Permanent Design Observatory and then published in the ADI Design Index yearbooks. Starting from the 2007 edition, all selected projects have been collected online and are free to access. As in the EDAwards case, all awarded projects among the various categories are published online.
Among the awards specifically dedicated to web design and related activities, it is necessary to briefly mention the Premio Web Italia (PWI), which ran from 2002 until 2012 and expanded to encompass all digital products, including apps, games, and social media channels. In addition to the Best Project of the Year category, awards were also given for Professional of the Year and Web Agency of the Year. Another referenced award was the Bardi Web Award, run from 2000 until 2008.

Of the main mentioned Italian awards, none have an active website, and there are no circulating yearbooks. This makes it difficult to reconstruct the Hall of Fame and identify any individuals or organisations that have particularly distinguished themselves.

Although awards have played a significant role in the construction of a culture and community within the Italian scene, they seem to go into a crisis from a certain point onwards. Some well-established and prestigious experiences seem to fade away and then close down for good gradually, others continue if they are more grafted into the broader sphere of communication and marketing by updating, adding or renewing specific categories in the digital sphere. A number of hypotheses can be advanced in this regard. In some cases, this is a physiological conclusion due to the waning energy, commitment and presence of the original organisers and the subsequent lack of new protagonists capable of taking up this legacy and renewing it as the digital project context rapidly changes. On the other hand, the renewal of the professional world made up of new generations of digital natives for whom certain areas, practices and processes were much more taken for granted and metabolised than for previous generations who had experienced the emergence of the internet and the web.

Lastly, it can be assumed that the visibility given by collective platforms - as in the case of Behance - and by social media, the possibility of direct contact, exposure and self-promotion, has partly diminished the ‘showcase’ role originally offered by awards in the face of new dynamics and interaction between people and peers enabled by Web 2.0 onwards.

The limited presence of web design in the various award categories, particularly in the area of communication design, represents a significant change in the sector. It is partly a sign of a structural transformation of design in the digital sphere: static pages, corporate sites and customised solutions are being replaced by platforms that have standardised various processes. New blogging frameworks – e.g. WordPress or Drupal – complemented by add-ons and plug-ins offer a solution for most communication strategies and, in a serialisation context, interface design is sacrificed in favour of commercial or slightly customisable visual templates.

A second critical aspect is represented by the relationship between the traditional world of graphic design and the emerging sector of interface and digital artefact projects. The first seems to be less keen to recognise the latter as part of the same design culture mainly for the strong interdisciplinarity of the digital world and for the hybrid profiles – (user) researchers and experience designers, cognitive psychologists or computer scientists and developers – involved in the design practices.

4. Conclusions

As partially illustrated by this initial phase of research, here presented and discussed, the world of Italian web design has been extremely vibrant and diverse since its inception, at least in terms of quantitative production. The local project culture and research environment have expressed theoretical reflections and contributions, unfortunately, marginalised compared to the main trends at the international level, often due to the language gap. In fact, many of them have been published in Italian or have been translated only recently, losing the sense of originality brought by their first edition and within the then-contemporary debate. In this sense, the relationship between centre and periphery, between languages and mainstream modes of dissemination, seems to penalise original local productions in a (post)colonialist perspective, effectively weakening the broader debate or making it a solo rather than a choral one. As prosecutions of the research plan and as a possible further development of the whole project, the qualitative production needs to be reassessed in light of a more comprehensive mapping and compared with contemporary productions from other geographic areas. The critical issues and difficulties already highlighted in the preceding paragraphs are just the main ones that have emerged in the initial stages of this research. Others may arise.

Further reflection on the relationship between the centre and periphery should be made on the Italian territory and experience precisely because of the specificity that the research is bringing out. Referring above all to events, communities and awards, a specific and original distribution is, in fact, noted. The Italian panorama, in fact, as emerges from this initial mapping, is studded with polycentric and eccentric presences with respect to the large urban reference poles where most of the international web agencies or the big players in the sector are (have been) concentrated. Provincial towns, peripheral with respect to poles such as Milan or Rome, but central in their turn with respect to territories with specific productive, entrepreneurial, and cultural vocations that should be further investigated. In addition, some of the communities of practice and cultural reference have, in turn, fostered a great territorial connection between these different centres by organising events, conferences or meetings in different cities precisely to meet and contaminate local realities and contexts.

In this perspective the research highlights alternative point of view to the American West-Coast centric narrative proposed as the only possible interpretative approach to the digitalish storytelling. Besides, the exploration to be further expanded, faces the role and the contribution of women protagonists according to a decolonising (Lupton, 2021) and feminist discourse (Bollini, 2020).

In its future developments, the research intends to investigate and deepen precisely these peculiar and original aspects of the Italian experience, of an epi-centre, peripheral, but not marginal to the broader international debate.

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P/REFERENCES OF DESIGN

DYNAMIC TRADITIONALISM BETWEEN ARCHAISM AND FUTURISM: OBELISKS AS CONSTANT IN GLOBAL MEMORIAL DESIGNS.

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KEYWORDS | OBELISKS, DECOLONIAL APPROACH, GLOBAL CULTURAL TRANSMISSION, COSMOPOLITAN STRUCTURES, MONUMENT DESIGN

ABSTRACT | This paper examines the global transmission of obelisks from ancient Egypt to contemporary societies, employing a decolonial approach. While existing research has primarily focused on the Western reception of obelisks, this study highlights the dynamism of obelisk traditions in East and Southeast Asia, revealing a convergence of knowledge and aesthetics between East and West. The paper incorporates case studies from urban and rural Afro-Euroasia (China, India, Southeast Asia, West Africa) to illustrate the variety of designs and meanings associated with obelisks outside the Western context. It argues that modern obelisks are cosmopolitan structures but also symbols of Westernization and sources of tension in decolonization efforts. The paper emphasizes the importance of raising awareness of the spatiotemporal context of obelisks and encourages designers to reflect on their choices in monument design. However, it acknowledges the potential perpetuation of colonial narratives in futuristic obelisk designs and questions the feasibility of achieving a decolonial obelisk. The study concludes by considering the future evolution of obelisks and the challenges of disentangling them from colonial paradigms.

1. Introduction

The study of obelisks holds a significant place within the realm of Egyptology and, occasionally, Cultural Studies, drawing attention from various disciplines including architectural history, epigraphy, political history, religious studies as well as scholars interested in the reception and cultural influence of ancient Egypt up to contemporary times. This paper seeks to bring attention to obelisks as a constant in global memorial design and as a traditional structure between archaism and futurism. Enhanced by a decolonial approach, it also aims to use the opportunity to reflect on the future of obelisk design based on its historical trajectory presented in the form of regional case studies, thereby inviting designers and other practitioners to become involved. The selected case studies showcase the Egyptian origins of the obelisk followed by a discussion of the imperial Roman and subsequent early modern European and modern Western appropriations of the concept. With the latter being arguably instrumental in the global spread of the obelisk, case studies from the global South – here China, Southeast Asia, the Indian subcontinent, and West Africa – illustrate the transformation of form and function through local adaptations. This then leads to a discussion of obelisks as cosmopolitan and politicized architecture. The case studies raise the problem of whether it is possible to disentangle the concept and design of the obelisk from its conflicted history, and whether its design can become decolonial to overcome the imperial/colonial paradigm.

Existing research on obelisks can be categorized into several focal points, each shedding light on different aspects of their history and cultural significance as outlined further below. With the exception of studies focusing on the original Egyptian obelisks, most research areas collectively fall within the broader context of Egypt's reception, encompassing various forms of cultural appropriation of obelisks spanning the past two millennia. These investigations predominantly center on reception hubs in the Western world. This geographic concentration can be attributed to the proximity of these regions to global centers of Egyptology and knowledge production (Langer and Matić, 2023, pp. 4–7), as well as to the ideological association of Egyptology with the construct of the West. Egyptology has historically played a significant role in shaping the perception of Egypt as a precursor to so-called Western civilization (Winter, 2019, pp. 60–62). Given this context, it is understandable that scholarly attention has primarily been directed towards Western receptions of obelisks. However, there is a growing recognition of the need to globalize obelisk research in order to advance theoretical understandings of these monuments (Langer, 2021).

Modern obelisks serve primarily in administrative and commemorative capacities and as mere embellishments, for instance, of bridges and squares. Administratively, they often function as waypoints and boundary markers, facilitating navigation and demarcating territorial limits. However, the more extensive and research-intensive aspect lies in their commemorative function, which can be further classified into collective and individual commemoration. Collective commemoration encompasses events of suffering and triumph, including successful wars, periods of (imperial) rule, liberation from oppression, and broader societal achievements. Meanwhile, individual commemoration occurs through burials or memorials honoring specific achievements or individuals. Notably, war cemeteries often blend collective and individual commemorative aspects, marking both victories and sacrifices on both collective and individual levels, thereby illustrating the multifaceted nature of obelisks in memorialization.

2. Obelisks Around the World Through Space and Time: Mapping and Overcoming the Rift Between Spatial Foci and Reality

This section provides a concise overview of the transmission of the obelisk from ancient Egypt to the modern global South beyond the traditional research foci of Egyptology and obelisk-related scholarship. While not exhaustive, the selected case studies provide the reader with an impression of adaptability of the obelisk depending on regional contexts.

2.1 Ancient Egypt and Rome

Obelisks, originating from ancient Egypt (Egyptian sg. *tḏn*), are narrow, four-sided tapering pillars with a pyramid-shaped top, known as the pyramidion. Initially associated with solar cults, the first obelisks were placed in Egyptian sun temples during the Old Kingdom around 2500-2400 BCE. During later periods, such as the New Kingdom in the Late Bronze Age (ca. 1550–1069 BCE), pairs of obelisks became common in Egyptian temples, often inscribed with praises of the king's power and conquests. The term obelisk itself is derived from the Greek term *ὀβελίσκος* 'little skewer', which relates only to appearance but conveys nothing about the function of obelisks. Studies focusing on original ancient Egyptian obelisks delve into various facets such as their construction history, symbolic meanings, current locations, and preservation states. Scholars like Labib Habachi (1977), Fekri Hassan (2003), and Bob Brier (2016) have contributed significantly to this area, with particular emphasis on the latter aspects.

After the Roman conquest of Egypt in 30 BCE, the Roman emperor Augustus began the practice of relocating obelisks from Egyptian sites to Rome, transforming them into symbols of imperial authority. This practice was later adopted by European powers during the Renaissance, leading to the revival of Classical architecture and thought in Western Europe, further solidifying the obelisk's association with imperial power. This line of inquiry explores the transport of obelisks to Rome, the construction of new specimens, and their embellishment with hieroglyphic inscriptions, all within the context of the ideological legitimization of Roman authority over Egypt. Roullet (1972), Curl (2005) and Sorek (2010), for instance, have explored the Roman appropriation of obelisks and other Egyptian motifs extensively. Essentially, the European appropriations of the obelisk since the Renaissance are appropriations of the earlier Roman adoption of Egyptian motifs that facilitated the integration of ancient Egypt with a European identity (Langer, 2023, p. 48). The next section introduces some results of the developments set in motion during the Renaissance.

2.2 Modern West

There is a continuum from ancient to modern obelisks, with European constructions representing a further stage in the appropriation of this architectural form. Among modern obelisks in the Western context, the Washington Monument stands as the most extensively studied and recognized. Erected in Washington D.C. between 1848 and 1884, it comemmorates George Washington, the first President of the United States. Torres (1985), Fazzini and McKercher (2003), Curran et al. (2009), and Gordon (2016) have examined its significance within the political and aesthetic landscape of the United States. Its design reflects a strong affinity with the Roman Republic, underscoring broader cultural connections.

Similarly, the Mussolini Obelisk commissioned in Fascist Italy symbolizes the regime's aspirations to revive the grandeur of the Roman Empire under Benito Mussolini's leadership. Other lesser-discussed obelisks in the western hemisphere include the Obelisk of Buenos Aires (1936) and the Trujillo Obelisk (1936) in Santo Domingo, commemorating historical events and figures. However, not all obelisks erected or planned in the West have received scholarly attention. For instance, obelisks planned in Nazi Germany and the Soviet Union represent intriguing yet understudied phenomena. In Nazi Germany, ambitious plans included obelisks in Berlin and Munich, reflecting Hitler's vision of connecting with ancient civilizations to underline dominance over contemporary powers (Langer, 2021; Spotts 2009: 21–22, 122). Soviet obelisks, on the other hand, were realized, serving as memorials to victory over fascism in World War II and as tombstones in military cemeteries (Langer, 2021). Despite their prevalence, research on Soviet obelisks remains sparse, necessitating further exploration into their cultural and ideological significance. Crucially, even within the West, research on obelisks is patchy and focuses on specific nodes, which are primarily concentrated around the North Atlantic.

Additionally, obelisks have become ubiquitous in pop culture due to Egypt's enduring influence on Western thought and Egyptomania. They feature prominently in various forms of media, including science fiction, serving as symbols of Egyptian mystique or futuristic architecture. While they are integral to studies on

Egypt's influence on pop culture, obelisks have yet to emerge as a distinct research focus independent of broader ancient Egyptian tropes.

In conclusion, the study of modern obelisks in the West offers insights into the complex intersections of politics, ideology, and cultural memory, highlighting the enduring legacy of ancient Egyptian symbolism in contemporary contexts. For a more representative picture, research should aim to broaden the scope of inquiry, encompassing obelisks beyond the Western hemisphere and examining their designs and multifaceted roles in shaping collective memory and identity. To this end, the following section shifts the perspective to cases in the global South of Afro-Eurasia: Southeast Asia, China, India, and West Africa.

2.3 Southeast Asia

In the 1940s, Thailand and Myanmar saw the construction of obelisks as national monuments, albeit with differing levels of scholarly attention. The Victory Monument in Bangkok, Thailand, has received more extensive discussion compared to the Independence Monument in Yangon, Myanmar (Wong, 2005; Noobanjang, 2011). Both monuments, however, are deeply intertwined with the political history of Southeast Asia during the 1930s and 1940s.

Thailand, known as Siam until 1939, underwent significant political transformations following the abolition of absolute monarchy in 1932, transitioning to a Western-style constitutional monarchy under Prime Minister Plaek Phibunsongkhram (Noobanjang, 2011, p. 58; Baker and Phongpaichit, 2022, pp. 128–139). Thailand's involvement in World War II was marked by territorial ambitions, aligning with Japan's regional agenda (Baker and Phongpaichit. 2022, pp. 149–152). The Victory Monument, erected in Bangkok in the spring of 1941, symbolized Thailand's perceived victory and served as a demonstration of power, echoing the urban restructuring efforts of Mussolini and Hitler. Designed by architect Pum Malakul, the monument featured a 50-meter obelisk adorned with five bayonets atop a pentagonal pedestal containing the ashes of fallen soldiers (Noobanjang, 2011, pp. 58–60). The monument represented a departure from traditional Thai values towards a modern, Western-style nation-state, encapsulating a new essence of Thai identity (Wong, 2005, p. 63; Noobanjang, 2011, pp. 61–63). In the post-war era, it became a focal point for nationalist discourse, reflecting on the trauma of colonial territorial loss and the futility of fascist expansion (Noobanjang, 2011, pp. 57, 66–68).

In contrast, Myanmar's path to independence was shaped by its colonial history under British rule. Independence movements gained momentum during World War II, leading to Myanmar's treaty-granted independence in 1948 (Charney, 2009, pp. 46–71). The Independence Monument, erected in Yangon in the same year, replaced a statue of British Queen Victoria and commemorated Myanmar's struggle for self-determination against British colonialism (Seekins, 2011, p. 83). Standing at 50 meters tall, the monument symbolized Burmese resistance and sovereignty, particularly through its association with Burmese general Maha Bandula, who fought against British expansion in the First Anglo-Burmese War (Myint-U, 2001, pp. 12–15). Thus, while the obelisks in Bangkok and Yangon both serve as national monuments, they convey starkly contrasting narratives—one of aggressive expansion and the other of anti-colonialism,

In the Philippines, the presence of at least two distinct obelisk traditions reflects the nation's intricate colonial past. From 1565 to 1898, the archipelago was under Spanish rule, during which the capital, Manila, faced occupation by British forces from 1762 to 1764. Spanish-Filipino resistance led to the establishment of two sun-crowned obelisks in Manila and Bacolor, commemorating the Spanish defence of the Philippines (Langer, 2021). Following the Spanish-American War in 1898, the United States assumed control of the Philippines, introducing a new chapter in the nation's history and further emphasizing the obelisk as a prominent monument form. Notably, the Rizal Monument was erected in Manila in 1913 in honor of Filipino writer José Rizal (Craig, 1913), who was executed as a revolutionary in 1896 (Kissling, 1916). While the reasons for selecting an obelisk remain unclear, this monument stands as a testament to Filipino nationalism and resistance against colonial oppression.

In the early 21st century, obelisks continue to serve as common monuments in the independent Philippines, often commemorating events from the colonial era. One significant example is the collective of obelisks memorializing the Bataan Death March, a tragic event during World War II. The march, which resulted in the deaths of thousands of Allied prisoners, predominantly Filipinos (Lansford, 2001), prompted the erection of approximately 100 obelisks along the march routes (Murphy, 2014, pp. 6–8). These obelisks, featuring representations of US soldiers assisting fallen Filipino comrades, were largely funded and donated by Americans, underscoring the enduring significance of the Bataan Death March in US-Philippine relations. Despite the bilateral appearance of these memorials, the dominance of American contributions suggests a prioritization of US perspectives in commemorating shared historical experiences (Langer, 2021).

2.4 China

The Chinese obelisk tradition is slightly older than those of Thailand and Myanmar, yet roughly as old as the Philippine tradition. Since the abolition of the monarchy in China and the creation of the Republic in 1912, Chinese memorial culture has revolved around so-called martyrs (烈士) monuments (usually 纪念碑 or 纪念塔; the former denoting a stone tablet, the latter a tower/pagoda) (Hung, 2008, p. 280; van de Ven, 2003, p. 100). Initially, those who died in uprisings against Qing rule were revered as revolutionary examples. Since the mid-1940s, the Communist Party of China has promoted a martyrs cult to commemorate those who died in wars against the Guomindang (GMD) and Japan. This cult, linked with the Qingming Festival, focuses on monuments, often obelisks, erected at cemeteries where war dead are buried. These monuments serve as sites for collective remembrance. By the 1990s, China had over 5,000 martyrs cemeteries and memorials (Hung, 2008, pp. 281–284, 302), though the exact number of obelisks remains unknown. Ongoing work (Xie Zilong Image Art Museum, 2023) argues that obelisks were seen as symbols of revolutions after Chinese travellers first visited Place de la Concorde in Paris with the famous obelisk of Ramesses II from Luxor. Yet little did these Chinese travellers apparently know that the obelisk came to Paris as a gift from the Egyptian ruler to the French king 40 years after the French Revolution in 1830, and that it came to stand at the site of the guillotine and revolutionary justice was mere coincidence; if anything, the obelisk at Place de la Concorde is rather a symbol of monarchy than one of bourgeois revolution.

The most important monument of the Republic of China is located in Huanghuagang Park in Guangzhou, Guangdong (Figure 1). Initially established in May 1911, following the Second Guangzhou Uprising against Qing rule, the site houses the tomb of 72 martyrs. It grew into a complex tomb structure aligned with traditional geomantic beliefs through various construction phases between 1918 and 1935. This complex became a symbol of revolutionary fervor and resilience, hosting annual rites as part of a martyrs cult (Ho, 2004, pp. 101–104). The central feature of the tomb complex is an inscribed obelisk, positioned beneath a pavilion at the cult axis center, signifying the modernization and westernization of Republican memorial culture. This integration of a Western/Egyptian architectural form into local geomancy highlights the complexity of cultural influences. Furthermore, the park contains graves of individuals seeking to benefit from the *qi* (life energy) of the 72 Martyrs Mausoleum (Ho, 2004, pp. 105–107). This interplay between secular commemoration, spiritual beliefs, and architectural symbolism underscores the multifaceted nature of memorialization in Guangzhou.



Figure 1. The obelisk atop the 72 Martyrs Mausoleum at Huanghuagang Park, Guangzhou. Source: C. Langer, April 2023.

Today, the Monument to the People's Heroes in the center of Tiananmen Square, Beijing is the central and single most important monument of the People's Republic (Figure 2). It resembles an obelisk with traditional Chinese architectural elements, thus essentially merging Chinese and Western architectural traditions while the Egyptian roots are concealed. The location at the former site of imperial power and its height of 38 meters – taller than the old imperial palace – also signified that the people in the guise of the CPC had ultimately won and a new era was beckoning (Hung, 2001, pp. 459, 463). Designed by the architect-couple Liang Sicheng and Lin Huiyin, the monument was supposedly inspired by an ancient Chinese stone tablet, yet the literature (e.g., Hung, 2001; p. 462; Wu, 2005, 24–36) refers to it as an obelisk as well; interestingly, Liang and Lin travelled extensively in Europe and North America at young age (having studied at the University of Pennsylvania) (Hung, 2001, pp. 459–460), where they would have encountered modern obelisks beyond any shadow of a doubt. The obelisk commemorates Chinese who died in conflicts starting with the First Opium War of the mid-nineteenth century, and since its construction in the 1950s has served as a standard blueprint for martyrs monuments across China (Hung 2001, p. 472). The design frequently appears in connection with martyrs monuments in provincial capitals, which symbolically refer to the Tiananmen obelisk as the spiritual 'superior'.

Yet in recent decades, architects and policymakers have, at times, developed the design further, toward the direction of postmodernism or futuristic designs. A fitting example is the Yunnan Monument to the People's Heroes in Kunming, capital of Yunnan province (Figure 3). Completed in 1995, it was built in the political and economic center of the city and its commemorative scope reflects that of the 'inspiration' from Beijing. Yet unlike the monument in Beijing, the design has departed the traditional appearance. While the basic appearance is recognizably inspired by the Monument to the People's Heroes in Beijing, and thus the Republican tradition and the Egyptian obelisk, its individual design elements have been greatly abstracted.



Figure 2. The Monument to the People's Heroes at Tiananmen Square, Beijing. Note the presence of a Chinese-style curved roof instead of a traditional pyramidion. Source: C. Langer, January 2019.



Figure 3. The Yunnan Monument to the People's Heroes in Kunming, Yunnan. Note the postmodern appearance and reduced elements vis-à-vis the Beijing obelisk. Source: C. Langer, August 2022.

These examples give a spectrum along which modern Chinese obelisks are situated in terms of design: from the design akin to Egyptian obelisks to the communist design incorporating traditional Chinese elements and postmodern variations thereof. In this context, local adaptations are noteworthy. The Chinese population consists of 56 'nationalities', or ethnic groups. Next to their own language, these often come with their own architectural designs somewhat distinct from the Han majority. The province of Yunnan,

China's most diverse region, on the border with Myanmar, Laos and Vietnam, shows that obelisks reflect subtle differences as well. The far north of Yunnan boasts a majority Tibetan population. The martyrs monument in Shangri-La/Xianggelila (Figure 4) reflects that in that it not only combines the monument form with Tibetan elements but the memorial inscription is in both Chinese and Tibetan. In turn, the far south of Yunnan on the Myanma border is inhabited by a Dai majority. The martyrs monument in Jinghong, Xishuangbanna, incorporates local Dai architecture and language (Figure 5).



Figure 4. Dedicated to Tibetan revolutionary martyrs, the monument in Shangri-La/Xianggelila, Deqing, Yunnan combines Tibetan architectural design with Chinese characters on the front and Tibetan characters on the back (depicted here). Source: C. Langer, August 2022.



Figure 5. The martyrs monument in Jinghong, Xishuangbanna, Yunnan incorporates a Dai-style roof and combines alternating Chinese and Dai-Lü inscriptions. Note the postmodern appearance and reduced elements vis-à-vis the Beijing obelisk. Source: C. Langer, August 2022.

The Chinese obelisks showcase the, ultimately, modular character of modern obelisks and their adaptability to local conditions, in a way that Western obelisks cannot, for they adhere to the same design canon. Since first obelisks were taken out of Egypt, the shape has developed a design dynamic that would remain hidden if we only looked at Western specimens. This dynamic comes to the fore once we leave the traditional purview of research. The transmission and evolution of obelisk symbolism in China present intriguing avenues for further exploration, given the abundance of material and potential complexities in their meanings and historical trajectories. China thus presents an ideal case study to illuminate the non-Western history of obelisks, offering insights into their adaptation and significance beyond Western contexts.

2.5 India

If we talk about China, we also have to talk about India. Similarly populous as China, India is also a BRICS member and an economy very much on the rise, and thus worthy of scholarly attention. Like China with the obelisk at Tiananmen Square, India boasts an obelisk as a central national monument to commemorate military personnel killed in armed conflicts since Indian independence from Britain in 1947. Commissioned by the Modi administration and unveiled in 2019, the National War Memorial features a stone obelisk as the centerpiece of concentric rings; the base houses an eternal flame while the top is rather a bronze statue of three lions than a pyramidion (Baruah, 2019). An example more in line with Egyptian design is the Batasia

Loop War Memorial in Sikkim in the triangle between the Nepalese, Chinese, and Bhutanese borders. This obelisk commemorates the Gurkha soldiers who have died in service since 1947 (Khan, 2022). Other monuments in a clear obelisk shape that commemorate the military service of individual units are distributed all over India (Chhina, 2014, 172–202).

In the case of India, the line of transmission seems to be clear since it was a British colony. British obelisks on Indian soil are the 1911 Coronation Obelisk in New Delhi (Datta, 2022) or the 1907 Obelisk Monument in Srirangapatna (Polash, 2019), the former in classical Egyptian appearance and the former with a sphere on top instead of a pyramidion. While both the British obelisks are a testament and celebration of the British domination of India, the recent war memorial refers to independent India only. Due to a lack of research, it has to remain unclear for now whether the Indian government went with the form of the obelisk as a reaction to British obelisks or whether the shape had been normalized as a monument form in the minds of decision-makers and architects. The absence of any discussion of the presence of obelisks in the available literature suggests that they are seen as given. These circumstances illustrate the need for research into obelisks on the Indian subcontinent.



Figure 6. Batasia Loop Gorkha War Memorial. Source: Wikimedia Commons.

2.6 West Africa

Similarly un(der)-researched are apparently modern obelisks in Africa outside Egypt. Despite the apparent absence of literature, one modern African obelisk has to be mentioned here, not least because of the importance of African decolonization movements. Place de la Nation in Dakar, Senegal, is home to a white obelisk as its central feature. The Roman numerals MCMLX on its side betray what it commemorates: the independence of Senegal from France in 1960 coming on the back of anti-colonial struggle (Ollivier, 2021). Besides a lion as the national emblem on the base, the shape is akin to the original Egyptian obelisks. This example concludes the survey of obelisks.

2.7 Obelisks as Cosmopolitan and Politicized Architecture

It has become clear from the case studies presented here that obelisks have transformed considerably in appearance and meaning ever since they first left Egypt as their place of origin. At the same time, obelisks as public monuments are highly politicized. This goes back to ancient Egypt. There, obelisks were religiously and ideologically charged, embodying and expressing the Egyptian king's and the Egyptian state's nominal rule over the world and foreign people as bestowed by the Egyptian pantheon. Since Roman times, there is arguably an inherent connection between obelisks and armed conflict, whether that is the celebration of conquest or the liberation from domination.

The analysis contrasts commemorative narratives of domination and liberation, highlighting two distinct ideological traditions. The commemoration of imperial or colonial rule, influenced by practices observed in the Roman Empire and pharaonic Egypt, emphasizes the use of obelisks to assert power. The opposite tradition celebrates resistance or liberation from imperial or colonial rule. This dichotomy suggests regional and ideological divides in obelisk symbolism (Langer, 2021). Further investigation is needed to validate this hypothesis through comprehensive data analysis. In these instances, obelisks not only convey messages but embody historical narratives of domination and liberation.

Yet, despite all the focus on conflict, obelisks are ultimately cosmopolitan architecture as well. This becomes apparent once research leaves the traditional spatial confines of the North Atlantic and incorporates other regions in the analysis. Especially the Chinese obelisks with their modularity and adaptability to local conditions embody a conversation between China and ancient Egypt via the West, but also among the diverse Chinese nationalities, linking the majority Han traditions with minority cultures.

Such a cosmopolitan reading may be in line with one contemporary obelisk in Central Europe. The Nigerian-born American concept artist Olu Oguibe developed a contemporary concrete-and-metal obelisk for *documenta 14* in 2017. The Monument to Strangers and Refugees is inscribed with a Christian Bible verse ("I was a stranger and you took me in") that appeals to hospitality given to strangers (Kassel, 2024). Oguibe (2017) related the shape of the obelisk to timelessness and universality of African origin. Ironically, the artwork became the site of conflict between the artist and local right-wing groups who were against the subsequent purchase of the monument by the city of Kassel. Nonetheless, conflict surrounding obelisks deemed controversial for whatever reason should not detract from the hopeful moment that, ultimately, they represent intercultural dialogue and cultural compatibility despite any nationalist messages of individual obelisks.

3. The Future of Obelisks in Architectural Practice: A Speculation

3.1 Awareness of Practitioners

A recurring problem among the case studies discussed here is the why: why did architects choose the particular shape of the obelisk for their monument? Whereas in many cases there is no answer in the literature or archival material, in the cases where we can tell, it was usually a reference to an already existing monument; in other words, designs were simply copied, obelisks erected for monuments simply because

someone else had done the same earlier. This generally raises the issue to what extent practitioners, i.e., architects, designers and those who commission public monuments, are aware of the meanings and histories behind design choices. Oguibe's choice to construct a contemporary obelisk due to its African origin and global relevance suggests that he was aware; yet the case studies suggest that same cannot be said for many. That means that this paper and related research can also serve as invitation to designers to reflect on their choices and raise their awareness of the spatiotemporal intricacies of the obelisk.

3.2 Designing for/in the Future: Toward a Decolonial Obelisk?

It has become clear that the global presence of obelisks alone is the outcome of colonialism that may go back two millennia. The bulk of existing monuments either commemorate domination or liberation from colonial-imperial domination. Colonial and anti-colonial obelisks are thus part of the same conversation since they negotiate the relationship between colonizer and (formerly) colonized. Speaking with decolonial thought of the South American school (e.g., Mignolo, 2021; Mignolo and Walsh, 2018), even anti-colonial obelisks are still colonial obelisks since they pertain to the same logic as the monuments placed by colonizers. The question is if we can break out of this colonial logic. What would a decolonial obelisk look like? What would a decolonial obelisk even be? The obelisk's track record of over four millennia and its global variability suggests that the concept is here to stay for the foreseeable future; hence, these questions are worth pondering, or generally what an obelisk of the future may look like.

First of all, decoloniality is an option to bring about a world where colonial relationships are entirely absent. As already mentioned above, the obelisk is spread around the world in large part thanks to European colonialism and because local elites intended to westernize their memorial culture, as in the Chinese case. An alternative may be an obelisk that represents potentially everything. The Chinese obelisks highlight the modularity of obelisks. That means in theory it should be possible to combine several traditions in the same monument (Figure 7). Yet this would then raise the question which traditions to choose to represent various local identities to create a truly cosmopolitan obelisk. Depending on the choices, these may entail the danger of essentializing representations ("this is Chinese, this West African") and thus reproducing colonial attitudes toward aesthetics.



Figure 7. Obelisk design combining several traditions (Prompt: an obelisk with a pointy top and West African and Asian design elements on the body). Source: Midjourney.

A possible alternative may be an obelisk that adheres to no recognizable traditions, one abstracted so much and stripped of any elements that are easily relatable (Figure 8). Incidentally, this may point toward the path China has already undertaken with its postmodern monuments. Yet a monument that is recognizable as an

obelisk by the shape may still be primarily linked to Egypt; the absence of any inscription may be enough to detach it enough from Egypt so as to render it suitable for more widespread use. Then again, if there cannot be any markings, what is the appeal for any local iterations to emerge



Figure 8. Futuristic/minimalistic obelisk design avoiding any recognizable tradition (Prompt: an obelisk in style of a space rocket with smooth undecorated sides and a metallic look). Source: Midjourney.

Perhaps a decolonial obelisk would be an obelisk that does not exist, in the sense of the cessation of the construction of obelisks altogether. Note the somewhat circular argument by Leo Name (2021, p. 8) in this context, "There is no decolonial architecture because there is no teaching of decolonial architecture because there is no decolonial architecture". He further asserts that architecture that maintains the link with its design roots in the Renaissance had been used by bourgeois white Europeans to conquer territories (Name, 2021, p.8). It is fair to say that obelisks satisfy these criteria, a decolonial obelisk is thus hardly possible.

Decolonial thought sets the bar admittedly high for decolonization, demanding no less than a wholesale departure from colonial structures, including modes of knowing. For the future of the obelisk, that may well mean that it would have no future outside Egypt, especially as its global transmission has been crucially facilitated by European colonialisms. Yet even within Egypt, one may wonder if modern iterations are not expressions of colonial mindsets and policies (Langer, 2017; Jurman, 2022, pp. 20–22); note that a glass obelisk is planned to become the tallest building on earth as part of Egypt's new administrative capital (Jungfleisch and Reali, 2023, 33). This may render the modern obelisk colonial architecture by default, in line with Name's intervention.

Yet per Mohamed Elshahed (2023), the bar may be lower when it comes to *moving toward* decolonization. He proposes the following five points in asking what it took "to decolonize architecture in contemporary practice and in history":

1. Recognize that history is never a linear progression of figures, events, buildings, or styles.
2. Recognize the impact of colonialism in its past and present forms on architectural production, on the fate of architectural heritage, on the fate or archives, and on the capacity to write architectural history, both in the colony and in the metropole.
3. "The only primitivism is Eurocentrism"
4. Decenter architectural knowledge production, support the building of independent architectural institutions in former and present colonies.
5. In a global economy, "meaning" and "value" in postcolonial contexts are often assigned from the

colonial center, maintaining a center-periphery dynamic. Restore the production of "meaning" and "value" to local communities.

This paper relates to Elshahed's points in the following ways:

1. We acknowledge that the transmission of the obelisk was likely a complex entanglement of agencies rather than a one-sided affair, and that the form and meaning of the obelisks around the world are fluid and subject to change.
2. We have acknowledged the Eurocentric/Western bias in scholarship on ancient and modern obelisks as well as the role of colonialism in the role of their transmission around the globe.
3. An outcome of this paper and related research is the overcoming of Eurocentrism by bringing into focus the under-researched regions and traditions outside the traditional Western focus.
4. We are moving toward the decentering knowledge production by adopting a global perspective that brings attention to local adaptions in former and present (semi-)colonies and those areas never formally colonized.
5. In turn, especially opening the research question toward a genuinely global perspective can allow local communities' input into the 'meaning' of their obelisks and engender further reflection. The global perspective allows for a shift of what appears peripheral at best in the literature, i.e., regions beyond the North Atlantic, to the center of attention, which may also reflect the fact that more innovation in the design of obelisks has happened there over the past century than in the West.

In this sense, local adaptions of obelisks could satisfy the criteria of a decolonized obelisk. Yet the ultimate issue remains that an obelisk at present cannot be decolonial in the way decolonial thought would have it. Irrespective of that problem, the quest to decolonize should leave enough room for artistic creativity and experimentation.

4. Conclusion

The paper has revealed the spatial focus in obelisk-related scholarship on obelisks in the West. It has also shown the feasibility to incorporate obelisk traditions from the global South to devise a truly global history of the obelisk, to fully grasp its transformative potential in design and function. The case studies ranging from ancient Egyptian to contemporary Afro-Eurasian obelisks reveal the evolving appearance and significance of obelisks outside of Egypt, emphasizing their politicization as public monuments, a tradition dating back to ancient Egypt. Obelisks historically symbolized imperial domination or liberation from it, reflecting contrasting commemorative narratives. One tradition – what can be considered the Western tradition – celebrates domination, influenced by Roman and Egyptian practices, while the other commemorates resistance or liberation – perhaps to be called the global South or anti-colonial tradition. This dichotomy suggests regional and ideological divisions in obelisk symbolism, warranting further investigation for validation. Despite their association with conflict, obelisks also embody cosmopolitan architecture, seen in Chinese adaptations and contemporary artworks like Olu Oguibe's Monument to Strangers and Refugees. Such instances highlight the potential for intercultural dialogue and compatibility amid nationalist tensions surrounding obelisks.

The global presence of obelisks is a legacy of colonialism. This poses questions about the potential for decolonial obelisks. The paper has explored the possibility of obelisks that transcend recognizable traditions, abstracting their form, or ceasing their construction altogether as a decolonial gesture. However, decolonial thought presents challenges that ultimately question the feasibility of a truly decolonial obelisk given its historical entanglement with colonialism. Existing propositions for decolonizing architecture offer insights applicable to obelisks, emphasizing the need to recognize colonial legacies and restore agency to local communities. While local adaptations of obelisks may align with decolonial principles, the inherent ties to colonialism pose barriers to achieving decoloniality in obelisk construction. Nonetheless, the pursuit of decolonization should accommodate artistic innovation and experimentation within the realm of obelisk design, which – as this paper has shown – is a highly dynamic field worthy of

further reflection by scholars and designers alike. Next to design experimentation, that may include careful theoretical deliberations over the nature of decolonial architecture to delineate the feasibility of decolonial obelisk designs.

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P/REFERENCES OF DESIGN

“DE OTRO MODO”: SOUTHERN THAN SOUTH.

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KEYWORDS | DECOLONIAL DESIGN, FEMINIST DESIGN, CRAFTS, TEXTIL DESIGN, STENCIL

ABSTRACT | The evolution of design in Chile has come about through the amalgamation of knowledge that fuses the practices of local artisans and craftsmen with the economic and cultural influence coming from the United States and Europe - the global North. This mix impacts a society marked by profound social inequalities, where design sometimes finds itself in an uncomfortable position of challenging the universal norms imposed by the North. Beyond questioning colonial models, Chilean design currently finds itself in a unique socio-political context by integrating intersectional gender perspectives and reflecting on diverse and distinct Latin American cultures. Challenging the central structures that govern economic development, design takes a different perspective by embracing local visions, the anonymous voices of indigenous peoples, and intangible cultural richness. Silently, craftswomen, caregivers, artists, and those who confront precarity with their skills nurture design and, at the same time, empower people, understandings that give non-neutral agency to design to transform reality in the remoteness of large dominant centers.

“De otro modo” is an integral perspective derived from decolonial perspectives and intersectional feminisms, which aims to bring together the knowledge and doings of the narrow and long Chilean territory from its idiosyncrasies marked by inequalities, disasters, and natural riches. A territory in which designers look between the Andes Mountains and the Pacific Ocean for the well-being of life in the future. The paper describes three case studies based on the authors’ research work, which weave together historical-political contexts and socio-cultural representation to understand the current dimensions of local design.

The first case reviews the significance and resignification of women’s popular-local culture in ‘Feminist May’ (Chile, 2018). The second case analyses the aesthetic and conceptual renovation undergone by both textiles and clothing during the 1970s due to the professionalization of design in the country. In this sense, it explores the influence of the discipline on the cultural transformations of the time, highlighting the role of women designers who integrated iconographic elements of popular and indigenous culture into mass-produced objects. The third case, from a critical-decolonial perspective - informed by ethnographic and anthropological design fieldwork - reviews the discourse of representation around the link between the traditional knowledge of local crafts and the aesthetic bases of contemporary Chilean export design..

1. Introduction

Chile, located in the south of the Americas, is distinguished by its peculiar territorial configuration: an extensive and narrow strip of more than four thousand kilometres between the imposing Andes Mountain range and the vast Pacific Ocean. A recognisably seismic country, Chile's landscape ranges from deserts to glacial regions. As a Spanish-speaking nation, Chilean culture shares common colonial traits with the rest of the Americas while exhibiting unique characteristics derived from miscegenation. In contemporary times, following the period of military dictatorship (1973-1990), Chile adopted a neoliberal economic model that has been a regional standout in terms of macroeconomics. However, growing social inequalities, the extractivist approach, political tensions and other complex challenges have become more prominent in the last decade, reflecting ongoing socio-political changes. Significant social milestones have strongly influenced design studies in recent years. Notable among these events are the feminist movement of May 2018, the Social Outburst of 2019, the coronavirus pandemic of 2020, and the coming to power of the first government with a feminist agenda on its political agenda in 2022.

This context places the study of design in front of critical cultural questions that influence its practice. These questions include the consideration of maintaining classical modern design guidelines, following northern hemisphere trends, or identifying critical territories to propose transformative knowledge and practices.

Design activity and reflection in the South America do not differ significantly from what the Northern hemisphere dictates, as the idea that the practices of the developed world are always "better" than those of the underdeveloped, colonial heritage has been "normalised". Whether true or not, it is undeniable that the application of "imported" knowledge and practices inevitably takes on the influence, emphasis and values of the local context. That suggests that subjective aspects, which are constantly evolving in terms of location and form, are relevant to considering different perspectives (Flesler et al., 2018). Moreover, to see things in an 'other way, other manner'.

In this approach, as pointed out by Yuderkys Espinosa (2014), ‘de otro modo’ relates to the commitment to the decolonial feminist perspective, which questions the explanations developed by white-bourgeois Western theory and radically redefines the concept of 'woman', making it impossible to reconstruct it. Moreover, in collaboration with the decolonial approach, feminism is committed to reinterpreting history from a critical perspective towards modernity, not only because of its androcentrism and misogyny, as classical feminist epistemology has done but also because of its intrinsically racist and Eurocentric character.

Feminist perspectives contribute to the visualisation of the contributions of women and dissenting people, as well as the recognition of situated knowledge. This integration reflects Haraway's proposal for "an embodied objectivity that is compatible with paradoxical and critical feminist science projects: feminist objectivity simply involves the consideration of situated knowledge" (Haraway, D; 1995, p. 324). Adopting this 'embodied', affected view of design allows us to highlight pieces of knowledge and practices that enrich understanding and engagement in the field of design.

In the context of the Chilean territory, design faces economic and social challenges, often accentuating its voices to solve problems within the limits of inequitable economic development. Situating ourselves from the creation of design education, whose vanguard was the women of textile design at the University of Chile in the 1970s, as well as the reflection of industrial design when observing local crafts or the use of global DIY aesthetics to leave traces on the walls of the Chilean capital of the rage and weariness of its communities, serves the recognition of three different scenarios for a situated view of Chilean design, of a critical look at what we do and think in this territory.

1.1 Questions and Objectives

In light of the above, the question arises: How has design, both in its theoretical approach and practical application, acted as an active cultural agent that promotes an "other way" perspective in its work? Through three cases linked to a decolonial-feminist perspective, the study aims to recognise the possibilities of an "other way" of looking that can shape transformative alternatives.

1.2 Methodology

The cases studied belong to the recording of information on three spaces of Chilean culture: women in the beginnings of the formation of design in Chile, the traditions of artisan communities and the design and graphic testimony of a Chilean social landmark (October 2019).
These three cases approach from:

Case 1: The methodology used in the first case involved the historical reconstruction of an object of study, the Textile Design career at the University of Chile, through a qualitative approach and with a gender perspective. The object was determined by conducting interviews and collecting personal objects, which became the primary source of information.

Case 2: For this case, theoretical information was collected and complemented with on-site observation and personal interviews to analyse the relationship between crafts and design critically.

Case 3: A theoretical review links the graphic testimonies of the streets to the slogans inherited from the 'feminist May' of 2018, specifically the stencils produced during the 2019 social outburst in Chile.

All of them compose an interweaving of historical-political contexts and socio-cultural representation to understand the current dimensions of local design. They respond to the need to establish ways of understanding design culture as an articulating axis of new perspectives for society as a whole.

2. 'De Otro Modo' Perspective

The feminist perspective of situated knowledge enriches the (design) project and, at the same time, decolonial; as Dori Tunstall says, "decolonising design requires us to break down our basic assumptions about what design is and what it has been" (Tunstall, 2023, p.6). Enrichment grows from considering women in an active role in the weight of history and attributes related to the 'feminine' that aim to tread a new path for the study - not always comfortable (Ahmed, 2018) - of communities and their doings.

Ibarra (2023), from her studies in Brazilian territory, proposes in the case of textile processes that "they offer a means to explore themes, communicate with interdisciplinary teams and advance in the knowledge of different areas of thought. Textile language impregns metaphors of collaboration and joint work, and the act of making transforms the metaphor into the potential for transdisciplinary practice" (p. 332); this understanding of craft activity proposes a disciplinary articulation that is no longer merely rational and or functional, objective, but adds a subjective and affective component that reflects in the work of the communities. This thinking is in line with what Escobar (2018) has proposed to define what is "appropriate" for the design of the South, where the cosmovisions (in the case of the original peoples) and appropriate modern visions of feeling and living the South American landscape, offer a particular view that, even under heteropatriarchal and Eurocentric structures, offers a becoming of its own.

Flesler (2018), on the other hand, from Argentina, was able to verify through the experience of design workshops in the classroom that from a gender perspective, "differences and inequalities can be considered in the processes of planning and design of urban spaces, objects and communicational statements" (p.45).

In the Chilean case, whose history and landscape are often convoluted, the wide range of feminism has tried to appear in areas on different axes of inequality, feminism being "not only an egalitarian movement in general but also a radical and transformative decolonial struggle for the positive affirmation of differences between marginalised people and peoples. These differences in material positioning manifest distinct life experiences and diverse forms of knowledge" (Braidotti, 2022, p.32). Thus, the historical events that occurred during the Feminist May 2018 and the Social Outburst of 2019 concur in a precedent in the meanings in which actors considered outside of structural power (women, dissidents and others), which allows studies within culture to draw on the phenomenon to re-signify their own methodological or critical components.

Maya Ober (2023), a decolonial, depatriarchal feminist design activist, invites us to understand that design can be "a critical, situated, reflexive and socially transformative practice, engaging in struggles and developing practice on the ground" (p. 4). Different voices and ways of doing weave a broader, more diverse, and more affluent way for design and culture and fostering transformations for the well-being of communities and territories.

2.1 The Vanguard of Textile Design in Chile: A Journey to the Aesthetic and Conceptual Revolution of the 1970s by women

In a historical scenario, the evolution of design education originates from women's work in a progressive socio-political context, leaving the legacy of a "struggle" that will later be recognised by the discipline of design and the history of Chilean design.

This history took place when the first university programme in Textile Design in Chile was born in 1970, during the socialist government of Salvador Allende Gossens, under the protection of one of the oldest public institutions in the country -the University of Chile-. In this context, and over almost a decade, a team comprised almost entirely of women developed innovative weaving, printing, and clothing projects with a strong national identity, rescuing symbols and modes of production typical of peasants and indigenous Latin American culture. The latter materialises by applying these elements in textiles and garments originating within the industry.

Between 1960 and 1970, most Latin American countries, regardless of their type of government, intensified their industrialisation policies with the intention of moving from an 'easy import substitution' to a 'difficult substitution' model. Thus, efforts were concentrated on making the objects produced in the continent more complex, which implied strengthening domestic markets.

In the Chilean case, the belief that only industrialisation would make it possible to leave underdevelopment behind led to the creation or restructuring of institutions dedicated to technological research, industrial innovation and product development. Consequently, design discipline progressively integrates into the state apparatus and the discourse of modernity, considered an instrument for updating local industry. Parallel to and derived from the same belief system, the first schools of modern design emerged in the country, promoted by left-wing youth as part of a profound restructuring of higher education.

At this point, it is essential to note that the notion of design import into the country during this period came mainly from the ideas of the HfG Ulm. This German school sought to provide a rational response to technological development and its influence on everyday life that "would forge over fifteen years a project methodology that was especially important for the consolidation of design as an autonomous activity, interdisciplinary in nature" (Castillo, 2010, p. 222). In this sense, the presence in the country of the German academic Gui Bonsiepe was relevant, who, in addition to working for the International Labour Office (ILO) and the Technological Research Committee (INTEC), gave some courses at the Pontificia Universidad Católica (PUC) and worked with some students at the Universidad de Chile (UCh).



Figure 1. Printmaking Workshop Class of the Textile Design course at the University of Chile, 1971. Personal archive of Ana María Hidalgo. All rights reserved, reproduced by permission of the author.

On 26 August 1970, by decree N°10.032 issued by the Rector's Office of the University of Chile, the Textile Design course was officially created, making official a discipline practised for decades by granting a professional title to future graduates. Initially, the course had two specialisations: Weaving and Printing (Figure 1), each with a specialised workshop. Later 1974, the Costume major was added, and a typical first year was created to promote interdisciplinary work. This educational project had a curriculum that sought to promote interaction between artistic education, trades and national industry in the context of an inward-looking development model in the first stage and a socialist one in the second. In this way, and following the technological guidelines mentioned above, although the university's aspiration was for designers to join the industry in order to modernise it, they "were also interested in generating a new, different productive space that conceived of creativity and manual work" (Montalva, 2015, p.85).

Like the rest of the mentions, the curriculum (Figure 2) focused on teaching industrial procedures complemented with humanities and science subjects—the latter, in order to distance the degree from the artistic field. However, as a differentiating element in Textile Design, learning about craft trades was maintained, incorporating technical knowledge and iconographic elements of the popular and indigenous Latin American imagination into the products designed. This approach, far from being an isolated event, was part of a general phenomenon in the Santiago fashion circuit, whereby many designers sought their language through the conceptually Chilean. This movement was called Moda Autóctona and, according to the historian Pía Montalva (2015, p.85): "It rescues the Latin American as a source of inspiration or cultural and visual reference, but always assumes the mediation that brings the own of the time, the contemporary elements. The designer's task [...] is to resignify these contents". The task was to reinterpret these contents, resulting in a unique proposal.

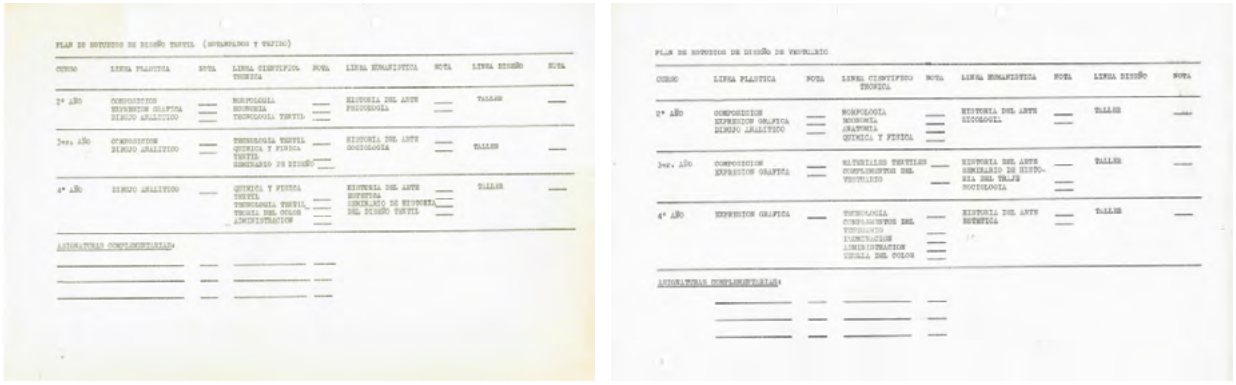


Figure 2. Syllabus of the mentions Prints and Textiles of the Textile Design Degree of the University of Chile. Faculty of Architecture and Urbanism of the University of Chile.

'Moda Autóctona' [Native Fashion], whose period of greatest apogee was between 1969 and 1973, prospered because it was supported and encouraged by the governments in power, mainly: "because the discourse that sustains it coincides with the Latin Americanist approaches that cross the public and cultural space of the period" (Montalva, 2015, p.84).

Regarding the latter, it is essential to note that textiles acquired a central role in the economy during the Popular Unity government. On the one hand, because of its status as an essential good, and on the other, because of its capacity to generate jobs. In particular, a relevant milestone was the nationalisation of 1971 of the prominent textile companies in the Metropolitan Region, which turned the sector into a fundamental pillar of economic nationalisation and workers' participation (Echeverría et al., 1987).

Seeing an opportunity to enrich local production in this economic growth, the University of Chile tried to incorporate its Applied Arts graduates in the factories by changing its curricula. The latter led to the creation of the Department of Design, which used professional internships to insert students into industry. In the particular case of the weaving and printing courses, this was almost exclusively thanks to two teachers: Margarita Johow, who had direct contact with important entrepreneurs in the area, and Ana María Hidalgo, who worked in Alejandro Stuven's printing factory. At the same time, students with family connections needed to be in the course. Such was the case of Ingrid Pollak, who obtained internships for her classmates.

On the other hand, thanks to the links between Johow herself and Paulina Brugnoli, a teacher specialising in gobelin weaving, with archaeologists, researchers and government institutions, some students could carry out research with state funding. One of the most emblematic cases was the CONICYT project 207 Pre-Inca Chilean Textiles (0 to 1350 AD), awarded by both in 1970, which incorporated a group of four students: Carmen Gloria Gajardo, Liliana Prado, Gioconda Pamparana and Liliana Ulloa, who developed the thesis Industrial textile creations based on a formal selection of pre-Inca textiles researched in the museums of the Norte Grande. The project consisted of selecting, studying and recording sixty-five pieces from four national museums, on which they studied weaving techniques, types of fibre, colours and dyeing plants. With this, they designed textiles based on the reinterpretation of the archaeological pieces produced and marketed by three textile factories.

Although this project can be considered the largest due to its funding and state technical support, 10 of the 28 undergraduate theses completed by the students of the degree course had the country's indigenous and/or popular culture as a central theme, giving rise to diverse proposals for prints, fabrics and clothing. However, although the degree course was created to introduce designers to the local industry, the efforts to build a bridge between the students and the factories were mediated by specific subjects. In this sense, it was a group of female professors who organised, independently and without the university's financial support, a series of events that brought the students closer to the national reality and allowed them to develop professionally.

However, it is crucial to acknowledge that, despite the efforts of artists, designers, and the backing of the Frei Montalva and Allende administrations, the textile industry showed little interest in creating fabrics featuring indigenous motifs because of the preference among women for foreign fabrics, aiming for dresses resembling original French, Italian, German, or English designs (Montalva, 2015, p.86). Consequently, native fashion only gained traction due to its smaller-scale production and artisanal methods.

Despite this and the brevity of its existence, this educational project trained many professionals who, faced with the collapse of the textile industry, the repression of the dictatorship, or simply out of personal interest, oriented their careers towards other ways of doing the discipline. In this sense, to date, an essential group of former students has been identified within the group of graduates who have continued to develop in the textile scene until the present day, achieving great notoriety.

2.2 Exploring the Local Identity of Contemporary Design Through Crafts

Object-oriented design situates the work at a critical crossroads regarding the recognition of the locals, the colonialisms in the work, and the dialogues between designers and artisans in the space of regional Chile beyond the capital. This recognition can be seen in how artisans have incarnated their habitat in crafts, adopting materials and forms, which has directly inspired designers to recognise in it a way of doing that has been very valuable, and at the same time, in tension with the need for co-creation beyond cultural appropriation.

Crafts can be understood as an expression of the cultural landscape of their makers. They are the material representation of community narratives and singular realities, witnesses and containers of long and dynamic processes of evolution and historical-cultural phenomena, objects where the dialogues between humans and nature embody, building a deep sense of local identity (Mier y Terán 2013; Sepulveda, 2003; Turok, 1988).



Figure 3. Three generations of craftsmanship. Betancourt family’s work with ox horns. Left: traditional ox horn (Achurra, 2018); Right: Necklace by Walka (Klunes, 2016).

In the case of Chile, the diversity of the landscape, with desert, ice, mountains and ocean, is rich in raw materials from north to south. The transformation of these materials into functional objects reveals a deep connection between people and territory as an essential characteristic of Chilean craftsmanship; the piece is recognised first by its material and then by the technique. Most craft traditions in Chile are rooted in local communities, where knowledge of materials and techniques is transmitted from generation to generation through practice and observation. Artisans dynamically integrate elements of their environment into their creative work, continually enriching what understood local identity - a process in constant change as cultural contexts evolve.

This notion of local identity has also influenced wider creative and Design fields. Materials, technologies and aesthetics that were once associated only with craft traditions now constitute the foundations for constructing a notion of identity unique to contemporary Chilean Design. The current generations of creators have adapted and transformed traditional practices, creating pieces that resonate in spaces of cultural exchange different from those of traditional craftsmanship. One example is the creative work of the Betancourt family, who, over three generations, have worked with ox horns, evolving from traditional use as wine glasses to the exploration of contemporary jewellery (Figure 3).

According to the Consejo Nacional de las Culturas, las Artes y el Patrimonio (2017), the relationship between artisans and designers in Chile began approximately in 1990, along with the return of democracy, when independent designers seeking to differentiate their proposals and broaden their academic bases began to investigate expressions of widespread and informal knowledge that were not accessible in formal educational spaces (CNCA, 2017). The interest of designers has evolved in recent decades, mainly due to Chile's participation in European design fairs. In 2011, state agencies ProChile and DIRAC selected a group of emerging designers to represent Chile at the 100 Design London exhibition, part of the London Design Festival. Under the curatorial leadership of Luz Méndez, products with a cohesive identity were brought together, highlighting pieces made with local materials. The final selection included objects that combined traditional carpentry skills with digital fabrication. The exhibition was entitled "Southwest View: Contemporary Design from Chile" (Figure 4). After that first experience, the presence of Chilean Design at these fairs has continued to be characterised by objects that represent a connection with local techniques and materials over other options. According to Francesca Bucci, DIRAC coordinator, Chilean materials translate a narrative connotation that materials can help characterise these creations as "Chilean", thus fostering their internationalisation (Guzmán in INE, 2018), as crafts are the creative industry that produces the highest percentage of foreign exports of cultural goods (CNCA, 2014).



Figure 4. Screenshot of 'Southwest view' catalogue, for the participation of Chile in the exhibition 100 Design London in 2011. Retrieved from PROCHILE, 2011.

Since participating in these events, the notion of Chilean Design has become associated with a distinctive aesthetic that reflects the characteristics of traditional crafts. A recent newspaper article entitled "Mapping National Design" in 2020 presents examples of artefacts where craft practices inspire the technique or materials or involve the direct participation of artisans in the manufacturing processes (Figure 5). In one example (LUP), the design team produced a recycled plastic fibre that was provided to a group of traditional basket weavers to weave baskets in combination with natural fibres. Another example (Prima) integrates traditional material, technique, and production with wicker fibres from Chimbarongo as a distinctive aesthetic feature in the cabinet design (Figure 6).

These examples show that contemporary Chilean Design has found in crafts a deep-rooted connection, a source of inspiration and knowledge guided by practice, consolidating a distinctive aesthetic, using the notion of local identity emanating from the territory to its advantage. It makes sense because crafts are the

sector most valued by the population because they are associated with a notion of "national identity" and a "sense of belonging" and represent the labour of Chilean workers, while their products are evidence of territorial diversity (País, 2016, p.47).

However, although there is a shared value base centred on highlighting the nobility of local materials and celebrating diverse 'ways of making', even when techniques, technologies and aesthetics differ, the problem lies in the fact that this model tends to view crafts as a fragmented activity, separating the value of the object-product, the artisan's expert knowledge (technical, experiential and bodily) and the narratives contained in the practice. Moreover, artisans are not included as expert creative partners but rather as providers of manufacturing services (Mier & Teran, 2013; Parada en Cattan, 2019).



Figure 5, 6. Examples of current Chilean design where the influence of artisanal techniques is visible. Left: LUP Design; Right: Prima furniture; MasDeco, 2020.

Unfortunately, despite the visibility granted by the showcase of foreign design fairs, the craft sector continues to be perceived by audiences as a "minor art" and artisans as "technical workers" having a subsidiary position compared to Design and other areas of the cultural production milieu (Pais, 2016). In this sense, cultural policy researcher Beatriz Navarrete reflects:

> "Beyond the harsh survival under a model that ignores and marginalises them, the trades and productions grouped under this denomination -that of Popular Art and Crafts- have survived in a world that does not recognise and marginalise them. -(Popular Art and Crafts) have suffered a harsh effect of transculturation due to state policies that have tried to retranslate them to the new imperatives of globalisation". (Navarrete, 2017)

The paternalistic protective role of institutions and the market, installed through heritage preservation and promotion policies, can have a negative impact to the extent that dichotomies installs turn crafts into a representation of the past (Navarrete. 2017), while Chilean Design would be the image of the present. Thus, artisans cannot imagine a future, limiting themselves to repetition to safeguard the intangible heritage.

Thus, although the linking and referencing of contemporary Chilean Design with traditional crafts would be expected to be beneficial for both sectors, it is argued that, as a result of the lack of critical reflection by the creative sector of Design, it unintentionally reinforces the subsidiary position of artisans in the local cultural milieu (Noronha, 2018). There is a great contradiction in trying to protect and promote the local - as ways of making and thinking - through its alienation and subjugation to global regulations, being, in a way, a way back to colonialism (Navarrete, 2017).

2.3 The Explosion of Feelings: Walls as a Testimony of Rage and Resistance



Figure 7. Stencil records during the 2019 social outburst in Santiago de Chile. Iconographic representations of women. Reproduced from Iconografía del Despertar: esténcil [Iconography of Awakening: stencil], by Ch. Soto, 2022, Impuro ediciones. All rights reserved [2022], reproduced by permission of the author.

The urban scene of the Chilean capital has been fertile territory for the graphic expression of the population's social struggles, with its most relevant moment in recent years, in which politics and activism have gained relevance.

Preceded by large student demonstrations (2006, the “Revolución pingüina” [penguin revolution], allusive to the uniform worn by secondary school students; 2011, the largest student demonstration in the return of democracy of students of all levels), in 2018, students mobilised in the so-called "Feminist May", leaving a deep mark that prepared the ground for the "Estallido Social" [Social Explosion] that began on 18 October 2019. High school students refused to pay the metro fare, triggering an unprecedented escalation of mobilisations across the country, which led the conservative government of the time to decree a state of emergency. The demonstrations ceased with the arrival of the COVID-19 pandemic in 2020, but a process of constitutional change was agreed upon, which ultimately failed to materialise in 2023. For the inhabitants of Santiago, these experiences represented, in the words of one woman interviewed on the street, "living several Chiles".

The street was the canvas for expressing the slogans and symbols of these demonstrations. Urban Iconography (Figure 7) emerges from the movement of people agitated by the protests—the language of the street in performances, posters and on walls. Various designers and other professionals took it upon

themselves to compile these icons. The hybridisation of languages emerges by using DIY techniques, stencils, collages and others. In these expressions, the imprint of the 'Feminist May' is visible in slogans such as 'No is no. No more abuse. No more abuse. Girlfriend, realise. Fight Like a Girl’ indicates youth culture influenced by slogans on screens and digital platforms that repeat the same things ad infinitum. However, the appearance of these images in this context aims to challenge the social power relation (Hollows, 2001), more so because of their intensive reproduction that occupies all the walls of the city centre—resignifying the non-'gendered' citizen space (Flesler et al., 2018), as an empowered space, with the right to be inhabited even with discomfort.

On the other hand, the slogans 'Ni tuya ni yuta. Los pacos son inflamables. 1312. ACAB, All Cops Are Bastards' (Figure 8), emerges as a sign of global rage, of voices revolutionising social justice. The Chilean 'cops' are the 'pacos', the 'yuta', and occupy a large part of the messages on the stencils of the explosion, with the ferocity of a rage that no longer distinguishes the symbol from the living signifier. The violence unleashed in the streets remained in the voices of written hatred. Matapacos, the dog ‘companion’ of the student protests, by then already dead, emerges as one of the most recurrent symbols in the visuality and performances of the outburst. The carabineros are reflected as the ‘oppressive male’, in the words of Las Tesis' performance "Un violador en tu camino" (Colectivo Registro Callejero, 2019), alluding to Carabineros de Chile's advertising slogan in the 1980s: "Un amigo en tu camino"; the unbridled repression corresponds to the vicious circle (Cárdenas, & Ceballos, 2021) that perpetuates violence towards women and LGBTQ+ communities.

The stencils of the outburst (Soto, 2023) represent a discovery in popular graphics that reflects the sentiments of society in a simple and often precarious way. They are the voice of an affected culture, using what they have to complement the more enormous graphic slogans of the time. Rage manifests itself as an expression of hidden fear or sadness. It confronts the forces of desire and needs in a culture that prioritises economic growth and the value of money over other human qualities, such as affective and creative ones. This global culture adopts the Chilean accent in the metaphors created through the stencil technique and famous sayings.



Figure 8. Stencil records during the 2019 social outburst in Santiago de Chile. Slogans left: "Against patriarchy and capital I*G Women and Dissidence", right: "It wasn't my fault, where I was or how I was dressed". Reproduced from Iconografía del Despertar: esténcil [Iconography of Awakening: stencil], by Ch. Soto, 2022, Impuro ediciones. All rights reserved [2022], reproduced by permission of the author.

The stencils of the explosion represent the cultural heritage of a society that shared common feelings, fears and sadness, expressed through aggressive slogans, visual ironies and punk aesthetics that reflect a unique Latin American sentiment. These messages were made visible and joined the chorus of other citizen demonstrations. Women, intersectional feminists and LGBTQ+ communities vindicate in messages that relate to the experiences of what it is to be a woman in a hetero-patriarchal society. Visuality from the graphic becomes an archaeological object for the writing of a testimonial history (Carson & Pajaczkowska, 2000) about the problems of economic abuse and violence.

Although they contradict the culture of urban beautification and the academic canon, these stencils sincerely cooperate with the aesthetics of our culture based on feelings (Gatica, 2018, 2021, 2023). What is considered countercultural in the voices depicted on the walls of the capital gives form and image to popular sentiment, being an essential part of the cultural testimony and history of the country.

2.4 Recognizing Women's Contributions, Challenges, and Resistance

Due to political-social connotations, the professional practice of design in Chile is subject to the economic framework, which places it as an actor that must "give value" to consumer products and services. In this respect, the professional activity produces global pieces mediated by intermediaries who create strategies to improve sales. This economic context influences the dynamics of contemporary design, conditioning its processes and results.

From the situated, critical perspective seen in the three cases presented, we can point out that a relevant aspect to consider is the fundamental role played by women in the development and promotion of textile design - and its teaching - in Chile. It stands out how a team made up almost entirely of women carried out innovative projects, rescuing symbols and modes of production typical of popular, peasant and indigenous Latin American culture. Furthermore, despite the efforts to insert the designers into the local industry, these were mediated by female teachers who organised independent instances to bring the students closer to the national reality and allow them to develop professionally. This historical experience highlights the importance of recognising women's work in the field of design and their contribution to the cultural and economic development of the country.

On the other hand, the valuation and relationship between contemporary design and traditional crafts in Chile, valued by the population for their association with national identity and sense of belonging, and which represent the labour of Chilean workers, both men and women, is relevant. However, despite this valuation, artisans are perceived as technical workers and have a subsidiary position compared to design and other areas of the cultural production environment. This perception reflects entrenched gender dynamics in which manual work, mainly associated with women, is less valued than design, which has historically been dominated by men. Furthermore, it notes that cultural policies have contributed to the transculturation of crafts, limiting the capacity of artisans to imagine a future and relegating them to repetition to preserve intangible heritage.

Finally, the centrality of demonstrations led by women and feminists in events such as the "feminist May" and the "social outburst" provided a platform for expressing anger and discontent at patriarchy, police violence and social injustices. The slogans and symbols created at these protests reflect the struggle for gender justice, as well as resistance to male chauvinist and heteropatriarchal oppression. In this case, the stencils become a form of visual expression that makes visible the experiences of women and LGBTQ+ communities, challenging the dominant culture and contributing to the writing of a testimonial history of issues of gender-based abuse and violence. These manifestations highlight the importance of including feminist perspectives in Chile's analysis and practice of design, recognising the impact of feminist struggles in shaping contemporary society and culture.

3. Conclusions

Reflections on design and its culture from a situated and critical perspective, which seeks more significant equity and inclusion, lead us to recognise and value the work of women and dissidents. This alternative view promotes gender justice in all dimensions, advocating for a more egalitarian and diverse society.

From this perspective, which includes gender and decolonial perspectives, we seek to enrich design practice in the global south and everywhere where communities require transformations to promote their well-being and empowerment.

The particularities of Chile's territory and history have given design a character that, from a situated perspective, allows it to reflect on its work. This history and work are at the forefront of the norms that the North "dictates." However, they include local voices that may be invisible or non-existent in the economic dictates that usually govern the discipline.

Adopting an "other way" view implies a commitment to constructive critique of design, especially when it appropriates the landscape, the territories and the communities that inhabit them. In South America and beyond, this perspective allows us to recognise and address the inequities present in our societies and the urgent need for social justice.

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P/REFERENCES OF DESIGN

EVOLUTION OF URBAN RESIDENTIAL SPACE AND FAMILY DAILY LIFE DESIGN IN BEIJING SINCE THE REFORM AND OPENING-UP.

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KEYWORDS | URBAN RESIDENTIAL SPACE, FAMILY DAILY LIFE, REFORM AND OPENING-UP, INTERIOR DESIGN

ABSTRACT | This study is an interdisciplinary qualitative research on the history of interior design and the history of everyday life. It examines the evolution of living spaces, interior design, and family daily life in Beijing since the reform and opening-up. The research adopts anthropological ethnography as its method, exploring materials related to design and daily life from a micro-historical perspective. Through in-depth interviews with four different types of Beijing families, it investigates their living changes and daily experiences before and after the reform and opening-up. The study finds that there has been a spatial transformation in Beijing residences from “sleep-oriented” to “multi-functional” spaces after the reform and opening-up. This transformation was due to the increase in living space and the division of spatial functions. In terms of family daily life, there emerged a “visual-audio” lifestyle centered around the living room, along with the convenience brought by the popularization and smartening of appliances. In terms of home decoration, the pursuit of personalized and holistic spatial aesthetics gradually became the mainstream.

1. Introduction

Family life practices in the process of spatial production are both the result and the material for development, mapping the macro-level social, economic, and cultural developments from the micro-level of everyday life. The reform and opening-up, as the starting point of China's modernization efforts, not only achieved leapfrog growth in the country's economic growth and urban construction but also brought unprecedented changes to the daily lives of Chinese people, especially in living spaces and family life. Zou Qichang and others have linked China's design with social changes, believing that "design is closely related to socio-economic activities, and a certain economic base determines certain design concepts and behaviors. A history of design is a history of socio-economic changes." (Zou Qichang, 2021) This reflects the marketization introduced after the reform and opening-up and the promotion of design development through the improvement of industrial production levels. In terms of housing, the reform and opening-up changed the ownership of living spaces, transitioning from state-owned and planned allocation to commodities that individuals could possess. This changed people's understanding of space, rapidly initiated the production of space, and brought changes to living spaces and family daily life. Chinese sociologist Wang Min'an believes that since the 1980s, the space and family ethical structure have been inverted: spatial relationships have replaced ethical relationships, becoming the primary concern of home management and life. In a sense, the family is the effect of spatial production (Wang minan, 2006). Past research on interior design, especially the history of interior design, mostly follows the research methods of art history, focusing mainly on representative works of interior design styles and styles (Tang xingrong, 2015). This traditional historical research method overlooks the actual feelings and life experiences of "people" as subjects in space, leading to interior design research that "sees objects but not people," lacking mutual corroboration between macro-historical materials and micro-materials.

Therefore, this article takes Beijing as an example, based on in-depth research and interviews with more than a hundred families living in Beijing for over 40 years, and selects four families with typical characteristics for analysis. The study observes the changes in family living spaces after China's reform and opening-up from a micro-perspective, based on the living experiences and oral history narrations of the interviewees, as well as spatial information and photographs of family living spaces from various periods.

As the capital, Beijing's living conditions and personnel present very distinct characteristics, namely, communities centered around work unit compounds. According to the nature of work, these compounds can be divided into residences for research institutions and colleges represented by intellectuals, government agencies represented by civil servants, military units represented by military personnel, and factory units represented by workers. Families represented by these four types of personnel occupy over 75% of Beijing's permanent households, demonstrating strong typicality (Figure1).

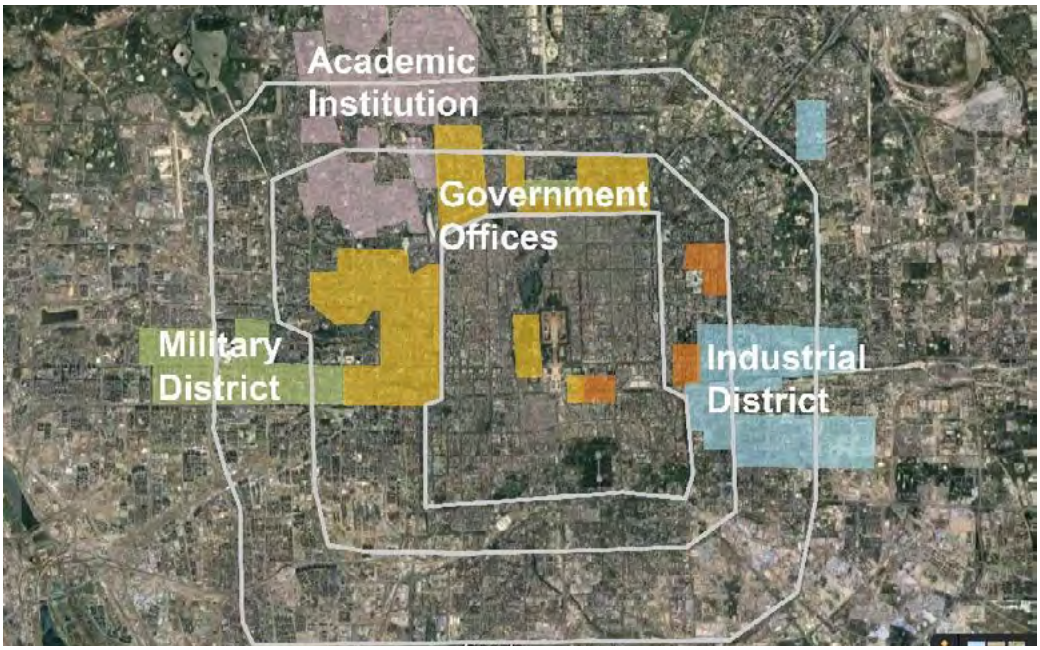


Figure 1. The four main types of work units in Beijing City. (The people working in these units constitute the majority of the population in Beijing City. They are mostly individuals who came to Beijing for study, work, and settlement after the founding of the People's Republic of China in 1949 and after the reform and opening-up in 1978.).

Therefore, this study selects families from these four types of personnel as the subjects of research. The research subject A is a retired university professor (71 years old) who came to Beijing to attend university in the 1970s, and stayed after graduation to become a university professor. Notably, he is among the first batch of university graduates in interior design after China's reform and opening-up. Over 40 years, he has not only engaged in design education but also personally led numerous interior design projects and developed a series of curriculum systems and training objectives for the interior design profession in China. Research subject B (62 years old) grew up in a military compound, joined the army in his youth, and entered a corporation after discharge. Research subject C (52 years old) is a local resident of Beijing for multiple generations, who went to work in the Capital Iron and Steel Factory after high school graduation. Research subject D (56 years old) is also a local resident of Beijing, who became a grassroots government official after high school graduation.

2. Egalitarianism and Collective Living: Residential Spaces and Family Life Before the Reform and Opening-Up

In the early years of the People's Republic of China, under the guiding principle of "production before living," housing construction was severely lagging. In 1949, the national per capita living space was 4.5 square meters. With population growth after the founding of the PRC, industrial backwardness led to a lack of infrastructure, and residential construction developed slowly, resulting in very low levels of urban family living standards. By 1956, the per capita living space of urban residents had not increased but decreased to 4.3 square meters. During the Cultural Revolution from 1966 to 1976, economic and urban construction was essentially at a standstill, and by 1978, per capita living space had further decreased to 3.6 square meters (Lv junhua, 2003). From 1949 to 1978, China's population growth rate far exceeded the rate of housing construction. After 1978, the state changed its closed population policy, adopting a relatively open policy of population mobility. As the capital, Beijing became one of the cities with the largest scale of population inflow, including people who left Beijing during the Cultural Revolution for the "Up to the Mountains and Down to the Countryside" campaign, and those who came to Beijing for higher education through the national college entrance examination after the reform and opening-up and stayed to work. The rapid population growth further exacerbated the pressing situation of housing issues, making solving the housing "debt" an urgent issue of the time. Corresponding to the severity of the housing issue, the 1950s-

1970s saw relatively monotonous residential interiors and family life: on one hand, the newly established PRC, just out of modern turmoil, was scarce in materials and lagging in industrial development. During this period, the state planned to invest heavily in the development of heavy industry, with slow development in light industry related to daily life; on the other hand, the planned economy system shifted people's focus from the nuclear family to the "collective" large family. The ideological socialist construction ideal replaced personal life's attention, and the planned distribution system for housing allocation, and furniture rationing, along with the political equality thoughts of "egalitarianism" and "decoration is a crime" meant that people did not pursue much in terms of interior decoration and daily life. In 1978, two years after the end of the Cultural Revolution, China initiated reform and opening-up, shifting the central task to economic and modernization construction. The state launched a series of economic reform measures to promote modernization and improve people's lives. The "housing problem," as the most pressing social issue, was given attention, and the state began to try reforms transitioning from welfare housing to commodity housing. To achieve the reform's goals of "affordable housing, separation of functions, and stable living," in addition to improving architectural design, the exploration of interior design also became an indispensable important part.

3. The Transformation of Family Space Structure: From Sleep-Oriented to Multifunctional

3.1 The Family Space Structure Before the Reform and Opening-Up

Before the reform and opening-up, China operated under a planned economy system, implementing a housing allocation system also referred to as “welfare housing.” With the state prioritizing the development of heavy industry and adhering to the “production before living” policy, urban living standards were maintained at relatively low levels. In terms of residential design, the main reference was the Soviet standard housing, aimed primarily at controlling the cost of housing construction. Between 1949 and 1978, although the standards for housing construction and types of residential designs varied at different stages, the distribution was based on the principle of equality, not considering the rationality of family living, described as “rational design, irrational use.” A typical example was the tube-shaped building, also known as barracks-style housing, characterized by narrow corridors connecting equally sized single rooms on either side, each about ten square meters, with communal kitchens and bathrooms on each floor (Figure 2). Before the reform and opening-up, a large number of work unit compounds, primarily consisting of tube-shaped buildings, were constructed in Beijing, with each compound inhabited by groups of people working in the same unit (Figure 3). Nearly all interviewees or their parents from the 70s and 80s shared similar living experiences in such housing, which became a memory of their childhood or youth.



Figure 2. The floor plan of the tube-shaped building. (The building is generally 1-3 floors, and the maximum is not more than 5 floors. The floor plan is generally rectangular or L-shaped.)



Figure 3. The tube-shaped residential buildings in Beijing during the 1950s-60s.

The allocation of tube-shaped buildings did not consider the functional needs of families but was purely based on per capita quota area, typically 4-5 square meters per person (Li dexin, 2014). The first housing of research subject A after graduating and working at the university in 1979 was in a standard tube-shaped building, measuring 12 square meters, housing the spouse, child, and nanny. Living, sleeping, storage, and dining activities were all forcibly integrated into one room, and the contradiction of small living spaces with multiple cohabitants revealed a reluctant complexity and ambiguity in the function of interior spaces. In such spaces, ensuring each person's "sleeping area" became the most important task (Yu aokun, 2022). A, leveraging his professional skills as a designer, designed and constructed a bunk bed himself: a large double bed for the couple to use, with a baby crib and ladder on the side of the double bed, and a single bed on the second level for the nanny, thus essentially resolving the living issue for a family of four (Figure 4).

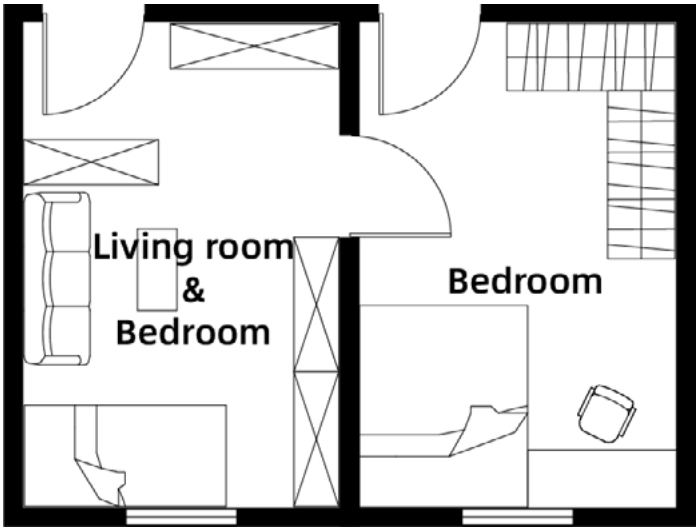


Figure 4. The floor plan of the residence where research subject A's family lives. (Research subject A is a university professor and designer who teaches interior design. The image is personally designed and hand-drawn by him.)

A described this living experience as "living in a can, suffocating." Similar examples of room functionality combinations were common among various types of families surveyed. Family B, consisting of parents and a younger brother, thus four people in total, were allocated adjacent two rooms, allowing them to open a door on the wall between the rooms, connecting them into a two-bedroom unit and further dividing the crowded space for different functions (Figure 5).

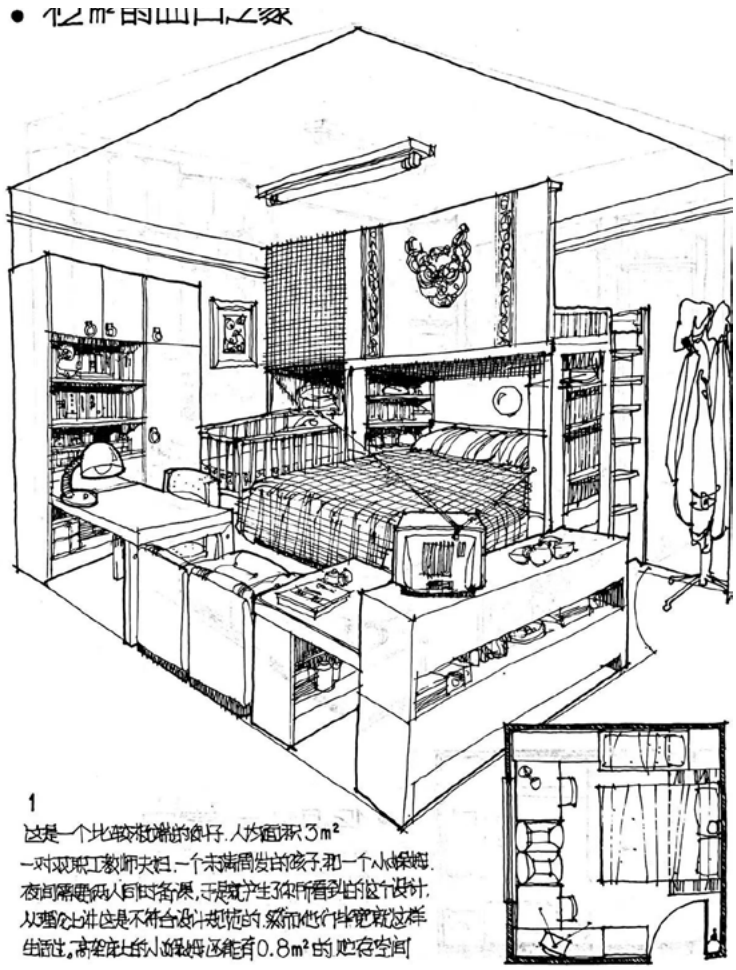


Figure 5. The floor plan of the residence where research subject A's family lives.

This separation allowed parents and children to have their private spaces, yet sleep still occupied the most significant portion of both rooms. When guests arrive, the outer room could serve as a living room, separating public and private activities. However, in tube-shaped building residences, regardless of how many rooms a family was allocated, kitchens and bathrooms were communal spaces shared by all families on the same floor, making shuttling between rooms, kitchens, and bathrooms a frequent and fixed activity route. Since residents in the same building were often colleagues from the same unit and familiar with each other, the blurring between private and public boundaries was further intensified. Although this spatial model brought some privacy concerns to each family, it unexpectedly created a tight-knit neighborhood relationship. In the oral history of research subject B, he recalled his childhood home rarely closed the door, always leaving it open or ajar, especially during cooking times at noon and evening when households would keep their doors open for easy access between the kitchen and bedroom; it allowed adults and children to freely visit familiar neighbors for dining or inviting neighbors to taste their own meals. Only at night, when it was time to sleep, would doors be closed, entering real private life. B mentioned, “At that time (70s-80s), despite poor housing conditions, there was an extraordinary neighborhood relationship. Although there was no blood relation with neighbors, it felt no different from relatives. Sometimes, when adults in the family couldn't come home on time due to work, children could naturally go to a familiar neighbor's home to do homework, play, and have dinner. In contrast, now, as living areas continually expand, the relationship between neighbors has become distant, closing one's door means entering one's own space, even neighbors across the hall would only nod in passing in the elevator, without more conversation or contact.” This situation, unthinkable in today’s urban life as an invasion of private space, was considered reasonable behavior in housing before the 80s due to the ambiguity brought by cramped spaces, shaping the public nature and special atmosphere of neighborhood living space (Figure 6).



Figure 6. The corridors within tube-shaped buildings and the communal living atmosphere. (Due to the limited space of each household, the corridor has become a communal space for children's activities. During the day, children play in the corridors. In real life, because the communal kitchen is too small, some families often set up simple kitchens at their own doorsteps for cooking and storing food.)

Aside from tube-shaped buildings, this period also saw a large number of relatively independent, complete set of multiunit housing, typically with two to three households per floor. "Multiunit housing" is a term unique to China, commonly referred to as "apartments" in English, and is a type of collective housing (Wang junjie, 2017). Multiunit housings are one-bedroom or two-bedroom units, each with its own toilet and kitchen. The "Baiwan Zhuang" residential area in Beijing, constructed in 1953, is a large housing complex assembled from standard units (Li hongduo, 1956). The families of research subjects C and D live in such residences. Although such housing offered more complete spatial functions compared to tube-shaped buildings, due to the design still following the area quota system and focusing primarily on meeting sleep needs, space remained limited. In actual family life, larger rooms still assumed multiple functions such as bedroom, living room, and dining room, sometimes also serving as the master's study or children's playroom, with the family's daily life largely centered in this room. The added joy brought by this composite function and uncertain spatial division is that families would periodically change the room's layout, utilizing movable furniture like sofas, cabinets, and beds to divide the room's space, meeting the family's needs at different stages or seasons, or adding freshness to family life. For instance, when A's family's child reached the age to attend kindergarten, requiring more space for activities and play, and no longer needed a nanny during the parents' work hours, the family reverted to a three-person state. At this time, A dismantled the original bunk bed and redesigned and made a low, floor-level large bed (Figure 7).

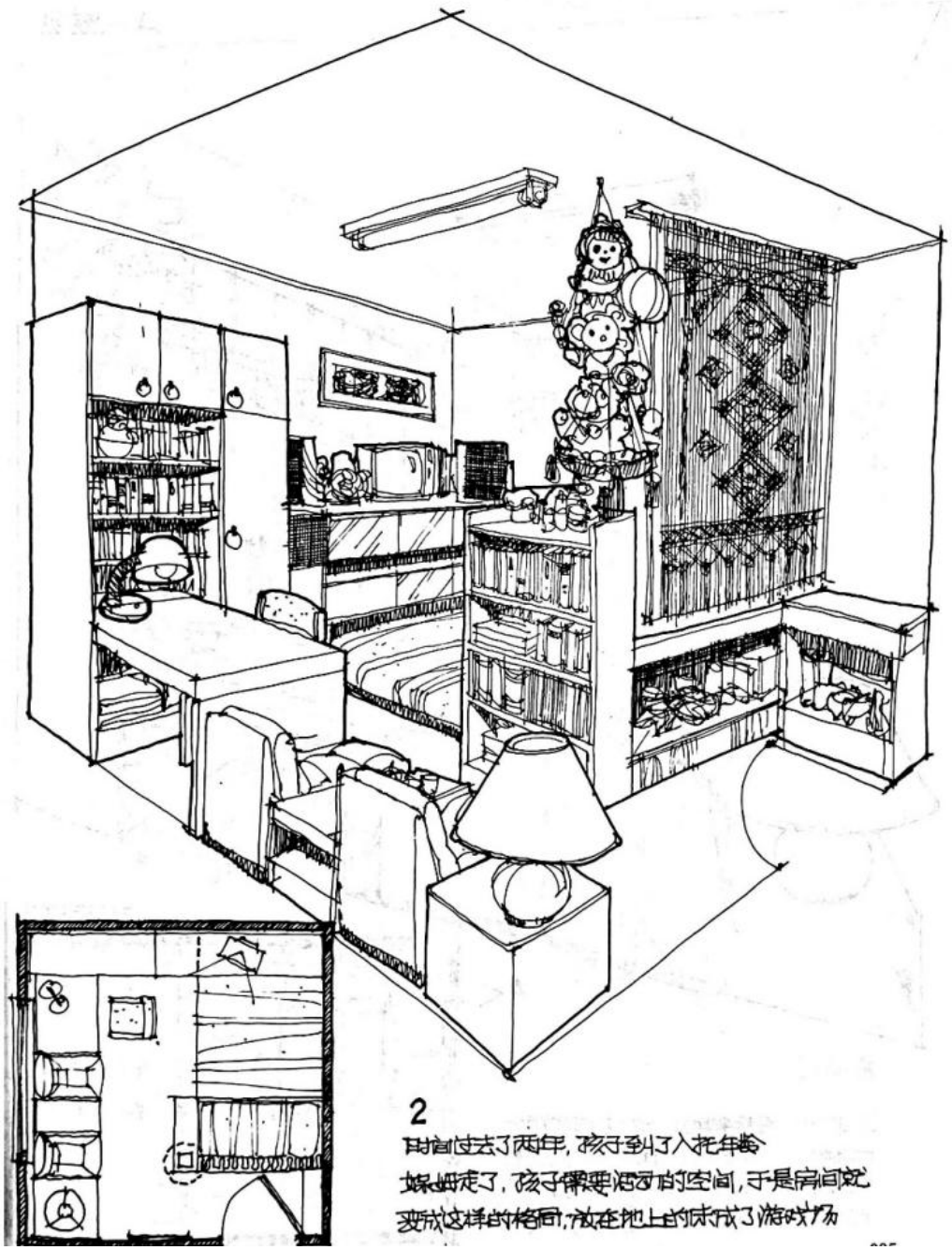


Figure 7. The arrangement of research subject A's family space after the nanny moved out.

When the child needed to play, the bed, serving as a sleeping space, formed an unobstructed connection with the floor, allowing the child to freely climb up and down, facilitating better interaction between parents and child. Family D would move the sofa to the south side of the room near the window for better living room lighting in winter, and make different adjustments in summer. As D grew older and needed to sleep in a separate room from the parents, a space was partitioned in the living room with a bookcase for a single bed, and a curtain was hung at the end of the bed. He mentioned, “When guests visit or my parents rest or read in the living room, the bookshelf and curtain isolate me in a relatively private space to do my own things without disturbing each other. The bookshelf was made by my dad, who later added a board in the middle, dividing the bookshelf into two parts, one side towards my bed where I could place my books and decorations, and the other side for their stuff (Figure 8).” This entirely “functionalist” design and home layout, autonomously designing living space according to life needs, reflected the design intelligence and daily life joy of families during that period. This type of small area, multifunctional, sleep-oriented housing, and family daily life was widespread before the reform and opening-up and continued until the late 1980s.



Figure 8. The floor plan of the residence where research subject D's family live.

3.2 The Family Space Structure Before the Reform and Opening-Up

After the reform and opening-up, the state began to improve people's living conditions. From a temporal perspective, the improvement of housing includes two phases: the first phase from 1978 to 1998, still adopting the welfare housing distribution model; the second phase from 1998 to the present, entering the era of commercialized housing. Specifically, regarding improvements in residential design, this can be summarized in two aspects: increasing space and rational room division. Regarding these two aspects, the 1980s was a critical period for residential development in China. Through reviewing literature related to housing, the author discovered that the 1980s experienced dense changes in housing policies, housing layout, spatial patterns, and interior design. In terms of increasing space: in the 1980s, to save land and increase residential density, Beijing began developing high-rise residences and accordingly relaxed the standards for residential space, significantly increasing the living area for families. In terms of functional division of housing, in 1985, the “suite concept” was proposed in the “China Technical Policy Blue Book” issued by the state, promoting residences composed of living rooms, bedrooms, kitchens, toilets, corridors, or living rooms for single-family use, equipped with corresponding facilities such as showers, gas, and heating (Lv junhua, 2001). The promotion of the suite concept led to homes built in the late 1980s gradually having complete and mature daily living functions (Zhao guanqian, 1999). In "The Discovery of Dwelling," the Japanese housing scholar Ryue Yosizaka proposes the "three types of living," categorizing human dwelling behaviors into three classes. "First living" involves actions to sustain physiological and vital needs; "Second living" covers activities such as production and consumption that support the first living; "Third living" encompasses art, entertainment, and intellectual activities (Zhang hong, 2002). It is precisely because of the increase in residential areas and the rationalization of spatial functions that family living has been able to move towards completeness. The four families surveyed in this article also moved into

residences with larger areas and more rational functional zoning in the late 1980s to the mid-1990s: a single room no longer needed to serve as both a bedroom and a living and dining room, members of different generations had their own private rooms, and kitchens and bathrooms no longer needed to be shared among several families. The separate kitchen and bathroom are integrated into the household, encompassing the basic aspects of family life (Zhang Qinyi, 1995). In the mid to late 1980s, kitchens and bathrooms in residential layouts were no longer bundled together but were adjusted based on functional needs. The number of appliances inside kitchens and bathrooms increased, and their layouts became more detailed. The usable area of the kitchen was increased to 5-7 square meters (Lao Yuanyou,1983), and storage space also began to expand: overhead cabinets made of concrete slabs were installed on kitchen doors, niches for storage were set up on the side walls, cabinets were mounted above the stove, and storage space was also created under the countertop (Bai naipeng, 1985). During the same period, the functionality and space of bathrooms in residences were also improved: to reduce interference between different functions, separations between areas such as the sink, bathtub, and toilet began to appear. Family life is clearly separated from communal living by the threshold of the door, with domestic functions becoming gradually more refined. Research subject C recalled moving in 1994, saying, “At that time, feeling that we could live in a house that was all our own, without having to share kitchen and bathroom facilities with neighbors or go to a public bathhouse for showers, felt incredibly blissful. It was like moving into our own happy paradise” (Figure 9).

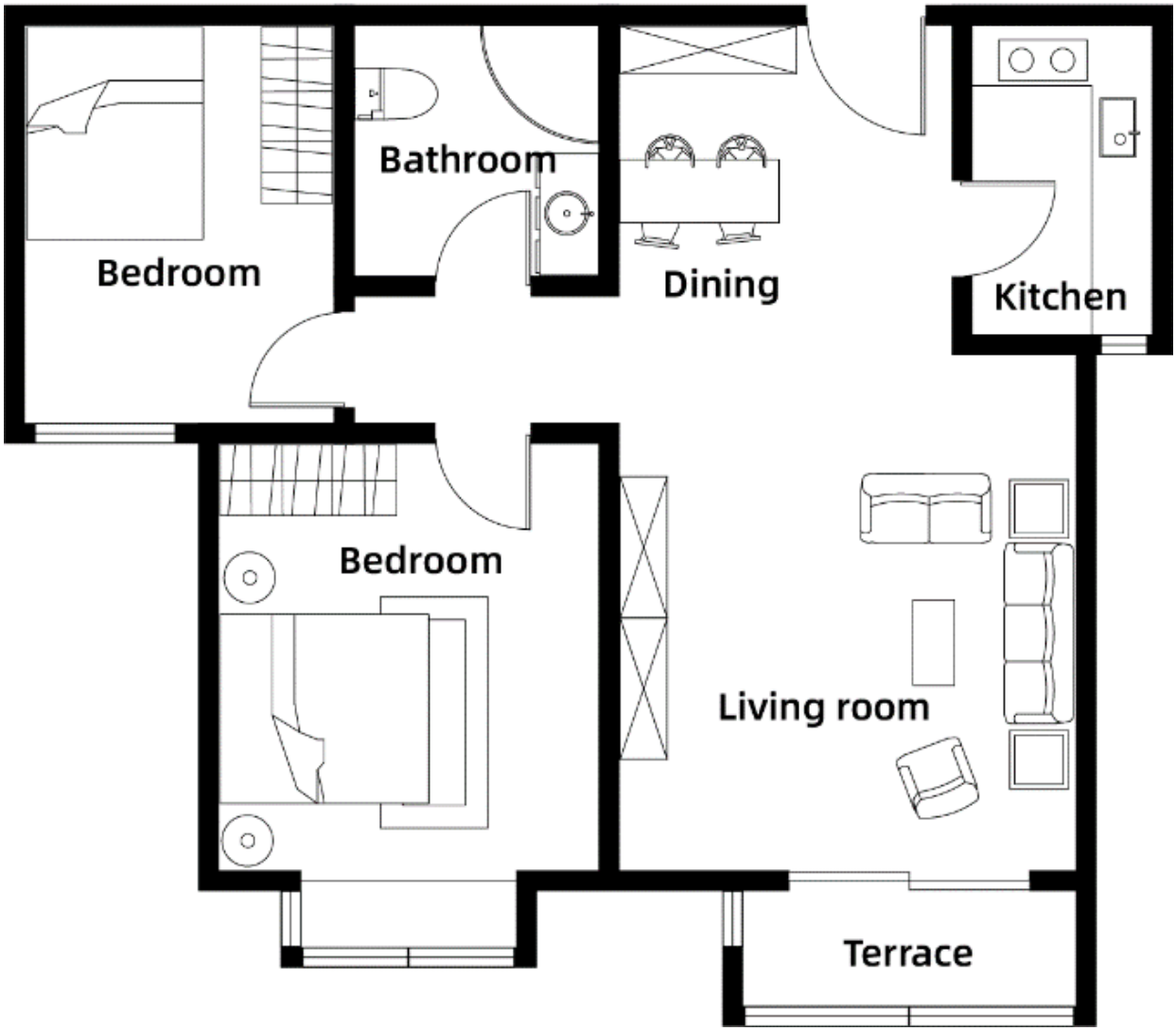


Figure 9. The floor plan of research subject C's family residence in 1994.

Research subject A moved into a two-bedroom apartment, allowing the couple and their growing child to have their own independent rooms. The increase in space and separation of functions also impacted family life: A could continue working at home after work without worrying about disturbing others. After some time, A used a modular cabinet to divide the bedroom space into a work area and a rest area, making the room more suited to actual needs (Figure 10). A mentioned, “Being able to work from home, I could spend more time at home instead of having to finish my design drawings before returning. I also had more time and space to spend with my daughter. She always watched me finish my design drawings when I wasn’t busy and asked me to teach her how to draw. It was then that she developed an interest in art and decided to become a designer when she grew up.”



Figure 10. The housing of research subject C's family in the 1990s(The photo shows the workspace separated by cabinets in A's bedroom, used for drawing design plans and preparing lessons.).

By 1998, China officially ceased the welfare housing distribution system, advocating for housing purchases through loans, with houses being fully introduced to the market as commodities. As products designed to meet people's purchasing needs, residential spaces began to be designed larger, with further rationalization of functional zoning to meet the area and usage needs of different families. Segmented spaces such as studies and bedrooms equipped with private toilets began to emerge. The average living space per capita for urban residents in China increased from less than 4 square meters in 1978 to about 9 square meters in 1997. In Beijing, a first-tier city, the average living space per capita reached 14.36 square meters (Li Yan, 2009). According to the author's research, from this time on, the majority of the research subjects' families no longer only owned one set of housing but began purchasing additional properties to acquire higher quality living spaces and family life. Research subject D mentioned, “Our family's living no longer needs to be cramped together, and as family members age, each member has more space needs.

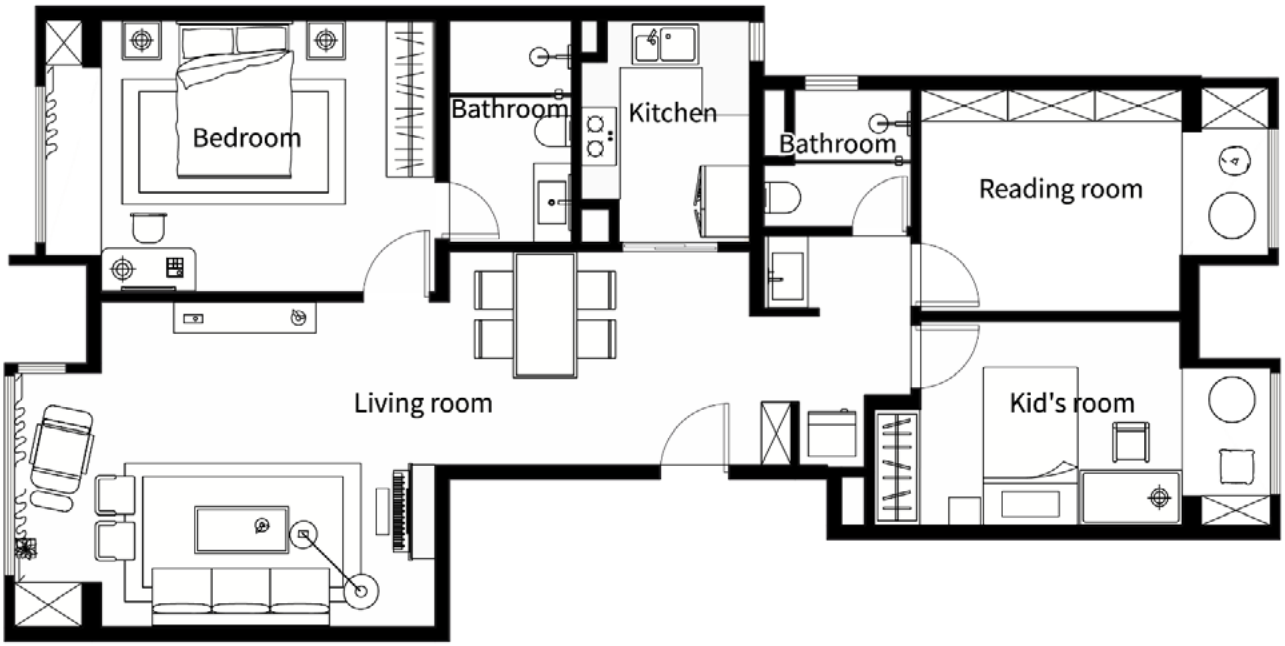


Figure 11. The housing of research subject D's family in the 2000s. (This housing unit is 128 square meters in size, which is twice as large as the previous residence of the D family.).

When we didn't have a living room, we wanted a house with one; after getting a living room, I started to want my own study to read and work at home; and as my child grew older, she also needed a larger and more independent personal space. Such changing needs prompted us to keep thinking about buying more houses (Figure 11)." Compared to the 80s and 90s, the increase in space not only satisfies the functions of living and daily life but has also become a property that adds value to the family. According to the research summary, starting from 2000, most of the Beijing families researched would purchase a set of housing within 5-10 years to improve their family housing conditions. As of 2020, the per capita housing area in Beijing reached 33.7 square meters, a tenfold increase from 1978.

4. The Changes in Family Living Spaces Brought about by Household Appliances and Home Facilities

4.1 The Family Public Life Centered around the Television and Living Room

After the reform and opening-up, the legitimacy of modernization was initially established within people's physical sensations. According to Zhang Xudong, at that time, Chinese people had many doubts about whether China was considered a modern country and whether they were considered modern individuals, which were actually rooted in these physical sensations. Inherently, there was a collective historical impulse to embrace, possess, and create a truly modern life as quickly as possible (Zhang Xudong, 2014). For families, objects, especially household appliances, were at the core of this modern life imagination. In the 1980s, China's economy saw a significant uplift, and the reform and opening-up led to a leap in family consumption. From the 1950s to the 1970s, the "Four Big Items" were the dream of many families, symbolizing the standard of living for families. The "Four Big Items" were "sewing machine, bicycle, watch, radio," colloquially known as "three rounds and a sound." By the 1980s, the new Three Big Items were "black and white TV, single-tub washing machine, single-door refrigerator"; by the late 80s, they became "color TV, twin-tub washing machine, double-door refrigerator." Before the reform and opening-up, due to China's limited industrial production capacity, televisions needed to be supplied by plan and ticket, and only families with purchase tickets could buy televisions from state-owned stores. Research subjects A and C's families each purchased a 14-inch black and white television in the late 1970s. According to C's

description, "At that time, families owning a television were very rare. Although it was just a black-and-white TV, the screen was very small, and the TV programs were very limited, it was more like a decorative piece in the house. But every time it was turned on, the house would be filled with neighbors, and several households would bring their children to watch TV. In summer, the TV would simply be moved to the corridor for everyone to watch together." Although the primary function of family residences at that time was for sleeping, the emergence of audio-visual household appliances like the television began to change the family's space and way of life—the audio-visual centered family life became an important feature of residential interior spaces after the reform and opening-up. As the national economy began to marketize, household appliances like televisions rapidly became popular in families. According to statistical data, in 1978, the number of televisions per hundred urban households in Beijing was 1.3, increasing to 24.3 by 1985, and rapidly to 145.5 by 2000 (Figure 12).

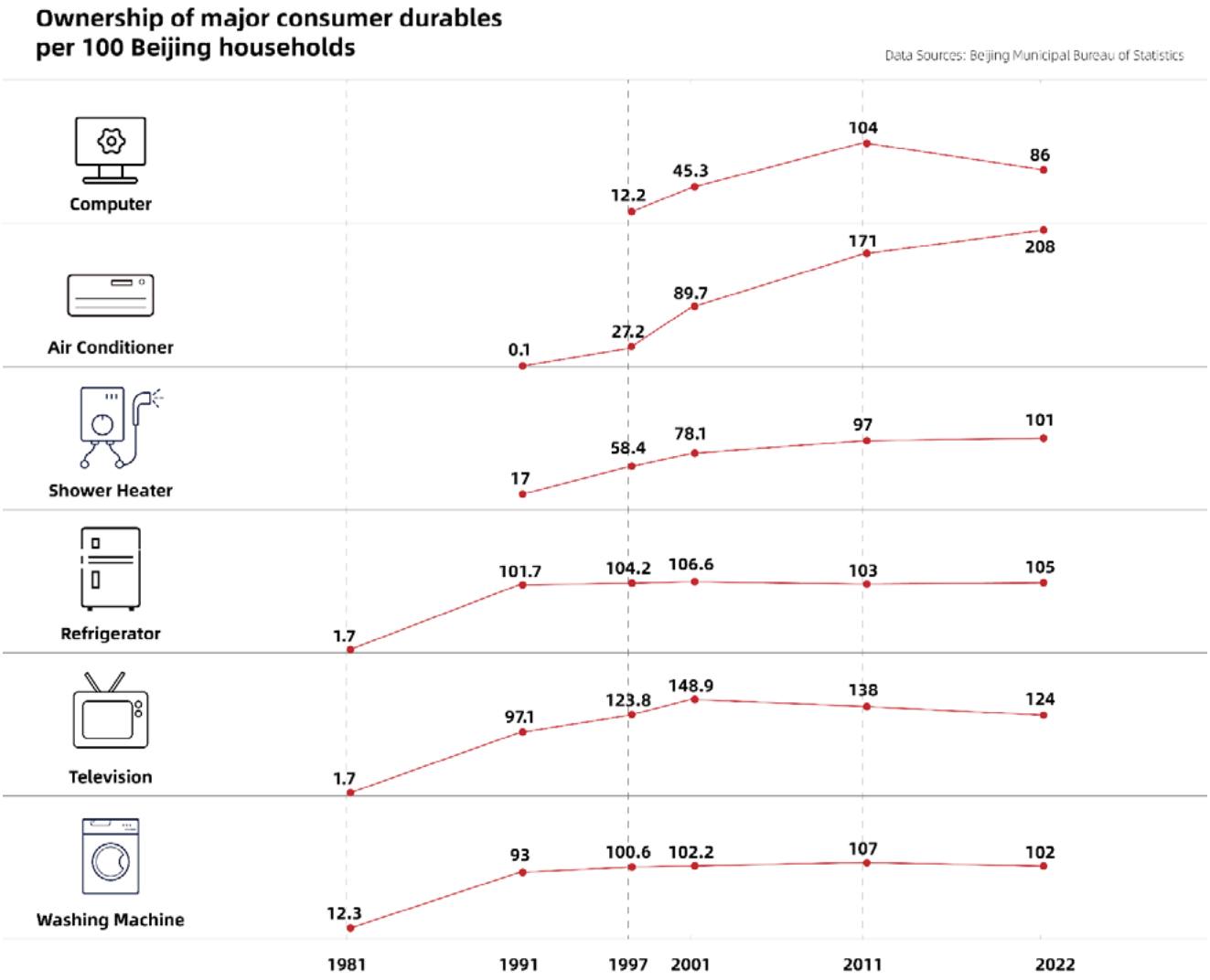


Figure 12. The changes in the number of major electrical appliances owned per hundred households in Beijing families from the 1980s to the present.

The proliferation of televisions made the "large living room" and "small bedroom" a trend in family spaces. When describing their living conditions around the year 2000, all four sample families mentioned "living room size" as an important standard by which they measured satisfaction with their housing. Research subject A mentioned, "At that time, every family wanted an independent living room, because the living room was not only the public space for family members but also a place for receiving friends and connecting with the outside world, like a front stage that could be seen by anyone who came to the house." The living room, as a public space within the family and a transitional space to the social space outside the family, became the center of the entire residence. The television and corresponding audio-visual equipment became the focus of this center, with every family beginning to consider the placement of

audio-visual equipment. As the audio-visual equipment itself has a high degree of technical beauty and a sense of the times in terms of shape, size, color, and texture, apart from achieving the best audio-visual effects, it also has a display and decorative function. The style and personality of the living room became the visual center of the entire family and the display stage to the outside (Figure 13).



Figure 13. The living rooms of research subjects C and A's families in the 1990s and the 2010s.

As a place for rest, entertainment, and conversation, family life centered around the television and the living room also unfolded here. In interviews about the living room, it was found that almost all public affairs related to the family occurred in the living room, especially during TV watching, discussions, and resolutions; the family's emotions were also enhanced in the coexistence of living room audio-visual life. For example, after dinner, when the whole family watched TV, the living room often served as a space for internal family meetings to discuss family expenses, children's education and interest development, family outings, etc.; at the same time, when watching TV programs of mutual interest, exchanges would start, and personal views and opinions would be shared. Parents' understanding and discipline of children were also generated here, making the living room a place that accommodates the commonality of family members.

4.2 The Convenience Brought to Family Life by Electrification and Smart Home Appliances

Consistent with the television, from the mid-1980s, white goods such as washing machines, refrigerators, and air conditioners gradually became popular in urban residences, ushering in an era of electrification in family life. The increase in household appliances led to an expansion in the usable area of residences, making an increase in auxiliary space inevitable. Correspondingly, the use of auxiliary home appliances also provided convenience for family life, changing family habits. Taking the kitchen and refrigerator as examples, in the author's interviews, all four respondents unanimously chose the refrigerator as the appliance that has had the greatest impact on family life since the 1980s. The refrigerator not only changed the way food was stored but also affected eating habits, kitchen space design, and usage. Research subject B emphasized the impact of the refrigerator on family life, especially in terms of food storage and preservation: "My family bought a refrigerator in 1987. The biggest change after having the refrigerator was that we could buy more meat in the summer. Because my home and workplace were far from the market, it was troublesome to go there, and in the summer heat, the meat bought back would spoil quickly if left outside. With the refrigerator, we no longer had to worry about meat spoiling if we bought too much." Research subject C mentioned: "My father and I are both sports fans. In 1990, when we got a refrigerator, it was the year of the Asian Games in Beijing. That summer, my father bought a lot of beer, and after dinner, we'd start watching the Chinese team's games with chilled beer and snacks from the refrigerator. I was just 18 then, and it was the first time he allowed me to drink. I remember many nights we'd drink and talk about the games, and life. It was the happiest summer I had with my father."

Interestingly, initially, the refrigerator in Chinese homes was not placed in the kitchen but in the dining room. One reason was the small size of family kitchens in the 80s and 90s, only enough to accommodate a sink, countertop, and stove; the second reason was that the refrigerator, as a relatively high-end household appliance at the time, had a certain display function and was thus often placed in a more conspicuous position in the home. After 2000, the electrification of kitchens further increased: microwaves, rice cookers, exhaust hoods, induction cookers, ovens, and other small kitchen appliances and equipment gradually became popular, making cooking behaviors and procedures more complex, and allowing for larger and expanded kitchen spaces. To make the cooking process smoother, some families with large kitchens began to place refrigerators in the kitchen, considering the refrigerator and cabinets as a whole in the design and layout of kitchen space, to balance convenience and aesthetics (Figure 14).

the commonly used household appliances	Household A	Household B	Household C	Household D
Air conditioner	○	○	○	○
Air purifier	○		○	
Air quality monitor			○	
Bathroom heater	○	○	○	○
Clock	○	○		○
Curtain motor	○		○	
Camera	○	○	○	○
Dehumidifier				
Dishwasher	○		○	○
Electric heater	○		○	○
Electric kettle	○	○	○	○
Fan	○		○	○
Fresh air system	○		○	
Humidifier	○		○	
IPTV set-top box		○	○	○
Lamp/light	○	○	○	○
Kitchen hood	○	○	○	○
Massage chair			○	
Microwave oven	○	○	○	○
Pet feeder				
Projector			○	
Refrigerator	○	○	○	○
Running machine				
Rice cooker	○	○	○	○
Robotic vacuum cleaner			○	
Smart mirror				
Smart bed				
Television	○	○	○	○
Temperature and humidity sensor			○	
Video doorbell	○		○	
Washing machine	○	○	○	○
Water purifier	○		○	
Water heater	○	○	○	○

Figure 14. The kitchen arrangement of research subject A. (The left image shows a refrigerator from the 80s-90s, which can be seen placed outside the kitchen, serving a certain display function. Nowadays, refrigerators are more often placed in the kitchen, forming a kitchen layout closely linked to cooking activities.)

In recent years, with the emergence of small smart home appliances with more refined functional divisions, thanks to the development of mobile internet and smart IoT, these smart home appliances have begun to more deeply integrate into daily family life. The interconnectivity of home appliances facilitated by IoT technology and smartphones further brings convenience to family life, while also effectively reducing the energy consumption of appliances (Figure 15). For example, research subject B purchased a smart air conditioner and humidifier for the family, which can set the ideal temperature and humidity on a smartphone. When the temperature and humidity are not within the ideal range, the air conditioner and humidifier will automatically start working and stop after adjusting. Additionally, the use of smart vacuum robots and dishwashers significantly reduces the cleaning tasks for family members, especially the elderly, allowing them more time for rest or leisure activities.

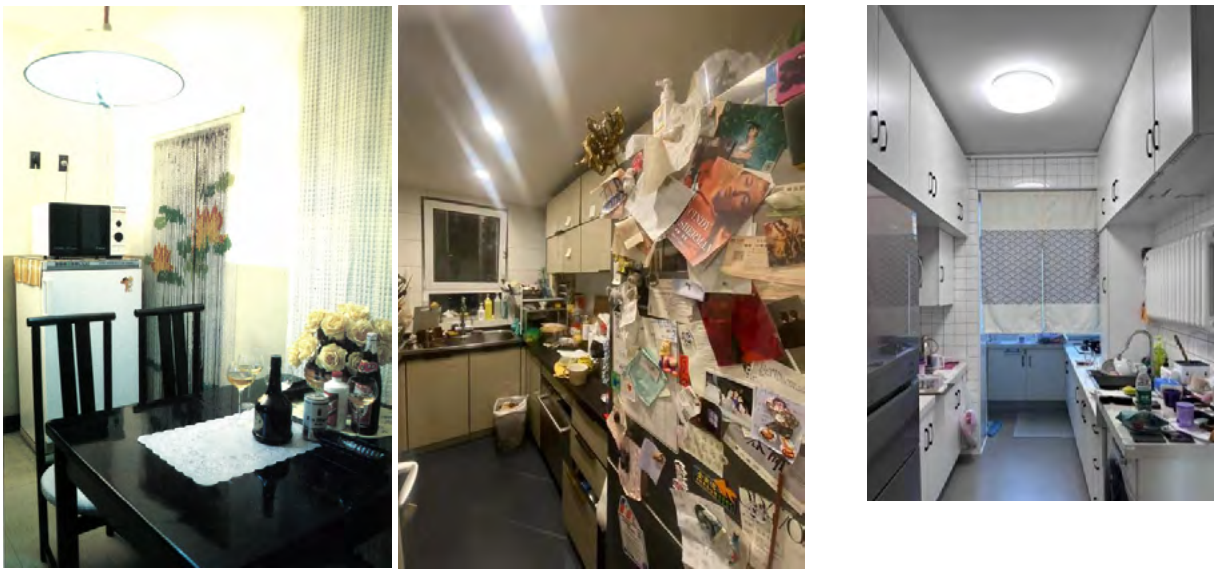


Figure 15. The types of smart appliances currently owned by the four surveyed households.

5. Characteristics of Changes in Home Decoration

5.1 From Standardization to Personalization

During the planned economy period, urban residents' home decoration tended toward standardization. This design approach was partly to save economic costs and, on the other hand, to reflect the equality of people's social status through standard home decoration. The arrangement of facilities within the room could also collectively display the socialist political characteristics of the space. From the 50s to the 70s, the interior furnishings of ordinary families were very simple, consisting only of essential furniture for daily life such as beds, chairs, tables, and cabinets. As for decorations, walls in the rooms were usually adorned with portraits of Chairman Mao. After the reform and opening-up, the concept of the family as an "individual" rather than a "collective" began to emerge. Marketization, bringing a rich variety of products, made people not only pay more attention to the practicality of home layout but also break away from standardized interior furnishings to show individuality, creating a family living atmosphere became the need for most families. Design scholar Hang Jian, based on the overall social situation in China and the general level of design awareness, argued that China's "modern design" began in 1978, pointing out that only a society that realizes the best development of industrial civilization is through design to improve life, can echo the spirit of design at all levels, and by choosing design through consumption, thereby achieving the highest good of mass behavior (Hang Jian, 2018). In terms of home layout, in the 80s and 90s, there were no professional interior design companies and designers in Beijing yet. Many families' walls, floors, and ceilings were treated very simply, mainly using combination furniture of different shapes and sizes to divide and plan family space. This furniture was usually made based on the ideas and needs provided by the family, asking furniture makers to produce them. Research subject A mentioned, "At that time, all the furniture in the

house, from cabinets and tables to sofas, were created based on my design drawings, and then I had a carpenter make them for me, and most families did the same. If you had no ideas, the carpenter would offer suggestions based on their own experience." After the new century, with the furniture market maturing, people could choose ready-made furniture or customized furniture according to their aesthetic preferences. In recent years, the concept of "minimalist decoration, emphasis on adornment" has gained popularity, with simple interior decorations filled with personalized home decor becoming the choice for many families when doing interior design. In the current home of research subject A, one can see the display space specially designed for his favorite ornaments, showcasing his personalized collection of hobbies and aesthetic taste.

5.2 From Intricate Decorativeness to the Integrity of Space

After 2000, professional interior designers and construction personnel began to be active in the market, and home decoration tended more towards personalization: walls, floors, ceilings, and other interior space interfaces were decorated and processed, and people paid more attention to the coordination of lighting, furniture, and furnishings. Interestingly, between 2000 and 2010, some families were keen to imitate and draw inspiration from the decoration style of hotel rooms: wooden wainscoting, multi-layered ceilings, and patterned wallpaper became the main elements of the space. Unfortunately, in terms of furniture and furnishings coordination, most families lacked an overall aesthetic awareness, leading to discordant home spaces, such as "Baroque" style wallpaper matched with Chinese-style furniture. After 2010, under the influence of internet media, the Scandinavian minimalist style of "IKEA," the modern design concepts from Italy focusing on wholeness and materials, and the impact of "environmental consciousness," led to a home interior design philosophy that began to emphasize the integrity of space: simple spatial interfaces, harmonious color atmospheres, unified style furniture, personality-showcasing furnishings, and decoratively functional fresh green plants became the aesthetically pleasing decoration choices favored by families (Figure16).



Figure 16. The current interior appearance of the homes of research subjects A and B.

6. Conclusion

This study aims to showcase and reveal the changes in interior spaces and family life of urban households in Beijing since China's reform and opening-up. Utilizing methods of literature analysis and anthropological ethnography, this research combines historical documents as objective materials with oral facts from family surveys. Based on interview data from four types of families, it outlines the changes in Beijing's family interior spaces over the past 40 years. Accordingly, the conclusion of this paper is that after the reform and opening-up, the spatial structure of households has transitioned from sleep-oriented to multifunctional: the increase in area and the rational division of spatial functions are the main reasons for this change. In terms of family life, the prevalence of televisions has shaped an "audio-visual" life centered around the living room; the popularization of household appliances, electrification, and smart technologies

have made modern family life more convenient. In terms of interior decoration, there has been a shift from standardization before the reform and opening-up to showcasing the personalization of family life; from focusing on intricate decorativeness to emphasizing the aesthetic integrity of space.

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PERIPHERIA X COR (AGENCY OF AMBER).

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DOI: 10.63442/VSEJ1014

KEYWORDS | AGENCY OF THINGS, AUTO-ETHNOGRAPHIC DESIGN, MICRONARRATIVES, PRACTICE-BASED RESEARCH, INTERROGATORY DESIGN

ABSTRACT | Peripheria x Cor (Agency of Amber) is a research project that delves into the intricate dynamics of global structures, focusing on the historical impact of binary thinking, particularly within colonialist systems. Rooted in the concept introduced by Jane Schneider, the project distinguishes between a core of urban consumers, a periphery altered by its role as a raw material supplier, and an outer margin indirectly influenced by innovations. Exploring the post-pandemic world, the study seeks a paradigm shift away from binary perspectives. The investigation delves into the historical role of dichotomy in geographical, economic, and political structures, with a particular emphasis on the 'amber route' as a precursor to European polities. Challenging established perceptions, Peripheria x Cor adopts a post-humanistic phenomenological approach, rejecting human ontological primacy over material reality. The project engages artistic research methodologies, providing a structured and critical inquiry framework for artists to explore concepts and perspectives and foster innovation. The study focuses on amber as a foundation for interrogatory design research, aligning with the theory of material engagement, asserting the agency of inanimate objects. It argues that objects like amber possess a distinct agency, shaping human intentions, interactions, and cultural systems. Historical contexts, such as Lithuania's peripheral location on major trade routes and its evolution from Soviet occupation to colonial rule, are examined to understand the complexities of power dynamics and economic integration. As the research progresses, the project contends that the Global East occupies a unique position, being too rich to be part of the South yet too weak to be the center. The periphery, in this context, extends beyond geography to represent a space in history and culture. Addressing the colonial wound, the study emphasizes the need to consider colonial and imperial differences in global knowledge production and circulation, emphasizing the intertwining of the geopolitics of knowledge with the geopolitics of knowing. The creation of a new virtual earth serves as a symbolic space where global networks and local environments intersect, offering potential for new grounding. The study advocates for recognizing multiple virtual earths as sites for political alternatives, extra-earthly findings, and journeys into cores and cosmos.

While previous studies on amber often focus on symbolic analysis and historical contexts, Peripheria x Cor takes a unique approach by exploring the material itself and its motivations. Departing from conventional auto-ethnographic practices, the study utilizes creative production to showcase design's transformative impact on understanding the world.

The project acknowledges the challenge of conveying accumulated knowledge transparently in artistic studies, emphasizing that the artwork itself becomes a tangible representation of the research. The study aligns with postmodern critiques of traditional linear models of progress, acknowledging the importance of small narratives or micronarratives in understanding fragmented histories, especially within the context of amber material.

The narrative transcends individual experiences to describe collective culture, employing autoethnography as a method to access nuanced and specific knowledge. The significance of historical figures like Feliksas Daukantas and Hermann Brachert in shaping perceptions of amber is explored, emphasizing the need for small narratives to avoid ideologized histories.

In conclusion, Peripheria x Cor represents a multifaceted exploration of binary thinking's impact on global structures, leveraging creative production, autoethnography, and a post-humanistic phenomenological approach. The study challenges conventional perspectives on amber, advocating for a deeper understanding of material agency and its role in shaping cultural systems. Through an interdisciplinary lens, the project seeks to contribute to a broader discourse on post-pandemic shifts, colonial legacies, and the transformative potential of design research.


Research Focus: Exploring the Potential Shift from Binary Thinking in a Post-Pandemic World
Peripheria x Cor investigates the historical impact of binary thinking on global structures, particularly in colonialist systems where power dynamics were determined by relationships with the center.
Objectives:
• Analysing the influence of binary thinking on societal constructs.
• Examining the post-pandemic scenario as an opportunity for a paradigm shift.
• Investigating the historical role of dichotomy in geographical, economic, and political structures.
• Tracing the historical significance of the 'amber route' in shaping European polities and its influence on later developments.
Following a suggestion by Jane Schneider, a distinction is drawn between a core area of urban consumers, a periphery that is actively altered by its role as a supplier of raw materials to the core, and an outer margin that is indirectly affected through the spread of innovations.
The 'amber route' was an important precursor of the structures underlying the later development of European polities.


My design research project, Peripheria x Cor, challenges established perceptions about the emotional impact of specific materials by adopting a post-humanistic phenomenological approach.
I reject the notion of ontological primacy of humans over material reality, proposing instead that both are part of the same "ecology of representations."
Employing interrogational techniques in artistic research, this approach provides me with a structured and critical inquiry framework. This enables me to refine concepts, engage with diverse perspectives, facilitate dialogues, and stimulate innovation. The methodology goes beyond surface-level understanding, fostering profound and meaningful artistic expressions.

Peri-phe-ria x Cor

The current research phase centers on utilizing amber as the foundation for interrogatory design investigation.

Grounded in the theory asserting the agency of inanimate objects, this study explores the potential impact of such materials.

According to Renfrew's theory of material engagement, it is the experiences of things that make them come alive to the people engaging with them.



Renfrew uses gold as an example and claims that gold has a potent agency which is obvious because of all the trouble we go through to mine it. This means that people do not always choose to pursue ownership of things, sometimes things demand to be owned.The same could be said about amber.

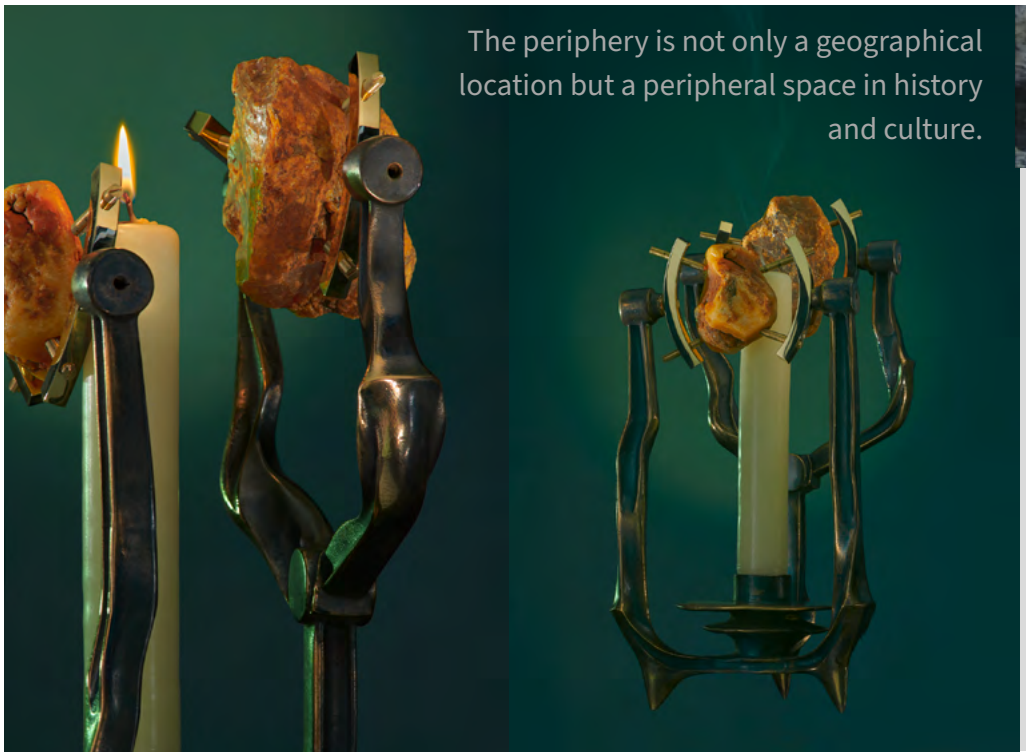


Lithuania has historically been located on the periphery of major trade routes and markets, limiting its influence and potential economic integration.



According to Epp Annus, initially, communist Russia did not seek to colonise the Baltic States but rather 'occupied' them. However, this initial period of occupation later evolved into a phase of colonial rule.

Today the Global East is too rich to be a proper part of the South, but too poor to be a part of the North. It is too powerful to be periphery, but too weak to be the centre.



The periphery is not only a geographical location but a peripheral space in history and culture.



The de-colonial path has one thing in common: the **colonial wound**, the fact that regions and people around the world have been classified as **underdeveloped** economically and mentally.

Ian Hodder posits that our perception of an object is influenced not only by its inherent qualities but also by our knowledge about it.



By recognising the agency of objects, we gain a deeper understanding of how they contribute to the shaping of human intentions, interactions, and cultural systems.



Departing from conventional auto-ethnographic practices in anthropology, my project goes beyond mere reporting. Instead, it embraces creative production to showcase how design can have a transformative impact on the world we seek to understand.

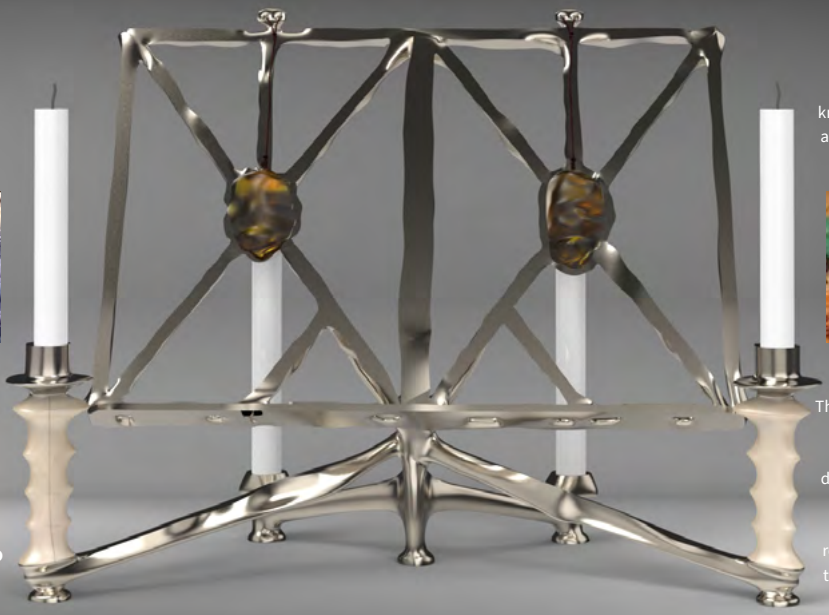
It calls for the necessity of considering colonial and imperial differences in discussing global knowledge production and circulation.

Geo-politics of knowledge goes hand in hand with geo-politics of knowing.

Cultural semiotician Yuri Lotman, who studied various cultural practices, argued in his theory of center and periphery meaning-making that it is precisely on the



periphery, i.e., at the edge of the dominant culture, where new meanings are most intensively generated, supporting (and sometimes overtaking) the relevance of the center. According to him, it is not the center, not the canon, but specifically the periphery that is the condition for cultural renewal.



The *crisis of representation* motivates researchers to recognize the limits of the knowledge claims they make about the contexts, subjects, and findings of their research.



The crisis considers the limits of *scientific* knowledge, particularly what can be discovered, understood, and explained about identities, lives, beliefs, feelings, relationships, and behaviors through the use of empirical or experimental methods;











Material kinship can illuminate the violent logics of history-making narratives.

If extraction means to draw forth by force, then something becomes 'material' or 'matter' - object not subject -through sheer will, force or domination.

Extraction is what fuels the engine of colonial-capitalism.

Through domination and oppression, colonialism named most life, land, people and waterways as 'material' or 'property' that can then be converted into capital.


New virtual earth in this map is used as the site where an interconnection lies between global networks and local environment, where potential to form new grounding exists: where power-seeping wires become a site for diffusion towards peripheries and overlooked actors.
https://peripheriaxcor.com
IG @peripheria_x_cor
IG @mantas_lesauskas
PERIPHERIA X COR
Exhibition
@
Palanga Amber Museum
Lithuania
24 05 2024 - 25 08 2024

P/REFERENCES OF DESIGN

CONTEMPORARY ART PRACTICES IN REVIVING FOLK ART / INDONESIAN - HUNGARIAN CASE STUDY.

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DOI: 10.63442/ROCI1938

KEYWORDS | DECOLONIALITY, TRAVEL DIARIES, FOLK ART, HANDCRAFT TRADITIONS, CONTEMPORARY ETHNOGRAPHY

ABSTRACT | Global tendencies in the aesthetics of art and design are led by the interests of capitalism. Globalisation expects mainstream aesthetics to be new and different, even (to use a controversial expression) we could say exotic, often borrowing motifs from local, traditional cultures. This cycle does not result in recognising and reviving certain folk arts but the opposite: positioning folk art for consumption through fast, market-based circulation. Contemporary artists, on the other hand, often face criticism when using folk art or traditional styles of handcraft techniques. The importance of local forms of knowledge represented in handcraft traditions and folk art is undeniable. However, the ways artists can use, reuse, interpret, redefine, transform, or distort such cultural heritage are unclear.

As a fine artist, I work with Indonesian wax resist batik dying. I find it a personal responsibility to question how I position myself in this highly critical Western discourse. I am committed to the revival of local folk art and believe that artists need to reconsider how we can approach folk art and what kind of relationships should and can be built with local communities. Artistic attitudes can be very different: from exploitative re-exoticising to traditionalist or sensitive. I seek to explore future-oriented artistic attitudes that are free from the colonialist narratives of West-East dynamics that continue to divide us today.

In the research methodology, I explore the questions of colonial heritage, focusing on Hungarian travelers of the 19th and 20th centuries whose ethnographic collections form a large part of the Ethnographic Museum in Budapest. Since the three travelers' personalities had different social backgrounds and personal motivations for traveling to the Dutch-East Indies, these case studies can provide an accurate picture of the semi-peripheral conditions of the period in Hungary. Intersections can be found when describing their attitude to "exotic cultures" compared with the relation to their "own" Hungarian folklore. Studying past narratives and understanding historical complexity can help shape our contemporary approaches.

My network in Indonesia allows me to explore the context of the theme among local artists whose practices involve handcraft techniques and make use of cultural references or who take up the topic of contemporary exoticness. The research touches on the issues and lessons of Documenta15, curated by an Indonesian collective, ruangrupa, in 2022. I discuss questions about the traditional authenticity in the framework of folk art, which often resists concepts of individual ownership or creativity. Folk art practices have a lot to teach us about community-based practices, sustainability, and the potential of learning slow processes, patience, and humility that offer counterpoints to the current trend of global aesthetics.

LONGING TO THE "OTHER" (?) IN THE 21TH CENTURY

Why should we talk about it?



Maori trading a crayfish with Joseph Banks, by Tupaia, 1769. © British Library

Is it a tendency?

In what kind of manner should we relate?

„Then, strip the word exoticism of its exclusively tropical, exclusively geographic meaning. Exoticism does not only exist in space, but is equally dependent on time. From there, move rapidly to the task of defining and laying out the sensation of Exoticism, which is nothing other than the notion of difference, the perception of Diversity, the knowledge that something is other than one's self; and Exoticism's power is nothing other than the ability to conceive otherwise." (Segalen, 2002, p. 18-19)

LONGING TO THE "OTHER" (?) IN THE 21TH CENTURY

Why should we talk about it?



Maori trading a crayfish with Joseph Banks, by Tupaia, 1769. © British Library

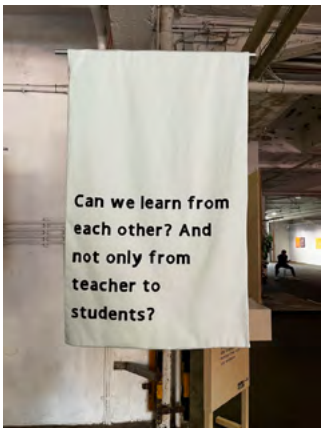
Is it a tendency?

In what kind of manner should we relate?

„Then, strip the word exoticism of its exclusively tropical, exclusively geographic meaning. Exoticism does not only exist in space, but is equally dependent on time. From there, move rapidly to the task of defining and laying out the sensation of Exoticism, which is nothing other than the notion of difference, the perception of Diversity, the knowledge that something is other than one's self; and Exoticism's power is nothing other than the ability to conceive otherwise." (Segalen, 2002, p. 18-19)

"TO FRAME THE FRAMER"

Issues and lessons
of the Documenta15



A banner of "foundationClass"collective at Documenta15, Hafenstrasse 76, Kassel.



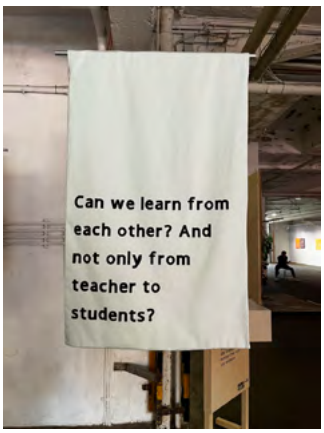
Dan Perjovschi's drawings on the front columns of Fridericianum façade, in Documenta15.

questions of
traditionality,
autheticity,
vulnerability, rural
agenda, vernacularity,
artists' responsibility,
reactions of the West

2022 Documenta15 organised by Indonesian curator-collective ruangrupa led to a long-lasting debate about what art should mean in the Western context. Ruangrupa's aim was to dismantle the fixed structure of the biennales and to rebuild a functional and appliable model for an alternative way of presenting "art" by destroying decentralising curatorial position and showing anti-art projects (Marchart, 2022). The issue of Documenta15 clearly shows how stuck is the debate of the West and the Other and how irreconcilable questions can come in front when talking about art in general.

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The way how artists can improve their ways of using, reusing, interpreting, redefining, transforming or distorting such cultural heritage are not clear. Artistic attitudes can be very different: from exploitative, re-exoticizing to traditionalist, or sensitive in artistic manner.

How can we find our identity
in artistic attitude?

personal connection:
Indonesian wax resist “batik” dying

visual and cultural coding

meaning-making

iconography


Ez nem pogánykori áldozati oltár — hanem a tihanyi camping nyílt tűzhelye, ahol a táborozók szalonnát süthetnek

recalling

atmosphere-making

“primitivist desire”

“This is not a pagan sacrificial altar — but an open fireplace at the campsite in Tihany, where campers can bake bacon.”

Page 25 from “The Balaton Herald”, 1959. The design is known from János Dianóczky.



Holy tree – installation in Project833: Floodplains, curated by Zsolt Miklósvölgyi in 2021.



reference: **kain poleng** - Balinese Hindu tradition of wrapping sacred trees where spirits reside









If I had a body – installation for the group exhibition in New Budapest Gallery entitled And Mistake These Walls for Skin curated by Flóra Gadó in 2021



reference: **jathilan/jaranan** - possessive dances in Java, Indonesia



different batik works using imagined/ fictive calligraphy, 2020-2021





Javanese alphabet and Arabic alphabet

Discoveries

Expedition

Arrival

Discoveries

Expedition

Arrival

SEARCHING FOR LOCAL CONNECTIONS

Hungary and the “Exotic”

Eastern European context

self-colonizing metaphor

microhistories



Ferenc Hopp’s collection of rarities in one of the upstairs rooms. 1900 k.
© Ferenc Hopp Museum of Asiatic Arts. Photo: Mór Erdélyi (?)

what is our heritage?

what is our agenda?

how to relate locally?

“The concept of self-colonizing can be used for cultures having succumbed to the cultural power of Europe and the west without having been invaded and turned into colonies in fact. Historical circumstances transformed them into an extracolonial “periphery,” lateral viewers who have not been directly affected either by important colonial conflicts or by the techniques of colonial rule. The same circumstances however put them in a situation where they had to recognize self-evidently foreign cultural supremacy and voluntarily absorb the basic values and categories of colonial Europe. The result might be named “hegemony without domination”.” (Kiossev, 1995)

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Archive photographs from the early 20th century, showing a collector, hunter Oscar Vojnich, and his curiosity cabinet, then Ferenc Hopp first museum space and the exhibition in established Ethnographic Museum in 1889.

Learning from past personalities' voices can help in shaping contemporary approaches. What is the relevancy of ethnographic collections today? How is it connected to our pathfinding processes?



Artefacts I visited in the archives of City Museum, Subotica, Serbia and Ferenc Hopp Asiatic Museum Budapest, in 2023

Discoveries

Expedition

Arrival

FOLK ART PRACTICES

Folk art practices in Hungary and in Indonesia contains collective and individual work, which can be used as a model. Indonesia's folk art traditions are alive, however Hungary's are preserved.



Community work
at a Fonó in Transylvania, Romania
(Népújság)



Individual work
Shepherd woodcarving. Pölöske, Hungary
(Múzeum Digitár Budapest)



Individual work
Wayang kulit maker in Yogyakarta, Indonesia
(own photograph, 2024)



Community work
Leksa Ganesha batik workshop, Yogyakarta, Indonesia
(own photograph, 2024)

What can folk art practices teach us? How can we implement them in contemporary art practices?

Contemporary artist examples in Indonesia, whose practices involve handcraft techniques, artisan work, who apply cultural references or who thematise the topic of colonial heritage.



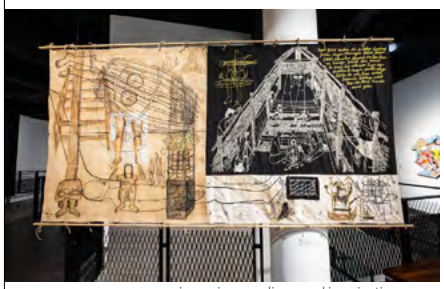
Citra Sasmita — re-creating traditional Balinese kamasan paintings into female dominated pictures



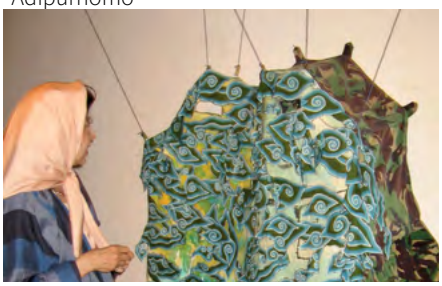
Nindityo Adipurnomo — using various mediums and imaginative narratives, conceptual crafts



Jompet Kuswidananto — Conceptual artist working with the questions of culture and identity



Ipeh Nur — using various mediums and imaginative narratives, conceptual crafts

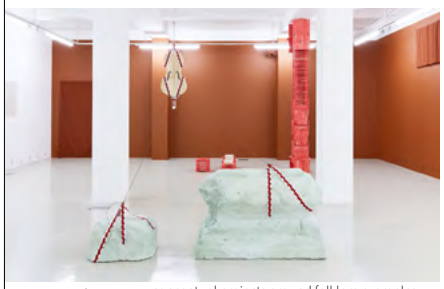


Mella Jaarsma — Dutch artist living in Java, working with traditional techniques



Gabber Modus Operandi — musical duo whose visual conept includes cultural motifs

Contemporary artist examples in Hungary, whose practices involve folklore as a theme or practice, or who thematise cultural topics as artistic-projects.



Dominika Trapp — conceptual projects around folklore examples, microhistories



Bence Pálinkás & Kitti Gosztola — a collecive working with stories from folklore mainly connected to nature



Eszter Ágnes Szabó — often working with traditional crafts and collective activities



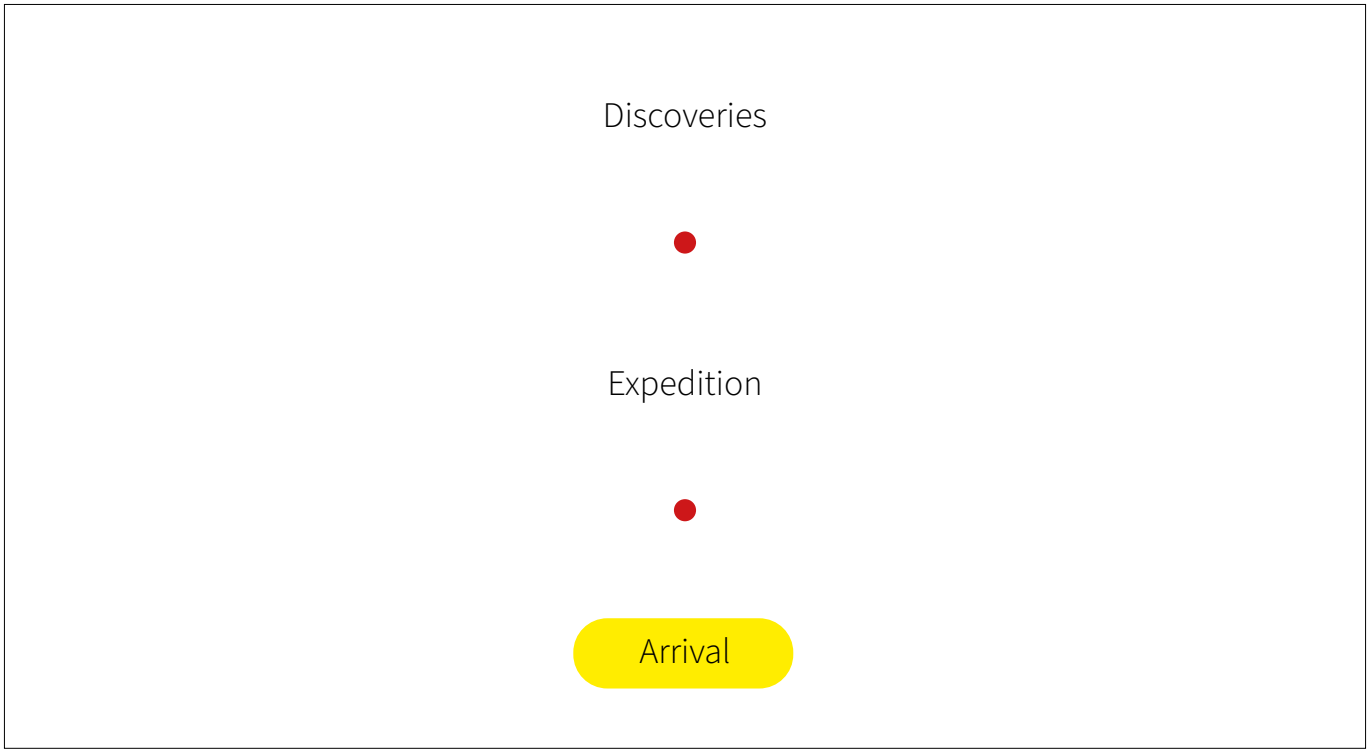
OMARA — Roma self-taught artist, often thematising her identity



Krisztián Kristóf — conceptual projects framing anthropology, human glaze



AU Workshop — architecture duo who work with rural practices in their process from Hungarian folklore


Discoveries
Expedition
Arrival


collaborative work
power shifts
cultural exchange
storytelling, sharing
local correspondences
learning-by-doing
visual coding

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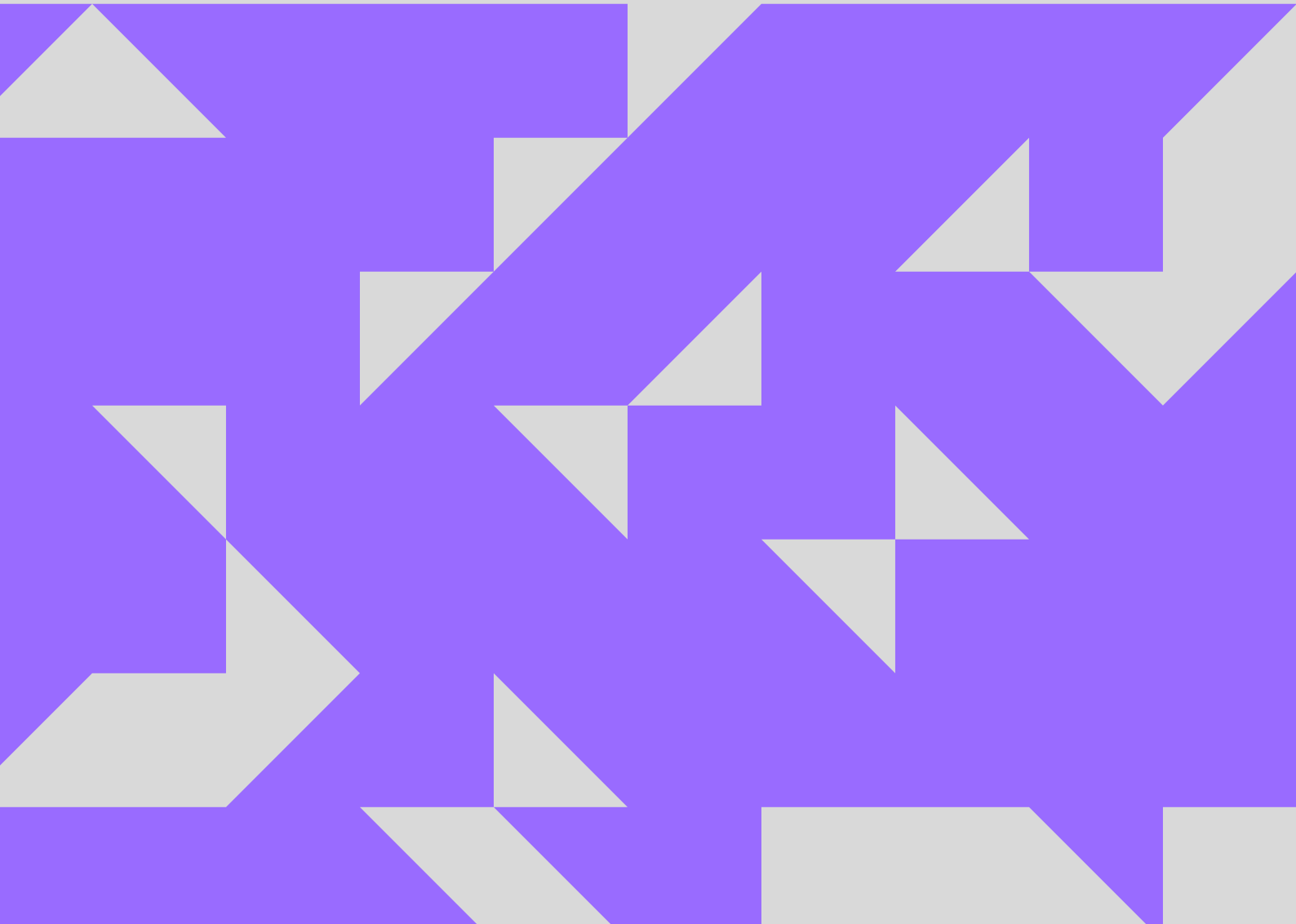
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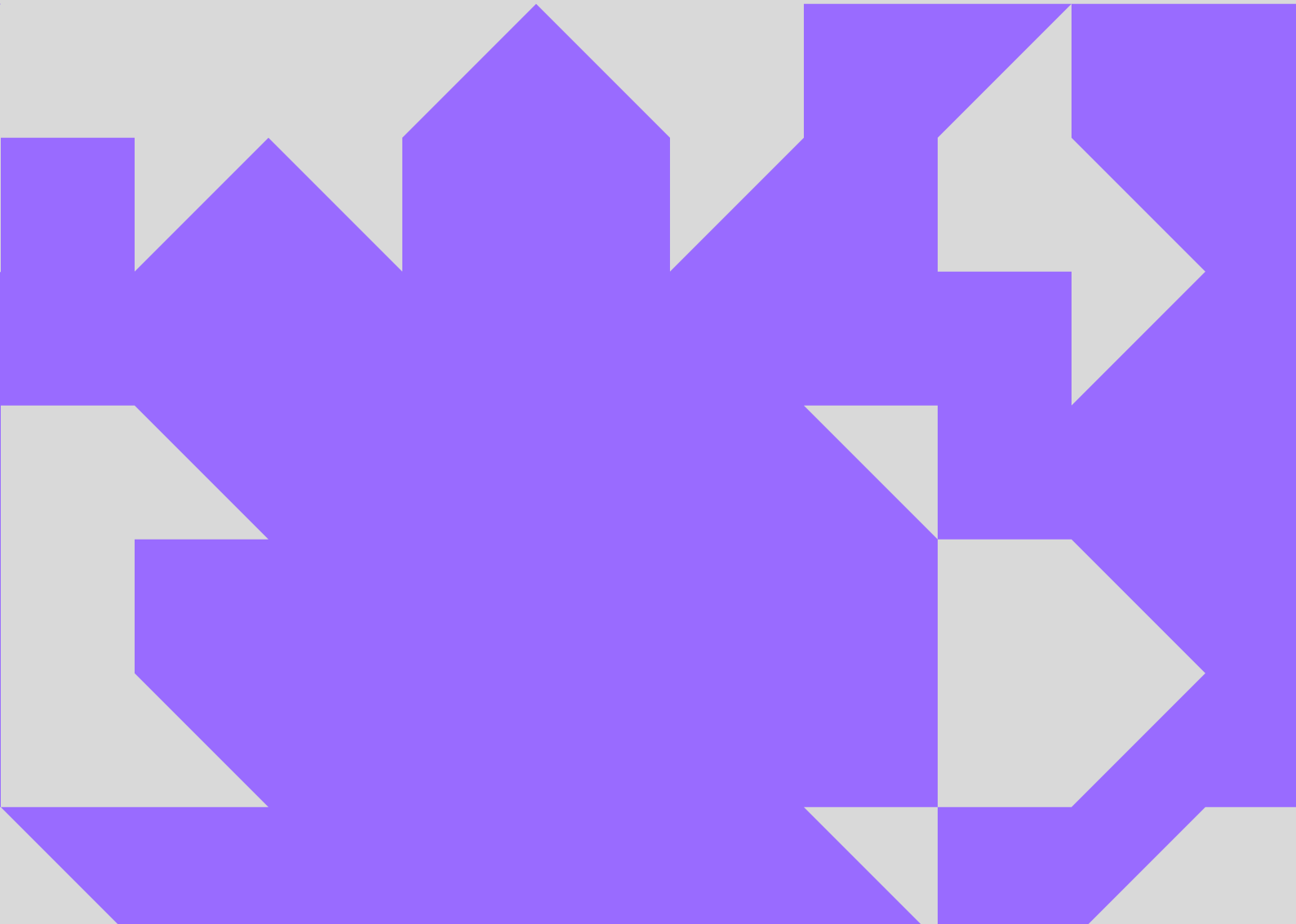
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CONVERGING BODIES OF KNOWLEDGE



P/REFERENCES OF DESIGN

CUMULUS BUDAPEST 2024



P/REFERENCES OF DESIGN

CONVERGING BODIES OF KNOWLEDGE: COMPULSION OR OPPORTUNITY?

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DOI: 10.63442/NVSZ6999

For a reminder, in our call, we wrote:
"Today, the necessity of taking joint action in the face of global challenges could not be more evident, yet the political economy is tacitly propagating and pressing for increased specialisation as a key to progress. The idea of converging bodies of knowledge cries for theoretical and practical support. The insights art and design education can provide might be instrumental here, as the conflicts underlying the separation between 'hard' and 'soft' sciences have been played out – in vitro – within their fields of expertise, between design and art. What then are the challenges and potentials of art and design education in integrating different modes of knowledge production? How can the often-opposing interests and assumptions of a variety of stakeholders be reflected through the diverging insights of design and art practitioners? How to address wicked problems, and propose new – whether feasible or utopian – ways of convergence?"

The urgency of the call stemmed on the one hand from the anxieties felt globally in the current multicrisis, and on the other, from the situation all of us – practitioners, theoreticians, researchers or educators of art and design – experience firsthand daily, since the introduction of a market-driven focus in higher education, potentially undermining the breadth and depth of creative and intellectual exploration. The neoliberal pursuit of knowledge production creates its unavoidable pressures for immediate impact and siloed approaches, however, it can also present opportunities for art and design to engage in co-creative, trans- and interdisciplinary collaborations with other domains within and outside of academia, capitalising on the holistic nature of creativity that makes art and design an ideal means of outreach and communication towards society.

Surprisingly, our track ended up competing for the highest number of abstracts for papers, workshops, slide decks and posters received, summing far over 100, from the most divergent research and educational backgrounds. This obviously created a difficult situation for the selection as most of the proposals, among which highly valuable ones, had to be declined or redirected to other tracks where they seemed to fit more properly, to remain within the limits established for the conference. In the end, three workshops, two posters, and a total of 24 paper and slide deck presentations were accepted. Considering shared themes and possible synergies, we configured the presentations into 6 sections that all went by a specific title.

Section 1. Self-reflexivity in Art and Design Education focused on the persona of the artist/designer (practitioners or students) and examined subjects spanning from agnotology, that is, the role of doubt and ignorance in education and design conversations through feminist epistemologies and the application of the concept of situatedness to the exploration of the designer's values and internal processes in critical design methodologies.

Section 2. New Disciplinary Domains and Frontiers: The three scholarly articles and a comprehensive slide presentation of this section presented bold endeavours to introduce new models, metaphors and practices in art and design education covering various areas of research, from endosymbiosis to ancestral practices and to the role of human and non-human agents, challenging the preliminaries of traditional design.

Section 3. Design Education for Children and Young Adults considered practical contributions to social innovation of design as a powerful pedagogical means of empowerment. The case studies presented in this section provided examples of how to improve early childhood development, address educational and material poverty, and facilitate therapies for children with disabilities through design methodologies, using participatory design, rapid prototyping, AI technology, or coding.

Section 4. Inside the Academia The contributions examined the curricula of a variety of HEI from specific points of view and proposed changes to conform them to the new market and societal circumstances. Besides presenting the current collaborative effort FAST UK ('Future Art School trends') by British educators, student collectives and third-sector partners, particular attention was paid to the development of the soft skills of design students under innovative concepts as Equality, Diversity and Inclusion (EDI), the Creative Thinking Style Index (CTSI) enhancing student's creative and collaborative skills, as well as the role of signature pedagogies.

Section 5. Case Studies: Practice-Based Teaching and Industrial Design discussed practices, new methodologies and models from the fields of industrial design with a perspective of potential applicability in "real life" situations. These included accounts on creativity enhancing practices for product design students, inclusive approaches to fashion design, the questions of 'material agency' in book design, as well as an innovative university mentorship and trainee program facilitating students' integration in the job market.

Section 6. Transformative Practices listed contributions with a stronger interest in introducing new pedagogical approaches, with references to the experiential turn in knowledge production and the role performative design can play in it; the transformative power of immersive storytelling design; practices directly addressing the climate crisis and the decolonial issues; as well as the case study of an international workshop where the exploration of the transformation of a specific urban milieu was at stake.

Due to their special relevance to the overall theme of the Conference, Section 1 and 2 were invited to the main Auditorium of MOME, while the others were presented in the convivial atmosphere provided by the Space Experiments Lab, facilitating more in-person discussions. We would like to thank all our contributors for their engagement, intriguing accounts and highly professional presentations, in the hope that their experience was as positive as ours as organizers and members of the audience.

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P/REFERENCES OF DESIGN

NATURA ARTIS MAGISTRA: THE ENDOSYMBIOTIC DEVELOPMENT MODEL IN THE FUTURE ART ACADEMY.

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KEYWORDS | ENDOSYMBIOTIC DESIGN, EDUCATION DEVELOPMENT, SOMAESTHETICS, CREATIVITY

ABSTRACT | This paper focuses on the transformative potential of the Endosymbiotic Development Model in the context of evolving art and design education. Against a backdrop of a rapidly changing geopolitical, technological, social, and environmental landscape (and the increasing societal awareness thereof), this text critically examines current paradigms within the author's own (art-) academic structure and substance. The urgency for art academies to align with the dynamic terrain beyond traditional boundaries prompts the exploration of educational models that bridge disciplinary gaps yet do not discard the expertise that comes with the terrain, advocating for innovative educational approaches based on smooth but radical symbiotic inclusion rather than on striated fractionality and reactionary replacement. The authors introduce a bachelor program named "Try Out," which is in development at the "ArtEZ Academy for Art and Design Zwolle," as an application of the Endosymbiotic Development Model in art education, emphasizing social engagement, creative thinking, and question-making. The curriculum prioritizes students' motivation and urgency, fostering a diverse and inclusive learning environment. The program's structure emphasizes ongoing 'exhibition performances,' minors focusing on specific issues, and real-world applications in the form of field projects or social internships, all based on the urgencies and social engagement of the students themselves.

1. Introduction

Against a backdrop of a rapidly changing geopolitical, technological, social, and environmental landscape—and the increasing societal awareness thereof—we have started to critically examine the current paradigms within our own art-academic structure and substance. Underneath this movement, a few assumptions have come to the forefront, some of which are not necessarily innovative but have been overruled by others or reduced to the status of a “paper tiger,” meaning that the basic idea is still there, yet in execution, it lacks the strength to make an impact.

One assumption is that there is an urgency for art academies to align with the dynamic terrain beyond traditional boundaries, prompting the exploration of educational models that bridge disciplinary gaps yet do not discard the expertise that comes with the terrain. Sadly, many reactions in academia to the fading boundaries of disciplines (and their historical professional hinterlands) have allowed a particular neo-liberalist agenda to enter the premises of the art school without much resistance. Many responses to the question of how to react to the excavation of vocational prerogatives have focused on filling supposed gaps rather than reframing the paradigm of education itself. We have witnessed waves of transformations in art education based on a supposed lack of theoretical components in the program, a lack of collaborative skills, a lack of social relevance, or a lack of generalist communication and presentation skills, and so on. Rather than succumbing to reactionary responses to the exigencies of the present, especially within the realm of art and design education, it is prudent to uphold certain traditional values. This does not imply an inherent value in tradition as a tool; on the contrary, change within the academic sphere is imperative to prevent a loss of relevance in ethical and political dialogues. Some traditions, which have long obscured our vision and hold no relevance to the contemporary, must inevitably fade away, including our submissive behavior vis-à-vis societal and political critique. In Holland, less than 4% of all bachelor education at this level is somehow related to the arts and design, and yet it is the segment that has been most scrutinized by political polemic and populist opinion-making. This will not cease by adapting to an agenda that is not part of our main purpose of existence. Moreover, the awareness that this world urgently needs a completely new agenda to somehow salvage what is left of it forces us to act in a far more radical and oppositional way.

A second assumption underlying all of this is the need to grapple with our ‘being in the world’ in a way that cannot be abstracted accountably. Similar to how major industries have escaped accountability for significant disruptions in our ecosystems due to intricate webs of legislation, economic priorities, and the availability of undervalued commodities, we – art and design educators ourselves – seek refuge in the proverbial ‘institutional curriculum’ to alleviate our burden of accountability. The institutional curriculum serves as shorthand for the entire complex of practicalities, legal and administrative demands, habits, automations, etc., that exert influence on us daily within the confines of the school system, resulting in the 'unavoidable average.' In other words, even when there is a specific desire for change, such as revolutionizing an educational program, accounting for all institutional values (work hours, study load, square meters, facilities, salaries, legal accreditation, company culture, etc.) leaves very few variables that can actually undergo substantial change. We colloquially refer to this as the 2% rule: irrespective of the starting point or the initiative, at most, only about 2% can be changed. Yet, the only constant is the expanding perspective of each generation, enabling a broader view of the world and thus heightening individual responsibilities. In this context, the contemporary is marked by perpetual change. The unceasing flux of today intensifies this dynamic; we possess the capacity to perceive more of the world and extend our gaze further into the future. However, the ability to see more does not necessarily equate to heightened insight. Changing the future is impossible as it has not been made yet; shaping it differently than its designated course directs requires drawing lessons from the past and opening ourselves to a radical review of all that we have been doing. This includes questioning the exchange of our individual accountability for institutional responsibility while simultaneously recognizing that some elements are unavoidable and contribute to the need for rethinking this equation. Therefore, the contrast with the old is perhaps not something new but something much older.

The third assumption forming the foundation of our development efforts is to prioritize the logic of embracing the inevitable rather than resisting its consequences. For many decades, we have witnessed a rapidly changing professional field, and yet we have been expected to produce alumni capable of operating at the forefront of these changes. Given that the 'incubation time' of major changes in curricula—apart from the constraints of the institutional curriculum—is about seven years (one year for development, one year for accreditation, one year for implementation, and four years for the first students to graduate under this altered curriculum), this seems like an impossible task. On top of this comes the inevitability of reduction: there is no sustainable agenda that can mitigate the exploitation of our biosphere based on any existing economic model of growth. Less is not only more but also crucial and inevitable. So, the question becomes one of larger contrasts: how can we deliver more with far less, in a changing world that is hard, if not impossible, to keep pace with given the constraints induced by our own systems?

To find an answer, we have started advocating innovative educational approaches based on smooth but radical symbiotic inclusion rather than on striated fractionality and reactionary replacement. To this end, we are working on the development of a bachelor program named "Try Out" at the "ArtEZ Academy for Art and Design Zwolle" which can be seen as an application of the Endosymbiotic Development Model in art education, emphasizing social engagement, creative thinking, and question-making. This program will center Joseph Beuys's credo: "Our true capital is our creativity," at the core of its curriculum and engages with the existing academic structure in an endosymbiotic way. The curriculum prioritizes students' motivation and urgency, fostering a diverse and inclusive learning environment. The program's structure emphasizes ongoing 'exhibition performances,' minors focusing on specific issues, and real-world applications in the form of field projects or social internships, all based on the urgencies and social engagement of the students themselves.

The reviews of this paper, while expressing enthusiasm and appreciation for the work presented, also noted that outlining "a concrete curricular path, as a pilot exercise, duly evaluated, could facilitate the understanding of this new training proposal". We fully acknowledge this suggestion; however, as of the time of writing, this development is still very much in progress. Our goal is to launch the new program in September 2025 for students, and the content presented here represents the foundational elements from which we will build a coherent holistic system. Your feedback is invaluable to us, and therefore we invite you to be a part of this journey. In the next paragraphs, we will conceptualize the workings of endosymbiotics, forefront somaesthetics as a baseline for an unmediated and non-abstractable way of relating to the world, and finally, present our first draft of a curriculum that aspires to address our concerns, by exceeding disciplines and replace paradigms.

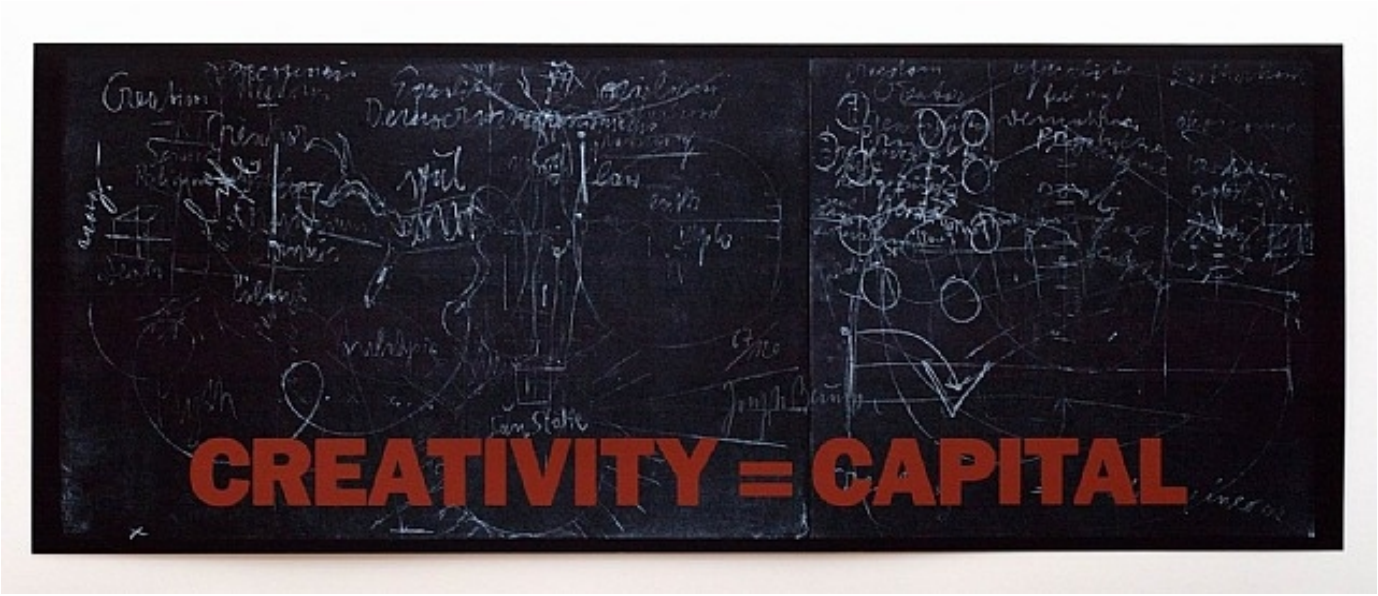


Figure 1. Joseph Beuys, New York Subway Poster "Creativity = Capital" (1983), Lithograph, edition of 120. This image of the work is used here under the fair use policy as stated in Section 107 of the U.S. Copyright Act of 1976 for academic purposes.

2. Endosymbiotics

2.1 In Biology

The Endosymbiotic Development Model is a scientific hypothesis derived from biology, proposing an evolutionary mechanism for the origin of eukaryotic cells. Eukaryotic cells, characterized by a nucleus as a central control center containing genetic material, possess various organelles such as the endoplasmic reticulum and mitochondria, each with specific roles. Surrounded by a membrane that regulates the passage of substances, these cells are present in plants, animals, fungi, and other complex organisms, distinguishing them from simpler prokaryotic cells. An endosymbiont, or endobiont, refers to an organism that resides within the body or cells of another organism, often in a mutually beneficial relationship known as endosymbiosis. The term is derived from the Greek words meaning “within,” “together,” and “living”. Examples include bacteria aiding plants (like legumes) in obtaining nitrogen, single-cell algae living in corals, and bacteria providing essential nutrients to insects. The concept of endosymbiosis is articulated in the endosymbiotic theory, chiefly developed by Neo-Darwinist biologist Lynn Margulis. This theory suggests that certain bacteria began living inside other organisms after being engulfed by them. According to the Endosymbiotic Development Model, ancestral eukaryotic cells emerged through the engulfment and subsequent integration of free-living bacteria by a host archaeal or bacterial cell. This integration is believed to have established a mutually beneficial relationship between the host cell and the engulfed bacteria, leading to the formation of organelles within the eukaryotic cell, such as mitochondria for energy generation and chloroplasts for photosynthesis.

We find inspiration in this model, as it effectively describes several key elements that we are incorporating into our curriculum development and the development of our new academy building. It is crucial for us to view this model in its most abstract form yet retaining its literal concept. Abstract, because we are applying it outside its original context and transposing it to another domain, and literal because we are extrapolating several elements that function similarly in our educational development. Similar to the visual metaphor employed by evolutionary biologist and philosopher Conrad Waddington to depict his view on epigenetics, we use endosymbiosis as the metaphorical embodiment of our development. Waddington posited that the outcome of (evolutionary) *becoming* is not the product of logical necessity but contingently obligatory, which refers to something that is not necessarily predetermined or logically necessary but becomes obligatory or necessary based on certain circumstances or conditions. It implies that an outcome or requirement is not inherently dictated by a fixed rule or necessity but is instead contingent on specific factors or situations. This concept acknowledges the role of chance, context, and the dynamic nature of biological processes in shaping outcomes. This allows for the existence of 'multiple optima,' signifying the possibility of different yet equally important outcomes. Moreover, any outcome can only be established after its formation, never as a result of a predefined procedure.

Waddington's metaphorical landscape, termed the ‘epigenetic landscape’, illustrates how evolution progresses and ‘takes turns’. It portrays marbles rolling down a hill, each representing a mutation in time, competing for grooves on the slope, and eventually settling at the lowest point. The marbles denote the options available in the progress of evolution, with their competition affecting the distribution and the landscape itself. Waddington used the term “creode” to describe the pathway of the marbles, embodying the 'contingently obligatory' argument. In a manner as abstract *and* literal as Waddington's, we apply the major premises of the endosymbiotic model as well as the contingently obligatory argument to the foundation of our future art school.

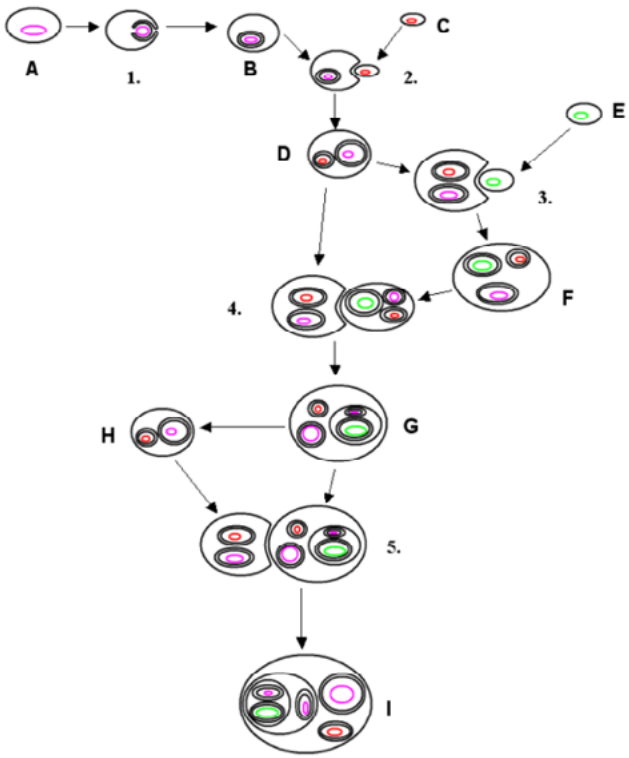


Figure 2. Endosymbiosis graph, Image source Wikipedia, permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License.

2.2 As Basis of Our Development

The Endosymbiotic Development Model is proposed here as a transformative approach in the context of evolving art and design education. It envisions a symbiotic relationship between diverse artistic disciplines, fostering collaboration, interconnected learning, and a holistic understanding of the broader societal potential of arts education. Challenging dualities such as 'specialization versus generalization' and 'theory versus practice', the model encourages a multidisciplinary learning environment where students from diverse backgrounds collaborate, disconnecting the building of creativity from artistic development per se.

The main 'learning' that we draw from this model has three components. Firstly, the model doesn't propose a complete renewal as a characteristic element in development. Rather, the developing structure absorbs other bodies for the mutual benefit of both elements. This gives right and tribute to the existing, as opposed to an idea of demolition and starting from scratch. Secondly, the absorbed entity retains a certain level of sovereignty; it is only assimilated to the extent that it becomes part of a larger system, with the added benefit of protection by the bigger body. Its functions are kept operational, as they are the main reason for the collaboration to begin with. Thirdly, it demonstrates the conditionality of use and perception. Many endobionts are classified as bacteria, which can do great good or harm to others, depending on the conditions (contingently obligatory). Yet when encapsulated, symbiosis regulates these effects and produces only positive qualities. In fact, the qualities of the endobiont can start to steer and determine the functioning of the entire cell. The consequent engulfment of new elements builds a holistic outlook on the concept of development itself; it fosters and shelters older developments and insights without being rigid or dogmatic.

A holistic approach as a pedagogical concept is not a new idea. A well-known example is the Humboldtian model, named after philosopher and linguist Wilhelm von Humboldt, which advocates for an education

system that fosters individuality, critical thinking, and the integration of research and teaching. It emphasizes the idea that education should not only impart knowledge and skills but also cultivate students' intellectual and moral character. The model promotes the notion that education should encourage students to become autonomous thinkers and lifelong learners rather than mere recipients of information. In a Humboldtian education system, there is an emphasis on academic freedom, the unity of research and teaching, and the belief that education should contribute to the development of well-rounded individuals capable of meaningfully contributing to society. It centers around the German term “Bildung” (Von Humboldt, 1794), encompassing the concept of self-cultivation, education, and personal development. Bildung is a complex and multifaceted idea that goes beyond the mere acquisition of knowledge and skills, akin to what any good school system should aspire to be. It is often associated with the holistic development of an individual's intellectual, moral, and aesthetic capacities. The term implies a lifelong process of self-formation and self-realization, emphasizing not only cognitive aspects but also personal growth and ethical considerations.

While valuable, we acknowledge that “Bildung” as a verb can act as “condescending and demanding,” as pointed out by Varkøy (2015, p.20). It favors a particular outlook rooted in the Humanistic paradigm, prompting us to question its validity in times that necessitate decentralizing the human in favor of sustainable placement in an ecology that includes the rights and urgencies of all things, not just human. Furthermore, its major premise underlines the necessity of contributing to society, at a time when there is growing unrest about what this society has produced in areas such as equity, inclusion, social injustice, imperialism, environmental and human exploitation, and more. For us, fitting into society is not enough; we need to change it. Hence, we have been exploring radically different ways of thinking about education. We feel the need to challenge the 2% rule and still build on the strengths of what we have. Instead of assimilating different entities into one (purposely constructed and monitored) holistic learning environment, the Endosymbiotic Development Model ensures the sovereignty of its participants in an environment that reciprocally depends on those very autonomies, again a contingently obligatory relationship. For us, this is an intriguing definition of inclusion. The engulfed becomes the *engulfer*, forming new alliances time and time again that are always to the mutual benefit of all involved.

3. Curriculum

3.1 Structure

Our overarching objective is the individual development and cultivation of the capacity for creativity, emphasizing its unrestrained and freely applicable nature as a key competency. The topic of their learning program will be based on the urgencies that students (V/X/M) themselves bring to the table. Therefore, a subsidiary aim is to equip students for sustainable income opportunities within the dynamic realm of supply and demand for creativity and imagination by addressing issues they care about. The program's structure is built on three major focal points.

Firstly, direct participation through individual thematic minors and the “free” selection of domains, meaning that from the first day, students will work on real projects and with real concerns rather than engaging in “sandboxed learning”. Secondly, students will produce a permanent output through the exhibition performance and the field projects, ensuring that their messages will be heard from the beginning and will only increase in strength throughout the years. Thirdly, diversification by stepping away from the traditional entrance exam. The program's structure is designed to attract students with diverse backgrounds. Many potential students have a gift for creation, but not all have had the opportunity to develop specific proficiencies in the arts. Therefore, in contrast to the typical entrance exam, candidates undergo an interview where their motivation and urgency take center stage, rather than an assessment of previous work or proof of artistic talent. These three structural pillars of the program will help shorten the time of addressing the urgencies considerably compared to more traditional structures.

The first year of the program revolves around a continuous “exhibition performance”, allowing students to choose a curriculum based on their passion and expressive abilities, spanning various disciplines from theater and music to graphic design and philosophy, and everything in between. Consistently working on their “exhibition performance” throughout the first year helps clarify which creative processes students need for further development. The classes are organized in several domains from which a selection can be made (more about the domains in the next section). In the second year, students choose so-called “minors,” engaging in intensive individual and collective work on specific issues. This promotes their collective problem-solving skills and individual capacity to ask questions. By the end of the second year, students have reached a conscious level of competence (according to Maslow's model), not primarily based on the use of specific media but rather on their creativity, analytical abilities, and reflective skills.

In the third year, students can apply these skills in their own “field project” or in a societal “internship” that aligns with their personal urgency and theme. Here, the focus shifts outward: the first two years are dedicated to self-development, while the last two years emphasize application and self-realization. This structure resembles the shape of a “diabolo,” setting itself apart from other art programs by not focusing on refining artistic skills but rather on broad societal engagement. During the final year, students create an intervention and regenerate their “exhibition performance” from the first year, this time incorporating all the experiences and knowledge gained during their studies as part of their graduation exam. This includes the applicability of what they have learned in the context of their societal engagement.

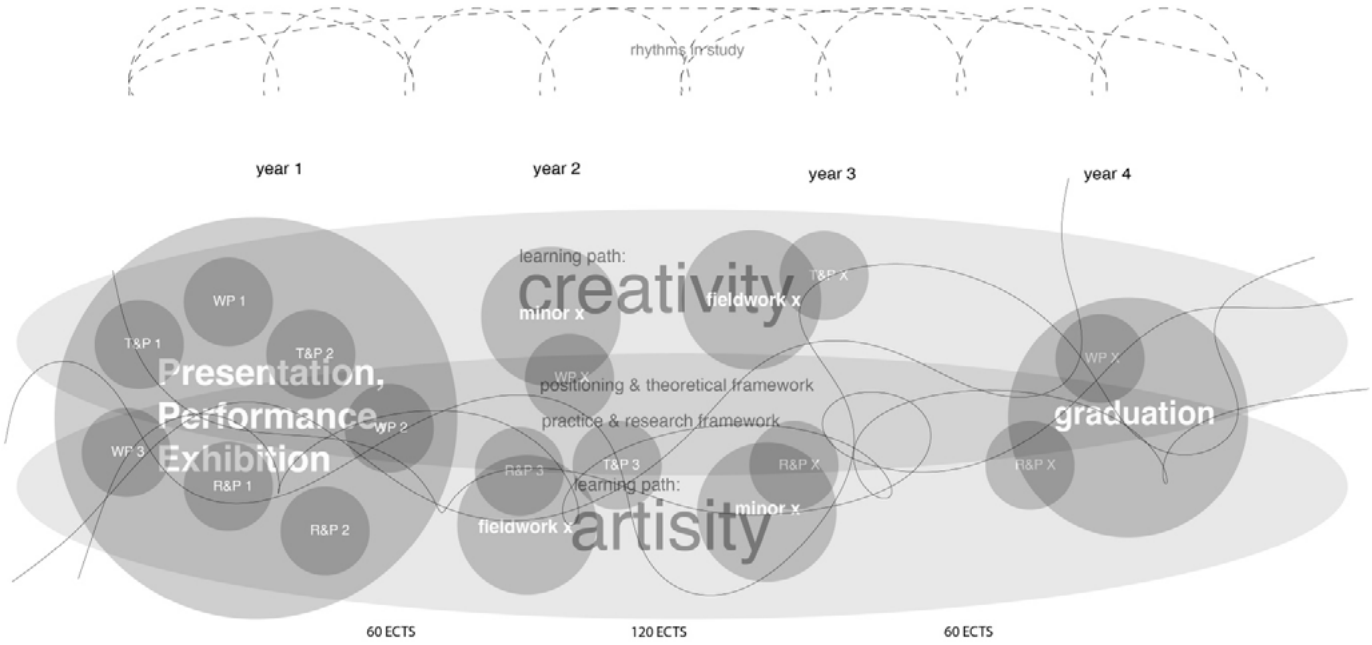


Figure 3. Organizational graph of the bachelor program “Try Out”.

3.2 Content Try Out

The development of the program was initially started by a team consisting of several heads of other departments, the director, and program manager of the “ArtEZ Academy for Art and Design” in Zwolle, The Netherlands. However, to ensure that we would not overlook any aspects (including our own perception biases), we implemented a structured development process with several phases or “Tiers”. Each Tier involves meetings with different groups of people, serving as temporary critics and advisors, ranging from external experts to students and everyone in between. After every session, the plan was elevated to a new level, a higher Tier, implying that the meetings were not inconsequential: every Tier has shaped the plan, incorporating and/or depending on the input provided by the participants.

The “Try Out” program is designed for students who want to express their commitment to social issues through creative thinking and practices. Throughout this program, students acquire valuable skills and insights that enable them to utilize their creative and artistic talents to contribute to addressing social inequality and complex problems in our society. They achieve this by continually developing their creative abilities and employing the creative production processes characteristic of art academies as methods to solve problems. The outcomes of their efforts are guided by the passion that both requires and inspires engagement. The program is committed to addressing the poly-crisis, which is producing pressing societal issues, such as the climate crisis, socioeconomic injustice, and the energy transition stagnation. Notably, our emphasis is on navigating transitions from profession to role, industry to movement, task to goal, ambition to urgency, method to serendipity, and identity to option. In pursuit of these goals, the department presents itself as a collective with an inquisitive spirit, eschewing a rigidly defined identity. It explicitly positions itself as inclusive, postcolonial, and pro-collectivist, evident even in its admission criteria.

At the start of this process, the fundamental question was whether we can continue to fulfill our mission within these premises by departing from media typologies and thinking in terms of disciplines. Even more important perhaps is the question of whether, in response, we should modify our existing departments to the point of diluting their character. We choose not to because we know that all our departments offer a high degree of specialization and high-quality, sought-after profiles that are crucial to the professional field. And still, there is a need for another. Thwartwise thinking is a valuable, unbounded competence that holds significant value across various market domains. By embracing these skills, this department distinguishes itself from others, partially entering a field predominantly served by non-art universities. The protective nature of art academies has allowed the emergence of a variety of programs in other types of universities and colleges operating under the banner of “creation,” even though the development of such competence is (or should be) a main prerogative of our sector.

Apart from the permanent “exhibition performance,” first-year students elect two of eight domains per semester to work in: ambiguity, scenario, dialogue, image, sound, craftsmanship, cartography, movement, and public space, all in the service of their function to address the specific urgency the student wants to tackle. Each domain has a designated ‘domain keeper’ who oversees providing a variety of learning prospects within their specific domain. In each domain there will be a variety of disciplines involved, coming for art, design, dance, music, and theater, which makes this program unique in its kind. By shifting to the level of domains, rather than disciplines, we render the discussion of inter, cross, or trans disciplinarity useless, as this is not adding anything to the development of the department. We actively promote a clear and integral combination of theory and praxis, a proper balance between conveyance and participation, and an unmediated learning environment, yet in terms of form, didactics and activities all is possible.

3.3 Somaesthetics

The new bachelor program will introduce several innovations, revisit older concepts, and incorporate foundational principles. One driving factor behind these choices stems from the observation that most prospective students have experienced a lifelong interconnectedness through the internet, particularly through the use of smartphones, significantly shaping their worldview. The continuous exposure to a stream of global issues can lead to information overload and, in some instances, desensitization. Students may find themselves overwhelmed by the volume and scale of problems portrayed in the media. Many “world problems” may seem insurmountable, potentially leading to a sense of helplessness or apathy. The resolution of the problem (how to stop climate change for instance), does not match the resolution of the student (I can take care of my plant) which leads to a level of abstraction that can be both paralyzing and useless. Additionally, media outlets may carry biases, influencing individual (and group) perception as they select and frame stories, thereby shaping the public's understanding of what constitutes a “world problem”. Without the ability to form a direct and unmediated opinion on the nature of the problem or its impact, one's thinking might shift to realms that are out of reach or non-sensible—for example, advocating to fix the rainforest while continuing to consume meat. To bridge this gap between feeling responsible for

certain world problems and the inability to address their sheer magnitude, an effective instrument involves scaling down the problem to the level of *direct* perception. Associating aesthetics with immediate perception requires finding a middle ground, specifically acknowledging the excluded middle – the inherent agency of the event itself, rather than the combined agency of interacting forces or any mediated extension thereof (Boumeester, 2022). This approach involves surpassing the individual level without reducing individuals to mere components of a group. The process encompasses a highly intertwined theoretical, analytical, and pragmatic aspect. We can only detect what is needed if we recognize the need to detect it, yet we cannot understand what is needed until we detect it. This necessitates engaging the entire spectrum of our bodily senses in the appreciation of our 'milieu.' Philosopher Richard Shusterman proposed somaesthetics as:

> "[T]he critical, meliorative study of the experience and the use of one's body as a locus of sensory-aesthetic appreciation (aisthesis) and creative self-fashioning [...], devoted [also] to the knowledge, discourses and disciplines that structure such somatic care or can improve it." (Shusterman, 2004, p.267)

This model expands the boundaries of "our reflective awareness and assessment of our own sensory appreciation" (Shusterman, 2004, p.268), also known as 'experimental somaesthetics', by extending the body to the level of a symbiotic whole. Sensory organs play a crucial role in sensing and converting stimuli, contributing to various human sensory systems such as vision, audition (hearing), tactition (touch), olfaction (smell), and gustation (taste). Interoception (internal sensations) involves detecting stimuli from internal organs and tissues, including systems like the vestibular system (balance and spatial awareness), proprioception (perception of position, movement, and orientation of the body parts in space), and nociception (perception of stimuli in the form of pain). Humans also experience internal chemoreception (perception of chemical changes) and osmoreception (perception of osmosis change) based sensory systems, influencing perceptions like hunger, thirst, suffocation, and nausea.

One goal of working with this approach is to (re)develop a sort of sense for one's own relation to the extended milieu, a type of "socioception" if you like, that registers and evaluates both the literal and metaphorical proximity and capacity of the mind/body and the socius/world. Essential to comprehending this approach is the perpetual preparedness to engage with any situation, whether actualized or virtual, *within its context*, including the context of one's own ability to engage. This involves approaching each scenario by considering its interrelations with others (its exteriority), rather than solely emphasizing its finite attributes. It fosters a continuous awareness of the assemblage in which one participates, explicitly acknowledging the role of the 'observer.' This entire constellation goes under the name intensive thinking and encompasses a broad spectrum of sensory information, facilitating heightened somaesthetic awareness (Boumeester, 2024).

Given that experiences reach us through various sensory channels, including those that are non-actualized, this comprehensive perspective is integral. This serves not only as a catalyst for innovative approaches in artistic and design processes but also as a potentially 'sterile' exercise where a tangible outcome is neither pursued nor essential. As all bodies behave distinctively in various assemblages, and these assemblages are in perpetual flux, the constancy of a body's capacity to interact with others yields varied effects contingent upon the specific assemblage. We posit that a genuine understanding of even the most elementary bodies necessitates an understanding of the entire universe.

Mastering the finer workings of somaesthetics can be achieved through exercises, while intensive thinking demands a theoretical and philosophical context to be efficacious. The designation of intensive thinking as a 'method' is inappropriate due to its inherent logic: every process constitutes a unique assemblage. Consequently, any observed linearity and causality in previous assemblages may or may not recur. Hence, we prefer to characterize it as a heuristic instrument rather than a method. The interconnected networks of capacities, actualizations, and flows link bodies across different strata and locations (non-local causality), and their precise mechanisms and effects remain inherently unpredictable (heuristics).

Despite its intricate meaning and background, the implementation of this concept in a classroom setting is straightforward. One example is of this is the “six-minute workshop”. The initial requirement is a reasonably sized space that accommodates all participants comfortably. Additionally, participants need some paper and a pencil for notetaking. In this environment, the exploration begins with an intensive approach, utilizing the “six-minute workshop” as a starting point. This involves physically investigating the site, focusing on one sense at a time for one minute each. Observations are recorded on paper and collectively discussed afterwards. The sixth sense is also explored literally, justifying the workshop's title. Though actions like literally licking, touching, and smelling the public space may attract attention, the valuable information gathered outweighs potential embarrassment.

Soma-aesthetic perception often yields entirely different insights than anticipated, proving crucial in subsequent design processes. Assumptions can subconsciously pre-format a solution, whereas affective empirical data raises different questions. This unique perception serves as a purification of general perception, unaffected by overflow and (mis)interpretation through sensory replacement. This refers to the tendency to extrapolate information gained from one sense to be universally valid for all senses. For instance, if something looks disgusting, there is an automatic assumption that it also smells or tastes unpleasant. The experience generates numerous new insights, importantly challenging existing assumptions held by both participants and tutors. The initial impressions based on soma-aesthetic cartography become the focal point of discussions.

4. Conclusion

The exploration into the Endosymbiotic Development Model has been a catalyst for transformative changes in the thinking about our education development, navigating through the complex terrain of redefining art education in response to the dynamic challenges posed by the contemporary world. By critically examining (our) existing paradigms and advocating for a departure from reactionary responses, we have proposed the Endosymbiotic Development Model as an innovative approach. Inspired by biological concepts, we envision a symbiotic relationship between diverse artistic disciplines, emphasizing collaboration, interconnected learning, and a holistic understanding of societal potential.

The “Try Out” program, born out of this model, prioritizes individual creativity, addresses urgent social issues, and fosters a diverse and inclusive learning environment. The incorporation of somaesthetics, emphasizing sensory appreciation and engagement with the environment, adds a unique dimension to the program, as it scales down global issues to the level of direct perception, the program aims to bridge the gap between responsibility and the seemingly overwhelming challenges of the world. Somaesthetics, as a key instrument in our pedagogical toolbox, will play a vital role in maintaining a connection to the self, amidst the complexities of the educational and worldly environment. This approach, characterized by continuous preparedness to engage with any situation, will enrich the understanding of the interplay between the mind/body and the socius/world as a powerful tool for students to engage with their urgencies in a way that is helpful and doable.

Drawing inspiration from the biological concepts of endosymbiosis and epigenetics, we have embarked on the journey of building a new curriculum that prioritizes the individual development of students while fostering a symbiotic relationship between diverse artistic disciplines, ensuring a mutual benefit for both the established and the innovative. This approach rejects the notion of complete renewal in favor of a continuous evolution that honors the sovereignty of each participant while contributing to a larger, interconnected system. The rejection of traditional entrance exams, inclusion of diverse domains, and a holistic approach to education challenge existing paradigms. The emphasis on creativity, urgency, societal engagement distinguishes the shift from discipline to domain, and the involvement of all arts (fine art, design, music and dance) in the formation of its content makes this program unique in its type. And we are happy to share our insights with you and expand our interconnectedness.

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P/REFERENCES OF DESIGN

THE MUSEUM AND ME: CO-DESIGNING A RESOURCE WITH FAMILIES TO ENHANCE PARENT CHILD INTERACTIONS THAT SUPPORT EARLY YEARS DEVELOPMENT GOALS.

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KEYWORDS | EARLY CHILDHOOD DEVELOPMENT, MUSEUM LEARNING, DESIGN FOR PLAY, CO-DESIGN, RAPID PROTOTYPING, PHYSICAL TOOL

ABSTRACT | The objective of this project is to explore ways in which playful museum interventions can enhance and increase parent-child interactions to support early years development goals, including language/communication and self-regulation. This pilot study has been based out of The Fitzwilliam Museum, University of Cambridge in the United Kingdom during August and September 2023. The approach used is a participatory design methodology with an emphasis on co-design sessions and semi-structured interviews involving users and stakeholders. The target group of this investigation focuses on children between 0-5 years and their primary family members living in Cambridge City. This investigation consists of (1) co-design of a museum resource through active engagement and creative development with children and their families (2) design and execution of a physical multi-component toolkit through rapid prototyping using the Museum's existing resources and distribution channels to achieve the social impact pilot study objective. This investigation focuses on the creation of a physical prototype as opposed to a digital one based on initial conversations with parents about use, accessibility, preferences, and interest. Thus, it serves as a blueprint for how design research methods can be applied to fields of early childhood development and museum learning, exploring new multidisciplinary domains while integrating different modes of knowledge production.

1. Introduction and Literature Review

Family Museum Visits and Spatial Ethnography

Research shows that families are crucial stakeholders by means of which museums carry out their general missions along with generating sustainable income (Louisa Hood et al., 2021). Moreover, as per the UN Convention on the Rights of the Child, museums play a central role in their ability to support and encourage children to participate in cultural life (Wallis & Noble, 2022). A museum thus becomes a place beyond historical knowledge and starts to encapsulate active sensory, aesthetic and cognitive experiences in extraordinary surroundings (Wallis & Noble, 2022). To understand the nature of participation that the parent-child stakeholder can experience, it becomes imperative to conduct research studies that actively involves participation in generating data.

Designing for a Sense of Ownership and Belonging

Participatory design can be defined as an approach to support mutual learning through equitable partnerships of communities and experts through the design of an intervention (Cumbo & Selwyn, 2022). By actively involving all stakeholders in the design process, this approach aims to generate a result that meets stakeholder needs and is usable. The process of co-design, although in the same realm, takes this approach a step forward and deepens the level of engagement, input and decision-making power that stakeholders wield in the designed outcomes (Ashley, 2022). This project uses a co-design methodology carried out in the form of various creative activities and semi-structured interviews, placing the users at the centre of the opportunity space.

Incorporating Ways of Seeing and a Child's Perspective

Duncan and Wallach 1980; Sftinteş 2012 relied on the concept of liminality which looks at the interplay between people and the built environment in museum research (Louisa Hood et al., 2021). Inspired by the use-case of liminality in family life (Louisa Hood et al., 2021) and as researched by Isabelle, Dominique, and Statia (2019), this project references the magic of *nesting, investigating and stamping* through guided playful museum interactions. *The Museum and Me* is therefore a case study of the production of socially charged, contextually relevant and culturally sensitive physical tools aimed to materialise the intangibles of early childhood development.

The Significance of a Co-Design Approach in Early Years Pedagogical Development

Design thinking in a pedagogical context is viewed as a central pillar to promoting competencies such as social creativity, collaboration, and critical thinking while enhancing student-centred solutions (Aksela, 2019). A co-design approach in educational practice is known to design *with* students, not *for* them (Corio & Mengis, 2020) by viewing them as active participants who have the right to feel empowered in decisions regarding their own way of life. In recent years, using age-appropriate co-design methods to support children's participation has become one of the main focuses of early years pedagogy, challenging traditional cultures to rethink practices as to take children's agency into account (Brinck et al., 2022). These roles are dependent on the application of co-design and offer many roles to children such as those of co-designers, co-researchers, co-authors, informants, and testers (Brinck et al., 2022). For the purpose of this research study, the participating children have played the role of *co-researchers* in the *discover and develop phases* of the methodological approach.

2. Approach and Methodology

This research investigation has been generously supported through funding provided by Nesta, UK's innovation agency for social good and Art Fund, a UK national art charity. The research questions were co-created with museum researchers and the funding partners to be as follows:

1. What archetypal personas manifest among children aged 0-5 years during their engagement with museum environments alongside their primary caregivers, taking into account their developmental milestones and linguistic competencies?
2. Which sensory modalities predominate in children's exploration of their surroundings, and what attributes of museum spaces (including scale, proportion, materiality, color, and texture) resonate most profoundly with them?
3. Who are the principal stakeholders entrusted with guiding children through the museum experience, and what foundational competencies must be cultivated to foster their agency, autonomy, and penchant for play?
4. How can a multifaceted physical toolkit be conceived to stimulate playful interactions within the museum, informed by insights garnered from the preceding inquiries?

These research inquiries were further refined and operationalized into two distinct studies denoted as Study A and Study B, as delineated in subsequent sections. In alignment with the project's ethos of participatory engagement and innovative inquiry, the funders expressed a vested interest in promoting an approach steeped in participatory methodologies and innovation-centric paradigms. Thus, the project adopted the Double Diamond Approach (Figure 1), as elucidated by the UK Design Council, which systematically guided the project through divergent and convergent phases, underpinned by pertinent theoretical frameworks encompassing museum curatorship, pedagogical strategies for early childhood development, and principles of playful design. This methodological choice was predicated on its facilitation of exploratory and innovative exploration relevance to the project's overarching objectives.

The research and physical kit have been created in close collaboration with experts from early years education and museum learning through a process of co-design sessions and semi-structured interviews with users and stakeholders. These co-design sessions, integral to the project's iterative design process, were meticulously orchestrated over the course of a month, punctuated by visits to the museum at strategic junctures, spanning the phases of discovery, definition, development, and delivery. Employing a mixed-methods approach, the research amalgamated quantitative and qualitative data gleaned from co-design sessions and semi-structured interviews. Qualitative data, elicited through observations and insights recorded via camera and written documentation, were subjected to a nuanced adaptation of Braun and Clarke's Thematic Analysis, affording a comprehensive synthesis of emergent themes. It is imperative to note that all research activities and documentation were conducted in the English language, ensuring coherence and comprehensibility across all stages of the inquiry.

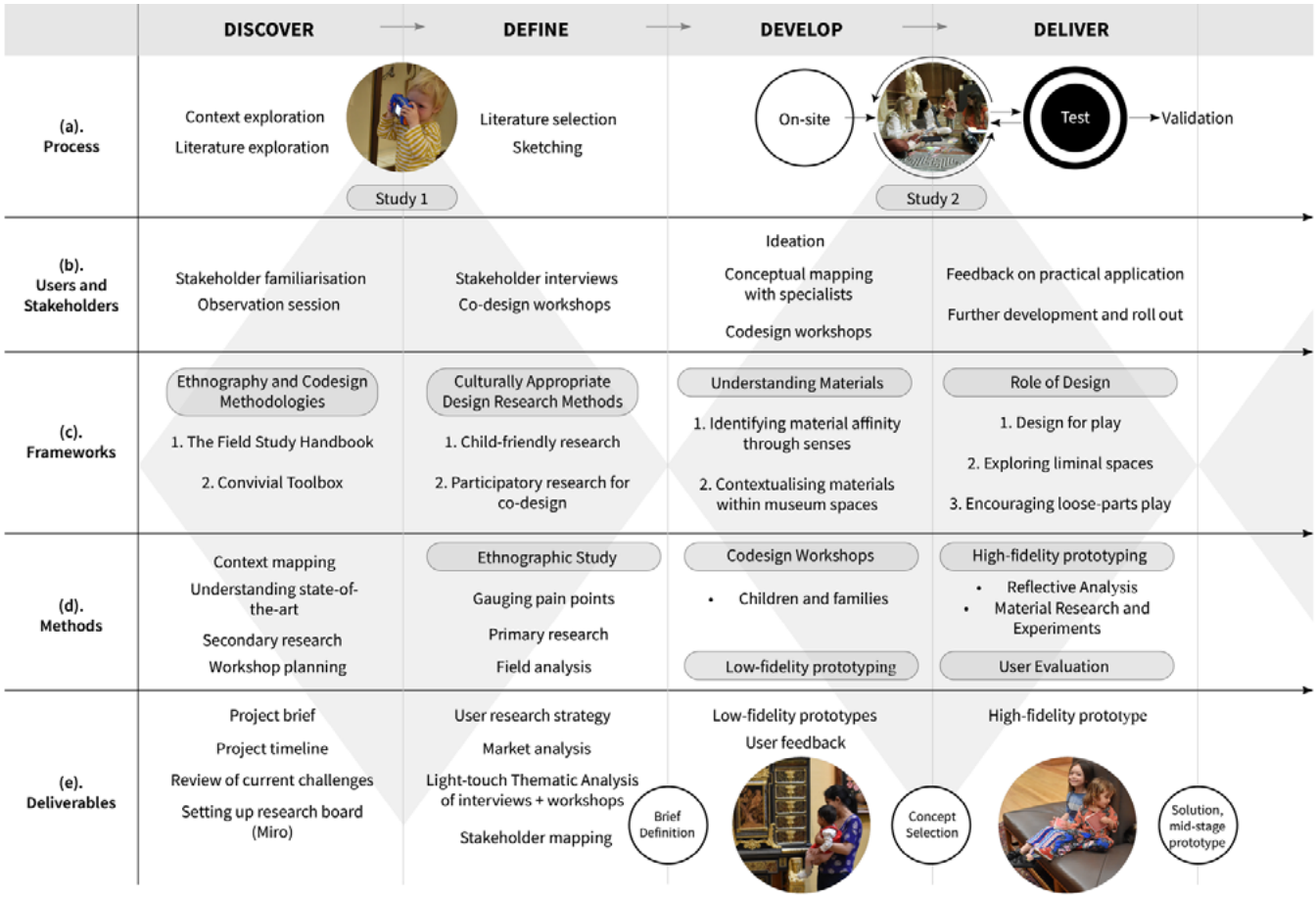


Figure 1. Methodology based on the Double Diamond Approach (full version in Appendix).

3. Study A: Co-design with Families

3.1 Aim

1. To understand the child's persona/s as identified by their parents.
2. To identify the primary sense that the child uses to explore the environment.
3. To understand the child's favourite object/area/destination in the museum to get a sense of the kind of spaces children have an affinity for.
4. To decipher a family's museum experience through parent-child interactions to identify the peak of both the most challenging and most rewarding experiences.

3.2 Study Protocol and Participants

All co-design sessions took place in the galleries of The Fitzwilliam Museum. Participants (N=10 families) were asked to choose an area/gallery they wanted to conduct the co-design activities in. Each session lasted for approximately 45 minutes, depending on the level of engagement per family. The sessions were

led by the designer along with support from a researcher at the Museum. The designer primarily engaged with the parent, while the researcher engaged with the child. However, due to the dynamic and co-dependent nature of parent-child interactions at that age, there was a fair amount of overlap in the interactions and the nature of the sessions was free-flowing.



Figure 2. Image from a Co-design Session with Remy and Leo.

3.3 Co-design Sessions

Each session was broken down into activities of material exploration (child), semi-structured interviews (parent) and storyline exercise (parent). The activities conducted are described below:

1. Gathering insights into material affinity (child)

Each child was shown a selection of different objects made from a range of materials that invoked responses from different senses. These included cloth, translucent and plastic frames, shakers, wooden blocks, etc. They were encouraged to interact with all/any of them as they preferred, and were asked to identify which their favourite object was. In situations where the child was too young to communicate using language, their actions for play and focus were keenly observed as guideposts. The researcher watched how they used/played with that object and took notes of any interesting actions and interactions.

2. Persona identification using the Blob Tree (parent)

Parents were shown the Blob Tree and asked to identify which blob/s best represented their child's exploratory nature when they came into the museum. To contextualise their blob selection, parents were additionally asked to give an example of this kind of interaction that they observed their child frequently displayed. This activity was conducted to identify core characteristics, behaviours and levels of engagement that a child showcased when in the museum space.

3. Persona identification using the Blob Tree (parent)

Using a multiple-choice question format, Parents were asked which sense (smell, taste, touch, sight, sound) or combination of senses their child was most keen to explore the environment through. They were additionally asked to give an example of this kind of interaction.

4. Storyline exercise (parent)

Adapted from the Convivial Toolbox, the storyline exercise helps design researchers understand how a particular user experiences a service, product, or environment. Parents were presented with an A4 sheet that had a line running through it. This line represented a linear timeline with the starting point on the left

being the time they entered the museum with their child, and the end point on the right being the time they exited the museum with their child.

a. On this timeline, they were asked to mark the most challenging moment they observed their child experience along with the most rewarding moment they observed their child experience.

b. Using post-it notes, they were asked to name an object/activity/toy/interaction that could make those respective moments easier or memorable respectively.

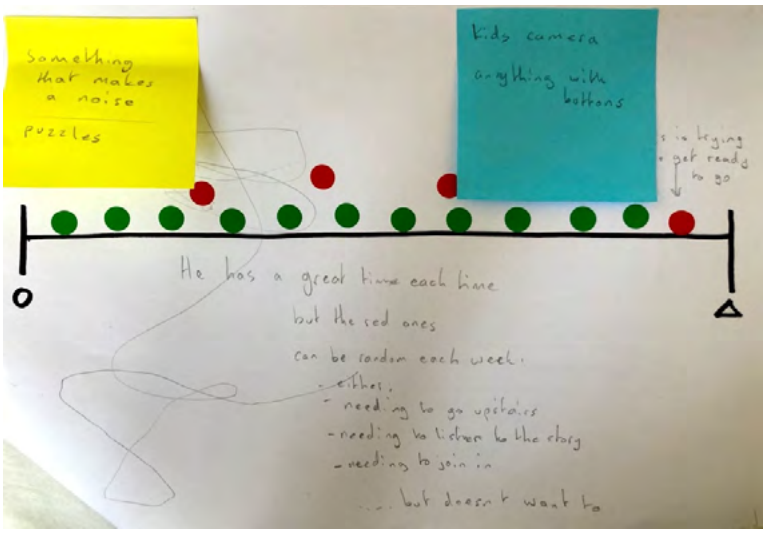


Figure 3. Image of the Storyline Exercise by Abigail.

To support these activities, parents were also asked questions like, “What would you want your child to take away from these museum visits?” and “Does your child ever talk about the museum when they are at home?” These semi-structured interviews provided details about the child’s experience of a new public environment and the types of things they remembered, were excited to share with others, were curious to come back for and were excited to experience again.

3.4 Findings

1. Children between the age group of 0-5 years are inclined to explore the museum as a physical space where the focus is not on the historical relevance (which comes at a later developmental stage), but rather the shapes, colours, sounds, scale and perspectives that they can play with. An example is shown below in Figure 4.

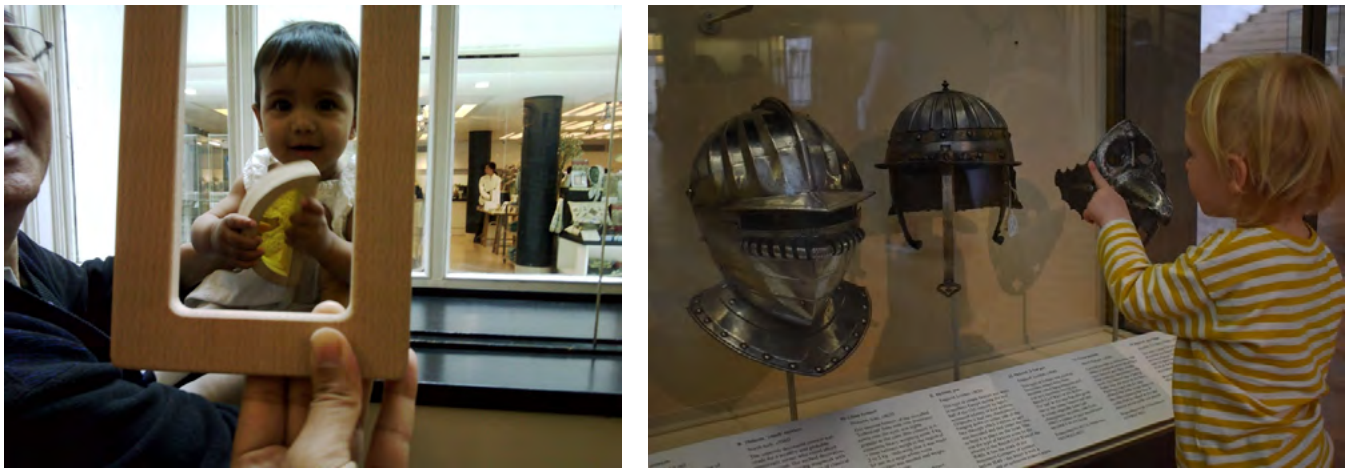


Figure 4. Image from co-design sessions with Tamana and Daniel.

2. Parents' answers to the Blob Tree helped identify the kind of child we were designing for. Descriptive words/phrases that came out of this exercise included *"loves being on the go," "making imaginary friends," "enjoys how much space there is"* and *"likes finding his favourite things"*. Looking at the trio of blobs 16, 17 and 18, Kamala exclaimed that *"these are just like us (the family), exploring the museum together!"*. An example of Lucy's answers about her child's persons as per the Blob Tree is shown below in Figure 5.



Figure 5. The Blob Tree as used by Lucy describing Lily's behaviour, interactions and energy in the Museum.

3. Most parents said that at this age their child relied on their sense of sight and touch to explore the environment as shown below in Figure 6.

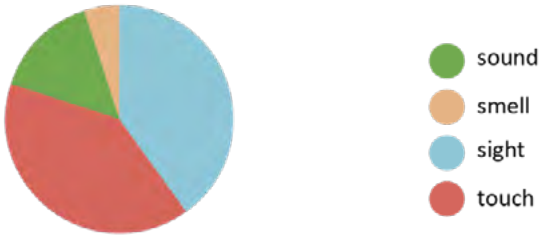


Figure 6. Graph representing parents' Answers for the question *"Which sense is your child most keen to explore their environment through?"*.

4. Majority of the parents marked a point roughly in the middle of their museum journey as the 'rewarding moment' where their child was in a complete moment of flow and absorption. While a point towards the end of their museum journey was the 'challenging moment,' where it was difficult for them to get their child to leave the museum space due to a range of personal, environmental and social factors.



Figure 7. The Average Data Gathered from Parents' Responses for the Storyline Exercise.

3.5 Results and Discussion

Table 1. Factors that emerged from co-design sessions and their thematic and design description.

Factors	Thematic and Design Description
(1). (a). Design interventions needed for the point of: Rewarding moment (experienced mid-way through)	(1). (a). Most parents indicated that their child enters a moment of flow and complete engagement at some point in the middle of their visit, where they are focused on enjoying themselves in the museum - be it by standing next to a statue, going up and down the stairs or crawling through the galleries. On further probing, parents described wanting a physical art book/magazine for their child to draw in to remember this moment.
(1). (b). Design interventions needed for the point of: Challenging moment (experienced towards the end)	(1). (b). Most parents described that their child would experience a challenging moment towards the end of their museum visit. They explained a multitude of factors for this - reluctance to leave a place that they're having fun in (environmental), exhaustion (physical) and agitation (mental). On further probing, parents described wanting a token that could be handed over to the child as a keepsake at the gate/desk as incentive to leave the museum as well as remember their time there.
(2). Parents' desire for their children to explore the museum in a safe way, without feeling like they are being judged for their child walking fast, singing, exclaiming loudly, asking questions, etc. (behaviour that typically goes against traditional expected norms of silent and watchful museum visits).	(2). All parents explained that they wanted their child to feel welcome in the museum space, and that it would benefit them in planning their visits if they discovered through the museum outreach and media channels that the museum was a child and family friendly space.
(3). Parent's desire for their children to learn about the museum as a place that's different from their home/other public spaces, to learn about the existence of an environment where things are preserved and about the ways that people lived in the past.	(3). This ties in with the need of a physical guidebook that illustrates how a museum can be explored through a child's perspective, taking into account their developmental stage and affinity for observing bright colours, exploring different heights and finding their own favourite markers that strengthen their sense of place.
(4). Parents' desire for their child to not feel scared or afraid of museum security staff.	(4). This ties in with training and capacity building that is needed to be delivered to museum staff, highlighting how charged representations of authority and uniforms can solidify fear and nervousness in a child. As at this age, it is important for a child to start being recognised as a developing individual, this can be supported by the museum staff handing out name tags for children to wear and write their names in. Subsequently, if a child is found running or touching something in the gallery, museum staff can thereby address the child directly with an ease and friendliness in their tone.

4. Study B: Design and Execution of a Physical Multi-component Kit through Rapid Prototyping



Figure 8. Work in Progress Image of the A3 Zine.

4.1 Aim

1. To develop a physical prototype that represented the participatory research insights garnered in Study A through playful interactions;
2. To identify areas of further development that go beyond the current form of the prototype.

Note: Outcomes that emerged from Study B of this project were low-fidelity prototypes documented in this paper and are currently being reviewed for further development.

4.2 Components

1. A3 Zine

To fulfil the identified need of *factor 3* from the *Results and Discussion* section in Study A, a low-cost and easily replicable A3 zine was developed. This zine title *'The Museum and Me'* is a visual guide to be used by parents and children (together or independently as preferred) to explore the physical museum space. The story of the zine is based on a child's perspective and use of their senses to explore a new environment (as represented in the empathy map in Appendix Figure 2). It makes use of a clay model developed by a family as the primary character that walks the parent-child through different spaces, objects and creative experiences.

This zine was prototyped in stages (refer Appendix Figures 3 and 4) and the low-fidelity version was tested with three families. Feedback was incorporated and elements modified, after which the high-fidelity zine was designed.



Figure 9. Digital File for the High-fidelity A3 Zine.

2. Acrylic Shapes

The co-design activities and semi-structured interviews reflected the importance of loose-parts play in supporting a child to explore the museum environment. Children between the ages of 0-5 years seemed to have an affinity for mirrors, cameras, and tinted translucent frames through which they could focus on and look through to surrounding objects, people, doorways and architecture. Based on this insight, a set of five tinted acrylic shapes were designed inspired by shapes found in the physical structure of the museum (as shown in Appendix Figure 5). They were subsequently developed by laser cutting blue and yellow acrylic sheets of 3 mm thickness.

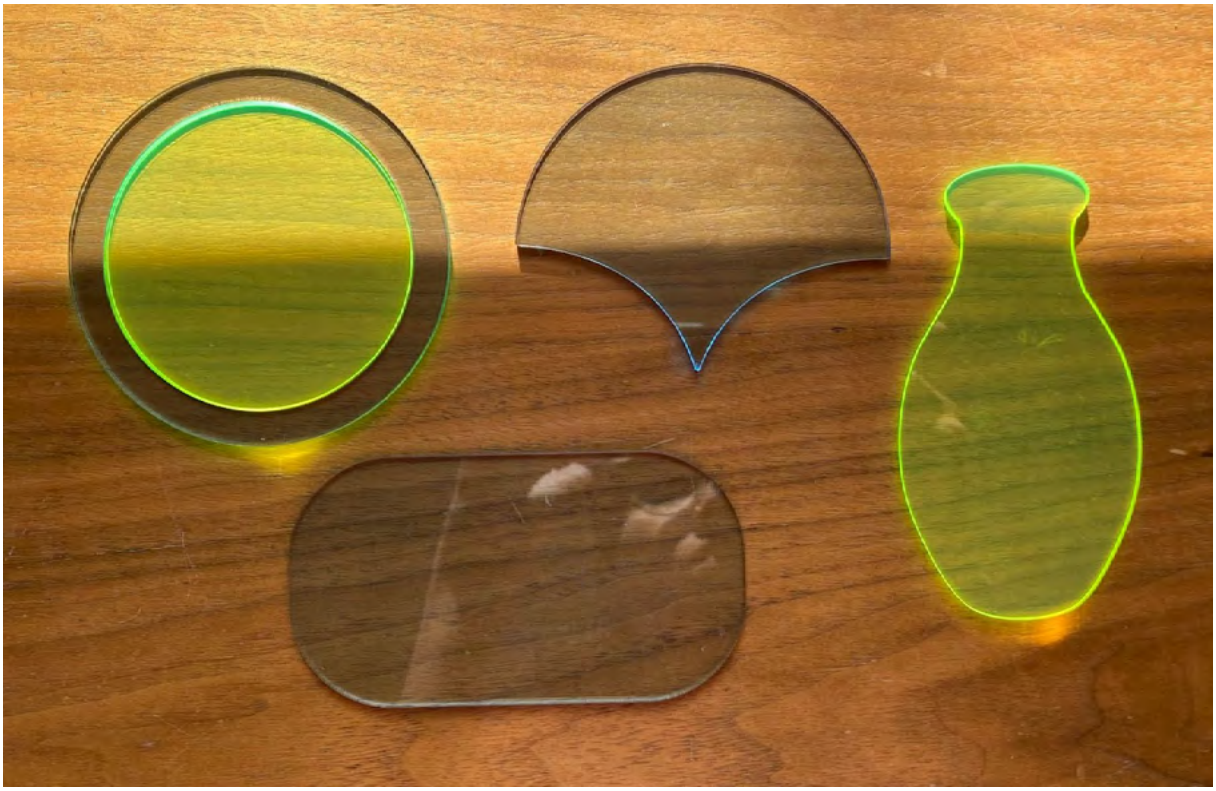








Figure 10. Image of Physical Prototypes of Acrylic Shapes.

Note: The poster in the above photographs is purely for representational purposes and not part of the display at The Fitzwilliam Museum.

3. Poster

To support the outreach and communication section of this project, two illustrations created for the A3 zine were turned into posters. Their intended use is for museum entrances, front desks and play corners which have resources and family learning material.



Figure 11. Digital Files of the Final A2 Posters.

4.3 Results and Discussion

The key contributions of this project lie in:

1. Achieving a practical, interdisciplinary collaboration between fields of participatory design, museum learning and early childhood education.
2. The use of a creative participatory design methodology - with a focus on co-design - from beginning to end, actively involving stakeholders in the design process to ensure their needs have been met.
3. The use of rapid prototyping to create a physical toolkit that is socio-culturally relevant, low-cost and easily replicable.
4. The creation of a physical multi-component prototype that can be rolled out in small groups for further user-testing and development.

5. Challenges Stemming from a Multidisciplinary Approach

This project adopted a design-led, multidisciplinary, and creative approach that allowed for the research to be crafted at the intersection of fields of early childhood education and museum learning. While such case studies are crucial to re-thinking traditional systemic modes of learning and promote inclusion, independence, and autonomy, they pose an array of challenges — ranging from maintaining a balance with stakeholders to divergent goals that are discussed below:

5.1 A Revolving Door for Stakeholders

A key challenge to a multidisciplinary approach is the frequent switching between individuals or entities involved in the flow of research. Recent literature underscores the necessity for a nuanced comprehension of 'good participation' in participatory educational contexts, emphasising socio-ethical principles such as agency and engagement (Cumbo & Selwyn, 2022). If such participatory research principles in education imply that research briefs and studies be set up in a space of earnest co-creation with students, members of educational committees and families, then the onus of maintaining the balance amongst stakeholders falls on the shoulders of the principal researcher, who in many situations may not be the expert authority on the subject matter, while remaining the expert on the nature of participatory engagement.

This provides a tricky situation for the principal researcher, as they must navigate the intricate landscape of diverse stakeholder interests, perspectives, and priorities while endeavouring to uphold the integrity and coherence of the research brief. In essence, the principal researcher assumes the role of a facilitator, orchestrating meaningful dialogue, fostering collaboration, and ensuring that the voices of all stakeholders are heard and valued. However, this task is inherently complex, particularly when stakeholders possess disparate levels of expertise, power dynamics, and vested interests.

5.2 Maintaining Educational Integrity Through a Design Lens

Participatory research is defined by socio-cultural principles that give stakeholders a say in the design of an intervention, while considering the benefits that emerge from stakeholder participation (Cumbo & Selwyn, 2022). Research indicates that participatory research in an educational context inherently aims to empower students by increasing their capacity for creative problem-solving across disciplines. While these skills are now starting to be recognised as core capabilities that support the navigation of systemic challenges, it becomes difficult to quantify and assess the nuanced impacts of participatory research initiatives within educational settings, particularly given the multifaceted nature of empowerment and the diverse array of factors that influence students' learning experiences and outcomes.

While this project emphasises learning through a design lens, the research insights acknowledge the difficulties of effectively integrating participatory methodologies into educational frameworks without compromising the integrity of the learning process. Thus, the exploration of participatory research within education requires careful consideration of how to balance innovation with fidelity to established educational standards and objectives. This endeavour necessitates ongoing dialogue, collaboration, and reflection among educators, researchers, and stakeholders to navigate the complexities of maintaining educational integrity while embracing participatory principles.

6. Future Needs and Opportunities

While the case-study has been successfully completed with key deliverables met, the majority of insights generated through this process currently remain in their early stages. This is due to a multitude of factors such as the short duration of the project, limited budget for physical prototyping and highly dynamic set-up of interactions with families. In order for the research to achieve its optimum potential in practical life, the following areas need to be considered:

6.1 Research and Development

Working with vulnerable groups requires flexibility in terms of stakeholder engagement, scheduling of sessions and the breadth of details that can be covered through interactions with the primary researcher/designer. While this project has taken these nuances into account, the depth of research could benefit with closer interactions with family groups. Areas that can be modified in the research design to achieve this include:

1. Ensuring that the structural integrity of interactions is maintained across all co-design sessions. For example, if planning for single family interactions while preparing co-design activities, it is important for all subsequent sessions to follow the same pattern. Otherwise, the risk of losing personal insights is enhanced in the face of group dynamics where people might be afraid, pressured or influenced by the other stakeholder's presence, opinions or answers.

2. To compare how families perceive museum learning and what they would want it to entail, it would be beneficial to supplement individual family sessions with focus groups for parents. This would allow stakeholders to have shared discussions about goals, ideals and value systems. It would also help in creating a network of family groups that feel connected about this topic, potentially leading to a strengthening of inter and intrapersonal relationships that could positively impact their visits to the museum. In order for parents to have such discussions with their full attention and without disruptions, it would be necessary for their children to be taken care of (if they are in a position where they lack child support) by museum/institutional staff.

6.2 User-Testing

In order to understand the effectiveness of the extent to which the current physical prototypes meet the needs identified, it is crucial for on-site user testing to be conducted. Given the contextual requirements of the project, the ideal test measures would follow a mixed-methods approach that would include the use of child-friendly likert scales, polling questions and journey maps. To gain a holistic evaluation at this stage, it would be beneficial to test the prototypes in individual families as well as in groups of families. The evaluation reached at the end would serve as a necessary blueprint for further iterations required, followed by mass development and roll-out phases.

6.3 Capacity Building for Key Museum Staff

The effectiveness of any tool, product or service depends on the openness, interest and curiosity of the stakeholders involved. In social innovation projects, this tends to involve more than the primary stakeholder as such environments flatten the curve between top-down and bottom-up structures. For children and parents to feel comfortable using the prototypes and guidelines provided, the supporting museum staff including the front desk, security team and museum curators need to be trained in the delivery of the toolkit. This would enable the use of the material in a safe, inclusive, positive and child-friendly environment.

6.4 Strengthening Foundations for Design Research in Pedagogy

Numerous research studies have consistently demonstrated the advantages of involving children in the co-design process during the initial stages of educational development. This approach not only enhances empathy but also encourages proactive problem-solving skills (Paracha et al., 2019). *The Museum and Me* delves into design research utilising creative methodologies, taking into account the specific needs of the environment, and employing readily available, cost-effective materials to facilitate inquiry. The results of this investigation highlight the significance of prioritising user input and providing the necessary tools for guiding their learning journey, thereby expanding the range of innovative outcomes.

A co-design lens diminishes the power gap between the adult researchers and children, establishing a conducive atmosphere for creative expression and affirming the belief that users are experts in their own domain. Viewing museums as learning environments unveils the multifaceted roles of museum curators, researchers, and childhood educators in shaping children's perspectives, communication skills, and overall development. Furthermore, adopting a multidisciplinary approach that integrates design research with early childhood development and museum education fosters new avenues for pedagogical advancements. This inclusive educational model, which emphasizes the active involvement of children, underscores the importance of community and peer engagement within the learning process (Brinck et al., 2022).

Co-design initiatives are able to specifically focus on children furthest from opportunity, help them explore their personal identities and engage in open-ended play within the museum environment. As we reflect on the convergence of various bodies of knowledge within educational research, the integration of co-design principles emerges as a powerful strategy for fostering collaboration and innovation. By bridging disciplines and perspectives, this approach enriches pedagogical practices and promotes a deeper understanding of child development within diverse contexts. This pilot study illuminates the transformative potential of co-design methodologies in shaping the future of education. Through similar collaborative efforts that unite theory and practice, researchers, educators, and practitioners can collectively strive towards creating more inclusive and impactful learning resources for children of all ages.

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Appendix

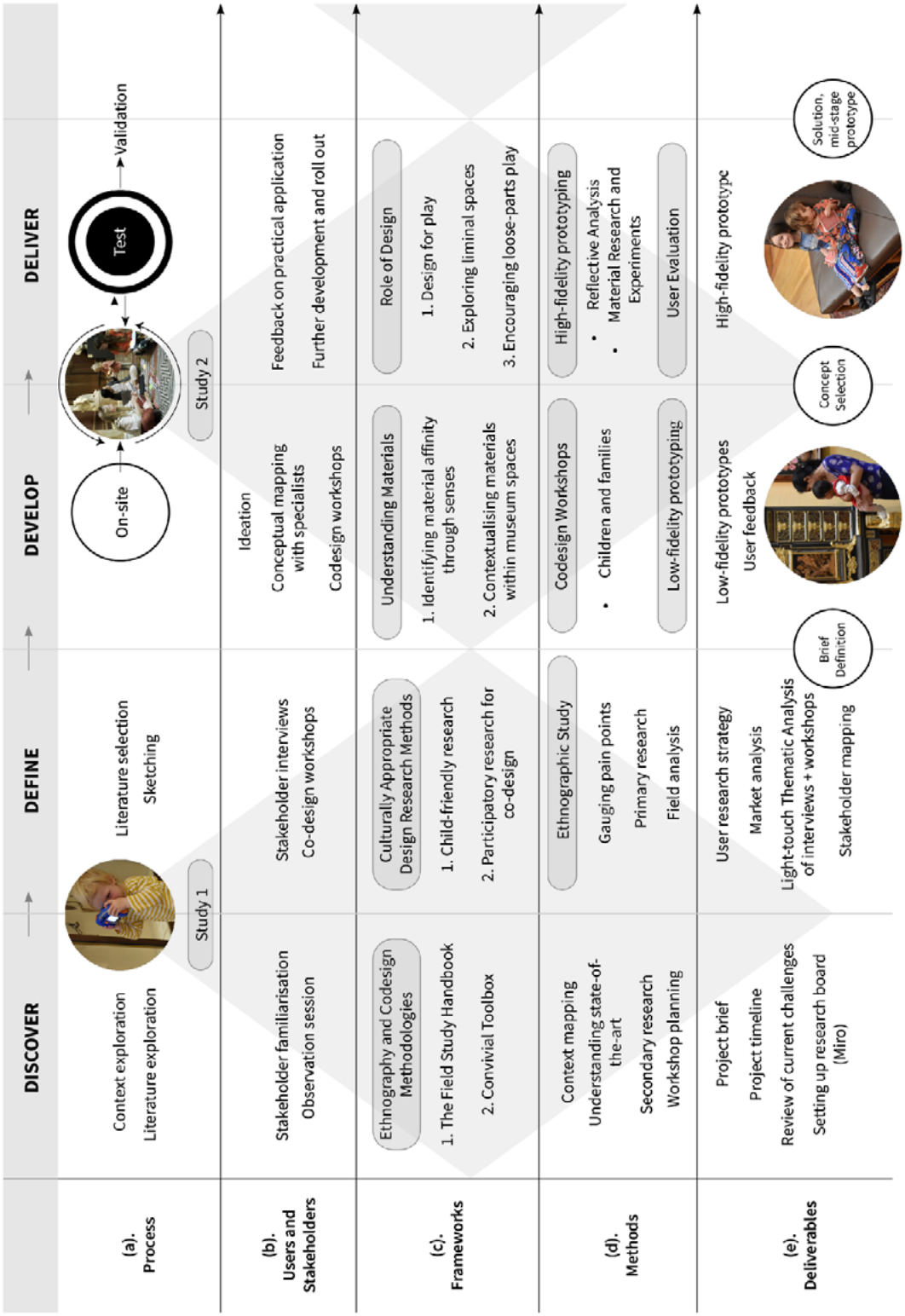


Figure 1. Methodology based on the Double Diamond Approach.

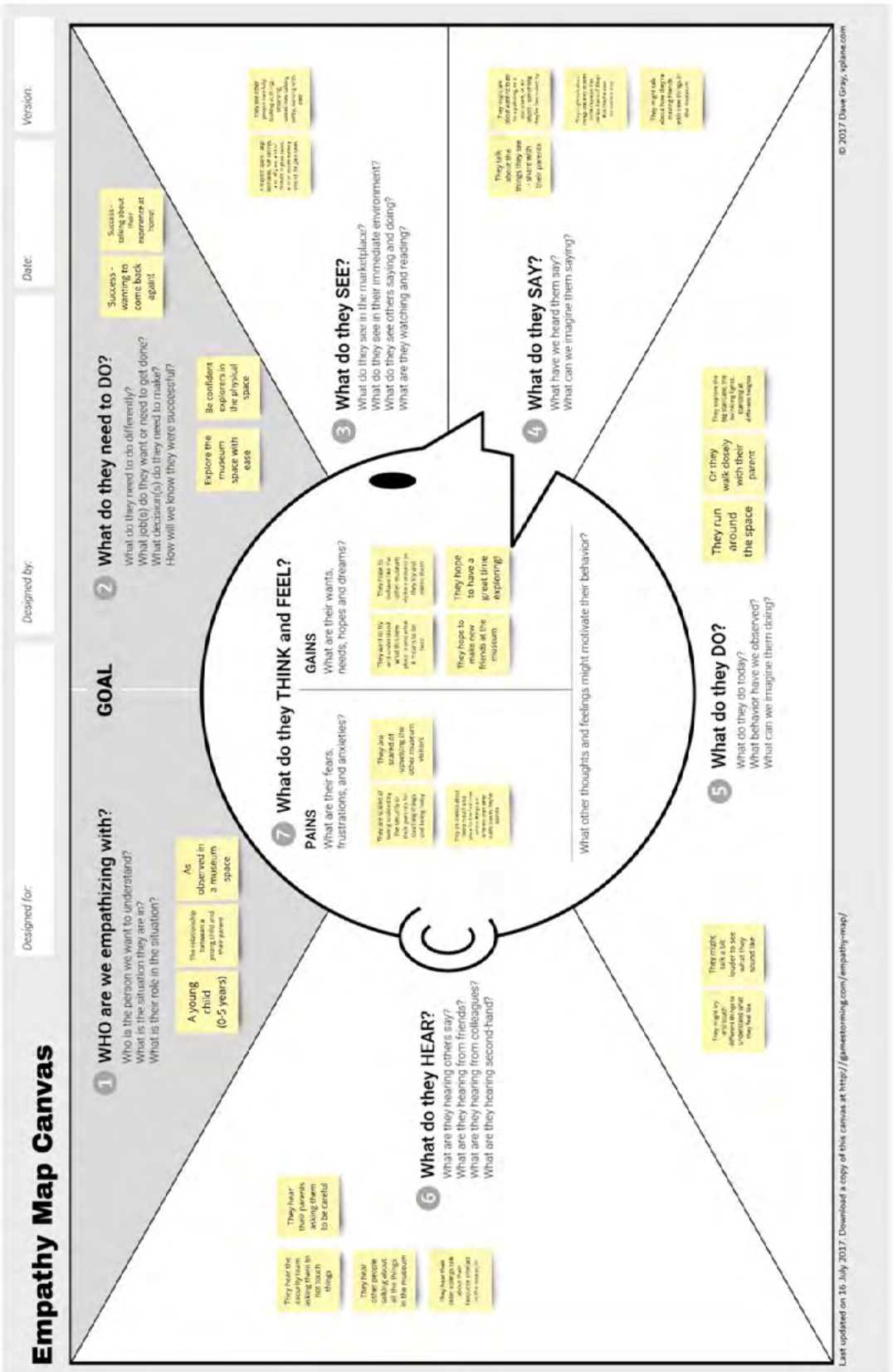


Figure 2. Empathy Map.

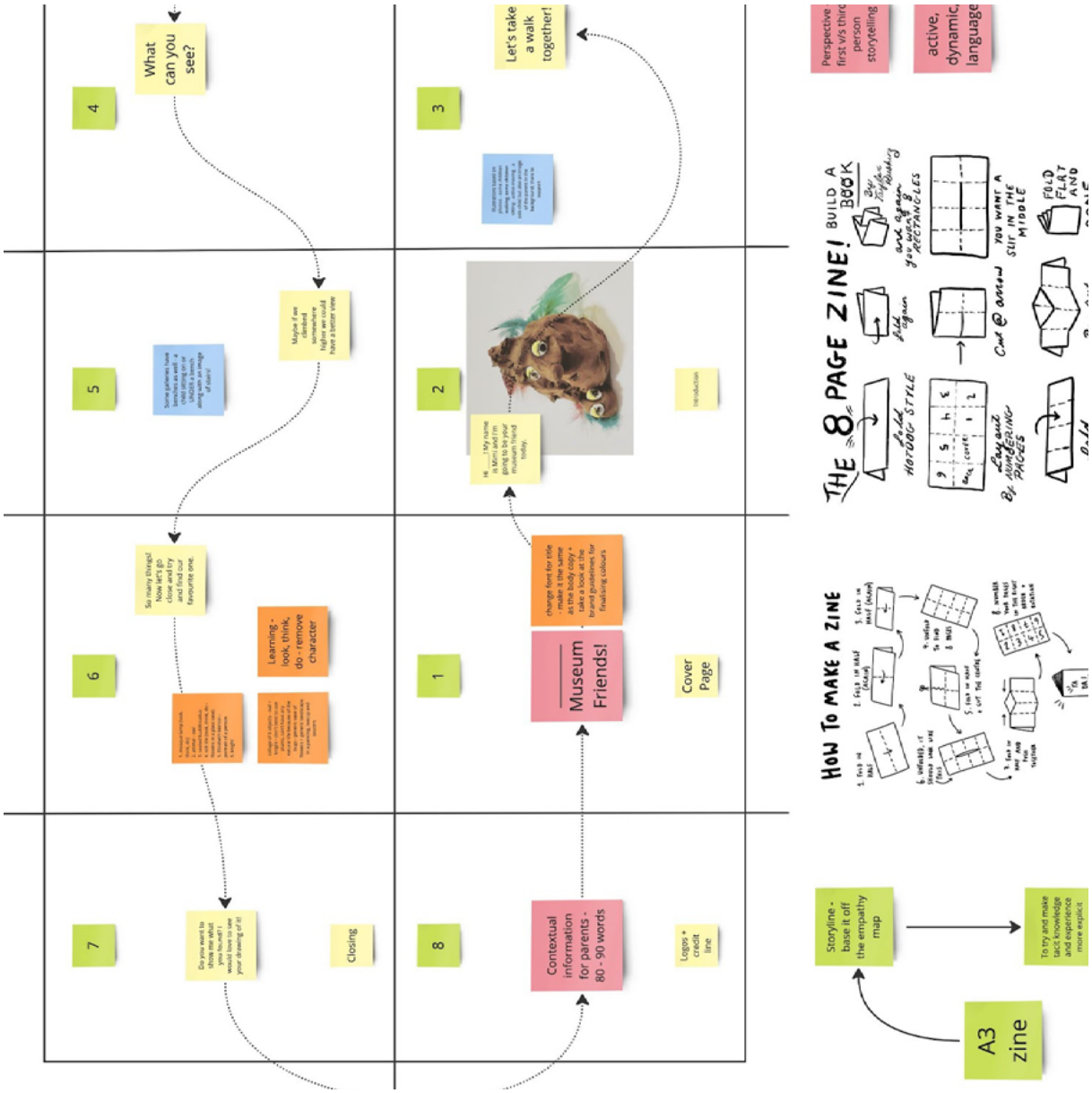


Figure 3. Zine Framework (V.1).



Figure 4. Zine Low-Fidelity Prototype (V.2).

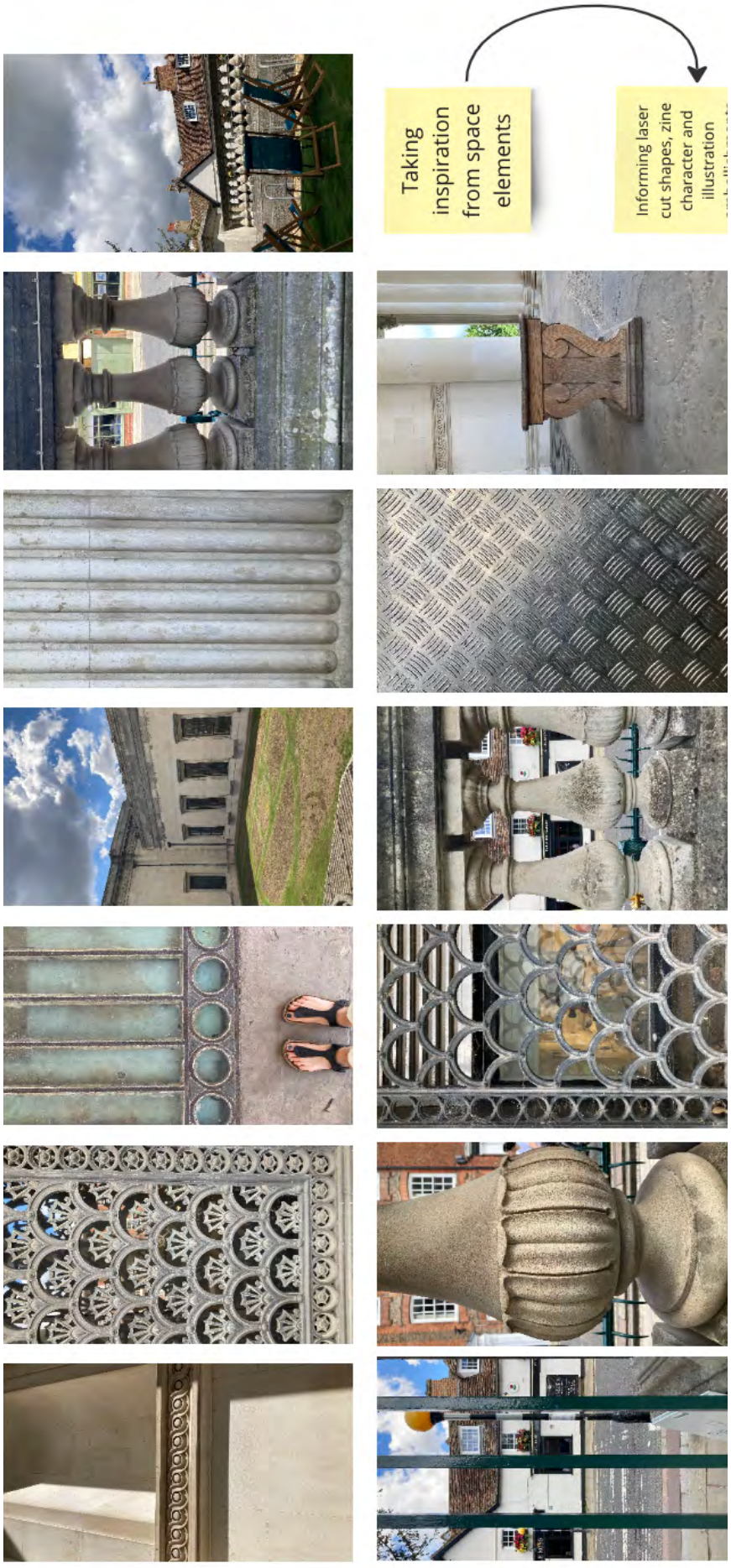


Figure 5. Physical Structure of the Museum as Inspiration for Acrylic Shapes.

MATERIAL AGENCY IN BOOK DESIGN.

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KEYWORDS | MATERIAL AGENCY, OBJECTS, MULTI-SENSORY DESIGN, SUSTAINABILITY, CONNECTION

ABSTRACT | As you take notes on this article in your black Moleskine, you are also connecting with it and with other objects. How might we explain this connection? How might we design it? This research is based on an exploratory analysis of the relationships designers establish with books, taken as examples of everyday artefacts. The hypothesis states that designed artefacts have an agency that affects designers in the more personal sphere. Initial research started a bibliographic review, after which a socio-material observation model of levels of agency was proposed. The model was validated by testing material objects in workshops that combined participation-action with observing relationships of agency. Finally, the results were read and expressed qualitatively. We have framed person-object relationships as a socio-material assemblage (Bill et al. 2015) in line with Lambros Malafouris's (2013) theory of material engagement, to reconsider the distributed agency of end objects as a shared characteristic, in the light of new materialism (Harman, 2010). The results from the two workshops conducted so far (with 4 and 13 participants, respectively) suggest that emotional involvement and the relationship between users and objects in the practical sphere is greater when participants are related professionally or academically to the design field. The initial interventions show that the number and types of users in the test need to be increased in order to compare data with non-expert users.

1. Introduction

When a person picks up a book, caresses the cover and inhales the scent of the paper, thousands of neurological reactions are taking place in their brain to produce an immersive sensory experience. How might we explain the connection we have with objects? How might this connection be designed?

In Stuart Walker's opinion, design is going through a critical phase of overproduction in the practical sphere (Walker, Stuart 2012). The maxim "form follows function" can be interpreted as an indicator of the value we assign to the practical side of things. In his critique of contemporary design, the author argues that the production of function-based artefacts acts to the detriment of social and personal function. Lack of meaning in the personal sphere is one of the reasons for rising consumerism. Hence the author considers that if designers were to emphasise the sphere of personal meaning, we would be able to generate more lasting relationships with objects.

Following Walker's point of view we understand that designing artefacts that affect us is relevant in establishing more lasting relationships with things. Designing artefacts that are meaningful in the personal sphere brings us closer to the goals of sustainability, reducing consumption and alignment with the needs of an environment suffering a climate emergency.

If we observe the relationship established between people and objects in the terms of New Materialism we can easily identify the problem as part of the living, changing mesh of these theoretical movement studies. As Bill et al. (based on Dolphijn & van der Tuin, 2012, p. 117) explain, this movement can be understood as part of the perpetual rewriting of modern philosophy. It aims to explain how matter imbricates our everyday processes of giving meaning to things (Bill et al. 2015, p. 12).

The authors explain that, despite the diversity of approaches to new materialism, they all share three common areas (Cudworth & Hobden, 2014). The first is that they are based on an object-oriented ontological model, as defined by Graham Harman, in which objects are things and all socio-material ideas, phenomena and constructs are also considered objects or things (2010). The second is that they see reality as an assemblage that is inseparable from human life and non-human processes. And the third is "the acknowledgement of the subjectivity of humanity in a world where the human isn't necessary" (Cudworth and Hobden, 2014, p. 3 in Bill et. al, 2015 p.12). Consideration of humanity's place in the cosmos also implies rethinking relations between what is human and a series of non-human processes "with a variable degrees of agency" (ibid. p. 400).

From this perspective, the end of the Anthropocene Epoch poses challenges to the study of the material relations and interactions established in the mesh of things. The study of connections established between people and objects needs updating in line with a model of variable agency, in which design is not human-centred but also includes xenodesign parameters (Shmeer, 2019), from the multiplicity of relations with non-human agents (Grove et al., 2019) to rethinking non-human-centred perceptive and interpretative processes.

To approach these issues systematically, three main objectives have been defined: (1) defining an experimental socio-material context to observe the designer's experience; (2) exploring material objects and their level of agency; and (3) displacing the point of view to the object.

2. Methodology

We developed a mixed methodology to achieve the objective of discovering the relationship established between objects and subjects, the former being printed books and the latter the participants in the workshop.

Initial research was based on a bibliographic review, which brought us closer to discovery rather than verification (Mejía, 1999), after which a social-semiotic model for observing levels of agency was proposed. This model is the central proposal in this paper and is inspired by the roles design prototypes acquire as sociotechnical entities, as defined in Amanda Guy, Bill Collier and Stephen Reay (2012). The data-collection instrument was constructed from the review, in the form of a printed qualitative survey (Bisquerra, 2004), which, along with the workshop dynamic, was tested with a small group of experts (four participants) in the first workshop.

The next step was to conduct the workshop, combining participation-action with observation of agency relations. The workshop involved participants who were experts in art and design teaching and were considered part of the same microculture. Galen Cranz introduces this concept in her book "Ethnography for designers" to describe specific cultural and social patterns that develop in local and particular contexts (Cranz, 2016).

The workshop was divided into four parts: 1) explanation of the concept of agency; 2) observation and participants' choice of material; 3) answering the questionnaire individually; and 4) discussion of each participant's experience with the chosen object.

During the workshop, the researchers carried out non-structured, exploratory observation (Campos and Lule, 2012), looking for variations in phenomena and behaviours that might be relevant to the purpose of the research.

Finally, a qualitative reading of the results was carried out, guided by the quantitative results from the relation assessment sheets.

3. State of the Art

By extending the definition of design, as proposed by Anna Calvera, we can go beyond the object to include human beings in the design concept. Designers and researchers refer to design as a process of defining an artefact, from its essence to the sensations, experiences, values and imaginary signs it activates in the user (Calvera, 2007).

By adopting an extended definition, we can, by way of reflection, trace how the designer's point of view has shifted throughout history. There are definitions that place the stress on the object, others that focus on the user and, looking further back, one can identify how the designer's point of view shifts in an action-reaction process, which for decades has reinforced the materiality of an essentially relational activity such as design.

Positioning design as a relational activity involves taking into consideration its context, as is the case with the designers and researchers Amanda Bill, Guy Collier and Steve Reay (2015). From their point of view, the designer and prototype are part of the same socio-material whole. They are inseparable from the very organisation, the very thing, and, furthermore, they extend this to users and all the animate and inanimate things that make up the socio-technological assemblage of design.

According to these authors, this point of view is part of the new materialism movement that arose at the end of the 20th century (Bill et al. 2015, p. 12), with the aim of creating a new conception of how matter imbricates our everyday processes in giving meaning to things. The production of meaning, extendable to scientific knowledge, is also one of the results of design, as we understand it in this paper.

The understanding between designer and object begins as soon as the designer and matter meet and extends to the materialisation of the product at the end of the process. It becomes a constant exploratory creation and evaluation process in which matter and its manipulation are considered through amusing, inventive and creative interaction, which can lead to innovation and originality in the design (Parisi, Rognoli and Sonneveld, 2017).

As Bedolla (2020) states, sensory processes play a relevant role in the design process and the resulting artefacts, leading to the search for benefits to skills and abilities at the cognitive and intellectual level, impacting significantly on people's emotional dimension. People's intrinsic nature demands constant multisensory stimulation, according to Bedolla, as we obtain all our information on the external world though our senses. According to Lefteri (2007), materials help us reach people's emotional level.

However, in recent times, the sense of sight has predominated over the others. Both designers and users of objects have neglected the possibilities offered by the other senses. Stressing the visual has left other possible perceptions by the wayside; for example, touch, is capable of producing different physiological and emotional-affective effects (Morales, 2015). Bruno Munari (2016) analyses how many designers adopt a distinctly visual approach to their work, with little interest in considering tactile qualities such as weight and temperature. If, as Munari continues, we consider all the senses when designing, people will gradually discover that we have many sensory receptors with which to discover the world in which we live.

One explanation of why designers (and many other humans) continue to love physical objects, their touch, and their smell, is the concept of the agency of objects. The archaeologist of knowledge Lambros Malafouris reconsidered the agency of objects and identified different coexisting levels of agency in what he calls "the theory of material engagement" (2013). According to the author, the agentic capacity of inanimate objects and animate beings is not the same:

> "(...) we distinguish between "agency", as in the agentic capacity of non-human animals or inanimate objects, and a distinctly human… "sense of agency" –that is, conscious agency" (Malafouris, 2013, p.214).

The distinction between the two provides a more inclusive and equal interpretation of the part of the socio-material whole consisting of people and their objects, as mentioned above. Lambros Malafouris does not consider agency a property of objects and humans; it is not a characteristic of the parts but of the relations established between them, through their shared material engagement.

In relation to the environment, there are different levels of agency with each artefact, a distributed agency. For example, a metro door button has a great deal of agency, even when it is deactivated.

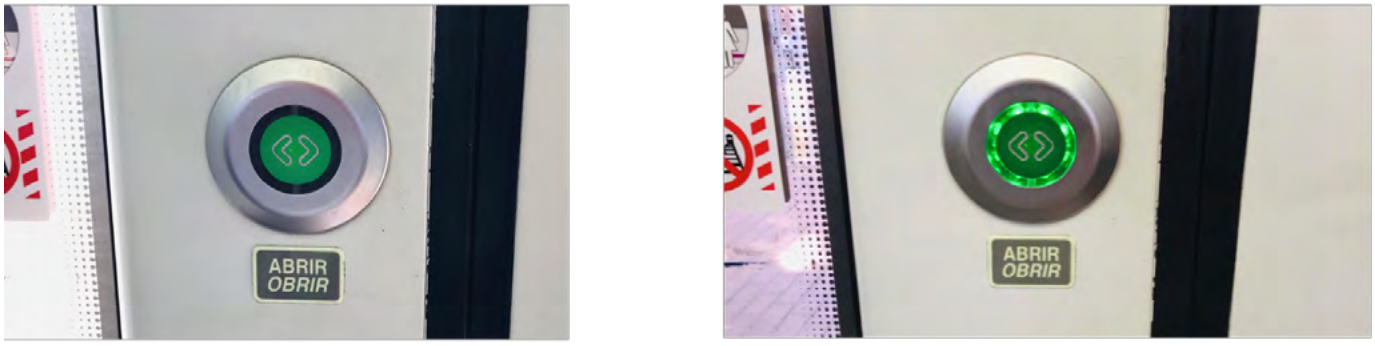


Figure 1. Door buttons on a Barcelona tram. Two levels of agency can be seen, where the one on the left has lesser agency than the one on the right. Photo: Elena Bartomeu.

If we see the design process as one of material engagement, we soon come to realise that designers do not really force their ideas on formats and, ultimately, matter. Rather than imposing their criteria on inert matter (Bill et al. 2015) they listen to the model, converse with it, enter into Malafouris's process of distributed agency, in which artefacts make us change our opinion and the two become a diverse socio-material whole, as explained above.

Material signs do not represent; they enact: They operate on the principle of participation rather than the principle of symbolic equivalency and substitution (Malafouris, 2013, p. 97).

This complements the initial definition of extended design, in which signs activate an environment that is already part of the design assemblage. As Amanda, Guy and Stephen explain, prototypes are not just evolving objects, or not just matter that will later become a final artefact. The processes in which ideas are defined, adjusted and tested through prototypes have more social significance, and more impact on the environment (Bill et al. 2015, 14). And this is even greater if we bear in mind that we have defined ourselves as a socio-material whole in which both human and non-human actors are united in the same organic whole. And even more so if we consider the amalgam of users, clients, partners and the whole network of agents that make up the design production assemblage.

But let us now focus on our interest in explaining the connection we feel with end objects, this connection that leads to personal enjoyment.

Stuart Walker, in The Object of Nightingales (2012), presents a vision of design in which the facet of personal meaning is in crisis. The author states that the designed object or artefact has three facets of meaning in which we may interpret it. All three originate in the anthropological principles of the human being, whereby we are individuals, each with our own body (personal facet), we live in groups of different sizes, be they family, friends, or the group of people with whom we share cultural or national characteristics (social fact), and we live in a natural physical world from which we obtain what we need in order to live (practical facet).

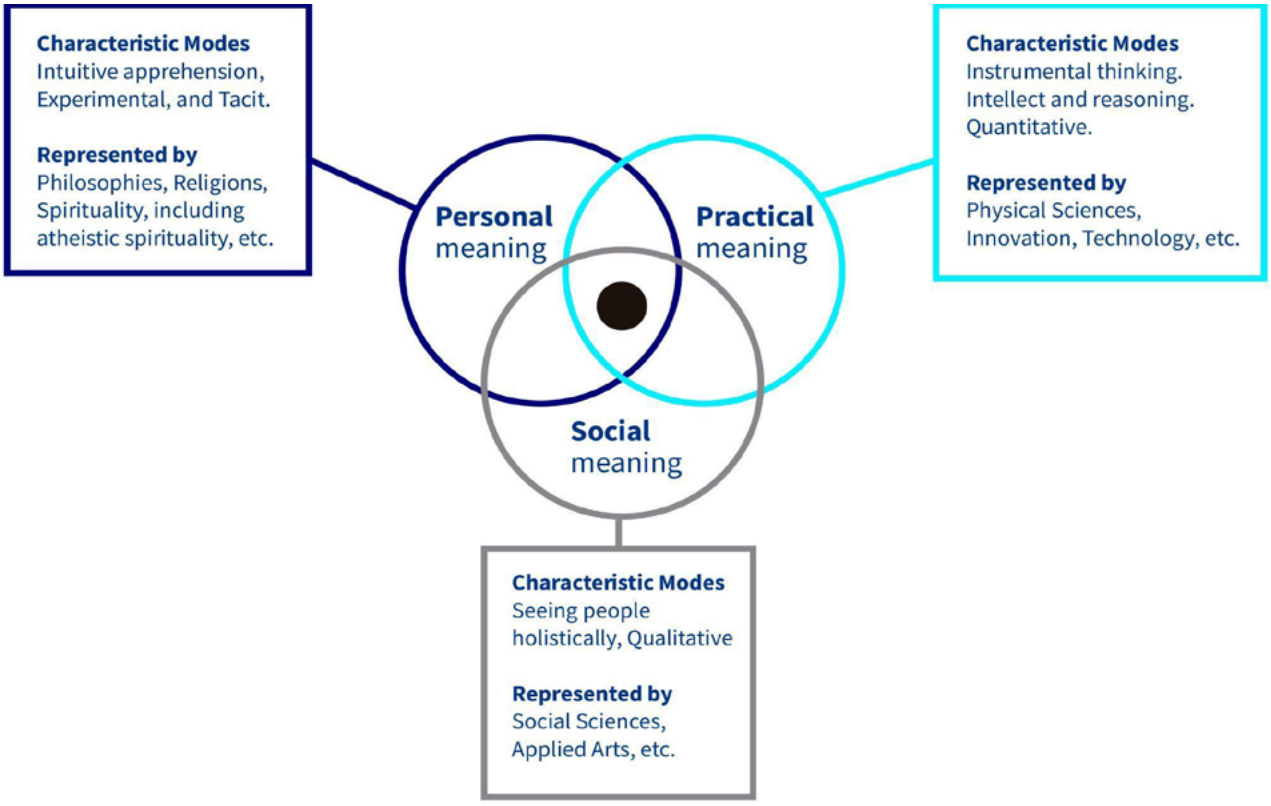


Figure 2: Authors' work, based on Three Facets of Human Meaning and their Interrelationships. Walker, 2012.

As explained in the introduction, the author argues that the production of function-based artefacts is detrimental to social and personal function. For this reason, Walker states that if designers were able to emphasise the sphere of personal meaning, they would be able to generate more lasting relationships with objects, they would place greater value on things and, returning to Bedolla (2020), they would feel more spoken to on the emotional level.

According to Rognoli and Ayala (2018), materials articulate emotions and provide much more than just form to objects; they can contribute significantly to the final perception of the artefact and the emotional

relationships they generate during their life cycle. Emotional relationships are activated when we interact with objects. Thus, a designer must be aware of these relationships to create more meaningful objects. According to Rognoli and Ayala, we do not realise the importance of the emotions produced by the objects around us, both when we interact with them and when we design them.

Thus, we see how sensory processes (Bedolla, 2020) have their own agency, which in turn activates the designers' sense of agency and affects them in the more personal sphere (Walker, 2012).

Karana, Pedgley and Rognolil (2015) refer to the concept of "materials experience" when they talk about the capacity of objects to activate emotions, suggesting that physical interaction with materials can positively influence the creative process. In this regard, the authors define three components: the aesthetic or sensory experience; the experience of meaning; and the emotional experience. Along the same lines, Maldonado (1993) proposes that designers should experience the "real" side of materials, and not just be familiar with the "virtual" details of materials.

If we integrate the main concepts into a model in which the points of view intersect, we can see how the authors understand design as a process or a result, or sometimes both, and also alternately assign the initiative of connection to the object or the subject.

The different arguments explored here permit us to map the design of socio-material assemblage with the following elements participating in the person-object relationship:

	Effect on the SUBJECT	Action with the OBJECT	Authorship	Focus DESIGN
Engagement	Distributed agency: listening to and dialoguing with the model		Bill, Cullier, Reay (2015)	Process
Material experience	· Sensorial · Emotional · Interpretative	Material The experience is activated by the material	Karana, Pedgley, Rognoli (2015)	Process
Interaction	Physical and emotional	To enact the relationship with the object	Rognoli, Ayala (2018)	Result
Meaning Sphere	Personal / Social / Practical		Walker (2012)	Result

Figure 3. Summary of the arguments on the person-designed object relationship in the design sociomaterial assemblage. Source: the authors.

When we integrate the arguments reviewed here, we see how proposals that place the point of view on the subject vary from those that place it on the object, although both work with similar ideas of interaction. We can see how the authors identify a directionality in the interaction that reflects their preferences regarding agency and the initiation of interaction. Sometimes it is the interface that initiates it, other times it is the user. Some concepts of design as process overlap with those of design as result. Nevertheless, by superimposing the contributions we can identify the common elements in the assemblage that enable us to design with a distributed agency, as shown in figure 4.

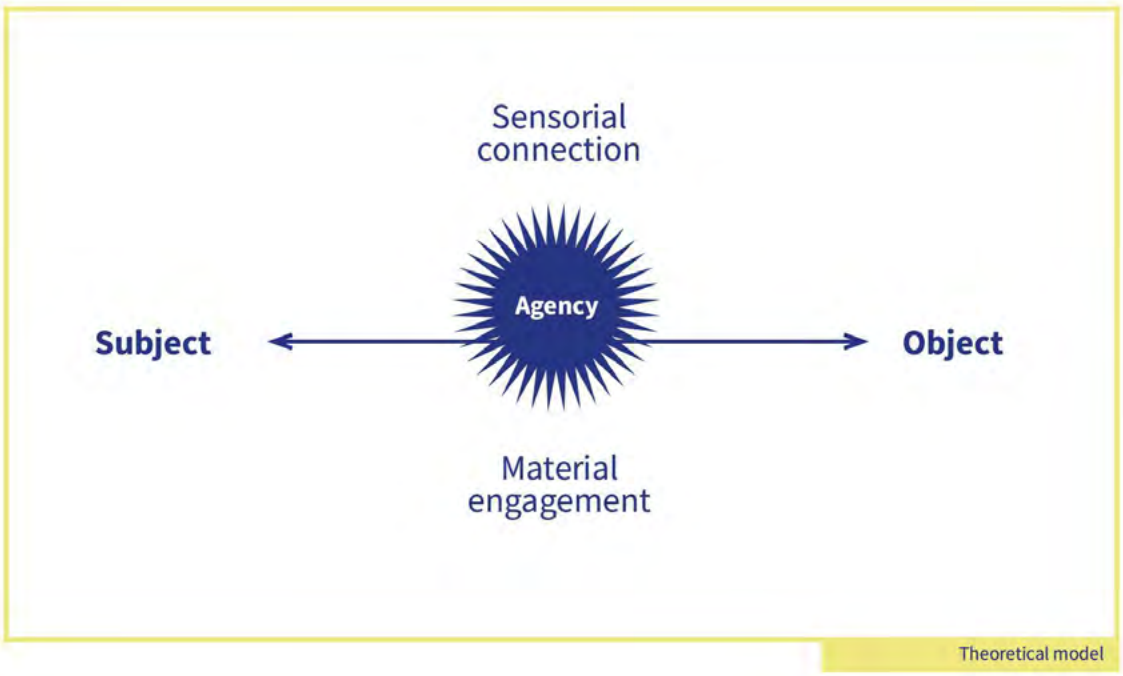


Figure 4. Theoretical model of the material agency of design. Source: the authors.

4. Development

To put into practice the model, we developed a relational practical activity in which we move the point of view to the object and observe the participants. This takes the form of a workshop titled “Is this print talking to me?”.

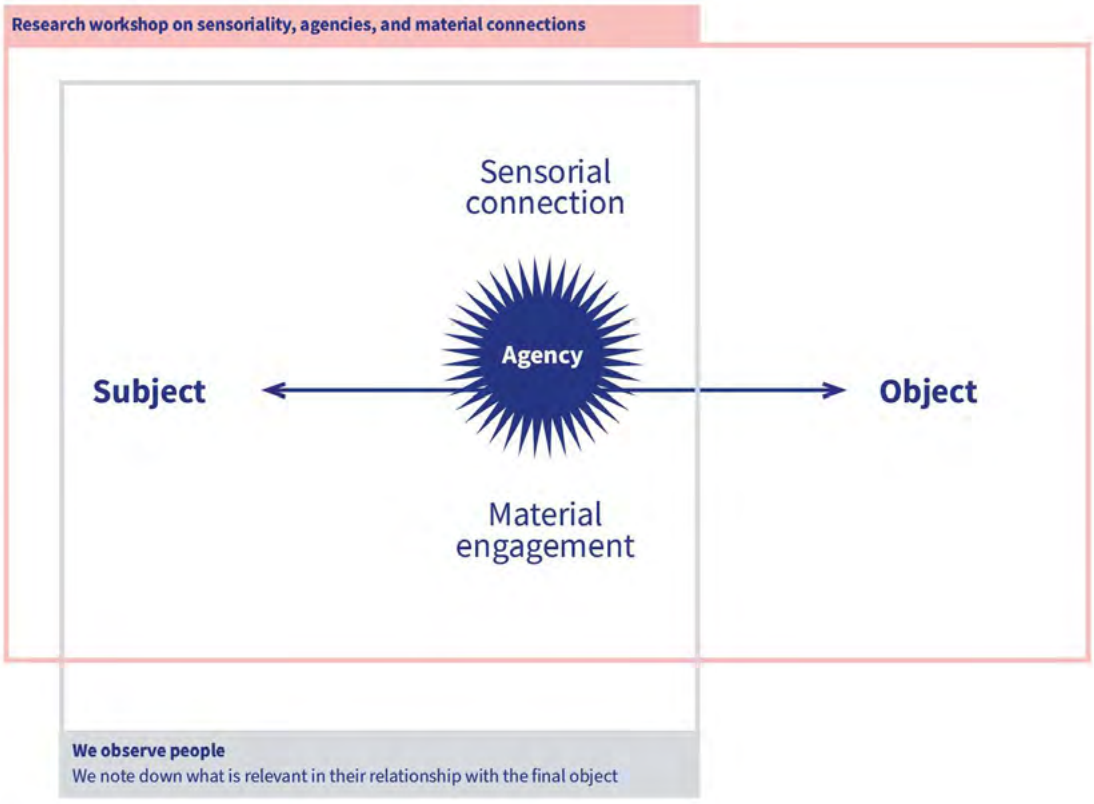


Figure 5. Relational observation of design material agency. Exploratory workshop. Source: the authors.

In the first part of the workshop, the authors/dynamizers present the basic information about the concept of material agency and the related key concepts so that participants understand the objective of the workshop and can develop it successfully.

In the second part, human participants are chosen by objects and the team of researchers observes and records the objects' level of agency, as shown in figure 5. At the same time, the participants reflect on and define the quality of the relationship they establish with their objects through a questionnaire handed out to them, whose purpose is to measure and describe the person-object sensory connection, agencies and material engagement.

Finally, participants, with the dynamization of authors, share their responses, sensations and aspects that have surprised them. They create a dialogue and come close to some first conclusions.

The questionnaire is used to collect information on how the end objects activate sensory processes (Bedolla, 2020), the level of agency participants recognise (Malafouris, 2013), and how the objects speak to the participants on the personal, social and practical levels (Walker, 2012). The participants share the experiences they have had with the object and with other human participants, and the collected data is used to validate the main hypothesis of the research, which states that end objects have an agency capable of affecting users in the more personal sphere.

The theoretical model and the questionnaire (research instrument) were improved and validated with feedback from previous workshops (a total of two).

The questionnaire is divided into four parts, which are ordered incrementally by the type of subject-object information exchange:

1. Level of agency (Malafouris, 2013; Harman, 2010, Bill et al., 2015)
- Origin
2. Material experience (Desmet, 2012; Dezcallar, 2012; Morales, 2015; Bedolla, 2020)
- Sensory
- Emotional
- Meaning
3. Interaction (Rognoli, 2018; Lefteri, 2007; Maldonado, 1993; Dezcallar, 2012)
- Physical
- Emotional
- In phases
4. Facets of human meaning (Walker, 2012)
- Personal
- Social
- Practical

The different sections are related in order to validate each part and help identify contradictory answers from participants. As this is an exploratory questionnaire with no extensive testing, no statistics have been used to measure the contradiction index; only a qualitative interpretation has been carried out.

The first part gathers information on the person-object relationship. Here, the object's level of agency is rated and a brief comment given on why the object chose the participant. If it is the participant who has chosen the object, a brief explanation must also be given. The premises on which the question is based are presented and discussed in the "State of the art" section.

The second part gathers data on the types of connection with the object and the qualities of this connection. Firstly, the intention is to ascertain the nature of the connection in terms of direct contact with the body, through three questions whose purpose is to explain sensations in order to identify the senses, locate the sensation in the body and provide details on the nature of the sensation generated by the object. Next, we ask about feelings through the emotions related to the sensations. In this stage, we use the list of emotions proposed by Pieter Desmet in “Faces of product pleasure: 25 positive emotions in human-product interactions” (2012). This list was developed and validated for designing positive experiences. To avoid bias in possible negative connections, the study was supplemented by the list of negative and ambivalent emotions identified by Desmet from Tomkins (1984) (ibid.). The emotional part concludes by asking participants whether they would add any other emotions, to facilitate open communication and collect off-the-record comments, on the understanding that the difference between sensation, emotion and interpretation is not intuitive.

With regard to the interpretative register, we ask participants about their memories, to relate the sensations and emotions of the object to the ideas that come to them when establishing the connection. As Juan Magariños de Morentin explains, the interpretative phase of the sign is fed by the subject’s knowledge, and thus can only be interpreted from memory (Morentin, 2001).

In the third part, the objective is to map the physical and emotional relationship arising from the connection. The questionnaire asks about the quantity of physical relationship established with the object (number of senses used) and the depth of the emotional connection. As emotions operate at the physiological, cognitive and behavioural levels (Dezcallar, 2012), if the object makes you smile or sweat you should indicate a high level of interaction . The questionnaire includes descriptive examples to help users rate their level of interaction. The premises for the third part are the physical and emotional dimensions (Ayala and Rognoli, 2018) and a third question is added to identify whether interaction occurs in different phases.

The information collected in the fourth part refers to how the object affects the participant, identifying whether this is on the personal, social or professional plane, on all of them, or at the intersections between the planes. This question is based on Stuart Walker’s model of spheres of meaning, as explained above.

The questionnaire concludes with an open question to make use of the participants’ knowledge and experience and gather suggestions for improvements and other connections.

Table 1. Workshop “Is this print talking to me?”. Questions for participants.

1. Level of agency	This section is aimed at studying the level of agency of the object.
	1.1. Indicate the level of agency you have perceived with the object, being 5 its maximum agency and -5 its minimum
	1.2. Why have you been chosen by this object? Briefly explain why you have been chosen, or why you have chosen it, if it has been you.
2. Material experience	Section aimed at collecting data on the type of connection with the object and the qualities of this connection.
	2.1. Sensorial experience. Questions aimed at collecting information related to the body.
	• Senses. With which senses has the object connected you? Sight / Touch / Hearing / Smell / Taste • Connection. Indicate with a cross where you have perceived the contact (includes a human body pict) • Sensations. Describe the sensations you have had, for example, cold, proximity, tension, etc. and the material part of the object that has activated it, if any.
	2.2. Emotional experience. Questions aimed at collecting information related to feelings.
	• With which other experiences have you associated the connection with the object? Briefly explain a maximum of three memories connected to the object.
3. Interaction	Section oriented to map the physical and emotional relationship arising from the connection.
	3.1. Level of physical interaction. Indicate the level of physical interaction with the object. The minimum level of interaction is understood as locating and grasping the object using the sense of sight and touch, and counts 1. The maximum level of interaction is understood as minimal sensory contact of four senses, sight, touch, hearing, and smell, and counts up to 5.
	3.2. Level of emotional interaction. Indicate the level of emotional interaction with the object, with 1 being the minimum level of interaction if your emotional state has not been affected by the object* and 5 being the maximum level, when you have thought about it again after ending the contact or have thought about taking notes of its references, or having the object.
	3.3. Interaction phases. Has your experience changed while interacting with the object? (Yes/No)
4. Spheres of meaning	Data we collect to know if the object appeals to you on a personal, professional, or social level.
	4.1. What is the impact of the object in each sphere of meaning? Indicate 1 when the object does not appeal to you and leaves you indifferent, and 5 when the object has connected with you to the maximum.
	• Personal: It has appealed to you as a person, connecting with your values as an individual, or with your beliefs, intuitively towards your inner world. • Social: It has appealed to you in your cultural context, you have shared it or want to share it with others, and it fits the social norms of your environment. • Practical: It has appealed to you at a professional, intellectual, technological level, it provides you with performance values in your environment.
5. Comments	Do you miss any relevant questions? Is there too much information? Tell us what you want to share: your help is valuable.

5. Results and Discussion

The results analysed below come from the survey completed during the workshop conducted at the ISEC Lisbon Centre for Studies Graphic Technologies, involving a total of 13 participants from the world of art and design teaching and research. Although we conducted a previous workshop in Barcelona with four participants from the field of teaching and research in communication studies, we decided to use this second source of results as comparative data, always bearing in mind they come from few participants and cannot be considered as a reference.

In the first question (1. Level of agency) we asked participants about the level of agency of the objects they chose and also their personal reasons for choosing them. With regard to the level of agency, the participants identified which object had chosen them with an intensity of 4.5 out of 5. In other words, they recognised the agency of the object without hesitation and required no further explanation.

With regard to why they chose the object, we analysed and classified the reasons using Stuart Walker's three spheres of meaning (2012). Personal reasons were mentioned in all cases, with participants using expressions such as "due to the cover with the lenticular image, which I've liked ever since I was a boy, seeing how the visual space is transformed" (L0302). Practical reasons were also included in all the answers, sometimes expressing highly technical details, such as "It shows that the same space (the cover), through a technical device (hologram), can be used for two different things" (L0303). However, social reasons did not appear in the answers from the workshop. Practical reasons were chosen in all cases and no social reasons were mentioned, although they rated this sphere when asked directly in the other sections.

The workshop called on participants to establish personal relationships with the objects, yet the participants rated the practical sphere higher than the personal, at 4.25 out of 5, compared to 3.8 out of 5 for the personal sphere.

Only in three cases did the reason for choosing the object given at the start of the questionnaire fully match the score for the spheres at the end. In eight cases (66%) participants did not mention the social sphere, but later gave it an equal or higher score than the practical and personal meanings. Finally only one case produced diametrically opposed scores, indicating that the participant had not understood the questionnaire (leaving some spaces blank, confirming the lack of understanding).

In the second part of the questionnaire (2. Material experience), which refers to the type and qualities of the connection with the object, we detected some confusion between "sensation" and "emotion" when participants were asked about the sensations conveyed by the object. The participants answered with emotions on nine occasions, an error which could be explained by the intensity of the emotional relationship established with the object, scored at 3.77 out of 5. We interpret this to mean there was an emotional impact resulting from using the object.

When answering about the participants' perceptive relationship with the object in their sensory experience, we identified an average of 2.5 senses. In the score for sensory interaction we identified 3.3 senses. As the questionnaire progressed, more senses were unexpectedly added to the perceptive relationship. This observation is analysed below. Nevertheless, it is interesting to note that in the third part (3. Interaction) participants scored the emotional interaction with the object higher than the physical interaction (3.77 vs 3.3).

Similarly, in the drawing where participants were asked to mark a cross on the part of the body where they had felt the connection with the object, parts such as the heart, head, feet and back were identified (figure 6). Even the whole body was circled in one case, suggesting more than a perceptive relationship focussed on the sensory organ, but rather a more holistic, interpretative relationship.

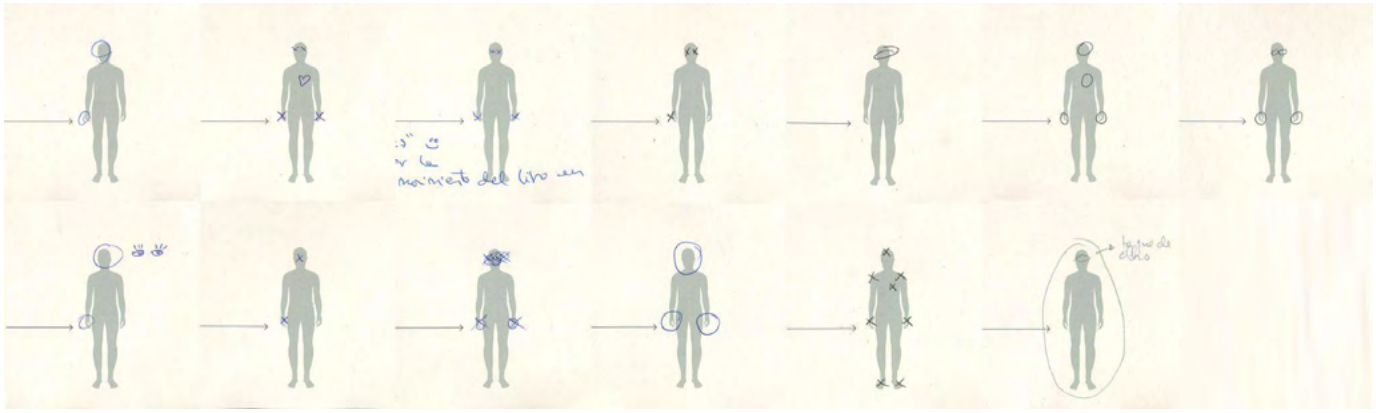


Figure 6. Sensory experience. Parts of the body in which the connection with the object was experienced.

In the emotional experience (see point 2 of the questionnaire), participants described positive and negative emotions. In the case of positive emotions (figure 7), those most frequently expressed were: surprise (10 out of 13 cases, 76.9%), fascination (9 out of 13 cases, 69.23%), inspiration (8 out of 13 cases, 61.54%), enchantment (7 out of 13 cases, 53.85%), and joy, love and satisfaction (5 out of 13 cases, 38.46%). None of the participants indicated emotions such as relief or compassion. Practically no negative emotions were indicated (figure 8). The only ones mentioned were surprise (2 out of 13 cases) and sadness (in 2 out of 13 cases). Only one person mentioned more than one negative emotion. In this case, they were anxiety, anger, sadness and aversion.

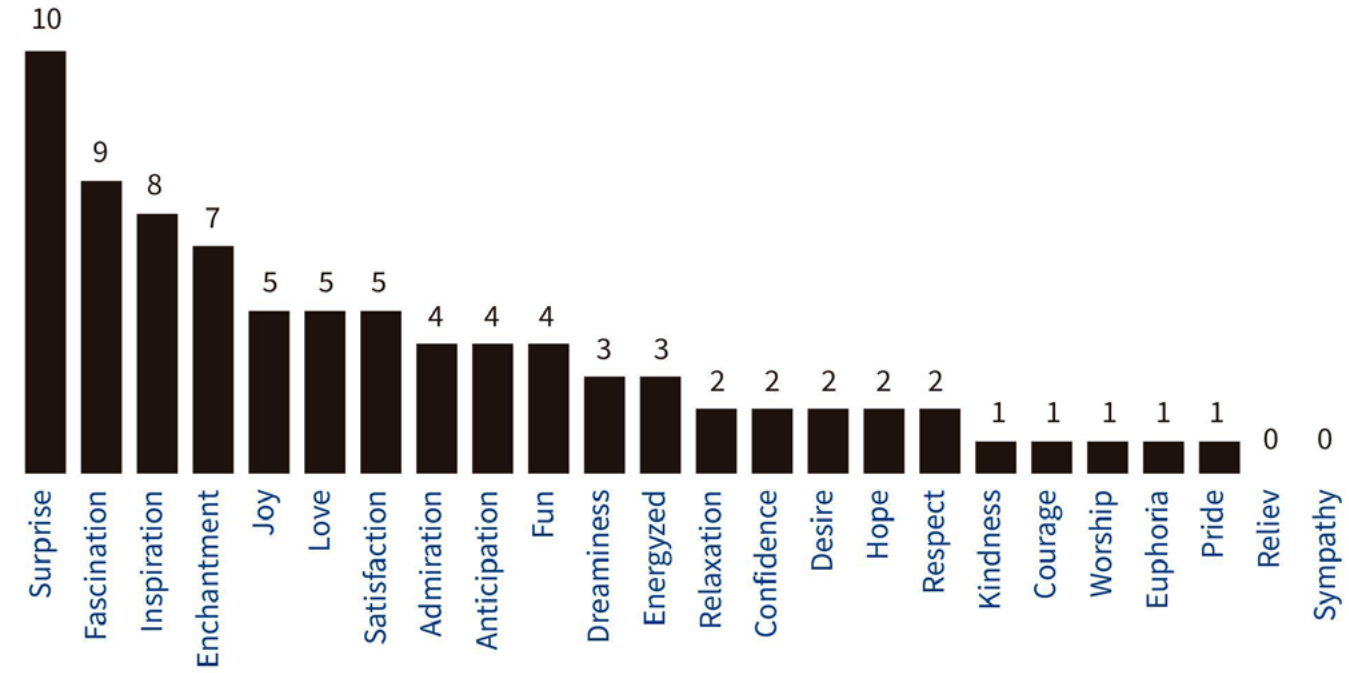


Figure 7. Positive and ambivalent emotions in the person-object interaction.

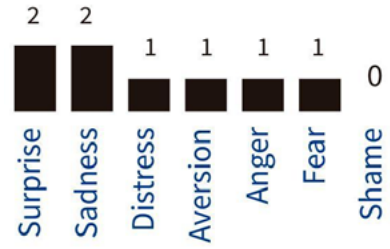


Figure 8. Negative and ambivalent emotions in the person-object interaction.

In the meaning experience (see point 2 of the questionnaire), which asks about other experiences (memories) associated with the connection to the object, most of the participants focused their narrative on personal experience (5.67 out of 10): “childhood games” (L0301); “new shoes” (L1002); or “wanting to keep the object, to run away and steal it” (L0101). Other participants related their experience to the practical sphere (5.33 out of 10): “playing when handling the object” (L0303); “typography, old-fashioned typography workshop” (L0702); “special effects used in graphic production” (L0501). Almost residually, only one person related the experience to the social sphere (0.33 out of 10): “relationships with significant people” (L0801).

6. Conclusions

Although there were a limited number of participants in this phase of the study, we have seen that the research-action works and the questionnaire permits data comparison and gathers relevant information. Various initial conclusions may be drawn with regard to the data obtained from the workshop and subsequently analysed.

Firstly, we see that there is an emotional impact after using the object. We also see that more senses are involved in the perceptive relation the more participants progress in the questionnaire. Practically no negative emotions were expressed in the questionnaire. In their observations, the researchers found that the workshop generated expectations that created an atmosphere of curiosity and a motivation to look, touch and feel the objects more actively than usual. Indeed, the first three positive emotions after surprise are those that make up the general typology of “interest”, as identified by Pieter Desmet.

With regard to spheres of meaning, it may also be stated that, after touching the objects aimed at stimulating the personal sphere, the practical sphere continues to receive higher scores. We think this is due to the profile of the participants (art and design teachers), who are used to coming into contact with printed products in their professional life. We venture to say that their ideas relate books and publications to their work environment, hence they score the objects in the practical sphere.

Finally, with regard to the level of agency, we note a striking difference between the Lisbon group of participants (13) and the Barcelona group (4). In the former group, they identified the object having chosen them at an intensity of 4.5 out of 5. In other words, they recognised the agency of the object without hesitation and required no further explanation. Despite their somewhat insignificant number, the Barcelona participants gave a very low score to the agency of the object, assigning the capacity for connection to the person. This difference may be due to the participants’ profile. In Lisbon, they had a specific academic profile in art and design, while in Barcelona they were academics, but from the general field of communication, not specifically art and design.

The low results in the sphere of social meaning seem to arise as a consequence of a bias in the analysis approach. By focusing on the object, we have neglected the social functions of objects and their effects. The entire realm of social meaning, including the staging of the workshop itself, has taken a back seat. A relevant question for the future will be how to approach the study of distributed agency while considering the social characteristics of humans without placing them at the centre.

We find several limitations about how the participant’s microculture was defined since we assumed there was a shared scheme of practices and social disposition among participants belonging to the group. But, observing how the social sphere emerged from results, we should consider habitus and cultural capital, as defined by Bordieu (2018) to gather the ideas, attitudes and other cultural attributes that impact a participant's behaviour. Our results suggest that there isn’t an homogeneous culture; instead, there are various subcultures and social microcosmos that influence practices and human interactions. Future work should gather data about participants’ specific cultural and social patterns that develop in local and particular contexts, such as design conferences where workshops have taken place.

Future lines for the study lie above all in testing the workshop in different cultural contexts with non-expert participants. Although there were few participants in Barcelona, their contributions were different to those from Lisbon, suggesting further testing among people with absolutely no connection to the field of design. On this basis, we would reformulate the hypothesis to: "Emotional involvement and relationship with the practical sphere increases when the participants are professionally or academically related to the design field".

Finally, we will apply the knowledge obtained here to improve the connection with objects, specifically, by providing an enriched description of elements in online materials libraries, thus seeking to overcome the distance between the library interface and the material.

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P/REFERENCES OF DESIGN

DESIGN AND SIGNATURE PEDAGOGIES: WHICH IMPLICATIONS?

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ABSTRACT | In the range of theories and practices related to the field of design, several “designerly” ways of knowing (Cross, 2007) can be detected, in which the axioms inherently characterizing the discipline converge independently from the multiplicity of professional domains in which it branches out. From an educational point of view, such qualities are commonly geared to the arrangement of learning experiences aimed at facilitating students in developing the ability to manage from both cognitively and executively the procedures connecting the ideation of a product, a service, or a process to its actual concretization. Particularly relevant in this regard is the confrontation with a “design culture” (Julier, 2008) appearing to be constantly in search for a balance between identity and transversality, pointing out a juxtaposition in relation to which the educational system is faced with a twofold responsibility: on the one hand, that of transmitting to students an awareness about the existence of a professional and academic design community, endowed with a specific disciplinary status; on the other hand, that of fostering the acquisition of skills that will enable future designers to fruitfully integrate also within other knowledge areas. It is thus necessary to equip those working in the field of design education with both technical and intellectual tools that would empower them in addressing their teaching in order to appropriately interpret and enhance this polarity. On this basis, a particularly useful contribution is offered by the Scholarship of Teaching and Learning (SoTL), a current of post-secondary studies oriented toward the consideration of the educational approaches adopted in the context of individual disciplines as indispensable factors in the processes of knowledge formulation and transmission. Attributing to the dynamics associated with teaching and learning a pivotal role in constituting the perspectives underlying codified knowledge, SoTL interprets education itself as a further upstream discipline, within which expertise can be reflexively built up (Hutchings, 2000). One of the most significant contributions introduced by SoTL lies in the theory of “signature pedagogies” (Shulman, 2005), a conceptual construct aimed at delving into the fundamental criteria that shape, to an only partially conscious extent, the mindset of scholars, educators and professionals; in configuring a bridge between the theoretical and practical dimensions, these frameworks reflect the forma mentis shared by the members of individual disciplinary communities, expressing the main cognitions they possess regarding how it is most appropriate to act, think and know in order to operate appropriately in their respective fields. In the wake of various studies emerging in recent decades on the topic of the relationship between design and signature pedagogies, this essay identifies the concept as a notion of particular strategic interest in order to understand more deeply the “hybrid” disciplinary status of design, and consequently to orient its educational practices. In accordance with these premises, such a relationship will be first framed from an internalist perspective, reflecting a principle of disciplinary affirmation, and then explored from an externalist perspective, consistent with an assumption of cross-sectoral integration.

1. Design Pedagogy Between Identity and Transversality

In the range of theories and practices that can be associated with the domain of design, several "designerly ways of knowing" (Cross, 2007) can be detected, in which the axioms inherently characterising the discipline converge regardless of the multitude of professional domains in which it branches out. In fact, the inclusiveness of design discipline is indeed impressively wide, ranging from the ideation of industrial products to the development of communication artefacts or the fabrication of fashion items, with frequent contamination with the domains of art, architecture, science, engineering, and business management. The training of this particular profile presupposes the arrangement of learning experiences aimed at enabling students to acquire the ability to manage from both a cognitive and an operational point of view the methodologies connecting the conception of a product, a service, or a process to its actual concretization.

Recent developments in the social, technological, and economic landscape, however, highlight the need for a substantial revision of design pedagogy itself, from the structure of educational institutions to the relationship between students and teachers, involving also the context of professional practice (Pontis & van der Waarde, 2020). Particularly relevant, in this sense, is the inescapable confrontation with a "design culture," (Julier, 2008) that appears to be constantly in search of a balance between the level of identity and transversality, defining the extremes of a juxtaposition which faces the educational system to a twofold responsibility: on the one hand, that of transmitting to students an awareness about the existence of a professional and academic design community, endowed with a specific disciplinary status; on the other hand, that of fostering the development of skills that would enable future designers to fruitfully integrate also within other sectors.

In light of such premises, it is necessary to equip those working in the field of educational research related to the discipline of design with both technical and intellectual tools that can support them in arranging their teaching activities to effectively understand and address this polarity. In this perspective, a particularly significant contribution is offered by the Scholarship of Teaching and Learning, a current of post-secondary studies that began to spread since the early years of the new millennium in the international academic landscape, with particular reference to the Anglo-Saxon and North American scenario. At the heart of the Scholarship of Teaching and Learning lies the investigation around the so-called "disciplinary perspectives," understood as the specific point of view through which individual disciplines incorporate and implement their criteria for acquiring, formulating, and transmitting knowledge. Attributing to the dynamics associated with teaching and learning a pivotal role in shaping disciplinary perspectives, the Scholarship of Teaching and Learning interprets education as an additional upstream discipline, where sectoral experience can be reflexively developed (Hutchings, 2000).

One of the most significant contributions introduced by the Scholarship of Teaching and Learning resides in the theory of "signature pedagogies" (Shulman, 2005), a conceptual construct aimed at delving into the fundamental criteria that help to shape, to only a partially conscious extent, the mindset of scholars, educators and professionals. Providing a bridge between the theoretical and operational dimensions, such criteria reflect the *forma mentis* shared by the members of individual disciplinary communities, expressing the main cognitions they hold regarding how it is most appropriate to act, think and know in order to operate in their respective areas of expertise (Thomson & Hall, 2015).

Since its formulation, Lee S. Shulman's theory has been received with increasing interest in the international landscape of educational research, intercepting an increasingly broad and heterogeneous range of disciplines, from mathematics, physics and natural sciences to medicine, humanities, and social sciences up to psychology, art, music, and theatre. In its early beginnings, the concept has been mainly understood according to an internalist attitude, aimed at a stance of disciplinary affirmation; in more recent years, instead, the concept has been frequently inquired through perspectives connoted by a more pronounced interdisciplinary scope. As far as a field such as design, marked by an intrinsic propensity toward cross-sectorality, is concerned, this polarity takes on particularly emphasised traits, which resonate with a still unsolved tension between the affirmation of a disciplinary identity and, on the other hand, the propensity toward a transversal attitude.

With reference to an illustrative sample of studies corresponding to these two main strands of research, this essay identifies the concept of signature pedagogy as a notion of particular strategic interest in order to understand more deeply the "hybrid" disciplinary status of design, and consequently orient its educational practices. In light of these assumptions, the relationship between signature pedagogies and design is first framed from an internalist perspective, reflecting a principle of disciplinary affirmation, and then instead explored from an externalist perspective, which reflects an assumption of cross-sectoral integration.

2. The Concept of Signature Pedagogy

The research approaches developed by the Scholarship of Teaching and Learning involve a systematic study of the models underlying the transmission of disciplinary knowledge, starting from the detection and the in-depth analysis of the educational formats through which learners assimilate and put these models into practice (Shopkow, Díaz, Middendorf & Pace, 2013). In shifting the focus away from the strictly content-related plan on which individual curriculums are based, these approaches place emphasis on those educational formats that are able to encompass in an experiential way the set of job-specific competencies that students are about to learn (McKinney, 2007). In fact, each discipline refers to a specific pedagogical horizon expressing itself, on a case-by-case basis, in a well-defined system of theoretical and methodological coordinates, which support learners in developing the set of skills, cognitions and expertises that are necessary in order to practice the future profession.

Since its establishment the Scholarship of Teaching and Learning has developed a broad repertoire of investigative criteria aimed at supporting educational research in its sectoral multiplicity, in order to develop a deeper awareness on the most relevant disciplinary models that come into play in training to the various professions. Particularly interesting in this regard is the notion of signature pedagogy, a conceptual construct introduced in 2005 by the American psychologist and educator Lee S. Shulman with reference to the main formats, highly characterising in disciplinary terms, that underlie educational activity oriented toward the training of specific professional profiles. Specifically, the concept was introduced in the context of an interdisciplinary program inquiring the relationship between pedagogy and e professions promoted by the Carnegie Foundation for the Advancement of Teaching, an educational studies centre based in Stanford (CA) of which Shulman was president at the time.

According to Shulman, the notion of signature pedagogy identifies those particular educational modes that, in a recurrent and pervasive manner, prescribe what, in a given field, is considered as knowledge, and the criteria according to which this is systematically subjected to analysis, approval, critique, or denial. In their very implementation, signature pedagogies generate substantial repercussions within the fields from which they derive, designating their instances of scientific and deontological authority, and thus consolidating the institutional architecture that serves as a support for such paradigms, and which in turn works in perpetuating them.

With reference to the most literal, yet hermetic, meaning of the term "signature" – etymologically speaking, the term derives from the Latin verb *signare*, which can be translated as "marking", "imprinting," "designating" – the concept paves the way for acquiring a broader awareness about the central role that certain specific educational models have traditionally played, and still play, in shaping culture as we consider it today. While emphasising the existence of an indispensable bond connecting signature pedagogies with their own respective field — or fields — of reference, Shulman's theory remarks, at the same time, how all of them share a similar conceptual organisation, structured according to three main layers of meaning: a surface structure, concerning the visible operations of teaching and learning, and their corresponding outputs; a deep structure, referring to the universal and personal assumptions underpinning the teaching activity; and an implicit structure, embodying the moral values that legitimise a certain discipline in the wider system of knowledge.

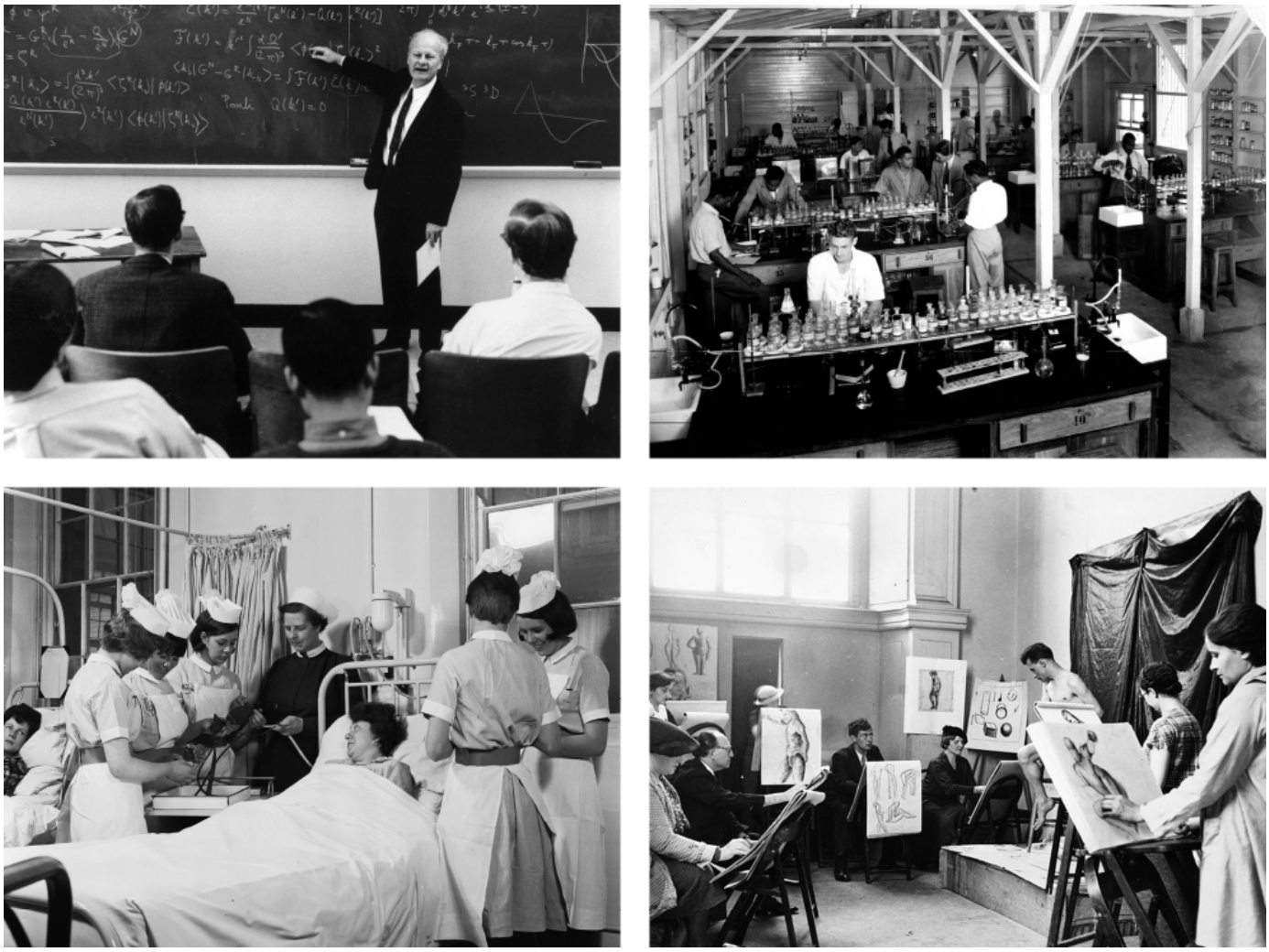


Figure 1. Examples of signature pedagogies in the context of different disciplinary fields: the frontal lecture in relation to disciplines with a theoretical stance, both scientific and humanistic; the laboratory in the field of natural sciences and, in general, applied research-oriented disciplines; clinical training in the field of medical and nursing sciences; the studio in reference to disciplines with an artistic and design orientation.

By simultaneously incorporating the epistemological and ontological roots inherent in the different branches of knowledge, the concept situates the relationship between learner and teacher within a state of mutual "interiorization" in which, according to Michael Polanyi (1966), the tacit components underlying any approach to knowledge reverberate.

Research about signature pedagogies can be give significant directions in order to build a deeper disciplinary awareness, that is functional, on the one hand, in conveying a condition of educational continuity in the different levels of individual curriculums and, on the other hand, in defining clear boundaries between different professional realms (Poole, 2010). However, this interpretation is not exclusive: the notion of signature pedagogy can also be framed following a cross-sectoral perspective, as a useful conceptual vehicle for encouraging the growth and consolidation of new communities of practice arising from the mutual interrelation between different disciplinary fields (Takayama, 2009).

Since its original formulation, the theory elaborated by Shulman has been received with growing interest and consensus by exponents of the Scholarship of Teaching and Learning and, more broadly, within the international educational research landscape, intercepting an increasingly broad and heterogeneous range of disciplines. Over the years, the design community has also begun to offer its scholarly input in this direction, and although the literature related to signature pedagogies is still rather fragmentary, a first core of research that confronts the topic from a disciplinary point of view is gradually being deposited. The following paragraphs will present two main strands of research detected within this body of literature:

a first attitude focuses on the detection of the signature pedagogies which specifically pertain to design; a second attitude, instead, is devoted to the interpretation of the design discipline itself as a signature pedagogy.

3. Signature Pedagogies in Design

As mentioned, a first strand of research carried out over the years within the Scholarship of Teaching and Learning on the topic of the relationship between design and signature pedagogies has been characterised by an interpretation of the concept tending toward a principle of disciplinary affirmation: in these cases, the inquiry has followed a predominantly internalist stance, which has expressed itself through research approaches aimed at classifying, and subjecting to critical analysis, the educational models through which individual disciplines have been, and still are, conventionally taught and learned (Ciccone, 2009).

Design pedagogy presupposes the arrangement of learning experiences aimed at enabling students in acquiring the ability to manage from both a cognitive and an operational point of view the methodologies connecting the conception of a product, a service, or a process to its actual concretization. The training of this particular profile presupposes an educational experience marked by a high degree of specificity, which is expressed according to approaches that are often very distant from the model of “formal education,” typically organised according to chronological and hierarchical criteria, commonly adopted in many other fields. This peculiarity can also be found in relation to fields bordering that of design, identifiable under the aegis of the so-called “creative disciplines,” in which the educational activity appears to be strongly characterised by the implementation of aspects related to instances of sociality, inclusiveness, permeability and flexibility (Thomson & Hall, 2014).

A first strand of research about the relationship between design and signature pedagogies has thus been oriented toward the identification and investigation of educational formats highly connoted in disciplinary terms, attributing to them an active role in shaping the identity of the field itself. Exemplifying this approach is a study on signature pedagogies in the disciplines of design and art originated in 2006 by the British scholar and educator Alison Shreeve as part of the Teaching Landscapes in the Creative Arts Subjects research program sponsored by of one of the United Kingdom's Centres for Excellence in Teaching and Learning, Shreeve returns the more strictly design-related outcomes of this experience in an essay published in 2016, in which the concept of signature pedagogies is introduced in relation to the design domain indicating those educational formats through which students learn to think and act as designers.

Within her contribution, precisely titled *Signature pedagogies in design*, Shreeve initiates a first, structured attempt to classify the most recurrent and significant formats that come into play in the context of design education, arriving at identifying a series of relevant signature pedagogies, of which we are going to look at some examples.

The studio, whose origins lie in the notion of “workshop apprenticeship” codified in the arts and crafts tradition, refers to the spatial context in which design education concretely takes place in its material and immaterial components, and where experience, both individual and shared, is placed at the centre of learning; the space of the studio determines educational conditions in reference to which the boundaries between the figure of the apprentice and that of the professional are often blurred, imprinting into design pedagogy a connotation that is, from the very beginning, strongly oriented toward professionalism.

The brief, referred to what is probably the most significant and recurrent formats employed in design pedagogy in order to progressively introduce learners to the cognition of the principles, methods and processes underlying design, namely through the execution of specifically formulated exercises; this approach reflects the project-based nature of most design pedagogy, where learners are expected to take an autonomous approach to finding their own way through the brief, and the finished design or artefact are open-ended and largely unknown to the tutor at the time of writing the guidelines.

Materiality, Identifying the experiential connotation that inherently qualifies design pedagogy, where the entire educational process should predominantly express in the form of physical objects, which prepares students to develop a certain know-how preluding the design profession; the focus on materiality reflects a paradigm where theoretical teaching is placed at the service of practical experimentation, and learning (in its performance, as well as in its assessment) is primarily based on the production of artefacts, expressing and revealing the accumulation of experience.

In its methodical and systematic attitude, Shreeve's inquiry of 2016 concerning signature pedagogies in design highlights a repertoire of paradigmatic approaches to disciplinary education, which paves the way for carrying out detailed investigations focusing more in depth on the singular ones. On these premises, a particularly topical horizon of inquiry lies in assessing the impact that the advent of digital technologies has generated, and will certainly continue to generate in the near future, in the reprocessing of these teaching models from both the cognitive and the structural point of view (Fleischmann, 2020).

4. Design as a Signature Pedagogy

In contrast to the previously outlined approach, a second strand of research carried out within the Scholarship of Teaching and Learning on the topic of the relationship between design and signature pedagogies has followed a diametrically opposite attitude, that is, interpreting the concept according to an externalist perspective. In agreement with this attitude, the notion is interpreted as a conceptual means for understanding how signature pedagogies can be employed across different disciplinary domains (Werder, 2013), and thus projecting the inquiry into a perspective with a more distinctly transversal scope. Rather than in a logic of disciplinary affirmation, this second strand of research interprets signature pedagogies as opportunities for sectoral hybridization, which can cross the boundaries that traditionally exist between individual knowledge domains, and which often tend to inhibit their mutual dialogue. In the specific case of design – which, as already mentioned, is itself characterised by an intrinsic propensity toward interdisciplinarity – the adoption of this perspective can open up particularly interesting insights of investigation, both from the field of design to the other sectors and *vice versa*; in fact, it provides an opportunity for scholars, teachers and educators to develop experimental approaches to teaching and learning that do not limit design to a merely instructional role, but methodologically seek to integrate it with other disciplines, fostering an effective knowledge exchange.

Even with the plurality of its potential applications and implications, such a purpose is consistent with the principle according to which it will not be possible to increase the quality of our educational systems until teachers begin to act as designers, and not simply as instructors (Spence, 2001).

Building on similar assumptions, this investigative attitude leads to questions about if, and how, it would be possible to borrow educational formats conventionally pertaining to the sphere of design in order to apply them as signature pedagogies within other disciplinary and professional fields. Exemplifying this approach is a study promoted by the Organisation for Economic Co-operation and Development (OECD), in which design is considered among the most relevant signature pedagogies to be involved in order to generate opportunities for enhancing creative skills and critical thinking in primary and secondary education. Carried out within the international project "Fostering and Assessing Creativity and Critical Thinking Skills in Education," the study was aimed at defining a set of rubrics on what it means to teach, learn and make progress in order to help students succeed in the context of contemporary, knowledge-based economies. With this goal in mind, between 2019 and 2022 the OECD worked with a network of schools in eleven countries, encouraging involved teachers in reviewing and improving their existing lesson plans according to a list of signature pedagogies useful for nurturing students' creativity and critical thinking. Encompassing approaches such as, for instance, metacognitive pedagogy, dialogic teaching, research-based learning, and the Montessori method, this list also includes design thinking, a procedure implying a systemic approach to problem solving based on the sequential conception, prototyping, testing, and iteration of new ideas.

In its narrowest sense, design thinking can be interpreted as the set of cognitive, strategic and practical methodologies used by designers while practising their profession; more broadly, it refers to the body of knowledge that has been developed about how people reason when engaging with design problems. Closely related to the realm of entrepreneurship, the design thinking method is now widely established also as a pedagogical approach in the context of "innovation courses" in both university and schooling, engaging students in learning experiences in which they are led to think and act like designers (Vincent-Lancrin et al., 2019).

The OECD rubrics thus interpret design thinking according to an understanding deprived of the more strictly business-oriented components, as a vehicle for providing educational experiences in which students are asked to inquire through different means to imagine innovative and multiple solutions. Potentially embeddable into all subjects in the primary and secondary school curriculum, the signature pedagogy of design thinking is meant to develop students' creative and critical skills in an applied way, emphasising their propensity toward exploration, openness, and sharing of knowledge (OECD, 2023).

Identifying design as a signature pedagogy can support learners in getting familiar with the phases that shape the design process in order to expand and consolidate their ideas, giving rise to educational formats that can be either implemented in short sessions in a specialised field or in longer interdisciplinary projects. In this sense, such identification may foster the development of "design literacy" strategies effectively capable of conveying the aptitude to relate creatively and critically to situations characterized by a high degree of complexity, ambiguity and ineffability (Christensen, Hjorth, Iversen & Smith, 2019).

5. Conclusions

In the totality of their disciplinary prerogatives, signature pedagogies contribute substantially to qualifying the designer's educational journey, supporting learners in developing the set of skills, cognitions and expertises

necessary to operate knowledgeably within the corresponding professional scenario. As seen, analysing the notion of signature pedagogy from an internalist perspective involves its acknowledgement in the role of a conceptual means which can be employed for understanding more deeply the system of disciplinary coordinates in which the design community recognizes and identifies itself. This perspective promotes an investigative approach aimed at decoding the linguistic and semantic paradigms through which, following Donald Schön (1983), designers describe and interpret the consequences of their actions, the implications of their discoveries, and the distinctive features characterising their acting in the world.

In turn, the interpretation of design in the role of a signature pedagogy corroborates the possibility of inquiring its potential role as a cultural substratum common to multiple fields of knowledge, not necessarily aimed at the development of a professionalism but, rather, at the acquisition of a mentality. A point of view, this one, that recalls the arguments expressed more than half a century ago by Herbert Simon (1969), according to whom design could constitute the core of any professional education with which schools of engineering, as well as those of architecture, economics, law and medicine, must inescapably deal.

Both perspectives pave the way for the development of structured approaches to research in the field of design pedagogy, and the production of further efforts in this direction would be definitively welcomed, detailing the investigation, when needed, at the level of the specific disciplinary branch. From this point of view, a promising field of application can be that of "basic design": this term designates a particular phase, placed at the beginning of the design curriculum, which promotes holistic and experimental methodologies aimed at supporting students in acquiring knowledge about the fundamental principles of the discipline. Such a stance may be corroborated in view of the high degree of pervasiveness by which basic design pedagogy spreads within both the curriculum — as its experience keeps echoing throughout the design training pathway — and the profession — as its principles recall those coming into play in everyday design

practice. In fact, working on this particular educational phase endorses the possibility to identify, and transmit through appropriately formulated exercises, the elementary grammar underlying the theory and the practice of design, providing students with a set of basic technical and intellectual skills preliminary to any further specialisation.

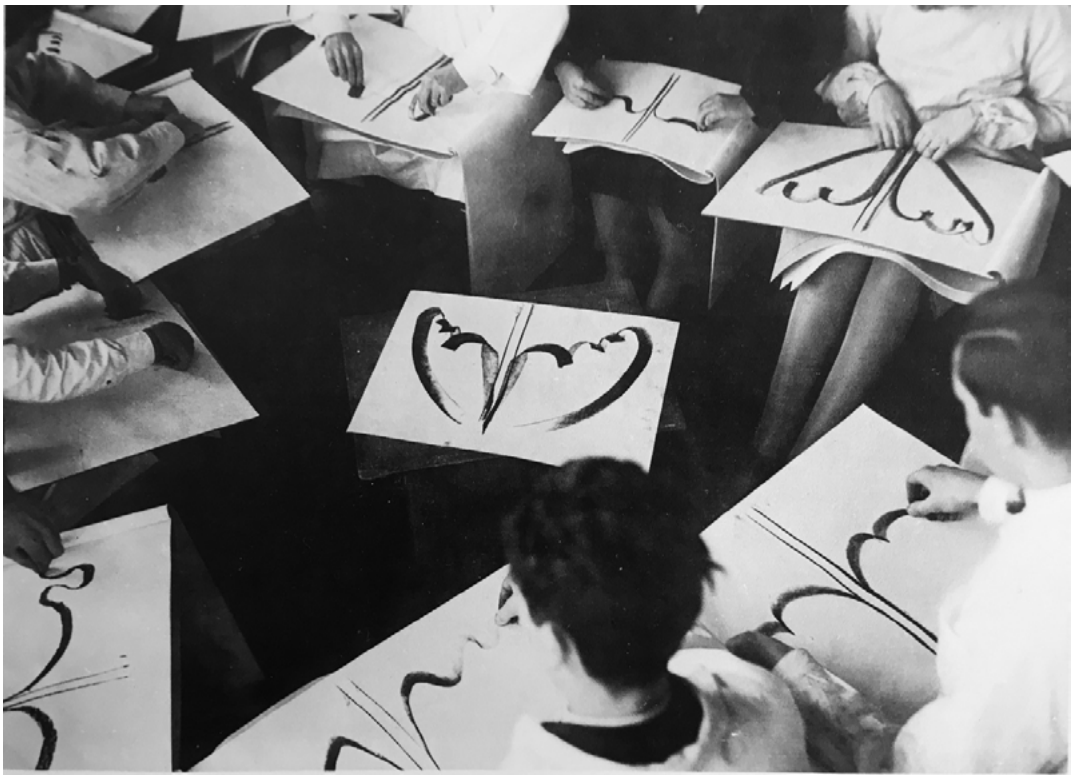


Figure 2. Johannes Itten: Basic design teaching class at the Staatliches Bauhaus of Weimar.

The impact of basic design reverberates not only upon the designer's intelligence of complex systems, but also upon the designer's professional responsibility (Findeli, 2001), and it is no coincidence that it has been interpreted as an essential educational phase by several of the most authoritative exponents of design pedagogy. By operating on the theoretical foundations of design practice, the dimension of basic design subjects the design discipline to a process of continuous revision and reprocessing, covering a function which in a certain sense, could be comparable to what in other sectors is defined as "basic research".

Weaving together preparatory training and disciplinary foundation (Anceschi, 2006), this model has traditionally played a crucial role in the history of design education, rooting on strong historical, theoretical, and methodological instances, and undertaking wide acknowledgement also within the contemporary disciplinary community: indeed, it is important to identify strategies for incorporating recent technological innovations into basic design pedagogy, focusing on the potential of digital tools from a critical point of view, in order to assess the value of this educational approach while adapting the course to a digital setting.



Figure 3. Josef Albers: Basic design teaching class at the Black Mountain College.

In light of the catalyst role it plays within the overall design curriculum, and the circularity it triggers in relation to the sphere of professional practice, basic design could even be considered and investigated in turn as a signature pedagogy in the general landscape of design education (Author, 2020): since basic design

represents one of the contexts where disciplinary statements are formulated more explicitly, such identification could provide a privileged point of view from which, on the one hand, address strategies for implementing this model in the contemporary context and, on the other hand, transpose it into other knowledge domains.

As a whole, the reasoning brought forward within this contribution corroborates the consideration of the concept of signature pedagogy as a useful interpretative lens through which it is possible to observe and

describe the phenomenology of design pedagogy in its varied expressions and manifestations. With the considerations here outlined, it is hoped to nurture a greater and more structured awareness about a conceptual construct that, bridging the level of theoretical speculation with that of professionalism, can provide useful insight in identifying and critically inquiring the processes involved in shaping the disciplinary status of design.

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P/REFERENCES OF DESIGN

SITUATED KNOWLEDGES: VISUAL REPRESENTATION IN SOCIAL DESIGN EDUCATION.

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KEYWORDS | DESIGN EDUCATION, SITUATEDNESS, VISUAL REPRESENTATION, KNOWLEDGE, DESIGN THEORY, SOCIAL DESIGN

ABSTRACT | As a concept, situatedness has been influencing various disciplines, yet its potential in the practice and education of design in general and social design particularly has yet to be fully articulated. In this article, we will present a visual model of situatedness in social design education and practice meant to facilitate the communication of situated knowledges between various design partners. We do so through two main venues: first, from the student's point of view, we use our model to instigate and trigger a process of self-reflection and personal definition, on individual and professional levels. Conversely, this tool can help students in the classroom find suitable partners to work with for the duration of the course (either complimentary or similar potential partners). Second, from the teacher's point of view, we use our model for several goals: mapping the students in the classroom according to various attributes; managing the progress of the class in general, according to personal efficiencies; and using the mapping to generate richer and more diverse outcomes at the end of the course. We will also delve into the advantages of developing this type of knowledge through visual representation tools, triggered through visual communication and service design theory and practice. Finally, this approach will highly benefit designers embedded in working with communities through strategies of participatory design, due to its dialogue nature.

1. Introduction

> "Every experience is a moving force. Its value can be judged only on the ground of what it moves toward and into." (Dewey, 1997[1938]:38)

In the beginning, there was survival. In its early stages, design was focused on the primary mission of helping in the survival of individuals and communities through material objects. As surroundings and conditions changed, so did design shifted and evolved offering better solutions and influencing the ways we interacted with the world. The Industrial Revolution introduced deeply rooted changes that influenced not only the ways consumers interacted with designed products but also the ways designers influenced our daily lives. Mass production called for the annihilation of local differences and a direct connection of the craftsperson with their designed products, in favour of short-term profit (Heskett, 2016). Building on this overpowering capitalistic approach, the second half of the twentieth century added another dimension of marketing-oriented design to differentiate between competing manufacturers, vying for the consumers' attention.

However, since the late 1980s, socially-oriented design approaches surfaced, opting for a more ethical and people-centred practice. Instead of fighting for ever-growing consumption, social designers (although perhaps, not defining themselves as such) started tackling the "wicked problems of design" (Buchanan, 1992). These were identified as broad, deeply-rooted and global challenges that designers traditionally ignored either due to their professional irrelevance, or due to their seemingly insurmountable difficulties.

Due to the complex and varied nature of design practice, designers need a complimentary expansive body of knowledge. Famously noted by design thinkers and researchers (Simon, 1996; Cross, 2023, among others), this knowledge is situated between science, art and craft and between the humanities and social sciences. Famously, designers specialising in social design tackle "wicked problems", which not only lack a decisive or single solution but involve various points of view and a broad understanding of changing scenarios and situations. As a discipline (theoretical and practical) that presents a worldview rather than a specified subject matter, the knowledge designers need is even more complicated to define:

> "This is the creative or inventive activity that Herbert Simon has in mind when he speaks of design as the science of the artificial. What he means is 'devising artifacts to attain goals' or, more broadly, 'doctrine about the design process'. In this sense, Simon's Science of the Artificial is perhaps closer to what Dewey means by technology as a systematic discipline of experimental thinking." (Buchanan, 1992)

Alluding to both Simon and Dewey is extremely relevant to contemporary design education due to both the complex nature of design as a practice, and more so when dealing with social design education and working in a crisis-laden reality. Following this stream of thought, Suchman (2002) called on designers to acknowledge both the situated nature of our practice, as well as the intricate layers of this knowledge vis-a-vis working with and for communities. Naturally, this is even more relevant and important when working in the spheres of social and participatory design, in practice, as well as in education. Suchman continued to highlight two perceptions of designers' role in knowledge production. First, designers must pay attention and be aware of their own situated knowledge, values and rooted ideas they bring to each project (or to use another term, the so-called researchers' bias). This premise also holds significant political and sometimes critical aspects, as Haraway observed. Second, designers need to pay attention and highlight their positioned knowledge vis-a-vis other stakeholders in each project. Thus, their own set of values and attitudes need to be considered when presented with other, sometimes conflicting worldviews of community members, local government workers and other stakeholders.

Famously, Suchaman (1987) juxtaposes planned action and situated action, meaning that the latter is more relevant to designers who work in ever-changing and complex environments than the former. Conversely, she (ibid: 188) defines situated action as "actions taken in the context of particular, concrete

circumstances [...] the circumstances of our actions are never fully anticipated and are continuously changing around us… situated actions are essentially ad hoc [...] local interactions with our environment, more or less informed by reference to an abstract representation of situations and of actions." Conversely, Lave and Wenger (1991: 32-3) lament the extensive and somewhat over-used nature of the concept, claiming that "on some occasions 'situated' seemed to mean merely that some of people's thoughts and actions were located in space and time. On other occasions, it seemed to mean that thought and action were social [...] or that they were immediately dependent for meaning on the social setting that occasioned them." They add to Suchman's important account the concept of "situated processes", which allows for the integration of improvisation and bricolage as practices suitable for innovation in complex scenarios, which defines every act of design. While all these are true and have at least a layer of relevance to our research, we start our interpretation of situated practice in a political-critical stance, echoing the complex situation designers and educators find themselves in between students/novices, community members and other stakeholders in a social design setting. We can surmise then, that every practice of design, and especially so in social design, is an act of communication and an act of interpretation or translation. As in Clifford Geertz's classic depiction of interviewing as a double act of translation (from their mouth, through our understanding and then into a research-oriented depiction of their narrative), the fluid and complex flow of the design process passes through the various stakeholders, navigated by the designer, aiming for a clear narrative that considers every stakeholder relevant to the project. This process is even more important when applying participatory design practices in a social context. Indeed, as is the case in situated knowledge, design is also temporal in that its understanding, interpretation and movement towards a proposed solution changes continuously as it faces an unknown future. Returning to the classroom adds another layer of temporality since we aim to educate professionals who would influence the discipline in the short and long timeframes.

2. Situatedness and Social Design Education

> "Feminist objectivity means quite simply situated knowledges [...] Situated knowledges are about communities, not about isolated individuals. The only way to find a larger vision is to be somewhere in particular. The science question in feminism is about objectivity as positioned rationality." (Haraway, 1988: 581, 590)

Relevant as ever, Haraway identified the need for situated knowledges, a need further heightened when dealing with social design. Not only is this knowledge necessarily situated, but the designer's values, as well as the socio-cultural context of the community to whom they design, affect the design process and its outcome. As previously mentioned, design differs from other bodies of knowledge. As in anthropology, design is unique in its relative lack of specific subject matter in favour of broader worldviews or work methods. In other words, design is not about "what" but rather "how". However, when adding design theory to the mixture, and when focusing on social design we add other layers of "why" and "who" (or rather "with whom" or "for whom"). Contrary to other classic design venues, social design revolves around several key layers that are crucial in our focus. First, social design is heavily dependent on collaborative work (co- and participatory design); second, social design is very much dependent on a specified socio-cultural context, of both the designer and the design partners. As previously mentioned, Suchman (in Ciborra, 2005: 10) defines a situation as "being the full range of resources that the actor has available to convey the significance of his or her action and to interpret the actions of others. Concern for the situation denotes the material and social circumstances of every course of action". This definition is important in our context since it involves the resources available to the designer, an active act of interpreting others' actions, and finally setting a creative act into motion.

When reflecting on the fluid meaning of 'situated' knowledge in action', Gherardi (2008) offers several dimensions:

- Situated in the **body** - somatic materiality, gender-oriented design and general aspects of collaboration and ergonomics are all situated in the body.
- Situated in the **dynamics of interactions** - in social design, as in other broader venues of the discipline, communication is key, not only between the design partners but also with non-human partners (technological systems, environmental entities and more).
- Situated in **language** - 'discursive practices' are key in social design, as each design partner and stakeholder communicate with different discourse systems. Thus, when working with community members, the designer translates their knowledge and undergoes another stage of translation when communicating with other design partners.

These three dimensions are extremely important when conducting social design projects since the intricacies of a given socio-cultural context are embedded in somatic knowledge, interactions and used language frames. Rohlfig et al. (2003) propose looking at situatedness as a dialogue between context and situation. They continue to say that "a situation consists of the spatiotemporal ordering of objects and agents alongside physically given constraints or characteristics like gravitational force or light intensity […] in our view, situatedness refers to special situations in which actions take place." Indeed, this elaboration is interesting in our context for two main reasons. First, situatedness is a combination of space and time, as both influence it and second, it is a trigger for action, which is crucial in design as a practice. Moreover, the concept of context is rich and elaborate as well, including broad socio-cultural venues, such as language and narrower venues, such as local knowledge and norms. The importance of context, then, lies in the multitude of agents and stakeholders involved in social design projects, conducting multiple levels of interactions between themselves, and their individual situations.

Stoner and Cennamo (2018) describe situated learning as "learning theory and a model of instruction that focuses on learning through authentic learning environments in which students can immerse themselves in an academic domain and participate in authentic tasks." Indeed, when embedding situatedness approaches in higher education and pedagogy we can address situated learning, which can be viewed as learning through authentic learning environments. Social, cultural and later on ecological and ideological context will render learned knowledge relevant for students on all learning levels. Therefore, understanding social practices, real-life technological knowledge, as well as the cultural essence of language is critical for the acquisition of knowledge. However, as Contu and Willmott (2003: 283) suggest, we should "focus not just upon cultural and organisational artefacts, but upon the embeddedness of learning practices in power relations, rather than the cognitive contents of individuals' minds". As learning in general is located or situated within everyday practices, when dealing with design the issue is even more pertinent. Therefore, we can agree that "learning is conceived as an integral part of generative social practice in the lived-in world" (Lave and Wenger, 1991).

Moreover, design education is further unique in its ability and necessity to integrate situated knowledge aimed at various efficiencies. Aside from linking theory and practice, these situated knowledges are also stemming from a dialogue between 'knowing' and 'doing', in that design is based on understanding through dialogue and communication, but it is also judged by its ability to influence the visual materiality of our reality. Gheradi (2008: 519) traces the roots of this assertion to 1960s ethnomethodology and its ability to offer "understanding of how individuals successfully use indexical behaviours and expressions whose meanings are constantly negotiated and renegotiated in the course of interaction. One meaning of 'situated' regarding practices is that their performance depends on how indexicality is locally resolved." Two other important traits of situated action, according to Gherardi, are reflexivity and accountability, which are a crucial element both in PD (participatory design) and social design education.

Situated knowledges in social design is especially important when practising it through the lens of participatory design. Focusing on values, various social groups, and often also political issues, the socio-cultural dimension of design practice becomes even more pronounced. Agid (2016: 81) describes this important connection between PD and situated knowledge:

> "Here, I propose that a focus on designers' positions, and how we make the relationships through which infrastructuring takes place, helpfully complicates what is at stake in both building and engaging with various infrastructures. This includes learning to design together with others through collective engagement in the work itself. Additionally, I suggest that how we understand, contextualize, and articulate the aims of acting on infrastructures, especially those with uneven material consequences for people living with them, is critically important to what it means to do infrastructuring in different contexts, and with whom. How we infrastructure is a political concern for PD that includes both the structural and systemic contexts of that work and the people and relationships with and through which it happens."

Agid (ibid: 81, 87) continues to define infrastructures as "systems that are made up of continually renewing, complex socio-material relationships that form, inform, and shape their parameters and ways of working [...] infrastructuring helps to hold complex intersections between people, groups, technologies, systems, and ideologies in view as one means of seeing how they might work in and for designing". While differing from classic industrial design, these definitions illustrate a majority of design practices and fall well between the parameters of contemporary design education. In social design, practitioners and educators navigate and bridge between various worlds of situated knowledges (the designer's, technological attributes, and the community's, among others), thus rendering the importance of mapping and grounding these various micro-worlds.

The combination of situatedness approaches in the classroom and participatory design values led us to develop a visual model as a reflection medium for all relevant design partners. Aside from it being more intuitive for designers, we surmised that complex issues are best presented in a simplified manner, specifically when working with partners from differing areas of knowledge and understanding.

3. Visual Situatedness in the Classroom

The last few years presented various complex challenges (wicked problems if you will) to higher education in general and design educators in particular. Ranging from communication issues stemming from the COVID-19 pandemic, through wars and political strife, as well as coping with immigration flows, ever-growing social exclusion and segregation and more. These complex challenges echo the necessity to reframe and redefine the role of design educators in society. As these changes bring our personal beliefs, core values and priorities to the surface, they influence our professional sphere as well. They also demand a departure from traditional linear educational models towards a deeper integration of diverse modes of knowledge production throughout the design process.

Considering the classroom as a complex system composed of teachers, students, and design partners can deepen our understanding of the intricacies and power dynamics within the social systems where the educational, professional and personal intersect. To support this shift in perception, there is an emerging need for new tools in design education. These tools should be capable of visualising and comprehending the complexities of individuals, social groups, and communities, particularly in light of their often-conflicting interests, assumptions, and backgrounds. In response to this need, we propose the 'Situatedness Model' - a visual representation of situatedness in social design education. This model aims to represent both individual and collective situatednesses within the learning and designing processes. Our objective is to design tools (in line with Buchanan's concept of 'devising artifacts') that will cultivate a design approach that is sensitive to the diverse needs, perspectives, and knowledges in the classroom while seeking to foster a more inclusive, empathetic, and pluralistic perspective in social design education.

3.1 Developing the ‘Situatedness Model’

Mapping knowledge through visualisations is essentially a way of envisioning, interpreting, and spreading information. Tufte (1990) describes this process as a way of creating a multidimensional model of different worlds to better understand them. The primary value of visualisations is their ability to transform discrete sets of implicit knowledge into an explicit set of relational knowledge quickly and directly. Typically, designers tend to start using visualisations in an early phase of the design process. In this phase, visualisations are used either as tools for translating raw data into insights or as a way of communicating insights (Segelström, 2009). Yee (2012) categorises the use of visualisations in design into three purposes: “for reflection and exploration, as an analysis and knowledge generation tool and as a communication, facilitation and discussion tool”.

Indeed, reflection is a central activity in various creative practices. It is often viewed as a cognitive process that allows designers to develop new insights into their design, generate alternative solutions, reframe the design problem (Kinsella, 2007), as well as create a steppingstone for future projects. Reflection is also considered a form of design-embedded knowledge gained through practical experience which influences the creation of assumptions, methodologies, and decision-making. Schön & Wiggins characterise design activity as a “conversation with the materials” (Schön & Wiggins, 1992) associating the act of seeing with sense-making, sudden discoveries, and learning from the present situation. These activities are collectively referred to as “reflection-in-action” (Schön, 1983). In the classroom, as we shall see, reflection is doubly important, as both a professional way of navigating through the project, as well as an educational venue for self-understanding and situating one’s work in a broader community.

Using visualisations for analysis and knowledge generation represents a multifaceted approach; while words and numbers primarily cater to logical and sequential processing, visual representations engage the brain's capacity for quickly and intuitively perceiving patterns, relationships, and abstract concepts. This approach, which engages both analytical and visual-spatial intelligences, enhances comprehension, memory retention, and the ability to identify trends in data sets. This is extremely important vis-a-vis two key attributes of design practice - its temporal nature, previously discussed, and its tendency to work through iterative creativity, rather than linear reasoning. Creating visualisations from research material allows the integration of the material's heterogeneity into design decisions. In this context, visualisations are akin to what Geertz (1973) famously described as “thick descriptions”: the research phase focuses on (re)framing and understanding, necessitating clear articulation of assumptions and features, as noted by Segelström and Holmlid (2009). Thus, visualisations allow for interpretation and translation processes, necessary when shifting through various bodies of knowledge, typical to design practice.

Designers commonly use visualisations for communication and discussion, both within their teams and with external design partners or stakeholders, common in social or participatory design projects (Segelström, 2009). Visualisation of research materials facilitates designers in externalising their 'sensemaking' (Krippendorff, 1989), thereby fostering a shared understanding of the research insights. Yee (2012) describes the dual nature of visualisation in research, emphasising its role as a tool for internal cognitive processing by researchers and a medium for external communication and engagement with a broader audience. This dual functionality highlights the critical importance of visualisations in both the exploration and dissemination phases of design research (ibid).

The ‘Situatedness Model’ draws inspiration from visualisation methods commonly used in service and systemic design practices. These fields are highly visual, due to the intangible nature of services and systems, and the diverse types of data involved in their conception and construction (Diana et al., 2009). Research on service design visualisations spans both academic and professional literature. Segelström (2009) characterises the use of visualisations in service design for three main communication goals, each differentiated by the intended audience: articulating insights (“communication within the design team”), maintaining empathy (“communication with one’s memory”), and communicating insights (“communication with stakeholders outside the design team”). Segelström & Holmlid (2009) suggest that

the visualisation techniques proposed by designers are not merely tools for mapping and describing the existing situation, but rather aid in interpretation and understanding. The choice of visualisation character (the "how") helps to keep empathy with the user throughout the design process, particularly when engaging with different stakeholders who might not be familiar with the users' perspectives. Diana and colleagues (2009) classify the types of representations according to a matrix with two dimensions: iconicity (ranging from abstract to realistic) and time (synchronic versus diachronic).

Common and popular visualisation methods are widely and almost universally used to enhance empathy with users by visualising their experiences, including the potential of different interactions and choices. In this category, we find tools such as personas (Pruitt & Grudin, 2003), cultural probes (Gaver et al., 1999), design documentaries (Raijmakers et al., 2006), mood boards, empathy maps (Xplane, n.d.), and user journey mapping (Parker & Heapy, 2006). Later adaptations have led to different techniques that represent the irreducible complexity of service organisations and make them more tangible, such as service ecology maps (Polaine et al., 2013). The web resources *Service Design Tools* (Tassi, 2009) and *This is Service Design Doing* (Stickdorn et al., n.d) serve as practical, open resources for presenting the most common and popular tools. Akama (2012) cautions against the oversimplification in visualisations sometimes found in service design, as they often lack the representation of complex and messy realities and the contextual knowledge grounded in action. She argues that service design methods should "never be severed from their complex human and situational contexts. Design that is generalised, sanitised, and exported out of its applied contexts loses its power and agency for potential interventions and transformations."

As designers increasingly address complex and wicked problems, they are adopting new visualisation methods originally developed in systemic design (Besplemennova and Tassi, 2018), to convey complex ideas and solutions. Recent developments in systemic design emphasise generative and transformative values (Jones, 2014), stemming from the understanding that dynamic systems require equally dynamic tools for representation. Notable examples of these methods include Giga-Mapping (Sevaldson, 2011), Synthesis Maps (Jones & Bowes, 2017), Enhanced Service Design Tools (Tassi, n.d.), and Design Journeys Through Complex Systems (Jones and Van Ael, 2022). These tools prove valuable in highlighting intricate relationships and interactions among various actors, as well as the diverse ways they exchange values.

Building upon the foundation laid by a variety of visualisation methods in service and systemic design, our focus now shifts to social design education, specifically through the lens of situatedness. The 'Situatedness Model' draws inspiration from tools such as those found in the Enhanced Service Design Tools and aims to integrate the unique perspectives and experiences of teachers, students, and the community or design partners. It seeks to encompass the complex interplay of actors and values in socially oriented projects. In doing so, this approach extends the conversation beyond professional practices and into the educational domain, thereby enriching the learning process with a deeper understanding of real-world complexities. In this context, student situatedness emerges as a critical component of social design pedagogy, offering a more holistic and embodied educational experience that reflects the multifaceted nature of social design challenges.

3.2 Designing the 'Situatedness Model'

In the following section, we outline our interpretation of the 'Situatedness Model' in social design education, describing and illustrating its key principles and stages. We identify three correlating and entangled layers: the designer-educator's situatedness (who is both a practitioner and educator), and their own set of values, personal identity, and professional preferences. The student's, in turn, profess their own educational, professional and personal attributes as well as societal identities and expectations. Lastly, the community with whom we work in these projects, manifests their own identities, desired outcomes, and socio-cultural context and relations. Some facets of the model are shared across the three spheres and others are unique to each one.

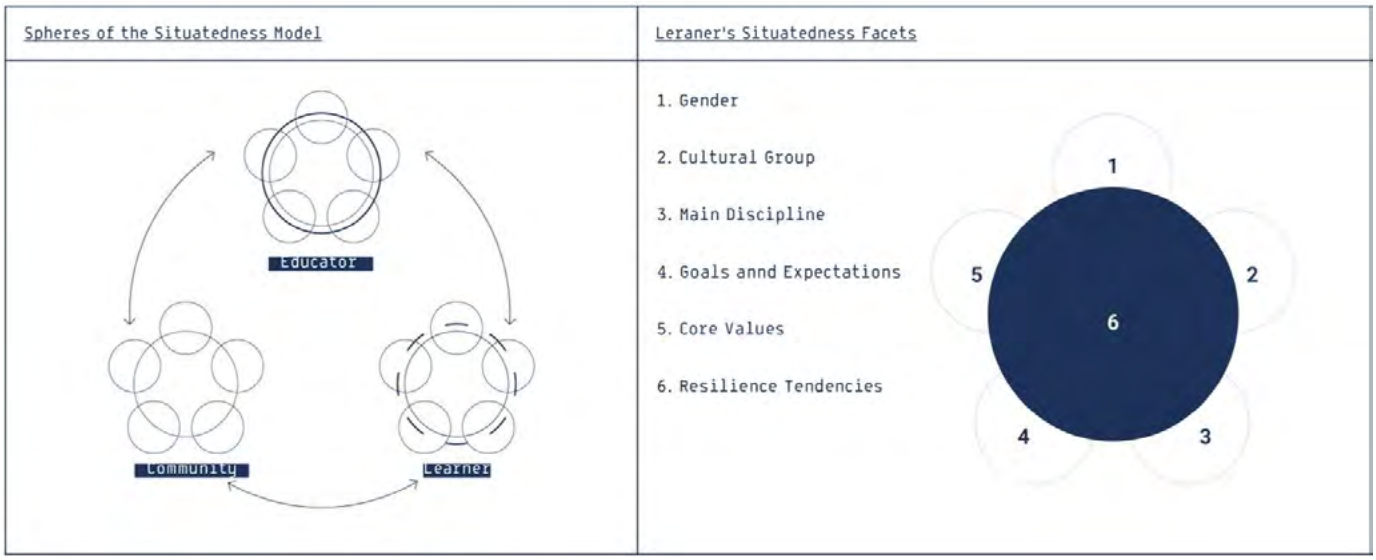


Figure 1. The three spheres of the Situatedness Model and the student's facet groups.

We based the design of the model on the geometric shape of a circle aiming to convey the continuity and relationality of the different attributes of situatedness to one another, as well as its a-hierarchical nature. We wanted to design a type of visualisation that serves as a symbolic representation of the interconnectedness of different perspectives and knowledges within individual and collective situatednesses. Our goal is to translate what is mostly perceived as abstract information within a class setting into visual representations that can be easily and meaningfully understood. We will demonstrate the different parts of the model by delving into the student's facet groups and attributes. This part of the model aims to describe the components that make up the student's situatedness at the beginning of a social design project. It does so by acknowledging the different facets that contribute to the knowledge, experience and expectations of each student. By doing so it places the design and learning processes in both the wider socio-cultural environment as well as the controlled design environment in which the project takes place.

Five outer circles represent the facet groups which are picked by the educator at the beginning of the course, in the current example - gender, cultural group, disciplinary background, goals and expectations, and core values. These may vary depending on the context of the course, student' background and project at hand. The inner circle represents resilience tendencies - it is the only constant facet. Each facet is categorized by a few attributes, and some may visually overlap.

The first three situatedness facets represent the student's background:

- **Gender:** Gender norms, roles and relations are powerful determinants of the health, social and economic well-being of individuals and communities around the world, as well as a central layer of our identity. In social design education, recognizing the student's gender perspectives can be pivotal; it can aid in integrating gender-based knowledge into the core of the design process, thereby facilitating the development of services and experiences that are more gender-aware and sensitive. In addition, when working with local communities, their perception of gender according to each socio-cultural context will dictate a different dialogue with the design team.
- **Cultural Group:** Typically, students' cultural backgrounds are not explicitly addressed in social design projects, with students more often integrating their cultural identities into personal or artistic briefs. By actively introducing cultural backgrounds into social design education, a more nuanced and context-sensitive understanding of design can be

fostered. This approach not only accommodates the specificities of different contexts but also helps in embracing diverse cultural identities and knowledge systems in design decisions. As social design deals in many cases with social justice, ethics and political issues, this is key to better defining the desired outcomes in each project. This aligns with Noel and colleagues' (2023) concept of a pluriversal design, where they advocate for a design environment where "multiple worldviews thrive and diverse lived experiences inform the entire field, as well as individual projects".

- **Main Discipline:** The complex nature of social design projects often requires collaborative and interdisciplinary work. Understanding each class member's disciplinary background can enhance the diversity of professional competencies within groups. Additionally, aligning students' design competencies with the specific needs of various projects can optimise project outcomes and learning experiences. The most advantageous aspect of social design is that it relies on cross-disciplinary skills, both inside the discipline (visual communication, urban design, inclusive design, service design and more), as well as outside its classic boundaries (social psychology, design anthropology and more).

The next two facets in the model are future-oriented and dedicated to the student's development goals through the upcoming project:

- **Goals and Expectations:** This facet draws on Richard Buchanan's four 'orders' of design, which categorise the outcomes of a design process on a scale from simple to complex: (1) symbolic and visual communications, (2) artefacts and material objects, (3) activities and organised services, and (4) complex systems and environments (Buchanan, 1992). This categorization encourages students to contextualise their current project within a chosen order as a strategic approach to their creative intervention.
- **Core Values:** We offer another name for social design - value-oriented design - to signify the importance of core values in socially-oriented projects from the project's starting point. We incorporate five values in the model: commercial, participatory, glocal (focusing on combining the global and the local), ecological, and critical/speculative. Students are encouraged to select one or more values to infuse into their project.

Mapping these values within the class serves dual purposes: to aid teachers in forming groups based on shared values, and to balance project expectations within each group.

The sixth facet in our model is **Resilience Tendencies**, placed at its core. The concept of resilience comes from the physical sciences, where it describes the ability of a system to create shapes, resist pressures, withstand challenges and return to its original form after a disturbance (Annarelli & Nonino, 2016). Resilience is manifested in times of change and crisis situations, denoting the capacity to remain in motion and to cope effectively. It is important to recognize that resilience is a dynamic and evolving attribute and can be strengthened through practice. In our 'Situatedness Model', we evaluate resilience, drawing on McGonigal (2015), within a holistic framework that encompasses four dimensions: physical, cognitive, emotional, and meaning-related tendencies.

We chose a visual code to highlight each of the facet groups in the model. Each facet varies by its colour, texture and size, as explained in Table 1:

Table 1. Visual Legend of the 'Situatedness Model'.

#	Facet	Attributes	Visual Language	Possible Interactions
1	Gender	Male		One option.
		Female		
		Non-binary		
		Fluid		
2	Cultural Background	Atheist		Students can change the size of the circle to mark their positionality between religious to secular.
		Jewish		
		Muslim		
		Christian		
		Undefined		
3	Main Discipline	Visual		Students were asked to choose one option.
		Product		
		Digital		
		Fashion		
		Other		
		Multi		
4	Goals and Expectations	Sign and Symbols		Students were asked to choose one option.
		Products		
		Services		
		Systems		
5	Core Values	Commercial		Students can choose a few values and arrange them by the degree of influence.
		Participatory		

		Glocal		
		Ecological		
		Critical/ Speculative		
6	Resilience Tendencies	Physical		The four tendencies are shaped as a compass, in the middle of the model. Each line is marked by the first letter for each tendency. Students can choose the length of each line to evaluate their resilience in each one of the attributes.
		Cognitive		
		Emotional		
		Meaning		

We used the MIRO collaborative online platform for the individual situatedness mapping activity of the model. This platform was selected for its user-friendly and collaborative features. On the MIRO board, a designated canvas (or 'frame') was provided for each student to construct their model. The board also includes an explanation of the model and a sample for reference. Following the mapping activity, students are required to complete a questionnaire to provide feedback for future iterations of the model. In some cases, this activity was supplemented with a group discussion to gather oral responses.

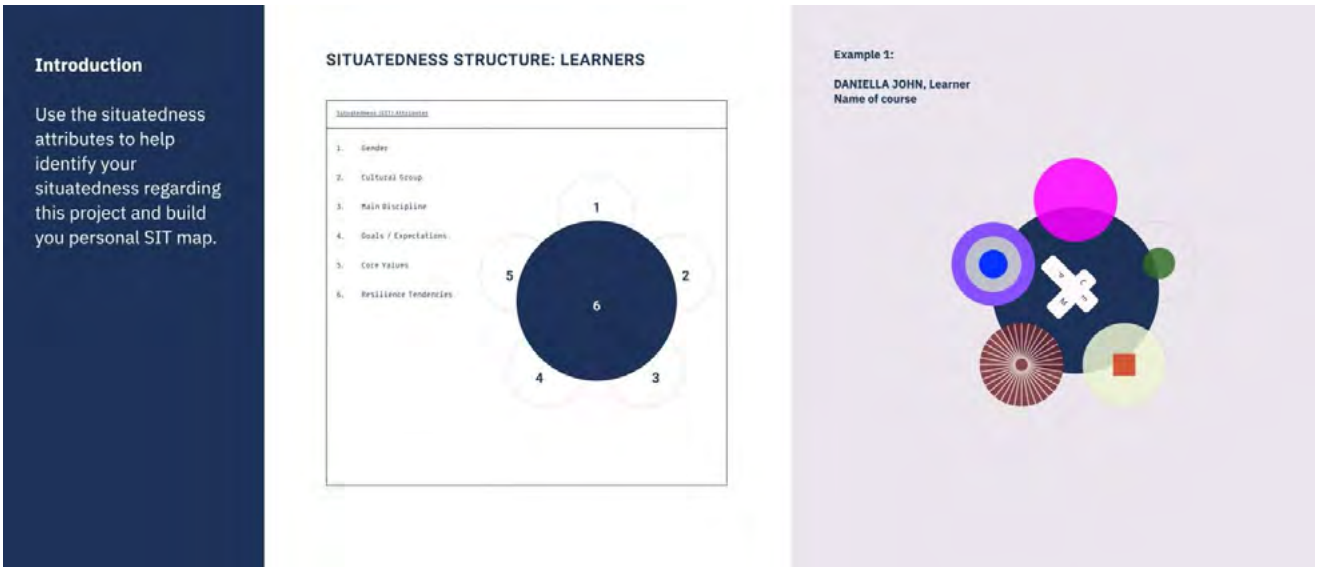


Figure 2. Details of the Miro board from the final project course (BDes) – HAC.



Figure 3. Details of the Miro board from the final project course (Mdes) – Shenkar.

The offered model is designed to work at two different levels. The first level focuses on the student's point of view - we use our model to instigate and trigger a process of self-reflection and personal definition, on personal and professional levels through a visual and conceptual model. Moreover, when introduced before choosing teams for a project the tool can help students in the classroom identify suitable partners to work with for the duration of the course (either complimentary or similar potential partners). The underpinning assumption is that there is an appreciation of expressed understanding through the visual model that triggers learning. Mapping, in this activity, serves as a platform for dialogue and reflection. This conversational approach plays a pivotal methodological role in enabling us to raise questions and address challenges that arise in the learning process. The second level focuses on the teacher's point of view - we use the model for mapping the students in the classroom according to various attributes; managing the progress of the class in general, according to personal efficiencies; and using the mapping to generate richer and more diverse outcomes at the end of the course.

To summarise the process of using the model we identify 6 main stages:

1. Identify the Individual situatedness of educators, students and community representatives, and highlight possible trigger points.
2. Harness empathy towards co-design and participatory design strategies.
3. Create a common denominator situatedness view for the collaborative project, defining boundaries and expectations.
4. Evaluate the design situation through sharing knowledge and applying co-design and participatory design strategies.
5. Define the type of design intervention needed, through innovation, improvement or non-design.
6. Choose the best possible outcomes that reflect the accumulated situatedness of the specific group, in this specific place and time.

As this is not a linear process, the last step is reflecting on possible changes in the actors' situatedness.

3.3 Teaching with the ‘Situatedness Model’

The first iteration of the model was held during a Health Design Lab course in the spring semester of 2023 at Shenkar, Israel. The second iteration was done within four design courses between December 2023 and January 2024 as represented in Table 2.

Table 2. Summary of Case Studies.

#	1	2	3	4	5
Date	May 2023	January 2024	January 2024	December 2023 /January 2024	January 2024
Location	Israel	Israel	Israel	Germany	Israel
Program	B.Des, Cross-Disciplinary Studies Shenkar	B.Des, The Department of Visual Communicatio n Shenkar	M.Des, Shenkar	MA Transformation Design, TH Augsburg	B.Des, Inclusive Design, HAC Jerusalem
Number of students	12	19	20	15	30

4. Interpretation and Conclusions

Visualising processes and interpretative knowledge through design is hardly a new concept. Immerging sub-disciplines of service design and visual communication use methods such as data visualisation to imbue raw data with emotions and create a deeper experience. However, we believe that visualising individual and communal situated knowledges will help designers and design teachers in facing present and upcoming wicked problems, especially when working on social design projects. Shifting perspectives and converging bodies of knowledge fall within an interesting change we have witnessed lately in design education. While the history of design education far surpasses the scope of this article, it has been widely accepted in the last several decades that the design teacher deals with the dissemination of knowledge or instruction of pedagogic processes. These approaches, rooted in traditional modernist paradigms, often portray the designer as a solitary master who analyses the design challenge from afar. This perspective neglects the potential benefits of synergizing conflicting worldviews of various stakeholders from the outset of design briefs and as a central aspect of the educational environment. The absence of tools in design education for visualising and comprehending the complexities of individuals, especially when considering their often-conflicting interests, assumptions, and backgrounds, profoundly affects how students are prepared to become future practitioners.

As we have seen throughout this article, the growing awareness of designers in the ever-growing sphere of wicked problems led to reframing the very role of designers in their communities and society in general. As such, designers in social design deal primarily with reframing value-oriented design to create change and tackle these wicked problems. Therefore, as teachers, the emphasis should be on educating—not merely instructing—future practitioners to expand their potential for deep and much-needed change in design practice. Further expanding this sphere of education needs a deeply rooted socio-cultural context stemming from understanding our values and those of our students, colleagues and communities. The core idea is that designers, when attuned to situational factors within groups, can foster a collective sense of situatedness, thereby cultivating a synergistic design language that is reflective of these factors. This approach is expected to enrich dialogues, encourage the exchange of ideas, and, hopefully, lead to

outcomes that reflect the diverse backgrounds of their creators. Furthermore, as new technologies such as social networks and generative AI, stimulating at first glance and frightening at a second glance, influence our work in ways not entirely comprehensible yet, the need for particular knowledge, sharing and meaningful dialogues is becoming more pressing. Both could be achieved through tools such as the model presented here.

Moreover, the temporal nature of design, i.e., meaning that designers are situated in the present, rooted in their past but designing for an uncertain future, holds immense implications for the use of our model in social design projects. As the future becomes more uncertain and crises are ever-growing and expanding, the necessity of a clear value-based system of professional guidance will become a must for individual designers and design educators even more so. In addition, the ability to navigate these obstacles and conflicts through dialogue techniques would be aided by such visual tools.

Finally, as we expand the possibilities of this model through empirical data (questionnaires, visual content analysis and observations) we wish to stress we are not offering a finalised one-stop-shop for use on the go. Rather, we offer a first stage for a new way of starting a project and facing the new faces of a fresh classroom. Furthermore, this is a part of a broader view of the history of design (see, Gal and Ventura, 2023) and our agenda towards the role of design and the designer in society and the upcoming future. We believe that designers are not problem-solvers, nor are they 'educated carpenters', but rather highly-professionals, multi-faceted mediators and visual-material interpreters of practical ideas (see www.socialdesignnetwork.org). As such, we hope this model will help us better understand our complex present to better face the uncertain future.

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P/REFERENCES OF DESIGN

DESIGN FOR CHILDREN: THE CASE STUDY OF DESIGN-DRIVEN LABORATORY AGAINST EDUCATIONAL POVERTY.

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KEYWORDS | SOCIAL INNOVATION, STEAM EDUCATION, DIGITAL MANUFACTURING, THIRD MISSION, DESIGN EDUCATION

ABSTRACT | Design for social innovation advocates for challenges Institutions are trying to align with in the evolving societal needs. This contribution reflects on the results of a series of laboratories designed and carried out at the 'Punto Luce delle Arti' of Ostia in Rome, with Save The Children, combat educational and material poverty using accessible technology. Eight workshops in different fields of creative manufacturing foster digital and manual skills, guided by computational and design thinking.

Design strategies stem from understanding social context and politics, fostering systemic change. Designers become politicized agents, transcending production, and technology to enhance social cohesion. New methods and tools emerge, defining well-being beyond economic values, emphasizing the balance of social and environmental capital for societal betterment. The Third Mission integrates University and Research with society, labor, and institutions, fostering territorial empowerment and meeting public demands for societal change. Design and education serve as strategic tools for social innovation, supporting initiatives in disadvantaged communities and empowering designers as infrastructure for autonomous development.

In the context of citizen empowerment, informal education, and STEAM disciplines fuels sustainable development and societal change. Citizen empowerment enhances community engagement and decision-making. STEAM education fosters creativity, innovation, and problem-solving through hands-on learning, offering a transformative perspective on societal challenges and promoting a "learning by doing" approach.

By these premises, the contribution offers an exemplary case study of how Design can effectively foster community building, sense making and introduce novel competences in replacing educational poverty, while advocating for a better urban development and vibrant neighborhoods.

1. Introduction

The reflection on methods and approaches that Design can adopt towards social innovation advocates the challenge that most of the institutions face in accomplishing and aligning with evolving societal expectations and specific knowledge demands (dos Santos et al., 2021). The diverse tools and strategies that can be used for this purpose stems from a symbiotic relationship between a profound understanding of social and political context (Manzini, 2018), fostering systemic change within operational contexts (Transit, 2017). Designers are called to rethink their role as politicized agents of change (Fry, 2010), expanding their impact up to a broader disciplinary field that overcomes production, technology, and market concerns (Meroni, 2007). This expansion enables new combinations of methods and tools (Villari, 2012) for social and territorial cohesion, ultimately contributing to the definition of new well-being indicators that encompass aspects beyond mere economic values, being conceived as the complementary balance of social and environmental capital (Stiglitz et al., 2009).

Within the realms of University and Research, these factors converge under the banner of the Third Mission, which bridges civil society, the labor system, and institutions. This principle facilitates territorial empowerment by enabling new forms of knowledge acquisition, competence, and skill development, aligned with public expectations and demands for societal change (Lange et al., 2019). Design and education serve as strategic tools in instigating, supporting, and enhancing social innovation beyond the academic environment, positioning designers as infrastructures to bolster initiatives for more autonomous or disadvantaged communities (Morelli & Sbordone, 2018).

To do so, it is crucial to understand the interplay between citizen empowerment and social awareness, which are factors commonly thrived through informal education and local activities derived by locals: in this context, it has been acknowledged how STEAM education can advocate for sustainable development and societal transformation (Taylor & Taylor, 2019) acting at the early stage of future civic society. While citizen empowerment garners attention as a means of fostering community engagement and participation in decision-making processes, STEAM approach and practices have also emerged as potent tools offering a comprehensive understanding of the world. They foster creativity, innovation, and problem-solving through a transformative lens and emphasize a "learning by doing" approach (Conradty et al., 2020).

By these premises, the project has been structured to have much clearer understanding of the following questions:

1. Can Design favor the creation of an environment where social inclusion and advanced technology collaboratively enhance the same educational scope?
2. Can Design in an educational context enhance the accessibility and inclusivity of those enabling technologies up to more marginalized social contexts?
3. How can education through Design stem a project culture aimed fostering cultural and social development?

To answer to these questions, the project "*Design for Children*" structured a didactic structured on a series of laboratories developed by Sapienza Design Research within the 'Punto Luce delle Arti' of Save The Children located in the Lido di Ostia Ponente district together with the local social cooperative of SS Pietro e Paolo.

The initiative has been designed to fight back educational and material poverty within the community by leveraging the accessibility of enabling technologies (Meutia et al., 2022) through eight laboratories focused on digital manufacturing in areas such as jewelry, gadget design, molding production, robotics, dynamic modelling, video creation, and serigraphy, ultimately aimed to foster the development of both digital and manual skills, underpinned by a computational and design thinking approach. Each workshop is presented and evaluated based on the skill and the competencies acquired by its young participants as well as by the technological challenge that the latter have been able to face and overcome thanks to the Design-driven approach.

Finally, the outcomes and the results of the workshops are measured based by 1) their capability to overcome the educational scope of the hosting local reality, 2) by the capability of the workshop to engage local users and stakeholders, 3) and ultimately highlighting the potential benefit it had at cultural and social level.

2. Education Through Design for Civic Empowerment

> "[…] digital has the ability to change content and form, a digital content does not remain identical but can be declined into very different versions from each other." (Magone & Mazali, 2016, p.110)

The aforementioned statement requires a deeper reflection on the different skills and abilities designers are required to have in nowadays processes and the development of technological skills. When tackling the issue of necessary update required to interact within digitalized systems, this project foreseen the necessity for a paradigmatic change that is leading the concept of education to provide the necessary knowledge and skills since the early stages of education through a "learning by doing" approach (Brown, 2009; Dziuban et al., 2018; Turakhia, 2022). Design and education acts as a strategic tool in triggering, supporting, and enhancing social innovation outside academic environment, while putting designers as infrastructures to support initiatives for those more autonomous or, so to say, disadvantaged communities (Morelli & Sbordone, 2018). Furthermore, the concept of situated learning in design education highlight the importance of authentic, real-world problem-solving experiences in architectural studio education (Buldan, 2021). This highlights the potential of design to create immersive learning environments that mirror professional practice.

Since first arguments on the role of the project in the civic context, the stability of architectural knowledge and its embedded nature within organizational practices, this stability underscores the role of designers as sense-makers, as their ability to navigate existing knowledge and drive innovation up to the social context (Henderson & Clark, 1990). In the realm of education, the people-centered and iterative nature of design thinking involves the use of specific sensible tools aimed not only to the comprehension of a context, but also to actively engage and provide fundamental tools to enable the civic society at the design process (Liedtka & Ogilvie, 2011). In the context, makerspaces can be configurated as center of learning, highlighting the significance of the physical environment in facilitating sense-making and learning (Woods, 2023). This underscores the role of designers as sense-makers in creating learning experiences that resonate with the needs and perspectives of learners, fostering a human-centered learning approach that involve and qualify the students and the teachers as enablers of conducive environments for learning purposes (Garcia-Lopez et al., 2020).

The concept of "Education through Design" (Bekker et al., 2015; Lewis, 2009; Lyon, 2016; Mentzer, 2011) encompasses diverse dimensions as design thinking offers a multifaceted approach to seek for potentialities or challenges and ultimately to envision solutions through the development of problem-solving skills (Brown, 2009; Cross, 2011; Kolko, 2015). In higher educational context, Design has already proved in many ways how it can emphasize collaboration, research, learning, and knowledge (Niederhelman, 2001). This highlights the potential of design to foster a holistic educational experience. What often is not considered is the way design can influence positively on the experience of learning (Beligatamulla et al., 2019). In this sense it could be relevant to address the importance of embracing the uncertainty that characterizes design education, which indeed often involves iterative processes, experimentation, and the acceptance of ambiguity, thriving for resilience, adaptability, and critical thinking skills among learners as well as in educators (Liedtka, 2015), thereby enriching the educational experience as a set of interaction towards common goals and achievements (Dym et al., 2005). Moreover, these highlight the role of design education in responding to social trends and needs, extending the learning environment through concepts such as Community-Based Education and Service. This bring to the attention the potential of Design to address real-world challenges and engage with communities (Tu et al., 2021), thereby promoting experiential and socially relevant learning.

Citizen empowerment means getting involved in activities that help everyone and make a difference in the community. (Lerner et al., 2009) This can lead to shared goals and positive changes. Impactful resources and solutions, in this sense, stem and derive from civic participation which involves engagement with local community, voluntary associations, local governments, that actively and collectively solve shared problems (Eccleston & Perkins, 2019; Ostrom, 1990; Sehner et al., 2022). Furthermore, empowerment programs are encouraged to provide greater opportunities for community roles in decision-making processes, especially for marginalized groups (Corbett & Le Dantec, 2018; Glowacki & von Rueden, 2015; Suwarno et al., 2019).

Social inclusion could be understood as the process of improving the conditions for the participation of individuals and groups in society, improving their skills, opportunities and dignity regardless of their identity (World Bank, 2013). In other words, a society is as much inclusive as all its individuals are valued while facing situations of marginalization and exclusion. In recent years, this theme of social innovation has become an integral part of the vocabulary of urban regeneration, where space plays a radical role in the production of this innovation (Ostanel, 2017).

> "[…] For Politics to regenerate, it must receive ideas and energy from social planning. Conversely, for social planning to flourish, expand, and endure over time, it must recursively find a favourable environment. And this, in turn, to exist, requires good Politics." (Manzini, 2018, p.4)

In his introduction, Manzini refers to *Politics* (highlighting the use of the capital *P*) as the set of organizations and actions that enables societies to thrive towards higher forms of civilization. These dynamics could also be understood as the exchange that nurtures systemic shifts within operational realms (McGill et al., 2023), which complexity underscores the need for fresh combinations of different and coherent methods and tools of design and production. This factors enables the growth of territorial empowerment opening to new forms of acquiring knowledge, competences and skills in support of public expectations and demands for societal change (Lange et al., 2019).

Said so, it could be possible to argue on the concept of citizen empowerment which has gained significant attention as a means of fostering community engagement and participation up to the decision-making processes. Nevertheless, this potential requires adequate sensibility and awareness by its users, to be considered truly impactful and inclusive.

3. Design-Enabled Technologies in STEAM Education

> "The problem will be that work itself will no longer exist and a large part of work as we understand it today will simply no longer exist." (Daclon, 2020)

The evolution of technology is driving changes in paradigms and dynamics that are impacting both the economy and society (Schwab, 2017). The reflections carried out along this project explore how those advanced models for cities livability that are aimed at citizen empowerment, are also defining the networks of information, services, and products that surround them (King & Cotterill, 2007). These models involve hybridizations and connections of processes that go beyond just the exchange of data: they structure new ways of establishing relationship between suppliers, users, interfaces, having direct consequences on the way people perceive daily life, especially in urbanized context (Calvillo et al., 2015).

Popular and participatory applications of technology are subverting traditional urban models and empowering citizens to take an active role in data collection. In this scenario, there is also another the responsibility each user is called to take towards the actions that could be made and the role each citizen cover while interacting in the system (Gatsios et al., 2020). On one hand, and among its pluralities, it could be possible to argue that *Design Research* mainly focuses on the application of competencies and skills in programs that would guide users through various disciplinary backgrounds and scientific developments (J. Li et al., 2022). On the other hand, *Design Education* integrates design thinking process into the

development of skills, providing a natural and essential component of an authentic STEAM program (Bautista, 2021). This approach fosters reflection and intentionality in Design and implementation in STEAM programs, demonstrating the ways in which design thinking can enhance student capabilities of dealing with advanced systems (Champion, 2018). For instance, in the Maker culture, the STEAM approach fosters a pedagogy model through technology that advocates for student autonomy and personal ownership throughout the design and making process (Weng et al., 2022), thereby enhancing student motivation and sense of ownership. This highlights the role of Design as culture in shaping educational experiences that foster a sense of agency and ownership among learners (Y. Li et al., 2019). In this context, it is important to consider the connection between citizen empowerment, informal and STEAM education can promote sustainable development and societal transformation (Taylor & Taylor, 2019).

If the citizen empowerment has gained significant attention as a means of fostering community engagement up to the participation in decision-making processes, at the same time, STEAM practices have also emerged as a powerful tool that offers a more comprehensive understanding of the world by fostering creativity, innovation, and problem-solving through a transformative view and a particular attention for a "learning by doing" approach (Conradty et al., 2020). At the same time, STEAM practices have also emerged as a powerful tool for enhancing innovation and creativity. In this context, it is important to examine the connection between citizen empowerment and STEAM practices, as these two concepts are closely intertwined. By integrating science, technology, engineering, arts, and mathematics, STEAM education offers a more comprehensive understanding of the world and fosters creativity, innovation, and problem-solving (Aguilera & Ortiz-Revilla, 2021).

By the reflections put in place so far, becomes clearer the need for a transformative approach, that becomes therefore necessary to challenge future people's assumptions and values and to ultimately inspire future citizens – whether they would become designers or not – to advocate for a sustainable and inclusive change. The following paragraphs introduce an exemplary case study of a program that could possibly lead to a deeper understanding in the creation of effective STEAM educational models. This case study exemplifies diverse STEAM education methodologies employing design principles to instruct students in the practical application of novel technologies and "modus operandi". The following paragraph presents the structure and the results of the series of workshops, designed by Sapienza Design Research at the Punto Luce in Ostia, in collaboration with Save the Children Italy and the Social Cooperative SS Pietro e Paolo.

4. Design for Children Case Study

In line with the objectives of the project, namely those of promoting a center with a high educational density, open to children and adolescents between 13 and 17 years old, where they can find opportunities for growth, development and experimentation through free access to activities ludic-recreational and training, the proposal of the Sapienza Design Research foster cultural, recreational and planning activities carried out with an educational and inclusive approach, capable of stimulating creativity. The initiative promotes the creation

of eight workshops that applied diverse structures to implement a complete STEAM education approach. In this sense, each workshop has been focused on different practices, technology, and context of application.

The eight workshops designed and tailored for this initiative stand out for their use of various technologies and applications guided by Design methodologies, practices through the application of those enabling technologies. The objective of this initiative, entitled "*Design at Punto Luce delle Arti di Ostia*" (Figure 1) was to highlight the capabilities of Design in producing social value by building strategic alliances with the Third Sector, to initiate processes of social inclusion in the most disadvantaged suburbs.

The program designed eight workshops related to the following areas of Design:

1. 3D modeling and rapid prototyping for jewelry design;
2. Dynamic Modeling;
3. Graphics for stop-motion;
4. Screen-printing Design;
5. Small Robot Design;
6. Art in 3D;
7. Comic Gadget Design;
8. Design for Cosmetics.

All those didactic activities involved diverse figures of the University among professors, researchers, PhD students which have worked side by side with local social operators and experts specifically invited for each activity. Over 250 students aged between 10 and 19 participated in the workshop activities organized by the project, which also involved professionals and local businesses that contributed to the development of the activities.

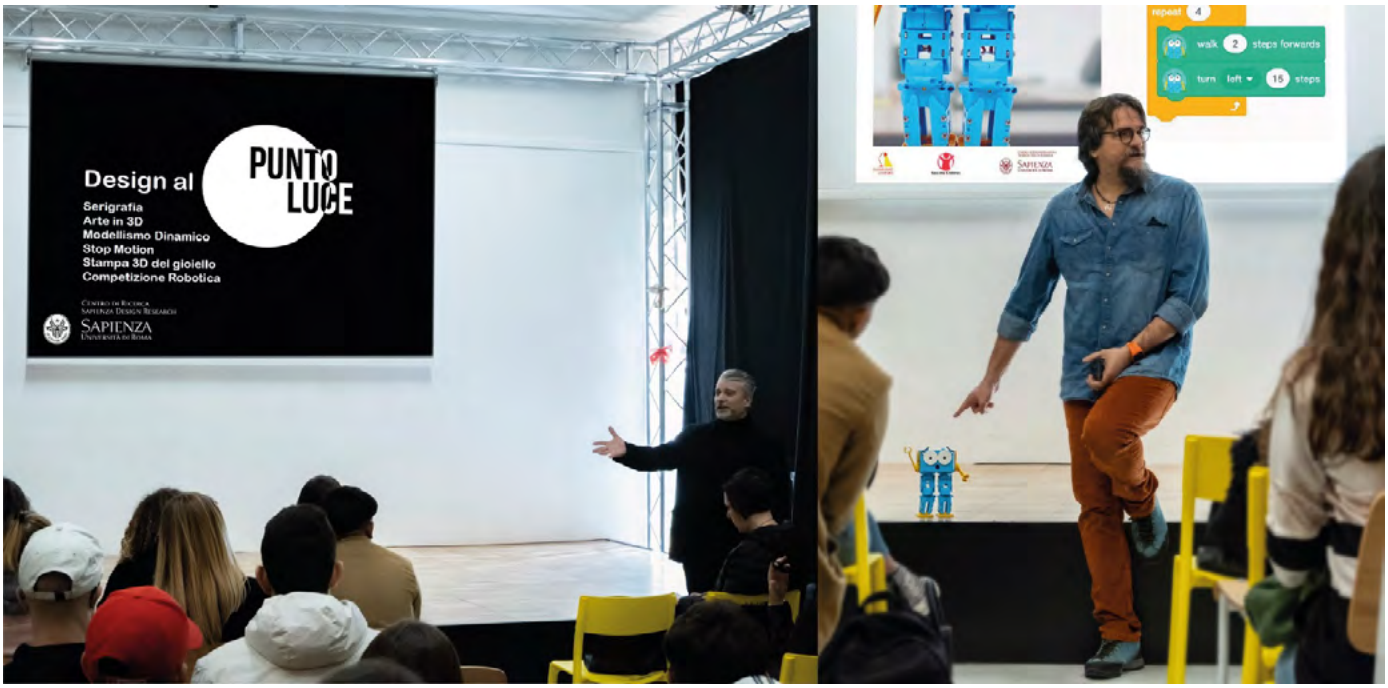


Figure 1. Kickoff day at the Punto Luce delle Arti di Ostia that introduced the workshops to the future students.

4.2 Design at Punto Luce delle Arti di Ostia

The following paragraphs are dedicated to the results of the aforementioned activities, with particular attention paid to the knowledge produced and the skill acquired by its participants. Each workshop is introduced by its structure of activities, followed by a small discussion on the skill developed by its participants and the impact this experience could have on the perception of the potential application of the technology.

3D Modeling and Rapid Prototyping for Jewelry Design

During the workshop, students were introduced simultaneously to CAD design, along with basic jewelry design techniques, while guided through a hands-on approach on the manufacturing process. Each lesson focused on a specific modeling process aimed solely at creating a finished model ready for the printing stage via a filament 3D printer.

Lessons were structured around various daily exercises that continuously produce different product such as rings, pendants, chains, bracelets, with a particular attention to the narrative of the products, which were aimed at communicating the territorial values of their territory or perceptions. Based on previous exercise, the last two sessions have been dedicated to their own designed jewel.

The entire structure of the course saw three main phases distributed in each session of 4 hours:

- The first phase was solely dedicated at introducing jewelry design principles (like ergonomical aspects, touching points, materiality) along with the narratives of formal choices (symbolism and aesthetical aspects).
- The second phase was straight to the practice, through a first rough and fast model on *Tinkercad*, where different shapes, related to the concept intended to be developed, were thrown on the digital scene to "assembly" the jewel. The main 3D modelling program was also used along with other free addon such as *3D2litophane* or *image2svg* to also implement a comprehensive customization of the designs. Once the elements were selected, they were assembled and optimized for the next 3D printing phase.
- The last phase was manufacturing, in which all the models were collected and ordered by the time required to be printed, to retrieve as many models as possible on the spot. In this way every day each student was able to retrieve its product immediately, giving a certain amount of satisfaction and confidence with the theory through a direct result of the practice.



Figure 2. Some of the projects designed by the students and its digital models realized during jewelry design workshop.

Throughout the course, participants gained expertise in 3D modeling, printing, and jewelry design, understanding the intricate relationship between products and bodies (Figure 2). They honed their design sensibilities, grasping principles of form, function, balance, and proportion. Through this, they explored how design choices affect wearability and usability. The integration of diverse disciplines—art, technology, engineering, and fashion—fostered an interdisciplinary approach, resulting in fashionable yet functional products.

Dynamic Modelling

The course aimed at designing and creating a dynamic model using rapid prototyping printers was adapted to the participants' prerequisites through reorganization into two phases:

- The first part involved students acquiring basic knowledge of sailing navigation principles and designing the customization of boat models.
- The second part focused on the creation of 4 sailboat models. Mechanisms for remote control of dynamic parts were installed, and customization was achieved through the creation of masks using vector graphics software, either in vinyl with a cutting plotter or with laser cutting and spray paint.



Figure 3. Picture of the models built and customized during the Dynamic Modelling workshop.

Conversely to other workshops, this course introduced students to the principles of dynamic mechanics, subsequently transitioning to a tuning phase conducive to customization (Figure 3). Furthermore, students were afforded the opportunity to delve into the principles of remote-controlled manipulation, thereby fostering enhanced proficiency in long-range 'hand-eye' coordination processes.

Graphics for Stop-Motion

The course was structured to introduce and guide students through its assembly technique. After an initial historical introduction, the course technically analyzed the differences between video and photography, positioning stop motion graphics between these two mediums. The workshop has been structured as such:

- The first step of the process approached the scripting part, where students imagined and wrote a small story to be told through stop motion, envisioning their characters, settings, and props. In this phase, participants were introduced by professionals to the concept of storytelling, in which they were invited to first describe a story (verbally) and then to reproduce every visual element they were able to seek in the story. Each element was listed and stored as potential "prop" of the scene.

- Secondly, students summarized the fundamental scenes of each story, creating a storyboard that visually shaped the scene. From the analysis of these scenes, each scene has been manually animated, acting as much on the character as the environment props made by hand with colored cardboard and improvised tools. A small photo set was created to capture individual scenes depicted in the storyboard, which have been later-on assembled through free online programs.

Creating narratives and storyboards stemmed advanced understanding for the young participant in developing critical thinking on the touching points of a narrative arc. In this sense, "crafting" their own narratives could ultimately help children to effectively communicate their ideas and thoughts by structuring it logically and conveying them clearly to others (Figure 4). Character and interaction design taught fundamental concepts for understanding the significance of actions, fostering empathy by considering diverse perspectives, while narrative structure analysis encouraged critical thinking about cause and effect, character development, and thematic elements. Ultimately, participants learned to identify patterns and comprehend how various story components contribute to the overall narrative.

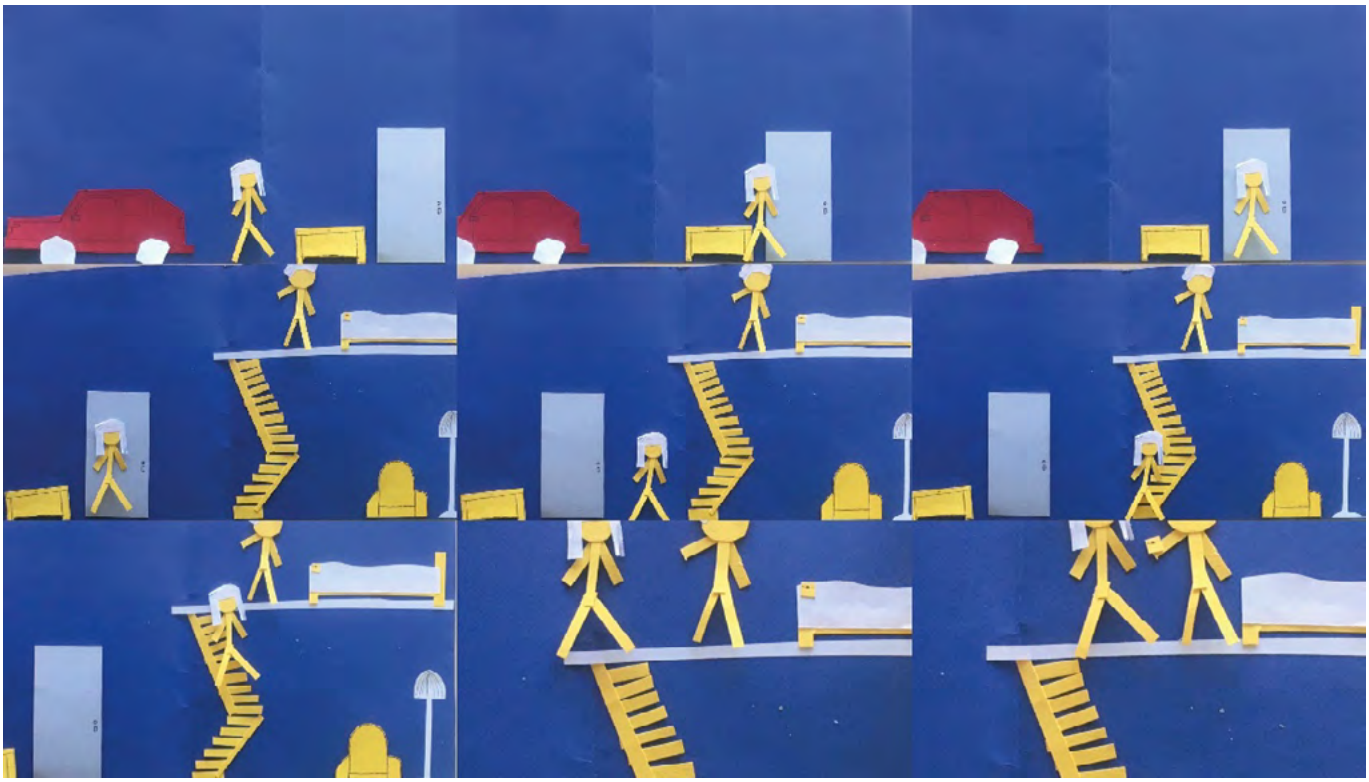


Figure 4. One of the novels represented by the "set" designed by the students during the stop-motion workshop.

Screen-Printing Design

The course aimed at creating screen prints on fabrics and was organized through learning phases, including the history of the screen-printing technique. A common project was identified to create the frame, engrave, and finally print. In its development and adaptation to the encountered context, the course was structured into two main phases:

- The first part involved a theoretical component of screen printing related to designs graphics that each participant wanted to reproduce. Each drawing was then to match the necessary characteristics to be transferred onto a screen-printing frame (by defining shar edges and small details).



Figure 5. The process of silk-screen printing was carried out with the students and some of the results of the workshop.

- The second part focused on the creation of the frames, which were then refined through engraving. Each step involved all the necessary phases of the screen-printing frame creation process, from reproduction on paper to the final exposed fabrics. Approximately 18 students aged between 12 and 16 participated in the course.

Participants have acquired practical manual skills, further deepening their understanding of the serial production process of t-shirts (Figure 5). Moreover, the developed drawing techniques have instilled an initial seed for the development of creative manual dexterity, encompassing drawing skills and selective analysis of the compositional elements of an artwork.

Small Robot Design

The course introduced students to computational thinking and related design, considering the growing impact of artificial intelligence on technical-economic development in various sectors, teaching them to master both the autonomous behaviours of digital systems and the programming of intelligent physical products. The course adopted a simplified model of a two-wheeled robot controlled, equipped with additional sensors and actuators. The course has seen Three main phases along its eight appointments:

- In the first phase the participants were introduced to the computational thinking and coding language through analogue exercises and the use of a development environment called *Makeblock*.
- After assembling the components and becoming familiar with the fundamental concepts of programming for robotics, participants focused on programming behaviours such as drawing on a horizontal whiteboard, creating repetitive patterns, managing input from sensors, and interacting with other robots for a competition.
- The course ended with a small tournament where participants could test the capabilities of their programmed robots.

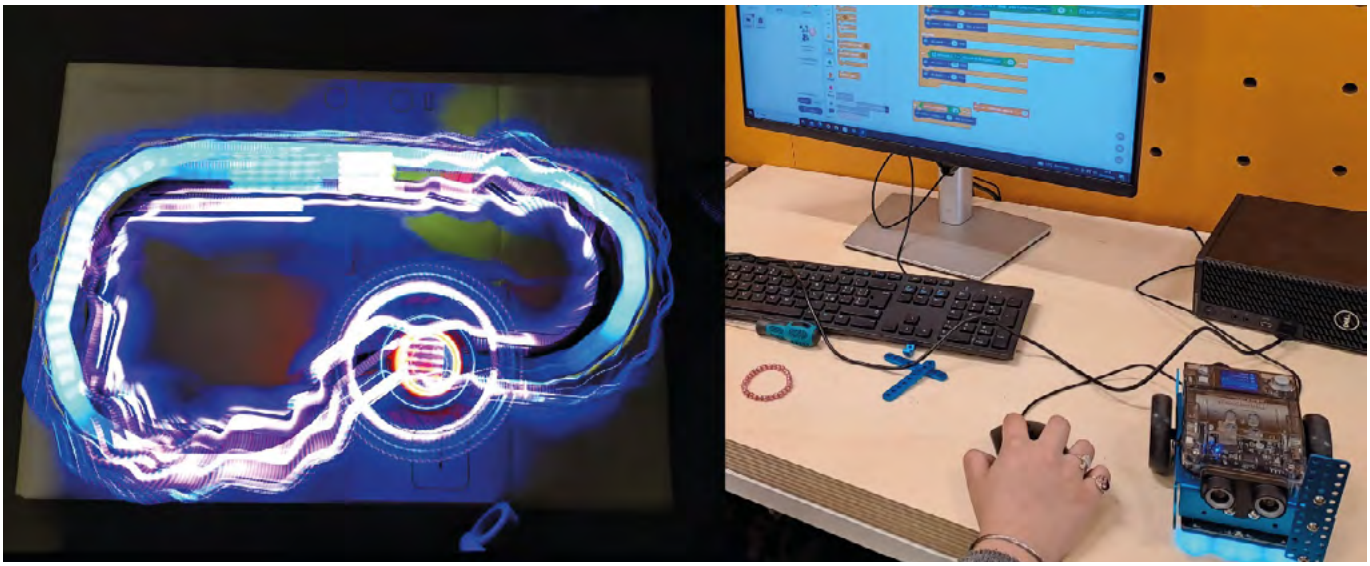


Figure 6. A light effect made to define the path of the robots programmed by the students and the program used to program the small robot.

Through hands-on robotics (Figure 6), children have been able to acknowledge and develop engineering and advanced design skills. While STEAM approach considers computational thinking and coding activities as crucial for children's skill development, the course has instilled in its young participants the ability to identify the basic logic of commonly used electronic products and the ability to perceive the communication patterns of automated processes. Additionally, the course enabled young participants to explore new forms of expression and representation such as light painting and pattern design. Similarly, it opened up to the development of new skills and the possibility to redesign (rather than reprogram) specific behaviours previously considered "preset" and inaccessible.

Art in 3D

The workshop of *Art in 3D* has been designed to let students approach to history of art through the analysis and to then digital redesign it of paintings using 3D modelling software. The course was divided into two phases:

- In the first phase, participants learned to use digital tools and fabrication by working together on a historical art masterpiece (such as *Piazza d'Italia*, 1948, by Giorgio de Chirico).
- In the second phase, the students developed critical observation and individual creative expression, repeating the exercise previously tackled collectively, but this time referring to abstract art pieces and increasing compositional complexity.

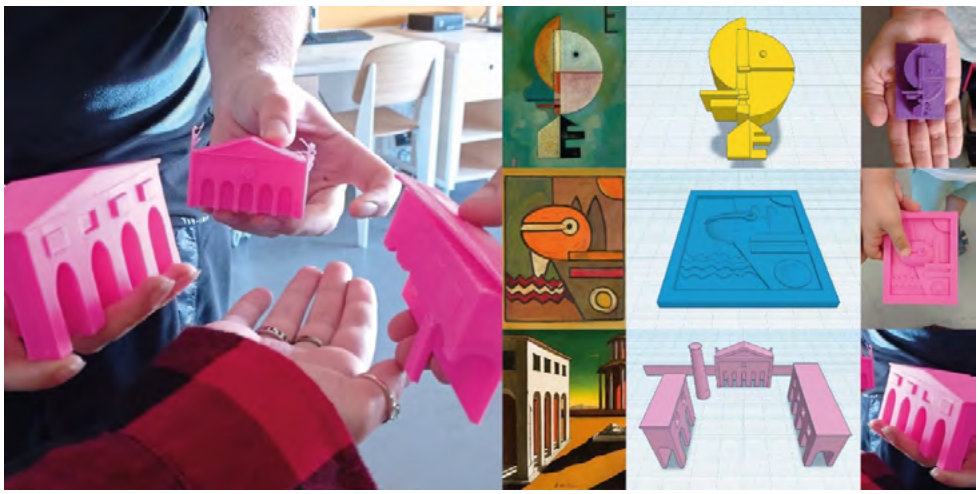


Figure 7. Some of the art pieces that were designed and printed by the students during the *Art in 3D* workshop.

In both phases, the painting was introduced through a short documentary on the artist's poetics and then reproduced in 3D. Here, greater emphasis was placed on individual creativity and problem-solving approaches, creating spaces for peer education. The characteristics of the suggested artists and Paul Klee's specific poetic of layering were discussed and provided the basis for the creation of new 3D interpretations by the participants. The resulting works, that were finally 3D printed (Figure 7), enable students to engage the original artwork from different perspectives, stimulating a process of "active reading" that enhance, above creativity, a sense of critical thinking and analysing skills towards the existing scenarios.

Comic Gadget Design

The workshop was structured with the aim of creating 3D-printed gadgets of hand-drawn characters, covering design, 2D graphics, 3D modelling, and 3D printing. In a very straight forward structure, the workshop consisted of three sessions, organized as:

- In this initial phase, participants engaged in the creative process of drawing their characters. This step involved short sessions of brainstorming, sketching, and refining ideas to create compelling designs. Participants adopted traditional drawing activity (through a piece of paper and a pencil) in which the only requirement was to keep an heavy stroke of the trace.
- In the second phase, participants started the digital design and 3D modelling. They made use of the usual *Tinkercad* software to transfer their 2D drawings and translate them into three-dimensional digital models, adding depth, volume, and eventual details to their characters. This phase involves learning the basics of 3D modelling and applying them to their designs. Lastly, the designs were applied on a plan keyholder 3D model to give final portability and functionality to the design.
- In the third phase, the designs were 3D printed. Participants learned about the process of setting up 3D models for printing, including considerations like scale, orientation, and support structures.



Figure 8. Students during the design process and an example of the final outcome of the printing process.

The structure of the workshop was linear and progressive, with each phase building upon the work completed in the previous one. By dividing the workshop into distinct phases, participants focused on specific skills and tasks related to each stage of the design and production process. Additionally, this structured approach allows for clear learning objectives and facilitates a logical progression of knowledge and skills acquisition throughout the workshop.

Through various phases of analysis, development, and production, young artists navigated through the world of reproducing and revisiting plan graphic designs into 3D models (Figure 8). During the course, the main 3D printing technologies were explained, along with materials, techniques, and common issues. Participants also learned the basics of three-dimensional modelling, applying them to the creation of customized keychains using their own drawings, which were first hand-drawn on paper and then digitized and converted into vector format for modelling.

Design for Cosmetics

The laboratory focused on the use of digital technologies for modelling and prototyping, aiming to create 3D printed prototypes of moulds for the casting and compression of solid detergents. Through various phases of theoretical study and practical exercises, a series of prototyping was carried out using moulds made with additive manufacturing, followed by considerations on the efficiency of the mould and its improvement through the optimization of shape, material, and process. The workshop has been structured on 5 sessions of 3 hours each one:

- The first two sessions have been dedicated to the acknowledgment of the material, like its density, and malleability. Along with a design thinking approach, students have been also introduced to evaluate the stimulus they could retrieve from the sensorial features of the material such as the smell or the colour: this phase introduced the students into a first phase of sense making in design.
- This step involves the practical application of technology (3D printing) to create moulds. Participants gained technical skills related to digital fabrication and mould-making during this phase as well as they have been introduced to practical mechanical issues of moulding process (like the most common undercut issues). This part was particularly sensible since was the critical part in which participant started to develop problem-solving skills to intercept and resolve possible issues in the opening of the mould. Moreover, conversely to the previous workshops, in this phase participants were asked to model the final shape of the soap to perceive the potential result, but then were required to subtract the latter to the mould to have the proper tool. So, they have been also guided to think at their shape as the negative of their actual print.
- In the final step participants used the printed moulds to produce the final shape of the soap. It involves applying their understanding of the material and the design thinking principles to create a tangible product.



Figure 9. Examples of final soap resulted by the moulding process and other designed digital models.

Despite the complexity of the subject, which required young participants to think of their design as the master for a mould, the participants were particularly engaged in the process, especially in customization phase, actively participating, generating, and achieving excellent results (Figure 9). Moreover, since the continues practical activities carried out along with the participants, the entire course has been able to adapt the activity based on the response retrieved by the participants and the technical requirements of the cooperative and the technical consultant. Lastly, the emphasis on sense-making participants interpreted and understood information by evaluating sensorial features like smell and colour, opening to a more comprehensive approach to design. This enhanced their ability to create products that engage users on multiple sensory levels.

5. Discussions

The project has had significant impacts on various aspects, which can be framed within fundamental aspects for territorial development and social fabric. In particular, the impacts of this project have had repercussions analysed concerning the territorial scope, specifically looking at the development of new awareness and social empowerment for the young beneficiaries. Furthermore, consideration is given to the economic, social, and cultural dimension of the structure itself that hosted the courses and the positive impacts for the educational staff, as well as the enhancement of the identity and reputation of the initiative gathered within the spaces. The overall project outcomes and impacts have been evaluated based on the following factors: 1) Educational Scopes, 2) Users Engagement and Involvement, 3) Local Cultural Development.

Educational Scopes

The eight creative workshops were characterized by activities that included the use of both manual arts such as screen printing and dynamic modelling, and digital ones such as 3D modelling, programming for robotics, and animation.

This diversification has allowed the development of specific skills, aiming to provide the Punto Luce with the ability to offer students advanced training in the context of project culture and new manufacturing technologies. The close collaboration with Save the Children Italy and the partner Social Cooperative SS Pietro e Paolo has therefore extended the social and territorial impact to the entire neighbourhood, involving profiles at risk of social exclusion from different municipal areas.

Users Engagement and Involvement

Main beneficiaries of the project were youths aged 12 to 19, including secondary school students, young people with learning disorders, those from families at risk of social exclusion, and NEETs (Not in Education, Employment, or Training). With regards to those more sensible citizens, the laboratory activities have contributed to social inclusion, countered educational and material poverty, and facilitated the orientation and integration of young people into the workforce. Collaboration with the University has also allowed beneficiaries to come into direct contact with the academic institution, opening prospects for educational growth. The project enabled students to approach new manufacturing technologies and programs for 3D modelling and robotic programming, taking an important first step towards learning both technological tools and thinking. Furthermore, the entire project pathway involved various actors, professionals, and local stakeholders who are nowadays continuing their participation in the project by contributing to the teaching and the sponsorship of the Punto Luce, as well as by participating at the dissemination of the project's results.

Notably, the overall project has ultimately increased the number of enrolments in the extracurricular courses offered by the Punto Luce delle Arti in Ostia, offering inclusive and highly relevant teaching in the acquisition of practical knowledge regarding new technologies.

Local Cultural Development

From a social and cultural perspective, the project has addressed the educational poverty of the Ostia Ponente area, becoming a reference point for local cultural development. Collaboration with the Social Cooperative SS Pietro e Paolo has introduced a project for creating jobs dedicated to individuals at risk of social exclusion at the city level. The project expanded its impact area through the organization of events, including an exhibition of the course results and the open conference "Design and Third Sector: Stories and Perspectives", which gathered testimonies and reflections from various actors in the world of scientific research, institutions, professions, businesses, and civil society. The event also hosted a workshop open to very young students from the Ostia neighbourhood hosted at the Save the Childrens headquarters.

Furthermore, the project considered an important temporal component in imagining the impact that such activities could have on the territory and specifically on the economic aspects of the Punto Luce space: it aimed both at the training of the very young, introducing them to the world of design and its rudiments, and at the enhancement of the internal staff of the space. The staff of the Punto Luce delle Arti in Ostia was therefore adequately updated and trained in the use of the tools necessary for the courses (robotics, 3D modelling and printing), which they could then integrate confidently and autonomously into their spaces. The results of the courses are also exhibited in an exhibition that, in addition to arousing the interest of students and young visitors, proudly represents the work that motivates young designers to offer themselves for mentoring programs to new members, thus promoting the knowledge production chain.

6. Conclusions

The research and experimentation activities applied during the workshops have brought out from the Capitoline social fabric a latent planning of the communities and new design spaces which, together with the theme of social inclusion and the active role of the citizen, are issues addressed marginally by the Public Administration when it comes to social innovation (Balbo, 2015). In this open scenario, design can operate to reveal the needs and will of the community, transforming them into possible solutions of public utility.

The result of the project has been ultimately exposed for at the Sapienza Faculty of Architecture in Valle Giulia (Figure 10). This project has been also selected as part of a dynamic observatory, launched during the national event *Design & Terzo Settore. Storie e Prospettive* (Design & Third Sector. Stories and Perspectives) in which occasion a final workshop has been setup to let participant of 8/10 years old discover the University and the design practices.



Figure 10. Exposition of final works at Exposition Gallery of the Sapienza Architecture Faculty in Valle Giulia.

The project and its outcomes highlight the role of Design Research in connecting Universities, citizens, and municipalities in applying design knowledge and principles to real contexts (Meyer & Norman, 2020). This research explored a built environment made of both physical and digital products that acknowledge the cultural richness stemming from the ethnic, cultural, social diversity present in cosmopolitan cities such as

Rome. The project provides in last instance, an overview of an emerging and ever-evolving alternative scenario which entangles on a global scale, and which ultimately could work as a means for further actions and research towards Design-driven education for social innovation and citizen empowerment.

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P/REFERENCES OF DESIGN

IMPACTS OF MENTORSHIP ON INTERNSHIP FOR INDUSTRIAL DESIGN STUDENTS: A CASE STUDY OF THREE COMPREHENSIVE UNIVERSITY PROGRAMS.

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KEYWORDS | MENTORSHIP, INTERNSHIP, INDUSTRIAL DESIGN, DESIGN EDUCATION

ABSTRACT | Building off previous studies demonstrating the positive impacts of internships for undergraduate students (Binder et al., 2014), this investigation explores how mentor/mentee relationships support positive internship experiences. Much has been written about the benefits of mentorship (Hamilton et al., 2019), including the development of 'soft skills' and greater opportunities for employment post-graduation. Notably, mentorship has up until this point not been researched specifically as it relates to the ultra-competitive and ever-evolving field of industrial design. This work has direct implications for university industrial design departments who are focused on providing a pathway for student success in entering professional practice. In order to assess the impact of mentorship programs on internship placements, we conducted a case study and research analysis examining three different industrial design departments' approaches to mentorship programs. These approaches include the absence of a formal mentorship program, the option for an informal mentorship program with professionals, and the option for a structured mentorship program with professionals. Other formats including peer-to-peer mentorship and on-the-job mentorship, are also considered. Obstacles to positive mentorships, including scheduling challenges, unclear expectations, and misaligned expertise are discussed. Results indicate that students engaging in any mentorship program demonstrate a higher likelihood of both applying for and securing internships. This investigation is a model for further investigations involving a broader range of institutions, mentorship, and internship experiences.

1. Introduction

The majority of Industrial Design (ID) also known as Product Design (PD) programs in the United States aim to prepare students for the demands of the profession upon completing their studies. This study focuses specifically on ID programs at three public, comprehensive universities that emphasize preparing students for entering professional practice. In many ID programs in the U.S., professional internships are an integral component in this preparation, typically conducted outside the confines of the academic institution. These internships are highly competitive and are widely acknowledged in improving students' prospects for success in the workforce. They offer invaluable opportunities for industrial design students to learn on-the-job skills, grow their networks, and build workplace readiness that cannot be replicated within a classroom setting alone. Students who have had internships have competitive advantages with post-graduate employment: internships help students feel more prepared and prospective employers value the work experience they've already had. Research indicates that students who engage in internships relevant to their profession stand a 14% higher chance of securing employment in their chosen field (Binder, Bagueley, Crook, & Miller, 2014).

Additionally, beyond the practical experience gained during internships, mentorship plays a significant role in growing students' professional development. Mentorships pair experienced individuals (mentors) with others who have less experience (mentees). Mentoring relationships are a long-standing tradition in many fields and range from periodic, informal conversations to structured mentorship programs that include regularly scheduled meetings. When professional industrial designers mentor industrial design students, students benefit from individualized feedback, perspective on the design industry, and guidance on how to elevate schoolwork to a professional level. Mentors directly connect students with their goals and opportunities to help them succeed.

Both internships and mentorships link design education to design industry, preparing students for entrance into the workforce. Although research has demonstrated the importance of industrial design internships and the benefit of mentorships in other fields, there has been limited research focused specifically on mentorship for industrial design students.

1.1 Types of Mentorships

This study focuses on five different types of mentorships:

- **Organic**: Not organized by a school or group, these connections often come from friends or family and are generally more casual in format.
- **Peer to peer**: This is a student-lead initiative connecting third- and fourth-year students with first- and second-year students. Although there may be some focus on professional practice, these mentoring relationships tend to focus on school.
- **Project-based support**: An industrial design department seeks out professional mentors for students in a specific project (i.e. the senior capstone). This is an organized program where each student is intentionally paired with a mentor.
- **Professional mentorship program**: Students opt-in to have their industrial design department pair them with a professional for general guidance and support. The department may make efforts to pair students with professionals based on skill expertise or sub-industry (i.e. automotive, footwear, etc.)
- **Internship-based**: Many of the best internship experiences include an on-the-job mentor who serves as a point person for the intern/student while they are at the company. These relationships sometimes continue even after the internship has concluded.

1.2 Participating Universities

The University of Kansas, Western Michigan University, and the University of Kentucky, all 4-year comprehensive university ID or product design programs in the United States, participated in this study. Each program has a distinctly different approach to mentorship, and this investigation looks closely at each program in an effort to assess how mentorship impacts internship placement.

University of Kansas
University of Kansas' industrial design program, established in 1941, is a four-year program with approximately 70 undergraduate students. Graduation does not mandate an internship; however, students are able to participate in internships during the school year and earn academic credit toward their graduation. This program has two voluntary mentorship programs for all students from 1st through 4th year, pairing a professional (usually alumni or personal contact of the Program Director) with two students, one 1st or 2nd year student with one 3rd or 4th year student. Both mentorship programs are affiliated with student clubs, IDSA and Women in ID. The Program Director spearheaded and now manages all aspects of both programs.

Both student clubs offer mentorship programs following the above structure, however the Women in ID club offers female identifying professional mentors for members of the Women in ID club. Interestingly, all female identifying students opted to participate in the Women in ID mentorship program rather than the IDSA mentorship program which does not specify which gender mentors are.

University of Kansas' mentorship programs are both structured, with an onboarding process for all mentors where expectations and best practices are discussed. The Program Director checks in every 3 months with all mentors to ensure their needs are met. Mentees are paired to mentors with the area of ID that they are most interested in mind, for example, research-minded students are paired with research-focused professionals, and consumer product design-focused students are paired with designers in the field of consumer product design. The mentors meet with both students together biweekly, usually virtually, so both students receive feedback from the professional. The 3rd or 4th year student also mentors the 1st or 2nd year student. The Program Director meets with students regularly to ensure the mentorship is running smoothly.

Western Michigan University
The Richmond Institute for Design and Innovation at Western Michigan University was established in response to local industry demand, and offers a relatively new four-year Product Design program. The program, which had its first graduating class in 2021, maintains an average enrollment of 100 students. Corporate partners have engaged with the program since its inception, with many individuals offering to support students in a mentorship role. The first director of the program personally paired professionals with all third and fourth-year students, providing contact information but no guidance or oversight for how and when mentors and mentees should meet, or what they might want to discuss.

Since the departure of that Program Director in 2022, the mentorship program has been in flux and there is not an established process for a consistent mentorship program. The school is continuing to develop their mentorship engagement including a new student-lead peer-to-peer mentorship initiative. Western Michigan University has internship participation as a graduation requirement, and students occasionally stay connected to mentors from their internships after they return to school.

University of Kentucky
University of Kentucky has a Product Design Department and graduated its first class in spring 2024. This is a burgeoning department with an anticipated average enrollment of 60 students. The University of Kentucky does not require internship participation in order to graduate from the program. Project-specific professional mentors were coordinated for the first graduating class during the fall semester of their fourth year. The focus of the mentorship program is currently to offer guidance and perspective on the senior thesis project. Mentors, most of which are not local, have been consistently invited to participate in virtual classroom critiques. The majority of mentors were found via the department Chair's personal connections or from online platforms such as Linked-In as the program does not yet have any alumni to pull from.

2. Research Setup and Focus

2.1 Measures

University
Participants were asked to identify their university. The options included: Western Michigan University (WMU), University of Kansas (KU) and University of Kentucky (UK).

Mentorship Program
Participants were asked to identify whether they were participating in a mentorship program. Participants were asked: “Do you participate in an ID mentorship program?”. They were given the following options: 1) yes, my department offers a mentorship program, 2) yes, I'm in a mentorship program outside my department, 3) no, my department does not offer a mentorship program, and 4) no, my department offers a mentorship program and I'm not participating. In one analysis, we recoded this variable into two categories due to small samples sizes; this recoded variable had the following categories: 1) yes, I am participating in any internship program, and 2) no, I am not participating in any internship program.

Internship Experiences
Internship experiences were measured three indicators. First, participants were asked if they had participated in any internships since beginning their ID program (responses were “Yes” or “No”). Second, participants were asked: “How many internships/ apprenticeships have you participated in?” with a range of 0-4 provided.

Third, among participants with internships, participants were asked “How did you land your internship? Please select all that apply” with the following options: 1) you responded to a job/internship posting, 2) you met someone at the company through networking, someone outside your university to the company, if so who?, and 3) someone inside your university referred you to the company, if so who? And Other (open response). For analytic purposes, we recoded these variables to include two categories: 1) applied via a posting only (participants who only selected “responded to a job/internship posting”) and 2) applied with any personal connections. Importantly, or our analyses, we focus only on how participants landed their first internship (if they reported more than one internship).

Internship Impact
Participants who had participated in at least 1 internship were asked: “How would you rank the impact of all your internships on each of the following? (With 0 showing no impact, and 5 showing maximum impact)” with the following domains: 1) career/professional learning, 2) benefit to your future, and 3) benefit to your industrial design education. Our analyses use each individual scale as well as a summed version of the three scales to determine overall impact, where higher scores indicate greater perceived impact.

Mentorship Program Benefit
Participants who reported participating in a departmental mentorship program were asked: “Rank benefit of mentorship, 1 being not beneficial 5 being extremely beneficial.”

2.2 Sample Size & Missing Data

In total 117 participants began the survey. Of these participants, 116 provided answers to which university they attended, but only 114 provided answers to the question about mentorship programs. Among those that provided information about mentorship programs, 109 provided information about whether they had ever participated in an internship. Among participants who had ever had an internship (n=35), 30 provided information on mentorship program participation, how they landed their internship, and how impactful they perceived their internships to be. Finally, among those who reported participation in a departmental mentorship program (n=55), 50 provided feedback on how beneficial they perceived this program to be.

2.3 Analytic Plan

The focus of this paper is on the impact of departmentally supported mentorship programs on internship experiences and impact as well as exploring perceived mentorship program benefit among students. To address these research questions, we used descriptive cross-tabulations and chi-square tests of independence as well as bivariate ordinary least squares (OLS), negative binomial and logistic regression models. Logistic and negative binomial regression coefficients are exponentiated to ease interpretation. Due to small sample sizes, we did not employ multivariable tests. Qualitative data from open-ended survey questions as well as interviews with n=12 students will be leveraged alongside quantitative data in the analysis.

2.4 Results

Mentorship Program Participation
Among the participants, 48.3% reported participating in a departmental mentorship program, 30.7% reported their department had a mentorship program they were not participating in, 17.5% reported their department did not have a mentorship program and they were not participating in another mentorship program, and 3.5% reported participation in a non-departmental mentorship program. A chi-square test of independence showed mentorship programs and university were not independent (chi-square=56.10, $p<0.001$) (Table 1).

As expected, Aa bivariate logistic regression analysis showed that compared to KU there were no statistical differences in likelihood of participating in a mentorship program at WMU. However, compared with KU students, students at UK had significantly lower odds of participating in any mentorship program (OR=0.0203, SE = 0.0216, $p<0.001$, Table 2).

Mentorship Programs and Internships
Next, using bivariate logistic regression we analyzed whether the 4 types of mentorship programs were associated with having any internships and how those with internships landed their internship (Table 2). Compared with students participating in departmental mentorship programs, students in departments with mentorship programs they were not participating in had lower odds of having any internship (OR=0.318, SE=0.162, $p<0.05$). In addition, there was a marginally significant lower likelihood of students having any internship experiences among students whose departments did not offer a mentorship program compared with students participating in departmental mentorship programs (OR = 0.318, SE = 0.200, $p<0.10$). Notably, however, there was no significant difference between the likelihood of having an internship between students participating in departmental versus non-departmental mentorship programs.

We found no significant differences in types of mentoring programs and the likelihood of landing a first internship via personal connection/networking versus responding to an ad alone (Table 2).

A negative binomial regression model, suitable for count outcomes, showed that students not participating in available departmental mentorship programs had significantly fewer internships compared with students who were participating in departmental mentorship programming (IRR=0.37, SE=0.16, $p<0.05$). There were no significant differences in the number of internships between the other groups and the reference group (Table 2). A Poisson model was also fit to these data, and the results did not substantively differ (available upon request).

Among students who had any internships, there was no association between the impact scale and the various mentorship programs (Table 2). However, respondents not participating in an available departmental mentorship program who *had* participated in an internship ranked the impact of their internship on their career lower than their peers who were participating in the departmental mentorship program (β =-0.900, SE=0.367, $p<0.05$).

Perceived Mentorship Benefit
Among students who participated in a departmental mentorship program, the average perceived benefit was 4.02 (SD =0.869) on a scale from 1 (least useful) to 5 (best). The perceived benefit of mentorship did not vary by internship experience (Table 2).

Participants also were asked an open-ended question: "Explain how your mentorship has or has not been beneficial." These qualitative responses provide further insight into the quantitative findings, suggesting that having a professional contact is helpful for getting more feedback on school projects and specifically for portfolio preparation. For example, one student drew a direct connection between their mentor and job placement: "My mentor… helped me prepare for interviews, better build and fill my portfolio to better attract jobs, and helped me construct strong presentations. Great experience!"

A few students mentioned differences in personalities with mentors and busy schedules as challenges. According to one student, feedback from mentors is not necessarily positive or empowering: "They also discouraged my participation/choice of degree in industrial design and claimed that I am not correct for this profession."

Interviews
Informal, semi-structured interviews (n=12) offered the opportunity to understand student perspectives and experiences with mentorship programs, mentors, and internships. Four students from each participating university, including equal numbers of 3rd and 4th year students, were interviewed via Zoom. Mentorship-specific questions were posed after a series of questions focused on internship experiences, which may have had an impact on how students framed their responses.

Questions posed:

For students who have a design mentor:

- How did you get paired with your mentor?
- How formal or informal is the relationship? When do you meet, what are those meetings like, etc.?
- What is one thing you've learned from your mentor?
- What do you think the benefit(s) of having a mentor are?

For students who do not have a design mentor:

- If not, would you like to have one? Why?
- How might you go about finding a mentor and starting the sort of exchange that would be most beneficial to you?

For everyone:

- Have internships or mentorships (if they had one or both) changed your approach to school?

Types of Mentorship

- Students mentioned many types of mentorship: peer-to-peer, professional, and on-the-job. All types of mentorships were perceived as supportive and beneficial.
- Internships that provide students with an on-the-job mentor were especially good experiences.
- These mentors act as a point person for the student, providing insight into company culture and guidance for the internship while also offering skill-based demos.
-

Mentors Facilitating Storytelling

- Mentors often focus on portfolio reviews and guidance for giving presentations.
- Emphasis was consistently on how to tell the story of a project or portfolio in a way that would resonate with the audience.

Mentors and Confidence

- Students are hesitant to engage with a professional mentor if they are not yet confident in their portfolio. There is a sense that professionals will only want to engage with students at a certain (high) skill level.
- Working with a mentor helps students feel more confident, which may encourage them to apply for internships.
- Mentors are a valuable resource for students on internships who need support navigating the professional landscape.
- During internships, students are not as engaged with the academic environment and less likely to seek out guidance from faculty.

Mentors are Desirable

- Students who don't have mentors due to lack of support from their program want them.
- Students are unclear on how to find a professional mentor if their program does not facilitate the process.
- At department C, most students were initially unfamiliar with the concept and function of mentors. However, after learning about them they all were interested in having one.

Mentors Define Professional Expectations

- Mentors offer up-to-date, professional, outside perspectives on student work.
- Students who have worked with a mentor are empowered and ready to graduate/enter the workforce.

Mentorship Program Structure Impacts Mentorship Experience

- Department A has guidelines for their mentorship program (how often to meet, what to discuss), which ensures all students have an opportunity to build a relationship with their mentor.
- Department B has provided mentorship pairing, but very little structure. The rate of success for mentorships in this program varies more widely.
- Department C offers mentors for one specific project. Students did not understand they could ask for guidance outside the bounds of that project.
- Internships consistently were recognized as providing valuable mentorship; students defined the difference between an internship and a job as the mentorship aspect during their tenure at the company.

Table 1. Mentorship Program Participation by University.

	B	A	C	Total
Yes, my department offers a mentorship program I am participating in	24	30	1	55
	63.16%	62.5%	3.57%	48.25%
Yes, I'm in a mentorship program outside my department	3	1	0	4
	7.89%	2.08%	0%	3.51%
No, my department does not offer a mentorship program	4	0	16	20
	10.53%	0%	57.14%	17.54%
No, my department offers a mentorship program and I'm not participating	7	17	11	35
	18.42%	35.42%	39.29%	30.7%
Total	38	48	28	114
	100%	100%	100%	100%

Note: The top row contains sample sizes and the second row has percentages.

Table 2. Bivariate Regression Models.

	Sample: All Participants with Responses			**Sample: Participants with Internship Experience**					**Sample: Students in Departmental Mentoring Programs**
	Any Mentorship Program?[c]	*Any Internship*[c]	*Number of Internships*[d]	*How Did You Land Your Internship*[ac]	*Impact Scale*[e]	*Impact on Career*[e]	*Impact on Future*[e]	*Impact on Education*[e]	*Perceived Mentorship Program*[c]
University (Reference = University A)									
University B	1.346								
	(0.630)								
University C	0.0203***								
	(0.0216)								
Type of Mentorship Program (Reference = Yes, my department offers a mentorship)									
Yes, I'm in a mentorship program outside my department		1.273	-0.180	*Omitted*[b]	0.400	-0.700	0.300	0.800	
		(1.323)	(0.434)		(2.651)	(0.752)	(0.875)	(1.437)	
No, my department does not offer a mentorship program		0.318+	-0.280	2.455	-1.600	-0.200	-0.450	-0.950	
		(0.200)	(0.221)	(3.041)	(1.417)	(0.402)	(0.468)	(0.768)	
No, my department offers a mentorship program and I'm not participating		0.318*	-0.423*	1.227	-2.200	-0.900*	-0.700	-0.600	
		(0.162)	(0.184)	(1.249)	(1.293)	(0.367)	(0.427)	(0.701)	
Any Internship (Ref = None)									
Any Internship									-0.0357
									(0.250)
Constant	1.824*	0.786	0.680***	1.222	13.60***	4.700***	4.700***	4.200***	4.036***
	(0.550)	(0.224)	(0.118)	(0.549)	(0.578)	(0.164)	(0.191)	(0.314)	(0.166)
Observations	114	109	109	29	30	30	30	30	50

Exponentiated coefficients where indicated; Standard errors in parentheses. + p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Notes: (a) This outcome has two categories including applying via an ad only compared with applying with any personal connection. The reference group was applying via an ad only.

(b) Category omitted due to collinearity (c) Logistic Regression Model; exponentiated coefficients (d) Negative binomial regression model; exponentiated coefficients

(e) Ordinary least squares regression

3. Discussion

Mentorship has proven to be an overwhelmingly positive experience for industrial design students, especially in preparing for and navigating internships. This research shows that students who don't engage in mentorship opportunities have lower odds of having any internship. Students who were not participating in mentorships even when they were available often cited a lack of confidence in their skills and not wanting to seem incapable or unprepared for the engagement or interaction. This study also indicates that students whose departments did not offer a mentorship program were less likely to have any internship experience when compared with students who participated in a departmental mentorship program. This raises a question in regards to the goals of higher education and reveals an opportunity to investigate the tension between the historical ideal of universities as hubs of knowledge creation versus the contemporary expectation that upon graduation, university-educated students will successfully enter the workforce. All three programs have a different approach to internships, including requirements to graduate, and that has an impact on the results of the study. That being said, for programs that are focused on professional practice, these findings demonstrate the importance of offering a department-organized mentorship program and encouraging all students to participate.

Students who have worked with a mentor emphasized the focus of that interaction being primarily on presentation skills and portfolio preparation. Mentors who are working in industry are well situated to teach students to talk about their work in a way that will resonate with professionals during internship interviews. Portfolio development often takes place outside of a classroom setting, without the formal guidance of a faculty member. Mentors offer an especially important point of contact for portfolio direction and feedback.

Mentorships can be a confidence contradiction. Students who don't feel confident in their work or skill level are less likely to seek out a mentor, but working with a mentor is a proven way to build confidence. Students felt that their mentors were a direct line to what is current and relevant in the field and trusted their input. Mentors at internships offered techniques and skill refinement, which helped them feel confident in their work. Mentors also offer students a networking foundation, connecting mentees with colleagues who are actively hiring. Departments that maintain a mentorship program, in which every student is paired with a mentor, ensure that all students have access to the demonstrated benefits of mentorship without the opportunity to opt-out.

The different mentor program approaches from the 3 institutions showed that when a mentorship is a school requirement, not all students are necessarily engaged, and this can be difficult to manage. If research shows that mentorships have a positive impact on students' success in finding internships, then it is imperative that programs have consistent and structured mentorship programs that ideally include all students from 1st through 4th years. This is likely to improve retention rates and student success. Importantly, it would also increase student confidence and the likelihood of gaining a competitive internship. Mentorship programs bring many challenges, including finding qualified mentors, identifying mentee/mentor pairings, and counseling mentors on expectations and goals. While most programs do not have a specific faculty or staff member who gets credit for managing their mentorship program, one individual typically takes responsibility. This can lead to inconsistency if there is faculty or staff turnover, resulting in the mentorship program dissolving or becoming disrupted.

Mentors benefit students in myriad ways, including helping them feel comfortable and confident while job searching. Students felt prepared to apply for internships, and they felt confident in the interview process due to the coaching they received from their mentors. The wide range of mentorships reflected by this study reveal that there isn't a standard structure or approach in industrial design departments or the industrial design profession. Developing guidelines for how to facilitate student engagement with professionals could encourage more departments to develop a mentorship program, and offer a strategy for pre-existing mentorship programs to improve.

Although most students who had a mentor considered it a good experience, some faced struggles. At least one mentor advised his or her mentee to consider changing majors, without offering counseling on how to improve after the student stated that they wanted to remain in the program. Others found it difficult to find available time to meet. Students did not always know how to navigate these situations, sometimes resorting to letting the mentorship lapse. Industrial design departments need to be aware that the mentor pairing may not be a good fit and need to have a system in place with regular check-ins with the student and the mentor to ensure that the relationship is beneficial and functional.

It is worth noting that a degree in industrial design is expansive (graduating students are equipped with a range of skills), and the field is competitive. University of Kansas will only offer academic credit for internships focused on industrial design, and intentionally pairs students with mentors currently working in industrial design. Western Michigan University and the University of Kentucky don't have the same guidelines, so students included in this study may have mentors and/or internships that fall outside the 'classic' definition of industrial design. Additionally, it can be a challenge to find suitable mentors if there is not a large pool of alumni to draw from. The benefit of engaging with alumni is that the faculty know their personalities and skills and are better equipped to pair them with students.

4. Conclusion

Both mentorship and internship experiences prove to be beneficial by offering industrial design students exposure to professional practice, contextualizing school work, and improving students' confidence in their ability to succeed in school as well as being prepared to enter the workforce. This study suggests that students who work with a mentor are more confident, consequently more likely to apply to and land internship opportunities. Students need support in initiating and maintaining mentorships, and one way that industrial design departments can offer that support is through organized mentorship programs.

This investigation is decidedly student-centered, seeking to better understand student experiences and perceptions. There is immense opportunity for further research concerning other stakeholders: industrial design departments, mentors, and companies where the mentors are employed. Although this research shows that departmental mentorship programs lead to better student outcomes, organizing those programs is a significant logistical burden. The mentorship program at Western Michigan University dissolved when the faculty member who organized it left the university. Given the clear benefits of mentorship, this suggests the merit of developing a more structured approach to insure consistency, regardless of faculty turnover.

There is merit in continuing investigation, including:

- Other fields, including medicine and engineering, have a long history of relying heavily on mentorship and internship. A comprehensive literature review of scholarship on mentorship and internship in these fields would help inform best practices for internship and mentorship in industrial design.
- Since there is no universal or consistent structure for mentorship programs in industrial design education, a wide-reaching audit of current mentorship programs would help inform strategies for organizing and executing successful mentorship programs.
- The perspective of mentors must be considered. A study focused on mentors could uncover insights on why mentors mentor, what they get out of it, and how they learn to guide and interact with students. This, in turn, could be beneficial for better equipping mentors for more consistently successful mentorships.
- Although mentorships are routinely integrated into educational experiences, they are less frequently assessed. It would be beneficial to identify the elements of a successful mentorship and consider development of an assessment tool for mentorship programs.
- Unwillingness to participate in a mentorship program could indicate lack of interest or ambition, but it could also reflect a student's need to be employed while in school. (Having a job limits time for extracurriculars like mentorship and internship.) Considering structures and formats that allow for wider access to the benefits of mentorship would lead to more universal improved student outcomes.

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P/REFERENCES OF DESIGN

ANCESTRALITY AS A MEANS TO LOOK FORWARD: THE PRESENCE OF INDIGENOUS KNOWLEDGE IN FOUR LATIN-AMERICAN BIODESIGN PROJECTS.

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ABSTRACT | The contemporary design discourse has witnessed a heightened usage of the terms “vernacular,” “bioregional” and “ancestral”, particularly against the backdrop of the prevailing climate crisis. Traditional knowledge of materials and techniques have been referred to as those capable of illuminating the future and frequently serves as a starting point for Biodesign, an emerging design approach that often commits to ecological practices. However, despite being a growing trend, there is a lack of well-documented case-studies that clearly connect contemporary design practices to ancient knowledge.Within this milieu, Latin-American design has recently arisen prominently, benefiting from the region’s abundant biodiversity and the indigenous presence. This study delves into the examination of four projects related to bio-products or biomaterials design undertaken in Latin America by different designers in the last five years, each employing indigenous ancient knowledge – clearly mentioned by the designers, in three different countries. As a result, we present clear evidence on contemporary design projects that incorporate indigenous knowledge as a pivotal reference point, spanning regenerative practices, biotechniques development, and biodiversity preservation. The subsequent discussion and conclusion show that, even though it is not always the first intention of their work, these designers have been amplifying the voices of relegated groups, inviting us to engage in intercultural dialogue and review the design field (Santos, 2008). We also identify a design trend wherein designers, in their pursuit of ecological practices related to Biodesign and Biomaterials, recognize traditional knowledge as a legitimate and invaluable source for contemporary design endeavors.

1. Introduction

1.1 Local and Traditional Knowledge's Relationship to Biodesign

The worsening of the climate crisis at the start of the new millennium has prompted designers to explore novel avenues. One discernible trend in recent years is the growing interest in local and traditional knowledge, evident in design-related exhibitions, events, and publications. In the global North, still considered the design mainstream and the birthplace of the discipline following the Industrial Revolution, three noteworthy examples underscore this thematic shift:

1. "Bioregional Design Practices" is the title of a 2023 book showcasing the endeavors of Atelier Luma, a French initiative established in 2016 and led by design curator Jan Boelen, supported by Foundation Luma in Arles. Boelen mentions that the practice started by mapping the surrounding territory of Arles and identifying local resources for contributing to social and environmental improvement. The term "bioregional," elucidated in a footnote, draws from John Thackara's definition emphasizing natural rather than political or economic boundaries (Atelier Luma, 2023, p.22). Atelier Luma's projects, featuring circular design and biomaterials like natural dyes, salt, sunflower panels, and algae-based objects, have gathered attention in major European design exhibitions. The book organizes these projects into four phases: finding, connecting, engaging, and sharing. During the "finding" phase, designers actively seek various resources, including agricultural byproducts and artisanal skill sets passed down over generations, highlighting the high value placed on traditional knowledge (p.27).

2. "Super-Vernaculars" was the name of the 27th Biennial of Design in Ljubljana, 2022. The curator Jane Withers explains that the term "vernacular" in design denotes practices based on local traditions, materials and ecological knowledge—representing structures deeply rooted in local culture, terrain, and climate (Withers, 2022, p.12). While acknowledging the past, the Biennial's exhibition aimed not to evoke nostalgia but to inquire about lessons from history for shaping a more sustainable future and seeking inspiration for innovation (p.13). The exhibition catalogue showcases design projects intimately connected to their respective territories and populations, with some projects explicitly recognizing their reliance on Indigenous knowledge.

3. "Lo-TEK: Design by Radical Indigenism," a 2019 publication by Julia Watson, amplifies this interest by bringing together indigenous examples of architecture and landscape design. Watson's objective is to demonstrate how societies labelled as primitive possess knowledge embedded in shaping our future (Watson, 2019, p.27). Traditional Ecological Knowledge (TEK) is elucidated as a cumulative repository of multigenerational knowledge, practices, and beliefs, inherently sustainable and responsive to environmental extremes (p.21).

A closer examination of the content within the aforementioned books and exhibition reveals proximity to the design approaches of Biodesign or Biomaterials, both emerging design practices with a central ecological concern. Biodesign is commonly defined as a strategic approach that incorporates nature or living entities in its processes to generate alternative sustainable materials or products (Camere & Karana, 2018; Collet, 2017; Karana et al., 2020; Myers, 2018). This sets it apart from Biomimicry, a well-known approach proposed by Benyus (1997), where designs emulate biological forms, processes, patterns, and systems through analogy (Kennedy, 2017).

In the realm of Biodesign, the predominant justification for the utilization of living organisms is to create material artifacts with a minimal ecological impact, while creating novel material expressions and functions (Karana et al., 2020). Myers (2018) posits that initiatives in Biodesign signify “an overdue shift in social priorities towards sustainable approaches to building and manufacturing” (p.8). He further asserts that through the harnessing of biological processes, Biodesign projects hold promise in replacing industrial methodologies while demanding fewer resources of both materials and energy. Aligned with Myers' viewpoint, numerous authors argue that Biodesign marks the start of a new frontier or signifies a paradigmatic shift within the domain of Design (Esat and Ahmed-Kristensen, 2018; Karana, 2020; Mironov et al., 2009).

Some scholars extend the boundaries of Biodesign to include properties of formerly living organic elements (Esat & Ahmed-Kristensen, 2018; Mironov et al., 2009), incorporating Biomaterials into Biodesign practices. Ginsberg and Chieza (2018) define Biodesign as the practice of Design that operates concerning Biology, encompassing three fundamental modes: “of,” “with” and “from” Biology. They also note that, despite its contemporary veneer, Biodesign is rooted in traditional practices such as the refinement of organisms through selective processes, as exemplified in agriculture and animal husbandry.

In line with this comprehensive definition, the example of “The Living Root Bridges of the Khasis, India” showcased in the book “Lo-TEK” (Figure 1), featuring a bridge made from the surrounding tree's roots that withstands monsoonal rains, serves as a clear manifestation of Biodesign. Despite taking centuries to develop and not conforming to a typical Western design project, this example integrates local trees, highlighting the interconnectedness between traditional practices and the recent Biodesign trend. Another pertinent example is the project “Bananatex,” developed by Swiss designers in 2018 and exhibited at “Super-Vernaculars.” The canvas-like textile made from abaca fibers serves as an alternative to polyester: “One of the strongest of all-natural plant-fibers, they have been used to make textiles in the Philippines for hundreds of years. The Portuguese explorer Ferdinand Magellan recorded the use of abaca to make textiles when he visited the Philippines in 1521.” (Withers, 2022). These instances underscore the interplay between traditional practices within the design domain and the contemporary Biodesign trend, often associated with Biotechnology and innovation, with little acknowledgment of these venerable and significant roots.



Figure 1. The Living Root Bridges of the Khasis, India. Source: Watson, 2019.

1.2 The Latin-American Approach: Ancestrality

The current Design community's interest in local and traditional knowledge is a global phenomenon, extending beyond the confines of the global North[1]. Notably, Latin-American designers stand out in this trend, benefiting of the region's abundant biodiversity and the resilience of indigenous peoples, whose profound connection to nature is increasingly considered advantageous from an ecological perspective, steering new directions in Design and related disciplines. Several noteworthy events and publications across different Latin-American countries underscore the prominence of this thematic shift in the region:

1. The “What Design Can Do Mexico” event in 2023 dedicated a segment of its program to discussions on “Ancestral Knowledge and Heritage.” Speakers included Gabriel Calvillo, co-founder of Refugio, focused on design as a tool for native pollinator conservation; Rosa Hanhausen, curator of the exhibition 'Replicating Resistance: Landscape Revolutions,' based on research she conducted on the impact of maize on urbanization in Mexico; and Gerardo (Jerry) Osio, co-founder of Tierra de Saberes, a project that investigates, documents, and disseminates traditional knowledge in northeastern Mexico (What Design Can Do, 2023).

2. The magazine “Piseagrama,” established in 2010 in Brazil with a focus on public space discussions, has increasingly featured indigenous-related or, more recently, indigenous-authored texts. In 2022 and 2023, the platform launched books such as “Vozes indígenas na Saúde” (Indigenous Voices in Healthcare), “Saberes dos Matos Pataxó” (Knowledge of the Pataxó Forests), and “Terra: Antologia afro-indígena” (Earth: Afro-indigenous Anthology), aiming to provide direct access to the ideas of underrepresented groups and envisioning possible futures in alliance with various resistance collectives (Piseagrama, 2024).

3. The Latin-American Biodesign and Biomaterials meeting “Biopolimérica 2023” in Valdivia, Chile, organized by LABVA (Laboratorio de Biomateriales de Valdivia), emphasized the selection of projects based on the use of local biological raw materials and regional identity. The catalogue of the event describes Latin America as “a territory as diverse and abundant as it is exploited” and mention a growing articulation that positions Latin America as a reference for new and diverse material possibilities from the understanding of its own territory. The event proposed a space for understanding, recognizing and reflecting on this movement, as well as the opportunity to express from the material, sensory, personal and territorial aspects what characterizes and differentiates this community (Besoain et al., 2024) .

4. In 2023, Brazil received the award for the best National Participation at the Venice Architecture Biennale with the pavilion “Terra” (Earth). Curators Gabriela de Matos and Paulo Tavares sought to reevaluate the past to design possible futures, spotlighting Afro-Brazilian and Indigenous communities often overlooked by architectural mainstreams (Angelopoulou, 2023). The pavilion, filled with earth, symbolized both memory and future, urging a reconsideration of architecture in the face of contemporary urban, territorial, and environmental challenges.

[1] The Australian Design Centre, for example, mentions clearly their engagement with First Nations in their website and how it relates to the practices of the museum. Source: https://australiandesigncentre.com/latestnews/celebrating-first-nations-engagement-at-adc/.

In the Latin American context, unlike the global North, it is common to reference “ancestral” knowledge and employ the term “heritage” when discussing local and traditional knowledge. Labva designers observe that in Latin-America, biomaterials practices, while acknowledging the influence of the global North, primarily focus on the link with the origin—territorial and cultural—of materials and their potential in terms of biodegradability and compostability (Weiss & Besoain, 2022).

Arturo Escobar, in the book “Design for the Pluriverse,” underscores that ancestral knowledge, while rooted in a community's history and long-term practices, does not imply an inflexible attachment to the past. Instead, it represents a “living memory directly connected to the ability to envision a different future” (Escobar, 2018). Indigenous philosopher Aílton Krenak explains that ancestral peoples, retaining a spiritual connection to nature, learn through rituals to “get back to the root of existence,” where they transcend individual identity, experience other forms of life, traverse the future and past, and return to the present. Ancestral memories, according to Krenak, originate from ancient ancestors, and rituals serve to revive these memories (Krenak, 2023, p.37).

2. Methods

Although ancestrality is frequently mentioned in biodesigners' and specialized media texts as a “component” of many recent product design-related projects, the explicit integration of traditional knowledge is often challenging to discern, and comprehensive studies on this topic are lacking. In light of this, and with a focus on Latin-American examples, the primary inquiry of this study revolves around the question: how exactly these Biodesign projects incorporate ancestral indigenous knowledge?

This research was conducted between October 2023 and January 2024. Following a review of the events and exhibitions highlighted in the introduction section and an examination of key terms that motivated this study (traditional, vernacular, ancestral), we compiled an extensive list of projects that could serve as examples of the integration of Biodesign and ancestral knowledge. The projects of this first list were sourced from various outlets, including relevant publications (when accessible), events’ catalogues or press releases (Biopolimérica 2023 and What Design can Do México), the designers’ official websites and Instagram accounts, and texts

from reputable online specialized media (such as websites like Dezeen, Designboom, Wallpaper, Domusweb, and Frameweb). The criteria for inclusion in this list were the project's origin in Latin America and the presence of specific keywords in the project description, such as “ancestral,” “heritage,” “indigenous,” “traditional,” “historical,” as well as terms related to Biodesign and Biomaterials.

The refinement of this list, which led to the selection of the case-study projects (Table 1), involved using selection criteria that explicitly mentioned, in the project description texts provided by the authors, the utilization of indigenous ancestral knowledge, ensuring it was a deliberate design decision. A second criterion was to ascertain whether the specific knowledge could be identified for subsequent analysis. This was only possible when scrutinizing the designer´s texts. This meticulous approach was necessary due to the observation that many projects vaguely reference the use of “ancestral references,” making it challenging to discern the precise ancestral component, such as a material, technique, or specific use of an object. Additionally, the selection process aimed to encompass a variety of Latin American countries and approaches, resulting in the identification of four case studies, one of which was developed by the primary author.

Table 1. Case studies selected.

Project	Designer(s)	Year	Country
Totomoxtle	Fernando Laposse	2017	Mexico
Maqui Biotextile	Labva	2021	Chile
Cuia Colab	Andrea Bandoni	2022	Brazil
Carmín	Edith Medina	2022	Mexico

This study delves into the examination of four projects centered around the design of bio-products or biomaterials. These projects explicitly draw upon indigenous ancient knowledge and have been executed by different designers in three distinct Latin American countries over the past seven years. The main objective is to provide concrete evidence of contemporary Biodesign endeavors that integrate indigenous knowledge as a pivotal reference point, offering an analysis of their processes and outcomes whenever feasible. In the case of one of the projects developed by the authors, critical reflection also played a pivotal role in the analysis, contributing to a comprehensive examination of the integration of indigenous ancient knowledge within the design process.

3. Case-Studies: Indigenous Knowledge Applied to Design in Latin America

This section encapsulates the principal information regarding the selected case studies, providing an overview of each project and complementing it with a figure. Following this, Section 4 delves into the findings and interpretation of the case studies, and Section 5 summarizes the main conclusions drawn from their analysis.

3.1 Totomoxtle (Mexico)

Totomoxtle (Figure 2) is a biomaterial crafted from the vibrant husks of native Mexican maize. This sustainable veneer is derived from the naturally colorful leaves of native Mexican corn and is developed in collaboration with the community of Tonahuixtla, an Indigenous farming community.

These farmers lost their native seeds after the introduction of genetically modified corn to the area, and their traditional methods of growing native corn are at risk. This is because the small producers face unfair competition with big companies and the hybrid maize, which when combined with synthetic herbicides and fertilizers has bigger yields than native species. The consequence is that traditional farmers leave the area (Laposse, 2024).

In response to this situation, the Totomoxtle project, with the support of the world's largest maize seed bank (CIMMYT), undertook the reintroduction of 16 endangered varieties of heirloom corn with colorful husks native to Tonahuixtla. By incorporating these husks into the craft, the project not only adds value to the material but also creates local employment opportunities. Prior to the project, corn husks were considered leftovers, but now they contribute to the material's worth, generating additional income for locals and incentivizing the continued cultivation of native Mexican corn species.

According to Laposse, the creator of Totomoxtle, aiding a small community in Mexico in preserving their native corn is crucial. The risk associated with depending solely on few types of grain makes societies more susceptible to famine. Laposse (2024) emphasizes the importance of biodiversity in cultivated plants as a guarantee for the future, asserting that it is essential for adapting to the challenges posed by climate change.



Figure 2. Totomoxtle. Source: Dezeen, 2019.

3.2 Maqui Biotextile (Chile)

The *Aristotelia chilensis*, commonly known as the Maqui tree, is a native and abundant species in Chile (Figure 3 – left). Revered by the Mapuche community, it holds sacred significance as a symbol of benevolence and peaceful intent (Vogel et al., 2014). The Mapuche people incorporate Maqui into their daily diets, and, in their cosmovision, the Maqui tree plays a pivotal role, with its fruits serving as food, natural dyes, and medicine (such as wound healing and diarrhoea treatment).

The maqui is a pioneer species: the first to take over degraded soils, establishing the ideal conditions for other native plants to grow and also a food source for birds (LABVA, 2022). The Maqui fruits, classified as "superfruits," boast extraordinary antioxidant capacity and offer a range of health benefits, including anti-inflammatory, antimicrobial, antiatherogenic, anticancer, astringent, analgesic, and nutritional properties (Fuentealba-Sandoval et al., 2021).

Labva's Maqui Biotextile project is a manifestation of the designers' commitment to understanding local abundance and fostering autonomy and sovereignty in biomaterial production (Abud, 2022). This unique biomaterial (Figure 3 – right), made of bacterial cellulose with textile applications, is derived from Maqui trees located in the native forests of southern Chile, where Labva is physically based. The biofabrication process involves fermentation, akin to the kombucha production process, where bacteria and yeasts from the microbiota of the Aristotelia chilensis leaves and fruits engage in a symbiotic process. The outcome is a fully biobased, environmentally friendly material characterized by high mechanical resistance and flexibility, with a texture and appearance reminiscent of leather (LABVA, 2022). The designers emphasize their incorporation of information from ancestral processes, stating, "we borrowed the information that came from ancestral processes" (Abud, 2022, p.21).

In addition to its material attributes, the Maqui Biotextile project has heightened Labva designers' awareness of various details in processes. This increased consciousness enables them to confidently assert the environmental benefits, positive impacts on human well-being, and the promotion of biodiversity (Abud, 2022, p.21).



Figure 3. Maqui tree (left) and the material created (right). Source: Labva, 2022.

3.3 Cuia Colab (Brazil)

Cuia Colab is a project conducted in Pará, Brazil, within the context of the Amazon Forest. Cuias, derived from the fruits of the *Crescentia cujete* tree, have a rich history of artisanal transformation by women in the Santarém region. Historically utilized as daily objects, particularly vases, bowls, and containers, cuias bear a distinct black color, resulting from a natural resin that enhances their durability and allows for intricate ornamentation, carved onto them. These objects hold significant cultural value, embodying a profound partnership between humans and plants (Bandoni et al., 2023). Presently, the traditional craft of making cuias in the Low Amazon is recognized as a cultural heritage of Brazil, with local riverine artisans continuing this age-old practice (Carvalho, 2011).

Upon delving into the history of cuias, Bandoni observed disparities between ancient objects found in books and museums, credited to the indigenous populations of the area, and contemporary cuias. The older objects exhibited a broader spectrum of colors and modified shapes, with evidence indicating that ancient indigenous populations employed molds on growing fruits, reflecting an early form of “Biodesign” (Bandoni et al., 2023), a knowledge that had been forgotten over time.

In response, Bandoni initiated the Cuia Colab project with the aim of creating moulded cuia-objects including traditional techniques still practised by local artisans. This involved designing reusable molds placed on the cuia's buds as they grow on the tree, resulting in varied shapes and textures (Figure 4). Post-harvest, local artisans would then complete the objects by sanding and applying resin to the cuias. The project sought to provide a durable and fully compostable alternative to domestic objects while simultaneously strengthening local artisan communities. Cuia Colab emphasizes the collaboration with the tree and the crucial role of riverine women artisans who, due to their lifelong coexistence with cuieira trees, possess profound knowledge of the cuia craft and the intricate process involving the black resin cumate (Bandoni et al., 2023).

Initially supported by a Brazilian start-up program focused on bioeconomy and propelled to expand production, Cuia Colab encountered scalability and logistical hurdles during its first phase. These challenges, coupled with the prospect of adverse environmental repercussions, prompted a reevaluation of the project's trajectory. This stance underscores dedication to an approach that prioritizes the local environment and its ecosystem over large-scale production methodologies.



Figure 4. Cuia Colab prototype being molded (left) and the harvested object (right). Source: Andrea Bandoni, 2022.

3.4 Carmín (Mexico)

Carmín (Figure 5) is a material development project that harnesses the potential of “grana cochinilla,” a substance derived from the insect *Dactylopius coccus*, renowned for its ancestral applications in the realm of dyes. The utilization of this insect has historical roots in Mesoamerica, where it was traded and used, and it has been domesticated in southern Mexico since pre-Hispanic times (Besoain et al., 2024).

Designer Edith Medina conceptualizes Carmín as a venture that goes beyond the conventional use of cochineal for dyeing. Instead, it aims to rediscover and accentuate the insect's value as a substrate for creating a robust and pliable biopolymer. This biopolymer serves as the foundation for various textile applications, including organic sequins and bioleather (Medina, 2023). The unique chemical composition of cochineal opens avenues for revaluing and expanding its applications. By incorporating cochineal into this contemporary project, the designer not only accentuates its local significance but also broadens its applications beyond traditional dyes, imparting social, cultural, and economic value to this ancient material.

Medina explicitly emphasizes that the primary objective of Carmín is not mass-scale material sales but rather the reevaluation of the production of a historically significant insect in the context of material history (Besoain et al., 2024). This perspective underscores the project's commitment to fostering a deeper understanding of the intrinsic value of cochineal and its potential contributions to the material landscape.



Figure 5. The production of Carmín (right) and a detail of the biopolymer created (left). Source: Besoain et al., 2024.

4. Results and Analysis

The case studies presented above showcase diverse ways in which ancestral indigenous knowledge is incorporated into contemporary design projects. Each project highlights specific Indigenous knowledge and demonstrates how it is integrated into the design:

- Totomoxtle: The knowledge of growing native corn in the region of Tonahuixtla, Mexico, is central to the project. This knowledge enables the creation of a variety of corn husk colors showcased in the veneer panels and products. Moreover, the social aspect of the farmers' condition is also addressed, with the project not only creating local employment opportunities but also reviving the ancestral technique of planting a diversity of native corn varieties.

- Maqui Biotextile: The project draws inspiration from the knowledge and importance of Maqui in Mapuche culture and the diverse possibilities of utilizing the tree's resources. This aspect leaded the designers to pay attention to the tree's microbiota and explore symbiosis with its yeast and bacteria to produce bacterial cellulose. Natural dyeing properties of Maqui are also incorporated into prototypes, adding value to ancestral knowledge and to the many non-human species involved: the Maqui tree, the bacteria and the yeast.

- Cuia Colab: The indigenous knowledge integrated was the the reintroduction of the Biodesign or Biofabrication technique involving molding cuias while they are still growing on the tree, a practice no longer known or utilized by contemporary artisans. The project involves riverine artisans with knowledge inherited from ancient indigenous practices related to utilizing black resin and practical details when working with the cuieira tree. Concerns about social and ecological impacts are demonstrated in the process.

- Carmín: the grana cochinilla´s dyeing properties, indigenous knowledge, was revisited by the designer, who found that its use could be expanded through a biomaterial exploration. The knowledge of the designer on the field definitely played a crucial role to produce in generating Biomaterial innovations.

Several parallels emerge when discerning and aligning the approaches of the aforementioned projects. While the maqui fruit in the Maqui Biotextile project and the corn husks of Totomoxtle may not be readily identified as conventional design materials, projects Cuia Colab and Carmín center around pre-existing materials and methodologies, ingeniously re-evaluating their inherent worth. It is noteworthy that, in the instances of Maqui Biotextile and Carmín, the integration of scientific knowledge, particularly in the realms of chemistry and biology, played a pivotal role in conceiving and materializing innovative biomaterials. This strong interdisciplinary collaboration constitutes a necessity of the field of Biodesign (Bandoni et al., 2022).

Furthermore, the inclusion of diverse perspectives is manifest in Totomoxtle and Cuia Colab. Designers deliberately involve local actors, such as farmers and artisans, who serve not only as practitioners but also as custodians of ancestral knowledge. This intentional incorporation of different viewpoints underscores the projects' commitment to cultural heritage and social engagement.

Table 2 summarizes the analysis and gives an overview of each case study, emphasizing how indigenous knowledge was utilized, and the outcomes of the projects.

Table 2. Synthesis of the case studies.

Project	**Ancestral Indigenous knowledge**	**Biomaterial outcome**	**Other outcomes**
Totomoxtle	The cultivation of native corn in Tonahuixtla, Mexico.	Veneer / panels made with native Mexican corn leaves that are naturally colorful	Inclusion of the local farmers and alternative income generation
Maqui Biotextile	Importance of Maqui from a Mapuche perspective and the tree's versatile uses.	Bacterial cellulose with textile applications, derived from Maqui trees´ microbiota	Discovery of a symbiosis between maqui´s bacteria and yeast
Cuia Colab	Biodesign or Biofabrication technique with cuias while growing on the tree.	Cuia-objects that ally biofabrication to other traditional techniques	Revival of a forgotten technique and inclusion of local artisans
Carmín	Grana cochinilla's dyeing properties	Biopolymer with textile applications such as organic sequins and bioleather	Expansion of the applications of the insect

5. Discussion and Conclusion

Ibarra and Ribeiro (2014) assert that since the mid-20th century, design has been approaching and embracing pre-industrial modes of production, emphasizing vernacular solutions. This shift has prompted designers to appreciate local expertise, revive traditional practices, document them, and, in essence, acquire a substantial repertoire of opportunities. The adoption of a pre-industrial approach appears fitting, especially in an era where envisioning solutions to the environmental challenges posed by humanity becomes increasingly complex. As Santos (2008) wrote, a critical reassessment of design is imperative, and the precondition for this is the reconsideration of its cultural dimensions within the plurality of various cultural universes.

This study presents compelling evidence of the incorporation of ancestral indigenous knowledge as a central reference point in design projects. These works align with what LABVA designers' term "territory-based biomaterials" or "situated biodesign" (Weiss & Besoain, 2022, p.10). To varying degrees, these projects encompass regenerative practices, the development of ecological techniques, and biodiversity preservation. Each of them has produced fully biobased and compostable materials and objects, underscoring the Latin-American designers' foundational ecological concerns. Additionally, it can be

asserted that, while not always the primary intention, these designers have been amplifying the voices of marginalized groups, prompting an invitation to engage in intercultural dialogue and reconsidering the Design field (Santos, 2008).

These works illustrate a trend wherein designers, in their pursuit of ecological practices associated with Biodesign and Biomaterials, acknowledge traditional knowledge as a legitimate and invaluable source for contemporary design endeavors. Despite their looking at the past, these works are not driven by nostalgia; instead, they revere ancestrality and value indigenous knowledge, recognizing its distinct relationship to nature—one that is more respectful than the prevailing Western perspective. Therefore, it is suggested that this indigenous knowledge can illuminate our future as a species. Notably, in the recent past, Indigenous peoples and their references were entirely marginalized in the designers' scope. Today, there is a substantial interest among designers in this subject, although many projects still appear to remain at a superficial level.

The superficial treatment of traditional knowledge raises ethical considerations. On one hand, designers must “ensure that Indigenous communities who are most at risk from climate change aren't once again exploited for their knowledge” (Withers, 2022, p.17). On the other hand, there is an imperative to learn from these communities, actively engage with their knowledge, and contribute to its evolution. Addressing the issue of cultural appropriation demands robust discussions aimed at identifying pathways that mutually benefit all stakeholders. As emphasized by Aílton Krenak, “the future is ancestral” (2022).

5.1 Limitations and Suggestions for Future Studies

This study was limited to the analysis of four case studies featuring design practices originating from Latin America. It is noteworthy that in different geographical contexts, the methodologies employed by designers may diverge from those elucidated within this study. Examining other regions where Biodesign intersects with traditional knowledge can yield novel insights and unveil nuances that may hold greater significance within alternate contexts.

To extend the findings of this study, future researchers could engage in qualitative interviews with Biodesign practitioners to elicit direct insights into their engagement with indigenous knowledge systems. However, it should be acknowledged that the temporal constraints of this study, coupled with the availability of the selected designers, restricted the present analysis.

Furthermore, it is pertinent to reflect on the research question entitled “Vernacular Biotechnologies” posed by Professor Elizabeth Hénaff (2023) within the Biotechnology Design community of the Journal Research Directions: “what are we missing” in the (western) mainstream definition of biotechnology and design? She contends that despite the perception of biotechnologies as recent developments within Western scientific discourse and capitalist frameworks, societies have historically employed their understanding of biological organisms and systems to address diverse hierarchies of needs long before Western scientists. Consequently, Hénaff urges researchers to identify, evaluate, and speculate on this pressing topic.

Following Hénaff's inquiry, we may also pose the question: How can we disseminate the creative insights derived from “Vernacular Biotechnologies” to other cultures? The pursuit of answers to such questions not only underscores the importance of indigenous and traditional knowledge systems in contemporary society but also serves to mitigate colonialist perspectives within the domain of Design. This emphasizes the relevance of such inquiries in advancing the field of Design.

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P/REFERENCES OF DESIGN

THE DESIGNER'S STANDPOINT: FEMINIST EPISTEMOLOGIES AND AGNOTOLOGY AS A ROAD MAP FOR SUPPORTING WRITING PRACTICE IN DESIGN.

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ABSTRACT | This paper has a twofold objective: 1) to provide leads to explore design's epistemic potential, through standpoint epistemologies and agnotology. The former because they defend the possibility of a knowledge that is relative to a point of view, thus highlighting a pragmatic tone that fits very well with design's ambition. The latter because the acknowledgment of ignorance supports the consideration of ethical stakes– thus defining more accurately the designer's position; 2) to outline a writing practice that would embody this epistemic potential and solidify design as its own science. I believe that design provides a great opportunity to produce an irreducible knowledge, grounded in a specific social situation, embracing different social dynamics that structure it. I advocate the idea that such knowledge would come to existence if designers were to integrate a "writing phase" within the design process.

1. Introduction

This paper has a twofold objective. First, it intends to explore design's epistemic potential, to present leads for work to come that will support design as a science in itself. Secondly, it advocates for the integration of a writing practice within the design process, supporting the idea that writing will allow designers to extract knowledge from their field–information that would not be accessible by another discipline. I believe that these two dimensions are linked to each other: because writing is not merely an expression of knowledge but a way to consolidate its existence, notably by rendering it shareable. So while I intend to outline ways for designers to make the most of their singular perspective on reality, to redefine their epistemological ambition, I advocate that each of these ways should indicate something about the type of text designers should write.

One might want to ask first: what do designers pretend to know? What "object" to they "study"? One could say it is "the collected experience of the material culture, and the collected body of experience, skill and understanding embodied in the arts of planning, inventing, making and doing" (Archer, 1979). This implies that the kind of problem they face presents a specific complexity and that the skills that are better suited to solve them are not universally applicable (Cross, 2007). Each project asks designers to produce, *ad hoc,* the form of research demanded by the field of intervention. Regarding that requirement, designers occupy an ambivalent position. They approach a field, *borrowing* various tools from social and human sciences (Nova, 2014). But where do they "stand" vis-à-vis said tools and methods? What preliminary hypothesis underlies their inquiries?

Social sciences are somewhat torn between empiricism and theory (Berthelot & Collectif, 2012; Merton, 1997). The danger of an empiricism-dominated science is that it fails to place data into a broader context that will give its meaning (Moreau de Bellaing, 1990). That is the need for theory: only theories make sense of the phenomenon observed. Designers have empirical tools, but do they have theory? We have been struggling with this question for decades without coming to a consensus (Jones et al., 2016). There are different epistemologies out there: some are more dominant, or "popular", or "prestigious" than others (Silva, 2019; Studley, 1998), some aim at universality while others prefer local approaches, some are realists, some are constructivists (BonJour, 2009), some are individualistic, some are social (Bouvier et al., 2007). Which ones are the most fitting for designers?

In this paper, I intend to use two epistemological approaches that can, I believe, benefit design as a discipline: standpoint theories and agnotology. I will start by defining the conceptual foundations of my analysis and will try to clarify the designer's position vis-à-vis standpoint theories (1). I will then dive a little deeper into standpoint theories and, more specifically, into feminist epistemologies, in order to defend the idea that valuable knowledge comes from embracing the singularity of a point of view as well as the specific interests–ethical and/or political–that accompany said point of view (2). I believe these epistemological theories justify a pragmatist dynamic that fits very well with the design practice. I will finally explore the relatively unknown discipline of agnotology in order to show that ignorance is not a simple absence of knowledge but something to consider and deal with in order to tackle a design problem (3). These two approaches should help designers build ad-hoc theories, hypotheses grounded in the concrete situation their project takes place in. I will defend that these theories should admit a pragmatist dimension and assume a minority point of view.

2. What Epistemology? What Knowledge?

How do I understand epistemology? Here, I will leave behind an epistemology that is understood as the study of forms of justification of knowledge to prefer a conception of epistemology as the study of the modes of production of knowledge and ignorance, as well as of the social dynamics implied in the formation of cognitive and affective capacities involved in the production of knowledge (Frega, 2013). In that regard, I defend that knowledge is not only the representation of states of facts but also the knowledge that agents have of themselves, of others, and of the social world (Sullivan & Tuana, 2007).

Standpoint theories and feminist epistemologies insist on "situated knowledge" and reveal links between a social situation–its distribution of power–and the specific access to knowledge the situation allows. They highlight the epistemic privilege associated with a socially situated perspective. In other words: one's social situation defines the kind of knowledge they have access to. It is no surprise Marxism presents a classic model of standpoint theory, the standpoint of the proletariat offering an epistemic advantage over questions of social science and history (Lukacs, 1972; Marx, 2015). Workers attain this epistemically privileged standpoint through collective consciousness of their role in the capitalist system of production. Their oppression leads them to find out the truth about capitalism. The centrality of their role implies an experiential access to the relations of capitalist production.

Moreover, standpoint theories show that political and axiological neutrality isn't necessary. On the contrary: being involved in the situation, being concerned, letting one's value guide their research gives access to some information that would remain unknown otherwise (Harding, 2010). Since design projects are always grounded in a concrete social situation, and since design aims at changing the situation for the better, this conceptual frame appears fertile. But at the same time, because of the ambivalence of the designer's role within the capitalist system, one must clarify their position. They are closer to the client's brief than to the user's experience and, by default, occupy a dominant position (Beaubois 2019). Can designers work for the minor point of view while embodying a dominating perspective?

The position of being epistemically dominated favors the development of three epistemic virtues: humility, curiosity/diligence and open-mindedness. On the contrary, the dominant position, as shown per the Critical Race Theory, implies the symmetric epistemic vices: arrogance, laziness, and narrow-mindedness (Medina, 2012). I do not have the statistics of social representation among designers. There are obviously designers of different genders, races, sexual orientations… It would be counterproductive to reify the category of "designers". I cannot affirm they all are in a socially dominant position but I will start from the principle that they are for two reasons: 1) because of their dominant position within the system of production–they conceive for the user, they are the ones deciding what the user's experience will be like, and that is by definition a position of power (Beaubois, 2019); 2) because the goal is to embrace dominated perspective as much as possible (without reification). So, I invite designers to chase all the blindspots that can come from social privilege.

Because standpoint theories not only address perception and information availability–it also outlines whole realities or worlds (Chamois, 2019). What we know and what we ignore define what we call reality. Whether designers know it or not, each design project implies the building of a bridge over a gap: it is all about responding to the user's needs or desires which are, evidently, rooted in their "world". In that regard, I believe that designers should address both their own social situation and the user's, in order to appreciate the gap that exists between them.

Following standpoint theories (Anderson, 2020), for both perspectives, designers should define (i) the social location; (ii) their scope: (on what subject matters do they differ; (iii) the aspect of the situation that generates epistemic dis/advantage (social role, gender, ethnicity…); (iv) the ground of its dis/advantage ; (v) the type of epistemic superiority/inferiority it implies (accuracy, diversity, exhaustivity…); (vi) the other perspectives that may access/miss relevant information; (vii) the accessibility of the perspective (can one temporarily adopt it? Does it rely on years of experience?). Designers should investigate, in collaboration with the users, the epistemic privileges of the subordinated. What kind of fundamental social regularities do their perspective reveal? What arbitrary–and thus mutable–social arrangements?

Designers are not scientists and when they convey science in their work, they do so with a certain conception of science that they inherited. There again, a proper survey among designers to assess their understanding of epistemology would be extremely useful. Meanwhile, I postulate that they adopt the dominant conception of science: realist, formal, ideologically and axiologically neutral (Harding, 2010). In one word: positivist. This postulate is supported by Nigel (Cross, 2007) who presents the "values" of science as "objectivity, rationality, neutrality, and a concern for 'truth'", while humanities would favor "subjectivity, imagination, commitment, and a concern for 'justice'". Moreover, Cross considers that the

former's phenomenon of study is "the natural world" and the latter "the human experience". This is obviously caricatural: natural sciences can no longer pretend to be neutral (Girel 2017, Feyerabend, 1988) and human experience can evidently be objectively studied. In the following, Cross states that design's phenomenon of study is the "man-made world". I believe it is rather the experience of the man-made world. I want to defend the idea that design has a lot to say precisely about the experience of technical apparatuses, whether it is an object, a service, a system or an experience.

Audre Lorde famously said that the "master's tools will never dismantle the master's house" (Lorde & Clarke, 2007). And if a positivist approach to science is so intimately linked to the rise of modern industry (Carnino, 2015), designers who intend to take a step back from the industrial world should probably, following Lorde's wisdom, question the epistemic tools they're using. This paper is addressed to the community of designers who believe the trade must play a role in the cultural and political shift that is needed today. I believe that the specific knowledge designers can have access to is revealed to them only insofar as they embrace an activist attitude towards their project. Only when they see clearly what value they are defending through their project can they attain an epistemically privileged perspective.

3. Minorities and Perspective

3.1 Stronger Objectivity: Feminist Epistemologies

Bruno Latour called for a "proper description" (Latour, 2004), as a way to produce knowledge that is relevant to an issue. He semi-ironically claims to defend objectivist sociology as a way to reaffirm the necessity to conceive objects rather than just propose symbolic interpretations. A good description reveals the complexity of the object. It isn't a mere compilation of evidence-based data but a way to highlight the reality of one point of view, as an objective reality. The description is objective, not absolute. It does not pretend to say everything there is to say about the object, but it tells us everything one perspective has to say. The question that immediately arises then is how to define the designer's point of view. To answer that question, one has to first define the designer's object. What constitutes a designer's problem? I believe it to be the "technical experience" (Laborde 2023).

One way to represent it is to picture a spectrum going from pure technicality or functionality to pure speculation. For any topic, say, IA, there are an infinite number of discourses possible. At one end of the spectrum, there is the IT engineer's which describes the mechanisms of said IA, how it works. At the other end of the spectrum, one finds the philosophers questioning what IA means for human beings. Designers occupy a space at the middle of the spectrum: neither pure functionality nor pure meaning, they deal with the "meaning of functionality", the experience of a technical apparatus (object, service, system…) in all its complexity, calling in imagination, and values among other things. Designers are no philosophers, sociologists or psychologists, but they can channel these discourses to build their own: a description of what it means, for the users, to experience a technical situation. Once the object is determined, the perimeter of the description also is.

The idea that a pure description could be more than "just a description" resonates with standpoint theories: describing what you see, when you're the only one seeing it, becomes valuable information for everyone else. The minor point of view reveals unknown parts of reality–the mere expression of it can be enough. It is no surprise, then, that feminist epistemologies recognize the value of description. If one were to characterize Donna Haraway's "way of theorizing, it would be to redescribe, to redescribe something so that it becomes thicker than it first seems" (Haraway, 2013). In that perspective, one could picture the designer's job as an investigation in order to report on the minor point of views that are engaged in the project's situation. If done properly, a thorough description of the situation from these dominated perspectives would provide valuable information. But how to describe it? Where to start and where to stop?

For each project, there is a multitude of experiences and some of them are marginalized. As shown by feminist epistemologies, valorizing the forgotten point of views can lead to building stronger objectivity

(Harding, 2010). Thus, each project should call for a mapping of the relations of domination involved in the situation. The ones that are directly concerned (the relation between users) as well as the ones that are indirectly concerned (the social situations of all parties involved). For instance, if a designer were to work on a school classroom, they should take into account the relation of domination that constitutes a teacher-learner relationship but also, the social class of the teachers and students. As I experienced it myself, teaching in a school where students have a much higher social status than the teacher can alter the pedagogical dynamics of the teacher-learner interaction. Moreover, the social situation students aspire to also defines the class dynamics. To put it bluntly: if students aim at jobs that pay a lot more than the teacher's, it can have an impact on the learning experience in its whole.

Beyond the specificity of the situation designers intend to intervene in, they need to be able to situate the project within the broader context of social, political and cultural ideologies. In that sense, one would expect designers to be able to diagnose said ideologies: which ones are prevailing? How is their domination manifesting? What are their allies? Their "weapons"? They need a cultural understanding of the conflicts that structure the society they live in, in order to understand how their project is going to fit among these different forces. Acknowledging the complexity and diversity of these social conflicts will lead designers to see the world as a "non-neutral" reality. Certain paradigms are, indeed, getting the best of their opponents. Understanding as thoroughly as possible the unbalanced nature of society can help designers decide how to position themselves.

If designers, after their investigation, choose to embody a minor position, if they decide to take on some of the dominant forces, it should lead them to access data that would remain invisible otherwise. In other words, a win-win: access to data should be good for the project itself and also enable designers to produce knowledge. If they were to write/describe all the information they gather from the dominated perspective they investigate through, they will reveal specific knowledge that is irreductible–that only designers could reveal. This would support an epistemic ambition for design, participating, along other social sciences, in the description of an objective reality. Assuming the limit of one's perspective becomes the best way to reaffirm its epistemological ambition.

3.2 Embracing the Limitations & Mapping the Balance of Powers

Instead of trying to grasp and comprehend the situation in its entirety, instead of aspiring to attain a synoptic view, designers would work with and from blindspots, without pretending to overcome them. The goal could be to produce a map of all the ignorance and knowledge involved in the situation, as they approach it. Who knows what? What is unknown? What is needed to know? What should remain unknown? Designers aim at finding solutions to issues which can lead them to search for positive data to ground their project on. That can lead to an overconfidence bias and a false sense of expertise (Gigerenzer, 1991). Their research could very well, rather than just gather available information, highlight ignorances that are involved in the potential settlement of the product or service. In order to complicate the relationship between the project and reality. The project is not a pure solution to a problem and knowledge is not pure data answering a question. Knowledge is uncertain and ignorance is even more uncertain. To write about the evidence (or lack thereof) that constitutes the background of the project is to reveal its limits as well as its potential. It highlights the complexity of the design intervention.

Mapping the design intervention through the lens of domination, and situating the field of intervention within social dynamics and hierarchies will help designers free their views from the dominant perspective. Because if they do not produce that work, that critical map, they will be, inevitably, oriented by the dominant perspective. The dominant perspective feels neutral–it appears as "apolitical" precisely because it favors the status quo: norms are an expression of power (Deleuze & Guattari, 1980). Designers should, in that regard, approach the situation and the project as situated in a non-neutral social reality. In order to identify the axiological components intricated in the situation, designers need, in my opinion, to produce textual artifacts that report on all the dimensions involved. How is the power distributed? Who is heard? Who is invisible? Who is concerned? What are the material conditions of existence? What norms are convoked? Who has to put up with said norms?

Standpoint theories do not limit themselves to highlight a difference of experience. It is not enough to acknowledge that different situations imply different points of view. Standpoint theories insist on the relationship between knowledge and power, rather than knowledge and difference. And that is inspiring for designers: in order to understand the specificity of the perspectives of all parties involved in the project, they need to assess and clarify the relationships of power that structure the situation. It is not only about listening to the people concerned but also about working with them to build, through the writing of a text, a representation of the network of powers that frame and determine their experience. More than mere "social subjects", the goal is to establish minority political subjectivities. The design project then becomes the occasion to turn from an experience-centered approach to a situated-knowledge approach. Considering the design project as a political struggle, as a work that is in conflict with dominating forces, would help transform the mere experience into a situated knowledge (Hartsock, 1983)

Situated knowledge is the type of knowledge that is rendered possible by a position of minority, which can be described as a position of resistance. One has to identify the forces that we resist to in order to understand the form of knowledge that the position offers access to. It is because the individual experiences something that prevents them from expressing their power, that limits their actions, that they need to perceive, observe, analyze the situation. When one dominates a situation, they can act spontaneously. When one is dominated, they cannot but think things through. This is something that can be observed among handicapped persons: they create tools and services that answer better to their situation than the ones proposed by institutions (Ménard, 2023). This is the type of "stories" designers need to write about. They are in the best position to describe the system of powers that spreads in a situation that involves a technical apparatus (object or service). Thus, they can tell us about the hidden dimensions of the experience. As Maria Puig de la Bellacasa puts it: "we need to analyze the dominating, structural and institutional remit through which the experience is built and that is not necessarily readable in the experience" (Puig de la Bellacasa, 2014). Approaching a situation through the distribution of power allows to highlight information that is usually hidden.

4. Knowing & Doing

The second epistemological perspective that I find to be helpful for design is agnotology (Proctor, 2008). Every knowledge is related to what is ignored, every research is defined by what is left unfound or unsearched (Girel, 2017). Science practice and thus the knowledge produced by science are intricately linked to political decisions, if only in terms of fundings (Frickel, 2014b). No science or research is ever exhaustive nor neutral. Since design is not a science in itself and since its goal isn't a mere description of reality but rather an intervention, a modification of it, the research designers engage in is even more subjected to this form of partiality. Rather than fight it, I advocate for designers to embrace this partiality.

4.1 A Pragmatist Epistemology

As per William Kindon Clifford, science is not reducible to knowledge itself–science is a specific way to obtain and to use knowledge (Clifford, 1901). This is all the more interesting that such a definition can help support the goal of conceiving design as science–since design projects always articulate knowledge and action. If the design project can pretend to produce science, it is, precisely, because the knowledge that designers seek is directly correlated to a function, a practical goal. There is a pragmatist foundation to the epistemology design can aim at. Understanding knowledge within a pragmatist paradigm leads us to shift our values: what matters is not to know X but to understand what problem is concerned/affected by/solved by X.

In my opinion, a consistent writing practice for designers should adopt a similar approach: every information gathered, through inquiries, interviews, observations or theoretical research must be linked, as precisely as possible, to a practical problem. I believe that research for the project would be more efficient if it were driven by a pragmatic posture: what does this information change for our issue? This implies that design research should be about questioning the value of any information. When starting a project, designers face multiple issues embedded in each other. Some issues are entirely practical and concern the

feasibility of their concept. Other issues are more theoretical and concern their understanding of the situation they plan on intervening. Other issues are more clearly political and address inequalities, accessibility, inclusiveness… To clarify the goal is to clarify the relevancy of the data gathered.

There is a vast spectrum of questions that structure the research for a design project. These questions lead the designers to encounter various information/data/knowledge. To organize all that knowledge, to take advantage of the sum of information gathered, I believe designers need to write–specifically to produce science, to actualize links between knowledge and problems, data and function, information and value. Designers should always come back to the questions that started the investigation in the first place: why is this situation problematic/sub-optimal? What does the user's experience mean to them? What should we aim for, and why? These are some of the questions that should accompany the first step of the design process. Every information should be confronted with these questions. What does this knowledge tell us about them? What does this finding change? Does this observation ask us to reformulate them? Does it render them obsolete? To investigate the value of an information demands to write–because it demands to produce a discursive text, a reasoning, because problematization supposes to confront concepts with each other.

4.2 Knowledge and Ignorance

How is science, more broadly the production of knowledge, understood by designers? To wish for design to produce a scientific perspective, one has to question the relationship designers have with the "idea of science" and of knowledge. What constitutes knowledge? When is one able to state that X is a knowledge? What is a fact? What can we trust? Designers are not engineers. Engineers work within a perimeter of knowledge that has been established for more than a century–engineering is basically applied science. Their conceptions follow well established scientific facts. But because design intends to build an experience, it immediately steps out of the secure space of "well-established facts". It needs psychology, sociology, ethics… and these disciplines are built on very complex epistemologies. How does a designer conduct their research? What source do they privilege? When do they know they can trust a study–rely on it?

These questions are clear methodological issues. But I wonder, beyond these challenges, at the root for their inquiries, what do they aim at? By that, I mean to ask about the phenomenology of their experience of research: what are the signs they identify and believe in? What do they think is "supposed" to happen during research? When do they start thinking they reached a satisfying amount of "knowledge"? To explore this dimension of our problem, one interesting discipline is agnotology (Frickel, 2014a)–the science of ignorance. One intuitive option is to conceive knowledge in relation to ignorance (Girel, 2017). But an easy mistake immediately pops up: to think of knowledge and ignorance as a binary opposition–like light and darkness.

Another way of saying this is that research and science may be understood as a way to gain knowledge and, thus, to reduce ignorance. One can picture reality as a map to explore–scientists being the explorers who discover new territories. And since the understanding of the laws of the universe generally leads to mastering said laws, to use that understanding in order to control our environment, the map metaphor easily changes. Not only do we explore territories, we also conquer them–we subjugate them (Merchant, 2006). Each knowledge gained is like an annexed territory. But this is obviously not a neutral representation of science by any means. And one could argue that this view is directly linked to the ecological disaster we are currently facing (Merchant, 1990).

If designers intend to be part of a bigger movement which aims at avoiding the disaster, then they need to approach their projects with a different conception of knowledge than the one that led us to the catastrophe in the first place. What could be a healthier way of dealing with ignorance? Brian (Wynne, 1992) invites us to abandon a logic that aims at reducing ignorance, to adopt a logic of integration of ignorance. Instead of pretending to eradicate ignorance, we take its existence into account. Ignorance questions the link between knowledge and the commitments that are taken on its basis. These are bets (technological, social, economic, political bets) placed on the completeness and validity of said knowledge. Integrating ignorance allows us to leave a binary logic where one either refrains from betting or goes all-in, to adjust our bets, to adopt a gradual logic.

Following that idea, to think that each project needs to ground itself in knowledge is both true and insufficient. Not only does it need knowledge, it also needs a representation of what is ignored. If science can be defined as an ignorance fully aware of itself (Firestein, 2012), then designers should not only try to gain information–they should try to define the function ignorance plays in the situation they will intervene in. This outlines another way of working: instead of going from ignorance to knowledge, one could go from belief to ignorance. Instead of trying to build, to establish, to construct a representation of reality, one could try to define what is unknown, what is uncertain, and what will remain inaccessible. In that regard, the goal is not to "understand the situation better", but to better "not-understand" it. To understand precisely why we do not comprehend it and why our understanding will forever be limited.

I believe this is one possible outcome for a design epistemic discourse. If designers were to produce an "ignorance map", if they were to identify blind spots, if they were to write about their projects through the lens of what is ignored, they would learn a lot about what constitutes a technical experience. To narrate how a design project evolves among ignorance is to teach precious lessons on how technical apparatus are built, and installed. It reveals how we place our bets, teaching us how technical apparatus are expressions of our mental representation of reality. To narrate the project and to highlight how blindspots are dealt with is to reveal a fundamental aspect of human existence–how our technical relationship to the world is linked to our understanding of it and our system of values.

4.3 Epistemic Relativity and Political Responsibility

By mapping what we do not know, we identify what we need to know as well as what we might never know, thus revealing the epistemic solidity of the bets that structure the project, and, by that, highlighting the designer's responsibility. How far must we carry our research for this project? How careful must we be? If research is the formulation of interesting ignorance that defines territories to investigate (Girel, 2017), one has to question who is in a position to identify said territories. Scientists are not the only ones: local residents' associations, communities, social movements… I believe designers are in a perfect position to co-construct these territories with the users. If designers were to produce texts that would report on what users identify as things they need to know for such matter, this would constitute a precious piece of knowledge as well. Because it would help map the technical experience, showing how knowledge and ignorance play a part in the user's experience of the apparatus.

It is neither realistic nor safe to ask designers to ground their projects on scientific sources. For one, they are not trained to navigate scientific data, even less so given that social and human sciences do not always aim for universal consensus. Secondly, in order to trust a sociology or psychology study, one has to have a deep understanding of the different methodologies used and epistemological backgrounds–an expertise that only professionals can hope to obtain. Thirdly, because lobbies and governments can actually "produce ignorance" (Girel, 2017). What we can expect of designers, though, is to produce a form of "local knowledge" which gathers, on top of the user's feedback, their hypothesis, the degree of confidence they have in said hypothesis and all the significant ignorance they've identified. We can expect designers to build an argued map of the beliefs and ignorance which play a part in the conception and implementation of the product or service. Thus, they can inform us both on the field they're intervening in through the lens of the improvement of experience that is initially aimed and on the epistemic opportunities and difficulties faced by those who try to build a "better quality of life".

4.4 Science of Design

As previously said, standpoint theories defend the idea that being engaged in a problem actually leads to better understanding. In that regard, I believe that designers should state their commitments and explicitly link these to their research of information. It is because designers assume the responsibility to work for better living conditions that they will access knowledge that remains invisible to the rest of the world. Good science is a science that takes its pragmatic and political dimensions on. Designers can become that very kind of scientist: instead of letting knowledge shape their understanding of the situation they will intervene in, they could render visible the connections between a practical goal and a complex ensemble of

knowledge and ignorance: "When one tries to fix X and Y, this is the type of information that arises". This means we should leave objectivism behind, in favor of objectivity. The former implies a form of scientism which leads to mimic the style of the more prestigious sciences (Puig de la Bellacasa, 2014). And this is a risk that concerns us vividly: designers are susceptible, to gain a form of legitimacy, to adopt the tone and perspective of more established voices (sociology, anthropology…). I have personally witnessed this numerous times with design students (Author). Objectivity, on the contrary, reveals a point of view, assuming its limits.

Design science should not adopt a form of discourse but, rather, build forms ad hoc, for each project, each commitment. Because each project implies different values, different dominations, different networks of powers, each project asks for a specific description of how the "problem" is discovered, how the intervention of design is called and how this call implies values. And that also means we need reflexivity: as any social scientist, the designer must submit to the "systemic examination of their own positions, of their own social causes and of the beliefs that motivate their research" (Puig de la Bellacasa, 2014). We need to encourage designers to produce theories–however unfounded or prejudiced. A flawed theory is better than no theory at all: it leads the inquiries and helps give data meaning. Meaning needs context to arise and I advocate for that context to be the technical experience in all its complexity (emotions, values, symbols…).

The goal, for scientists, is less to "tell the truth" than to "make themselves understood" by other scientists, to allow dialogues and the collegial building of knowledge. Each scientific practice is supported by an epistemology. But this need not be absolute, neutral, or universal. It can be "held" by a collective project–by a community. Designers can write and produce science that makes sense within the design community. Designers should write papers virtually addressed to other designers. For a said project, they would highlight how their values–and the attempts to conceive something that supports them–lead to discovering valuable information. It would help the community of design understand how an ethical or political commitment, an aspiration to a "better quality of life" (WDO), enables an objective yet partial representation of reality

5. Conclusion

Instead of producing research that pretends to be of scientific quality but is actually never checked nor peer-reviewed, I believe designers should give report on a limited triangular space defined by three terms in relationship with each other: 1) their goal (in terms of practicality as well as values); 2) their ignorance (what needs to be known and what will remain unknown); 3) the distribution of power among all parties involved in the situation their project takes place in.

I believe that if each team of designers, for each project, were to explore these three dimensions, very valuable knowledge could be extracted. I think such exploration necessitates the practice of writing. To question prejudices and beliefs, to assess reasonings and values, to investigate the difference between perspectives, one has to dive into conceptual nuances that are only achievable through discursivity: every scientific discipline expresses its findings, theories, and conclusions in papers. To produce a complex thought, one has to build it with words and sentences. Moreover, for something to become data, or information, it needs meaning. An observable phenomenon has meaning only in so far as it is related to a theory–to a hypothesis about how things are or should be.

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P/REFERENCES OF DESIGN

MICROBRIEFS: USING DESIGN SPRINTS IN PRACTICE-BASED EDUCATION.

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ABSTRACT | This paper introduces an educational approach implemented within the Design Products MA programme of the Royal College of Art in London UK, focusing on enabling students to develop their personal practice around their values, concerns, and materialities. The approach integrates Kolb's experiential learning theory, design sprints, and the community of practice framework to foster hands-on problem-solving within set time frames, encourage collaboration, and facilitate reflective discussions. The 'Experimental Design' unit, building on the 'Locating Practice' unit, aims to broaden students' horizons through consecutive 'Microbriefs,' emphasizing trial and error to expand creative bandwidth and explore various design practices, materials, and technologies. The six Microbriefs undertaken during the curriculum explore themes such as self-portraiture, spatial design, communication, error, traditional meaning-making, and ethics in design.

1. Introduction

This paper presents the educational approach developed in the context Design Products MA programme of the Royal College of Art s a practice-based master's programme that focuses on enabling students to build their personal practice around their values, matters of concern and materialities.

In Design Products we view products as influential leverage points encompassing not only tangible goods but also services and systems, extending beyond the final outcomes to encompass the entirety of the design process and the territories it instigates (Meadows, 1999). Within this framework, we advocate for a more pluralistic approach to design, wherein products (outcomes) of the design process serve as a gateway to uncharted territories, with the objective of advancing new disciplines, research methodologies, and practices.

The nomenclature of the Design Products MA program at the Royall College of Art originates from the fundamental belief that "design is more important than the product." This position deliberately challenges the traditional boundaries of design as a discipline, propelling it into unconventional spaces. The focus of the programme is on shaping, redefining, and promoting best practices within sustainable parameters, openly articulated.

Unconstrained by traditional manufacturing norms, our approach encompasses a spectrum of possibilities, including the exploration of new intellectual property models, systemic transformations, integration of digital technologies, design for repair, stimulation of new behaviours, and the continual scrutiny of our responses to climate change. Rather than conforming to established typologies, we view design as a versatile tool for provocation, future envisioning, research facilitation, contextualization, and the redefinition of design industries, transcending the mere production of artefacts. Fundamental to our inquiry is the question, "What constitutes a product?" as we challenge assumptions and seek to uncover critical insights that inform cutting-edge creative practices, aimed at designing more sustainable and impactful futures.

The programme rests on two central tenets, first is values-based design education and the second is practice based learning. This leads to the creation of a programme that aims to facilitate the exploration and emergence of a design practice that is rooted in the learner's value system, matters of concern, materials and production methods.

Values-based design education integrates a pluralistic educational model by embracing project-based learning and creating creative environments for design practice (Thoring et al., 2018). This approach aligns with the idea of integrating pluralistic educational models, as it allows for diverse perspectives and experiences to be incorporated into the learning process. Additionally, the work emphasises the significance of values-led participatory design, providing insights into how values can be incorporated into the co-design process, reflecting a pluriversal approach to design education (Noel, 2022) and decolonising design education (Ansari et al 2019; Turnstal 2023; Adibrata et al 2023) movements. By drawing from these perspectives, we aim to acknowledge and embrace diverse values, cultural perspectives, and participatory approaches within the design process. This integration not only enriches the educational experience but also prepares students to engage with the complexities of real-world design challenges, where multiculturality, interdisciplinarity and diverse values are inherent.

The 'Experimental Design' unit, building on the 'Locating Practice' unit, fosters exploration and experimentation with various practices, materials, and technologies. Through consecutive 'Microbriefs,' it aims to broaden students' horizons and leverage contemporary design approaches, emphasising trial and error to expand creative bandwidth. This unit extends students' capabilities in designing interventions and explores a practice-based approach to design as experimentation. Each Microbrief starts with a thematic provocation that puts forward a one-to-two-week design project, inspired by the notion of design sprints. These projects serve as lenses for collective reflection on emerging practices, fostering dialogue, creating a community of practice within the studio. Microbriefs drive fast experimentation, strategically testing concepts

across various mediums to offer diverse proofs of concepts and design directions. The experimental proposals are free to explore mediums including: physical (including performative), digital, material, technology, computational and biological techniques to create proposals for a product, artefact, probe or intervention.

2. Practice-Based Design Pedagogy

2.1 Design Studio

The design studio is a fundamental component of practice-based design pedagogy, serving as a space for experiential learning, creative exploration, and collaborative engagement. In the context of design education, the studio environment plays a pivotal role in shaping students' understanding of design processes, problem-solving, and critical thinking. This section will explore the significance of the design studio in practice-based design education, drawing insights from relevant literature to elucidate its role in fostering experiential learning and creative development.

The studio serves as a space where students actively engage in hands-on, project-based work, allowing them to integrate theoretical knowledge with practical application and through reflection feedback to the theoretical and methodological models around design. This learning by doing environment is essential for students to acquire design skills and knowledge under the guidance of tutors.

The design studio aligns with Kolb's experiential learning theory. According to Anderson & Dron (2011), the design studio environment facilitates instructional designs and interventions that promote active experimentation and knowledge application. This resonates with Schon's concept of the "reflective practitioner," where students engage in reflective conversations with peers and instructors to critically examine their design processes and outcomes (ibid). The studio's immersive nature allows students to integrate theoretical knowledge with practical application, fostering a deeper understanding of design principles and methodologies (Saghafi, 2020).

The weekly pattern of Microbriefs creates a sense of ebb and flow in the studio with the space filling up with materials and works revolving around the theme of the week. The very presence in the space takes on an experiential significance as the space acts like a halfway point between workshop and exhibition space. Furthermore, the design studio serves as the basis for a community of practice, where peer-based learning and collaborative interactions play a significant role in knowledge construction and skill development. Iranmanesh & Onur (2022) emphasise the design studio as the core of practice-based pedagogy, highlighting its role in nurturing a collaborative and supportive learning environment. Moreover, the design studio's pedagogical significance extends to its role in fostering originality, creativity, and critical thinking. Saghafi (2020) underscores the studio as a space where knowledge gained from various subjects is integrated, promoting interdisciplinary thinking and innovative design solutions. This aligns with Schon's emphasis on "artistry, invention, and discovery" within the reflective practice framework, where students are encouraged to explore creative solutions and challenge conventional design norms.

The design studio stands as a cornerstone of practice-based design pedagogy, providing a fertile ground for experiential learning, collaborative engagement, and creative development. By integrating theoretical knowledge with practical application, fostering a community of practice, and nurturing originality and creativity, the design studio plays a pivotal role in shaping the next generation of designers. Creating a studio culture that fosters peer-to-peer learning and critical reflection is essential for design education. According to Lee (2009), project-based learning can serve as a vehicle for learning in design education. This approach allows students to engage in hands-on projects, promoting collaboration and knowledge sharing among peers. Additionally, Thoring et al. (2018) emphasise the significance of creative environments in design education. By establishing diverse creative spaces, students can be exposed to different contexts and stimuli, which can enhance their critical thinking and creativity. These findings suggest that incorporating project-based learning and providing diverse creative spaces can contribute to the development of a studio culture that encourages peer-to-peer learning and critical reflection.

In order to cultivate peer-to-peer learning within the studio culture, it is important to recognize the unique aspects of design learning processes. Caban and Wilson (2002) and Jones (2006) argue that the design learning processes, particularly in terms of creativity, possess substantial uniqueness. Acknowledging and embracing this temperament of design education can help in tailoring the studio culture to effectively support peer-to-peer learning. Furthermore, Thoring et al. (2018) highlight the significance of context in creative environments for design education. By creating diverse and stimulating contexts within the studio, students can engage in critical reflection and draw inspiration from their surroundings, thereby enhancing their learning experience. Therefore, by integrating the understanding of unique design learning processes and providing diverse contextual environments, a studio culture can be cultivated to promote peer-to-peer learning and critical reflection. In order to facilitate the emergence of such a culture we decided to integrate a series of design sprints, Microbriefs, in the second term of the programme. In the following section the characteristics of these sprints will be presented and connect to our educational goals.

2.2 Design Sprints as an Educational Unit

Design sprints have gained popularity as an educational approach that promotes faster iteration, experimentation, and prototyping, fostering a dynamic and collaborative learning environment. This section aims to explore the application of design sprints in education, drawing insights from relevant literature to elucidate their impact on pedagogy, student engagement, and learning outcomes.

Design sprints have gained traction in educational settings as a method to facilitate rapid problem-solving, idea generation, and prototype development (Kruger et al., 2023; Winfield et al., 2022). The implementation of design sprints in industrial design education has demonstrated the potential to cultivate discipline and rigour in the design process, preparing students for real-world challenges (Thomas & Strickfaden, 2018). This aligns with the iterative nature of design sprints, where students engage in time-constrained activities to address complex problems and develop innovative solutions (Thomas & Shin, 2016). Sprints provide students with hands-on experience in navigating ambiguity, making decisions under constraints, and collaborating effectively within multidisciplinary teams.

Design sprints can support students in becoming confident in conditions of uncertainty. By creating an uncertain space which demands a quick, deft response, by stimulating students with knowledge that is potentially transformative but also inevitably very partial, the students are exercising de-facto being in the liminal space. This is exercising elements of pedagogy within the setting of the students' own making - making them not only better designers but mostly better learners.

Furthermore, the integration of design sprints in educational contexts has been shown to enhance student engagement and motivation. The resolution of a project within a short period of time offers students a unique and intensive learning experience. This intensive format encourages active participation, creativity, and critical thinking, fostering a sense of ownership and accomplishment among students (Sanglier et al., 2021). Additionally, the studio environment supports the collaborative nature of design sprints, promoting peer learning, as students work together to ideate, prototype, and iterate, aligning with the principles of cooperative learning and knowledge construction.

Kolb's experiential learning theory posits that learning is a continuous process involving concrete experience, reflective observation, abstract conceptualization, and active experimentation Kolb & Kolb (2012). Design sprints, as a time-constrained and structured approach, provide students with opportunities to engage in hands-on, experiential learning that resonates with Kolb's learning cycle.

Kolb's learning cycle and design sprints intertwine seamlessly to enhance learning experiences. In the first stage, students engage in hands-on problem-solving during design sprints, mirroring Kolb's concrete experience phase. Reflective observation, the second stage, occurs as participants analyse feedback and refine their designs iteratively. This mirrors Kolb's emphasis on critical reflection. In the third stage, abstract conceptualization, students synthesise their reflections to refine their designs, aligning with Kolb's notion of forming concepts based on experience. Finally, in active experimentation, participants apply their

refined designs, akin to Kolb's idea of applying conceptualizations in new situations. Design sprints, with their rapid cycles, foster active participation, peer learning, and skill development in design education, complementing Kolb's framework effectively.

In conclusion, design education is heavily based on human models of learning and design sprints add to that the capacity to go through multiple cycles within a short time, creating cycles within cycles. Design sprints thus enable better design education by promoting active participation, situated learning, the creation of learning communities, rapid iteration, and technological enhancement. These mechanisms contribute to a transformative and experiential learning environment, fostering peer-to-peer learning and skill development within the context of design education.

In summary, each of the design sprints undertaken during Unit 2 of the programme needs to be seen as a distinct learning cycle. By providing students with an array of different opportunities for concrete experience, reflective observation, abstract conceptualization, and active experimentation. The final pillar of the educational approach developed for this unit was the need to create conditions in the studio that fostered the emergence of a community of practice in the studio.

2.3 Community of Design Practice

The community of practice framework provides a social learning environment, in our case the design studio, where individuals can engage in reflective discussions, share experiences, and collectively develop a deeper understanding of design principles and practices (Joyce et al., 2015). In the next section we are presenting four characteristics of communities of practice that we feel are integral to our educational approach

Active Participation and Learning by Doing: Rogoff et al. Rogoff et al. (2003) discuss how people learn by actively observing and "listening-in" on ongoing activities as they participate in shared endeavours. The studio provides students with hands-on, experiential learning opportunities, allowing them to actively engage in problem-solving, idea generation, and prototype development within a time-constrained framework (Sanglier et al., 2021).

Situated Learning and Legitimate Peripheral Participation: Lave and Wenger (1994) emphasise the concept of situated learning and legitimate peripheral participation, which is integral to organic entanglements happening within the studio. Students participate in shared endeavours and gradually increase their involvement in the design process, thereby fostering peer-to-peer learning and knowledge construction through their everyday participation in studio life.

Creation of Learning Communities: Marshalsey and Sclater (2020) discuss the creation and support of learning communities in the era of distributed studio education. Studio acts as a platform for creating collaborative learning communities, where students work together to address design challenges and share their insights and expertise, thereby fostering peer-to-peer learning.

Technological Enhancement and Pedagogical Change: Crowther (2013) discusses the opportunities for technological enhancement of the design studio pedagogy. Implementing design sprints in design education can leverage technological tools and platforms to enhance the learning experience, providing students with innovative and immersive learning environments.

The space of the studio in design education, emphasises the physical environment as a facilitator of community building and collaborative learning. The informal communication and social engagement in the design studio, creates an environment that fosters peer-to-peer learning and collaborative interactions. (Corazzo 2019) These are integral parts of a community of practice. The centrality of the studio in design education, underscores the role of the community of practice where teacher-student communication and collaborative learning take place. The key ways the design studio fosters peer-to-peer learning are multifaceted and encompass various dimensions of pedagogy and collaborative engagement. (Goldschmidt et al. 2010)

Mewburn's (2011) empirical research examines how the theory of reflective practice (Schon 1987) is applied within the design studio. This study underscores the tutor's role as a coach, assisting students in conforming to disciplinary norms and cultivating a 'designer's mindset' to facilitate peer-to-peer learning. This relationship has underlying issues related to power and representation in community-based design. This includes the establishment of trust and negotiation of intricate power dynamics, both pivotal components in fostering peer-to-peer learning (Schiffer 2020). Fostering peer-to-peer situated learning by doing, as a reflective practice while addressing issues of power and representation is, in conclusion, the goal that the studio needs to achieve. The design studio serves as a vibrant and transformative space for collaborative engagement and peer-to-peer learning in the context of design education.

2.4 Conclusions

The design studio serves as a cornerstone of practice-based design pedagogy, providing a space for experiential learning, collaborative engagement, and creative development. By integrating theoretical knowledge with practical application, fostering a community of practice, and nurturing originality and creativity, the design studio plays a pivotal role in practice-based design education. We set out to create a studio culture that fosters peer-to-peer learning and critical reflection through the development of a series of design sprints. Project-based learning and diverse creative spaces contribute to the development of a studio culture that encourages peer-to-peer learning and critical reflection. Furthermore, recognizing the unique aspects of design learning processes and providing diverse contextual environments can cultivate a studio culture that promotes peer-to-peer learning and critical reflection. Integrating design sprints into the educational approach can enhance the capacity for multiple cycles of experiential learning within a short time, contributing to a transformative and experiential learning environment in design education. The emergence of a community of practice within the design studio further supports peer-to-peer learning, collaborative engagement, and the development of a vibrant and transformative space for design education. In the next section we will be presenting the different Microbriefs run during unit 2.

3. Microbriefs

Microbriefs aim to form a foundation to a variety of practices by allowing them space and subjects to develop around. They aim to be diverse enough to act as a collection of lenses that allow every student to find a focal point that is suitable for them. The diversity of student projects necessitates such a flexible educational approach. In the broader context of the trajectory of students on the course, the Experimental Design and MB briefs are intended to allow students to explore the bigger matters of concern they are interested in by focusing on different key aspects of practice weekly.

Towards the end of the unit the students also produce additional output which is not guided by a brief and is responding to their major subject of exploration more specifically. By this point the students are able to approach the process of questioning and responding as "another Microbrief"

Some key defining characteristics make a 'good' Microbrief:

- Relevant to creative practices so to allow interpretation within a more confined definition of Design. These titles cover elements of routine practice in design;
- Relevant and legible in a broader human / cultural / societal context as to allow a very low threshold of engagement. It needs to mean something for EVERYONE no matter how early a stage they are in. (legitimate peripheral participation).

The title WAHTSO: (we're not here to save the world) We Are Here To Save Ourselves - positioning the experimental design as an ex-territory with its own set of rules, independent of the agenda, ethos and curriculum of the college. There is a message by design here, that experimentation must be accommodated

regardless of the consequences. Such ethos is losing ground in a reality where design has to assume a responsible role and quite literally save the world.

The unit ‘Experimental Design’ aims to challenge and deschool some of the models the students have been formed by through their industrial design education. This is done by truly committing to a spirit of experimentation. This involves embracing failures and exercising the analysis of the action (as opposed to the outcome) to extract positives from all produced work. To foster this experimental spirit, individual briefs are not marked and the assessment is done by examining learnings achieved over the entire course of the unit. For the students this means that putting in the labour guarantees success. This aligns with Richard Sennett in The Craftsman (2008) where he suggests that potentially EVERYONE has talent.

This is an important message to be receiving as a student, when one is in the process of turning raw talent into applicable practice, moreso when the briefs are actively taking apart previous methodological structures on which the students rely.

In this section a brief presentation of the area of focus of each Microbrief is presented followed by some conclusions on how they achieve the goals set.

3.1 Making Faces

This brief uses practices of Self Portraiture and self-reflection to create an introduction to a person and a backdrop to frame subsequent work in the studio.

It follows from the first unit of the year: "Locating Practice" where the students produce a (mostly written) manifesto to launch them into a year of work. The self-portrait is an invitation to use other media and techniques, to bring their values to the forefront and to assume other positions as practitioners than those suggested in their previous education.

The brief itself asks the students to create a self-portrait. This is positioning a very accessible threshold for engagement. The human form is a classic subject, explored by all creative disciplines since the dawn of man and the face (and by extension the human form) is a readily available thing to be responding to.

Know thyself.
Understanding one's perspectives, positions and biases is key to being able to respond clearly to external stimulations. Articulating something about oneself is a way of calibrating one's tools of observation and critical response.

Being the first brief in a newly formed community of practice, this is an opportunity for students to introduce themselves to their peers through materials, techniques, storytelling etc. This enhances the sense of community and invigorates the social interactions, building scaffolding for peer learning.

We believe and endorse the notion that Design is a creative practice, not only a service or a job description. As such, the creative author is never absent from the work - in their creative input, their biases, attitudes. This is an opportunity to explicitly explore the role that designers see for themselves in their practice, placing their own (often physical) self-centre stage. Furthermore, this legitimises the personal perspective as a 'portal' through which to be reflecting on the world.

3.2 Scratching Both Walls, on Space and Spatial Design

This Microbrief invites students to respond to - and on the scale of - spaces of significance. Expanding from reflection on one's physical self, this Microbrief takes the students one notch up in scale and asks them to be considering and responding to spaces and the way our physical selves interact with them.

We recognise similar practices and processes operate across a scale of physical dimensions; be it jewellery, furniture making, architecture etc. but often students tend to suffer from the 'cat size' syndrome - producing things that are on a small, contained scale whose existence is often confined to the studio.

Working on a large scale creates conditions / obstructions that are beneficial in a number of ways: Technically, it is more difficult to skim over undecided details. Being large means all design decisions are more visible, making them more obvious subject for discussion.

Responding to a certain particular space forces the students out of the studio, out of their physical comfort zone and into a space that will inevitably contain other factors as well. This is forcing the students to open up to the world.

Borrowing its title from the work of Artist Rebecca Horn "scratching both walls at once" (1974-5) the brief carries the notion that the physical person of the artist and the space - any space - in which it is placed hold the tension and potential to create work around (shifting the emphasis from finding the most 'unique' location to the actual act of engagement with space).

The brief asks students to consider spaces as: physical objects, places, holders of stories, containers of human lives and activities, building blocks of larger human environments and cultures. To respond to spaces, students need to practise the language of space and architecture: solids and permeables, passageways and walls, technical details and objects.

3.3 Mechanism

This brief builds on the notion that design in the broadest sense of the term is a set of intentional actions done for a purpose, to produce an effect. This distils the practice to understanding all manners of mechanisms which tie cause and effect, action and reaction.

The brief asks the students to identify a mechanism and respond to it, exploring the very definition of what a mechanism is in various iterations and contexts. References presented in the briefing include physical mechanisms, principles and devices (like producing sound from textured surface as demonstrated by Yuri Suzuki's works based on vinyl records and the works of Jeroen Diepenmaat who is 'playing' the surface of the streets with a large-scale phonograph cone) and also less precise concepts like 'reflection' (as explored by Daniel Rozin's mirrors). This introduces the notion that effects take place as a result of a constellation of factors and the practice of design involves the ability to observe and identify this interconnectedness, to understand the factors involved and the potential of utilising them. The idea of mechanism extends also to terms which are less technical; like 'empathy' (exploring how to evoke a sense of empathy even with inanimate objects) or 'instructions' (explicitly guiding someone to take certain actions: assembling flat pack furniture or playing a music score).

The work produced by the students for this brief typically emphasises control: controlling the conditions and variables in a situation to produce a predictable outcome, a predictable process of action and result. This is always a challenge on both conceptual and production levels: framing work in terms of control inevitably leads many students to describe their output as 'success' or 'failure' which can be detrimental to the process and the experimental attitude. The following brief in the series takes off from this point.

3.4 A Catalogue of Errors (Brief by Sophie Clements)

This builds on very similar brief work done by Sophie Clements with students in other programs / schools in the Design Products and outside it.

This brief is about control, lack of control, accidents and serendipity.

One of the foundations of the Experimental Design unit is to support the students in developing confidence in conditions of uncertainty (the liminal space). This is key to creating resilient learners in the studio but is also precisely relevant to professional design practice.

Where ‘Mechanism' sees students creating contrived mechanisms with a clear intention of controlling the outcomes, ' A Catalogue of Errors' asks them to practise the creation of conditions which will deliberately yield an uncontrolled outcome which nonetheless is the result of these unique conditions. Here lies the distinction between 'random interference' and just 'making a mess'. The element of control is ever present in the creative process. To borrow from the artist Andy Goldsworthy: "total control can be the death of a work". In 'Mechanism', there is a binary line separating success from failure. The students create a mechanism that's meant to deliver an effect and if it doesn't then the experiment is deemed 'failed' or at the least 'not working' - which the students can be too conscious of. With 'A Catalogue of Errors', the process taking place is very similar but the emphasis is shifted to the richness of the set up and the space allowed for things to go wrong. The line between success and failure is then explored not by calculated tentative means of feeling but by racing across and beyond it.
On a practical note, working with such methods as Dadaist poems offers useful techniques to get past what Richard Serra called "the indecision of beginnings". These align well with techniques for boosting creativity such as IDEO Method Cards as well as the arbitrary character of design sprints.

3.5 "Μύθος" (Myth)

Myth is a brief that acts as an exploration of traditional ways of meaning making, ritual and embodiment in the design of artefacts. The brief asks students to Pick a time and place in history and examine how their positionality aligns with the system of values of that era. After selecting a civilization that echoes their values students were asked to "Create a found speculative ritualistic thing, describe its role within a ritual (existing or imagined) and narrate the myth around the rituals. This brief is grounded on work developed by Bofylatos (2020) in developing artefacts to explore how the material culture developed by prehistoric civilisations embodied notions of their human experience (Bofylatos 2022).

This Microbrief aimed to inform students practices about notions of embodied movement in the context of rituals (Grimes 2012), speculative pasts, values driven design for sustainability (Walker 2017) and how other ways of knowing can be integrated into contemporary practices (Latour & Porter 2010). The past, in this case, was used to challenge the cultural hegemony of modernity and enable a more pluriversal perspective of value systems. The way the language of myths speak about facets of our shared human experience was leveraged to point to examples of narratives developed collectively to guide people both in practical and ethical behaviours (Levi-Strauss 1955; Campbel 2008). The value of storytelling in design was an important aspect this Microbrief aimed to distil to the emergent practices of our cohort.

3.6 Resist / Complicity

Resist / Complicity carries with it an explicit agenda that places design practice within a broader context of politics, values and ethics. Acknowledging that in the current climate design very often must choose a side - to resist or be complicit - and be informed and conscious of the consequences.

The brief asks the students to find something worth resisting and resist it through design, or else, self-consciously assume the role of the complicit and "design like nothing is sacred".

This is a call for students to explore the broader contexts of things and phenomena, to identify flaws, wrongs, misuse of power or distortion of justice, to seek leverage points and respond in a designerly fashion. This is also a platform to put their moral position and attitude front stage, an invitation to flex their muscles of resistance, to practise the firm belief that being observant and critical is a citizen's duty. Designing then is quite forcefully extracted from its comfortable space of 'form giving' and placed bare naked as an act of civic responsibility and moral duty.

This is the last of the microbriefs in the unit, delivered when the students are at their most confident, having engaged the sprint model 5 times already. They are at this point ready to make a statement of intentions that will echo throughout the remaining terms of creative work.

4. Conclusion and Reflections

In this concluding section we discuss some of the key principles that emerged when this unit was run. These principles are grounded on the authors' reflections on the process, context and work produced with the students in the studio. These conclusions are informed by discussions with colleagues and students and the overall embeddedness of studio life.

The medium is the message:
The Microbriefs are curated. The selection of the titles and the choice to deliver inspiration from a very broad field of references is indeed taking a position. This position reflects an ethos about the role of design, of designers, of citizens, of practices of critique and more. Microbriefs are a tool, a tool to deliver ideology. We believe that there cannot, there ought not be design education (pedagogy) that is without ideology. Values are the basis of ideology and given the nature of practice-based education, knowing your values - and ideology by extension - is a prerequisite to develop a meaningful design practice.

The choice to bring inspiration from farther afield than just design work (mostly Art) is conscious. This is to deliver content that has not been processed through familiar methodologies of design. Art tends to respond to similar components that you'd find in design methodology but most notably it does not have to meet standards associated with design practice (user, costing, market etc.). At the same time, it is explicitly driven by clear ideologies, taking positions and working with materials and mediums in a conscious, calculated and skilful manner.

Each brief is presented with a collection of references that embody the values that the brief is exploring and they are being 'unpacked' to demonstrate their relevance in context, technique, attitude etc. The students are explicitly invited to begin their process of exploration through mimicry to set their creative process in motion. This builds on a process of "virtual apprenticeship" used by Author 1 in work with students, exploring copying as scaffolding for the development of new projects and practices.

Creating unexpected connections between referred items help highlight the presence of certain principles (titles) to be observed in the world. The same happens upon reviewing the many dozens of outputs, all responding to the same brief title.

Microbriefs are much about articulation of intention. This is delivered in the briefings too. At times, the same references will be used for different briefs with the emphasis and interpretation being different every time. This aspect of the pedagogical delivery is inspired by the apprenticeship models and their capacity to facilitate embodied learning (Downey et al. 2014), with the briefing sessions providing examples of how observations and insights could be articulated, discussed and argued about.

Faster. More often. Repeat:
All the elements mentioned above are acknowledged and familiar and applied in design education in its modern form since the days of Bauhaus school (Finedeli 2001). Microbriefs build on this but dial it 'to 11'. The impact is achieved both by turning the designers' gaze inwards, to their own process and by accelerating and repeating the process over and over again.

Repetition creates habit, conditioning, method, practice. In later units, when students are asked to: "think of it as a Microbrief" this becomes a reflexive methodology that has been iteratively developed. It becomes a form of work that delivers results. In a sense the Microbriefs invite students to shift form 'workmanship of certainty", where the exercises done are characterised by uniformity and predictability in outcomes, and the "craftsmanship of risk," (Pye,1978) where the outcome is uncertain and influenced by the interaction

between the material and the craftsman's skill. In the craftsmanship of certainty, the focus is on achieving standardised results and developing technique, while in the craftsmanship of risk, there is an acceptance of variability and an embrace of the creative potential within the process.

The multitude of iterations at hand forces learners to go through six repetitions of Kolb's learning cycle. The sprints are stressful and the confined time frame can prevent meaningful ideas. So we're doing multiple sprints but at the same time giving students time to reflect and for the new knowledge to 'ferment' between weeks. Also, the outputs of each Microbrief are not marked individually but in the end of the unit as a singular body of work. Secondly, we prioritise the process and not the results - (this is where transparent pedagogy is important so students can understand what they are a part of) - the result of the sprint is "know thyself", from the brief: "articulate your attitude to design and start to form an individual language" as such the material outputs are seen more as an anchor of learning, a means not an end,

Generalist approach to specialism:
The breadth of inspiration and freedom to respond in any medium are conducive of a generalist approach to design. It is established that design is effective as a mediator between stakeholders and experts, termed the 'science of the particular' (Buchanan 1992), and this requires agility and ability to be inspired and respond using multiple mediums. Going back to the central tenet of the Values-based design pluralistic education model adopted by the programme, the need to create a space where a multitude of diverse practices can emerge and flourish takes this need for flexibility further. Microbriefs need to be a tool for the divergence of ideas creating new creative pathways. Microbriefs need to be effective lenses, distorting existing perspectives in unexpected ways. By reflecting on the body of work produced students will be able to integrate these perspectives in their practice.

Work individually within a community of practice:
All students are responding to the same brief yet the responses are completely different. One of the central goals for this educational unit was to trigger the emergence of a community of, design, practice in the studio space the programme occupies. Active Participation and Learning by Doing, Situated Learning and Legitimate Peripheral Participation, Creation of Learning Communities, Technological Enhancement and Pedagogical Change were identified as the main drivers in fostering such communities. The development and undertaking of unit 2 aimed to address all these principles. The students had to create material provocations for each Microbrief forcing them to learn by producing design work. The tutors pushed students to inhabit their studio space not only during tutorials and lectures but during their autonomous learning, events were organised, both led by students and staff to create clusters of dialogue around specific matters of concern. The use of IT and innovative ways of making to extend the physical space of the studio to the digital realm was also leveraged to expand the scope of the studio beyond its walls. This included different platforms that were used to share resources, events and engage in dialogue.

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P/REFERENCES OF DESIGN

A STUDY ON CURRICULUM DEVELOPMENT TO PROPOSE A NEW DESIGN EDUCATION MODEL: FOCUSED ON USING THE CREATIVE THINKING STYLE INDEX(CTSI) TO ENHANCE COLLABORATIVE CREATIVITY.

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KEYWORDS | DESIGN EDUCATION, CURRICULUM DESIGN, EDUCATIONAL MODEL, CREATIVE THINKING STYLE

ABSTRACT | This study introduces a pedagogical approach in design education, using the Creative Thinking Style Index (CTSI) to foster collaborative creativity among students. It responds to educational changes driven by rapid technological and cultural shifts, emphasizing the need for collaborative and self-directed learning, especially for Generation Z students influenced by digital personalization trends.

The research highlights the growing importance of creativity in education, driven by the democratization of creative work through digital platforms. It highlights the personalized learning preferences of Generation Z and the urgent need for education systems to promote more collaborative learning methods. The study identifies a gap in current design education in Asia, particularly in South Korea, where students are not adequately prepared to meet the collaborative and creative demands of today's world.

The aim of the study is to propose a new model of design education that focuses on self-directed and collaborative relationships and enhances creative skills through the CTSI. This involves a comprehensive analysis of creative thinking styles and the experimental implementation of a curriculum that promotes collaborative learning. The methodology includes a sequential literature review and the practical application of the CTSI in curriculum development to enhance collaborative creativity and problem solving.
Findings indicate that the CTSI effectively enhances students' creative thinking styles and fosters a more collaborative learning environment. The CTSI-integrated curriculum was shown to improve students' ability to work together creatively to solve complex problems. The study highlights the importance of mutual understanding and shared perspectives in the collaborative creative process facilitated by the CTSI.

The research concludes that the innovative educational model using the CTSI can significantly contribute to the advancement of design education by preparing students with the necessary skills for collaborative and creative problem solving. The model addresses the challenges of personalized learning trends and equips students for future collaborative work environments. It is expected that future research will build on this educational model and continue to demonstrate the value of using CTSI at the undergraduate level through more sophisticated and quantitative experiments.

1. Introduction

1.1 Research Background

Today, rapid economic and cultural changes and the emergence of new technologies and media have led to a surge of interest in the meaning and possibilities of creativity, especially with the popularization of various digital tools and platforms that allow individuals to share their creations and ideas with the world. The democratization of creative work has led to a new valuation of the professional skills of creatives such as artists and designers, and this shift has contributed to increased awareness and interest in fostering creativity in education. This study was motivated by the question: “How can learners' collaborative creativity be fostered in the context of this paradigm shift?”

People have different thinking frameworks and orientations depending on their cultural backgrounds, and people from different cultures are constantly socialized to develop certain habits of mind from the moment they are born. However, as the world becomes more globally and locally connected than ever before, human thinking habits are gradually shifting toward a more individualized and diverse society. This is particularly true in higher education. The pandemic has led to a transition from a more personalized digital environment to a society that encourages individualization more than ever before, regardless of generation. In particular, the collaborative methods that today's learners, who have grown up with competitive relationships, are exposed to in higher education have proven to be a major hindrance to spontaneous creativity.

The current design education system (at least in Asia, including South Korea) does not prepare students to respond sensitively to these challenges. Especially in Korean culture, the concept of hierarchy plays an important role in structuring society and influences various aspects of life, including the educational environment. This hierarchical perspective often emphasizes vertical relationships, such as those between teachers and students, rather than horizontal relationships, such as those among students. For example, in a typical classroom in some Asian countries, the teacher is often seen as the ultimate authority and primary source of knowledge. This perception stems from cultural values that respect age, experience, and position. Students are generally expected to listen, absorb information, and not openly challenge the teacher's authority. This dynamic can sometimes lead to classrooms where student-to-student interaction is minimal because the focus is primarily on the vertical teacher-student relationship.

There are two main reasons for this. The first is the increasingly personalized nature of learners. This is not just a problem for the current generation of students, known as Generation Z. The societal shift that has occurred since the pandemic, which has dramatically increased our reliance on personal devices, is perhaps the biggest culprit. But for digital natives, this societal trend has created a culture that is even more deeply and intensely personalized than before. This trend is particularly strong among young people in South Korea, who consume more digital content than any other country.

The second cause is that society and culture are shifting to a situation that requires more collaboration and consultation than ever before. However, in Asian cultures, where there is a relatively high sense of hierarchy within groups, there is less awareness of horizontal relationships. In addition, learners who have learned through more intense competition than ever before have a deficit in learning about cooperation and consultation. In such an environment, the concept of group work or peer-to-peer learning may not be as emphasized or valued as in Western educational settings, where horizontal relationships are often encouraged to foster a more collaborative and interactive learning experience.

1.2 Aims and Methodology

The aim of this research is to propose a 'new' model of undergraduate education in which learners can form self-directed collaborative relationships and discover and enhance the creative skills central to design

learning through complementary relationships rather than individual skills. In other words, the "new design education model" referred to in this study is a shift from education for knowledge transfer and solution training to education for self-generation of knowledge and solutions.

While many design programs still maintain siloed perspectives and inefficient mechanisms for tacit knowledge transfer, the ability to develop creative solutions to complex problems has become increasingly important, and design industry employers are beginning to recognize this need (Davis, M., & Dubberly, H., 2023). At this point, it is necessary to discuss what insights design education has to offer and what its ultimate direction should be, which can be explored through new approaches to fostering collaborative creativity among learners.

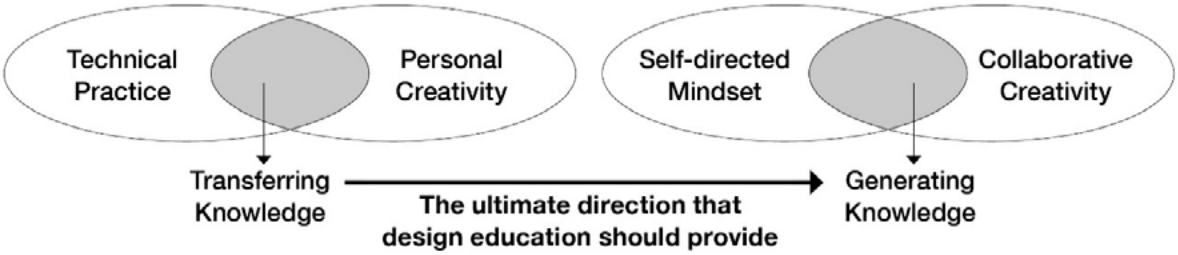


Figure 1. The relationship between two key factors for self-generating knowledge.

The focus of this study is to promote collaborative creativity for complex problem solving by helping learners develop a clear awareness of their own creative thinking styles and maximize their collaborative and self-directed skills. Through the Design and Creative Ideation class, which the authors developed and ran as a regular course at their school from 2017-2022, they found that design majors (at the undergraduate level and practical course in university education) were reluctant to collaborate. The course was a cross-curricular project that aimed to teach creativity through the extension of design concepts. This pedagogical experiment allowed us to discover the importance of encouraging collaborative creativity in higher education for both creatives and non-creatives, including designers. It also convinced us of the need for a new educational model in our time, where learning is accompanied by self-direction and the ability to generate knowledge and solutions on one’s own.

This led to the development of an index of “creative thinking style” to identify the ingrained creative tendencies and mindsets of individual learners. As an extension of this research, this study aims to examine whether the CTSI(Creative Thinking Style Index) can be used as a tool that can be applied to the undergraduate level of educational models. The main research method is a sequential literature analysis method that analyzes key data from previous research and synthesizes commonalities. Based on the results of exploring the theory and phenomenon, this study proposes an educational model by deriving a curriculum structure that applies the CTSI.

2. Theoretical Background

2.1 Implications of ‘Discovery Learning Theory’ for Design Education

Jerome S. Bruner’s Discovery Learning Theory, outlined in his influential work “The Process of Education” (1961), proposes a model of learning that emphasizes active engagement, exploration, and discovery. The theory is based on constructivist principles, which suggest that learners actively construct their own understanding of the world through interactions with their environment. However, in design education, which requires learning to balance logic and sensation, there is a risk that learners' self-expressive activities can lead to a somewhat subjective bias. For this reason, in today’s complex environment, we can expect a

greater synergy between active and collaborative approaches to design problem solving and the expression of creativity. Ultimately, discovery learning theory has positive and empirical implications for design education, allowing learners to construct their own knowledge and develop critical thinking skills.

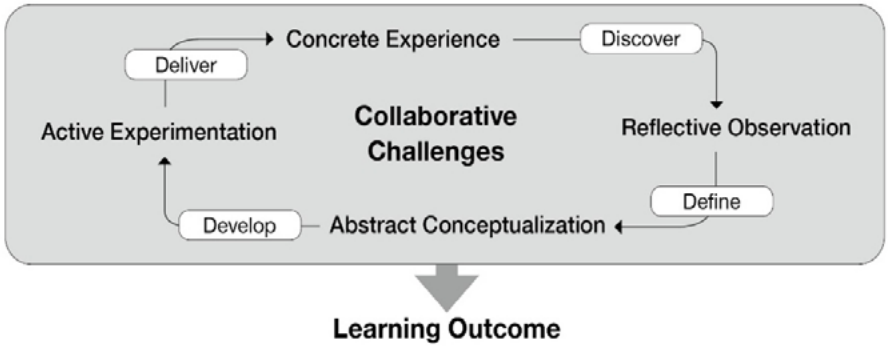


Figure 2. Design training course reimagined based on Bruner's discovery learning theory

These concepts are important in design education for fostering collaborative creativity because they empower students to take an interactive role in their learning, develop critical thinking skills, and cultivate a deeper understanding of design principles and practices. Students develop collaborative creativity through group exploration and problem-solving activities and gain confidence in their ability to experiment with different ideas and solutions to co-create design innovations and creative outcomes.

2.2 Group Dynamics for Fostering Collaborative Creativity

Creativity is a multifaceted phenomenon that is essential for innovation and problem solving in various domains. While creativity has often been perceived as an individual endeavor, the concept of collaborative creativity emphasizes the collective generation of ideas and solutions through group interaction.
The implications of collaborative creativity extend to the pedagogy of art and design. In education, collaborative creativity promotes active learning and critical thinking and prepares students for real-world challenges (Sawyer, 2006). Group projects, peer collaboration, and interdisciplinary initiatives foster creative skills essential for success in the knowledge economy. Collaborative creativity is explained by several mechanisms.

1. Diverse perspectives: Collaborative groups include individuals with different backgrounds, skills, and cognitive styles, increasing the breadth of ideas generated (Paulus & Nijstad, 2003). Diversity stimulates divergent thinking, allowing for the exploration of unconventional solutions.
2. Social interaction: Interaction within groups facilitates the exchange and integration of ideas and stimulates creativity through dialogue, debate, and feedback (Sawyer, 2007). Social interactions trigger cognitive processes such as perspective taking and idea elaboration, enriching the creative process.
3. Synergy and emergence: Collaborative environments enable synergistic interactions in which ideas converge, evolve, and combine to produce emergent outcomes that transcend individual contributions (Sawyer, 2012). This emergent creativity results from the dynamic interplay of ideas within the group.

2.3 Personalization Tendencies of Gen Z College Students and the Impact on Collaborative Learning

Generation Z, often referred to as Gen Z, comprises individuals born between the mid-1990s and the early 2010s. This cohort has matured in an era of rapid technological advancement and increased access to

personalized digital content, which has shaped their individualization tendencies. These tendencies have significant implications for their approaches to learning and problem solving in college settings. Notable research, such as Twenge (2017), highlights how Gen Z's upbringing in a digital environment inundated with personalized technology cultivates a preference for autonomy and self-directed learning. This inclination potentially diminishes their propensity for collaborative problem solving, as personalized content encourages a focus on individual preferences and experiences.

The influence of social media and prevailing educational paradigms further accentuate the trend toward personalization among Gen Z college students. The notion of "personalization" as used in this paper refers to tendencies among learners in a general socio-cultural sense, and it could be recombined and suggested in meaningful ways depending on the online platform or pedagogy. However, Boyd's (2014) analysis illustrates how social media platforms allow Gen Z individuals to create and curate their online personas, fostering a culture of individualism and self-centeredness. This digital self-curation may hinder collaborative efforts, especially in problem-solving scenarios that require collective thinking and collaboration. Furthermore, the traditional education system's emphasis on individual achievement, as discussed by Twenge and Campbell (2018), reinforces the notion of solitary success over collaborative efforts, potentially undermining the perceived value of teamwork in the learning process.

The trend toward personalization manifests itself in a variety of ways, with implications for collaboration among Gen Z students. Roberts and Foehr (2008) suggest that Gen Z's preference for personalized learning experiences may lead to a preference for solitary work, hindering the cultivation of essential collaborative problem-solving skills. Uhls (2019) notes that the generation's reliance on digital communication may hinder the development of important interpersonal skills, which are critical for effective collaboration. Additionally, Hershfield et al. (2018) discuss how Gen Z's online image consciousness and fear of failure may foster risk aversion, potentially stifling innovation and creative problem solving in group settings. Furthermore, Sullivan (2014) notes the potential pitfalls of over-reliance on technology, which could undermine the effectiveness of face-to-face collaboration and brainstorming, which are critical to collective problem solving.

3. Structuring Curriculum for Enhancing Collaborative Creativity Using CTSI

3.1 About CTSI (Creative Thinking Style Index)

The CTSI is an approach to finding a better understanding of creative competencies that focuses on creative mindsets, analyzes how creative mindset types are classified, and systematizes semantic categories, rather than assessing individual creativity. Creativity, which is presented as one of the core competencies in design education, has been measured by various assessment methods in the design of competency and skill-based curricula. However, it is not easy to diagnose the creativity of individual learners and apply it to education. In particular, different terminologies and concepts such as creativity, creative work, creative competence, and creativity seem to cloud the context of creativity research in the field of design. In addition, most creativity research has focused on assessing individual creativity skills. Since the basis for assessing creativity is based on the result of the creation of an output obtained through a limited process, it is inevitable that the criteria for creativity are variable and depend on many variables such as environmental factors, the purpose of the activity, and the learned state. In this context, the CTSI critically discussed the limitation that most of the studies related to creativity developed in various previous studies focused on the evaluation of individual competence, and reorganized the characteristics of creative thinking from cognitive factors to affective (non-cognitive) factors, determining the characteristics of creative personality and deriving the main keywords.

First, the key findings on the relationship between creativity and mindset are as follows. As a cognitive factor, creative thinking can be defined as a “purposeful mental activity” that starts from the recognition of a problem that cannot be solved in a conventional way and is not just an expression of imagination, but “something new”. At the same time, it requires an "active attitude" to solve a problem or perform a task in order to sustain it. The degree to which creative thinking skills can be expressed depends on how the inherent mindset is enforced. For example, ideation techniques such as the double diamond, brainstorming, and mind mapping used in the design thinking method represented by Design Thinking are tools for discovering the possibilities of incomplete ideas and promoting activities that connect the inner and outer logic. Therefore, the creative mindset presupposes an attitude that lies on top of an individual’s ideas and must meet the premise of an activity or method that enforces a way of thinking or a tendency to think.

Second, in the relationship between creativity and personality, the keywords are as follows: In the field of psychoanalysis, creativity is defined as an inner experience or personality centered on affective (non-cognitive) factors. The theoretical background of the relationship between creativity and personality has been proposed in various ways, but the most commonly cited theory is the five-factor theory of personality (Goldberg, 1992; Hofstee, de Raad, & Goldberg, 1992). In particular, de Young's (2006, 2015) cybernetic Big Five distinguishes five categories of personality based on two important hierarchical factors: plasticity and stability. Plasticity includes extraversion and openness to experience, which refers to a person's tendency to be social, active, and conversational. Openness to experience refers to how open a person is to new ideas, experiences, cultures, etc. People with high Openness tend to be curious about new ideas and creative, while those with low Openness prefer traditional and stable things and may be more resistant to change. Sub-keywords that can be derived from the plasticity category include outgoing, collaborative, open, and receptive. Stability, on the other hand, includes Neuroticism, Agreeableness, and Conscientiousness. Neuroticism is a personality trait that refers to an individual's emotional stability, which can make them more likely to react to everyday stressful situations or more sensitive to negative events. Agreeableness describes how a person interacts with others. People who are high in agreeableness tend to be cooperative and avoid conflict in their relationships with others, usually through respect and empathy. Conscientiousness is related to responsibility and diligence, and refers to people’s tendency to achieve goals, make plans, and do things thoroughly. Sub-keywords that can be derived from the Stability category include internal, solitary, closed, and conservative.

Taken together, creative personalities fall into a typology based on two non-cognitive factors: an individual's beliefs and attitudes, each of which dictates the corresponding conceptual categories of dependency and independence, growth mindset and fixed mindset. Creative mindset, on the other hand, is based on the cognitive factor of the form and direction of thinking, which dictates the corresponding conceptual categories of lateral thinking and vertical thinking, as well as narrative thinking and paradigmatic thinking. Based on the corresponding words in each conceptual category in this relational network, we were able to organize the tendency of each type of creative thinking according to its characteristics.

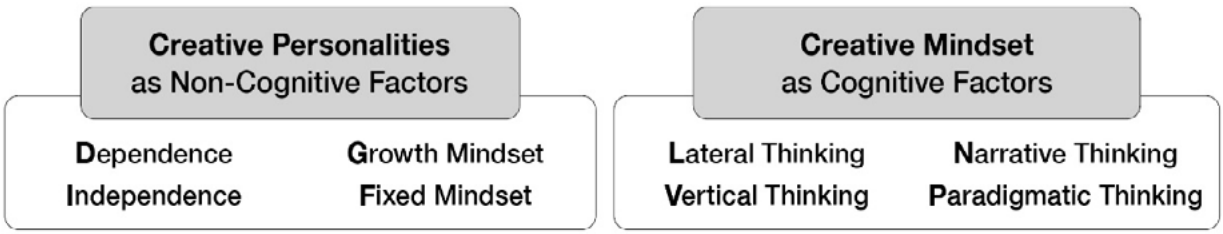


Figure 3. The Eight Factors of the CTSI.

3.2 Reframing the CTSI as Adaptation-Innovation Theory

Kirton's theory suggests that both adapters and innovators play essential roles in the creative process. Adapters contribute by refining and optimizing existing solutions, while innovators drive innovation and change through their willingness to explore new ideas and challenge the status quo. By recognizing and leveraging the strengths of both types of creative thinkers, teams and organizations can effectively address complex challenges and achieve creative results.

Adapters are individuals who prefer to work within existing frameworks and systems. They excel at making incremental changes, improving existing methods, and following established procedures. Adapters are pragmatic problem solvers who value stability, efficiency, and practicality. They tend to prefer familiar approaches and rely on proven methods to achieve their goals. Innovators, on the other hand, are individuals who prefer to challenge existing norms and explore new possibilities. They thrive in unstructured environments and are comfortable with ambiguity and uncertainty. Innovators are creative thinkers who generate new ideas, explore alternative solutions, and push the boundaries of conventional thinking. They value originality, experimentation, and unconventional approaches to problem solving.

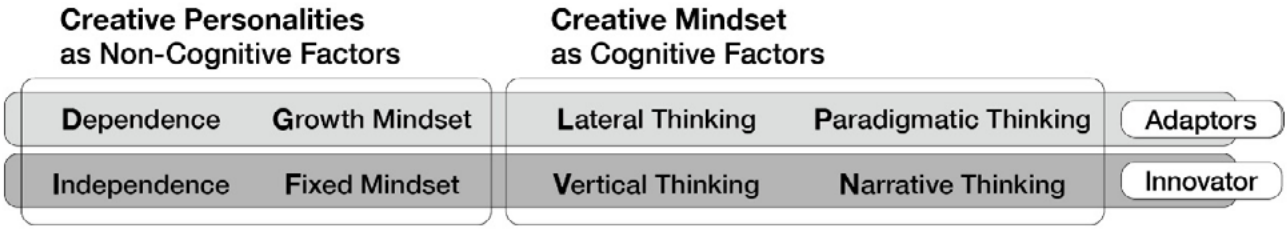


Figure 4. Reframing CTSI Factors into two categories.

The study on CTSI provides the 16 types of creative thinking styles by categorizing them into cognitive and non-cognitive factors. Cognitive factors are related to the individual's thought processes and can be divided into:

- Lateral thinking: Associated with creative idea generation, not focused on a single solution.
- Vertical thinking: Focused on finding the single best solution to a problem.
- Narrative thinking: Involves describing situations or problems in detailed and rich terms.
- Paradigmatic thinking: Relies on established norms and models to understand or solve problems.

On the other hand, non-cognitive factors are related to personal characteristics, attitudes, and motivations, which can be divided into:

- Dependence: Relying on external inputs and guidance.
- Independence: Focuses on self-direction and initiative.
- Growth Mindset: Believes in the ability to develop and grow skills and intelligence over time.
- Fixed Mindset: Believes that skills and intelligence are static and unchangeable.

The typology presented by CTSI can be compared and paired with the results of various psychological tests such as MBTI, TCI, etc., because it is based on psychological theory and derives the key factors necessary for creativity. Each of the 16 styles identified by the CTSI consisted of four pairs of corresponding keywords, each of which could be reorganized into categories of Innovators and Adaptors. Based on this, it is believed that teams can be organized according to the degree of individual creative mindset style to increase the efficiency of the collaborative creativity process.

For example, a dependent personality is used to getting energy from the outside world, while an independent personality tends to get their energy needs from within. In terms of how they think, those with a growth mindset tend to favor purpose and direction in their perceptions, while those with a fixed mindset tend to favor clear purpose and direction. On the other hand, people with a high preference for lateral thinking tend to be idealistic and rely on possibilities and meaning, while people with a high preference for vertical thinking tend to be realistic and grounded in experience. It can be said that narrative thinkers prefer to make judgments contextually and comprehensively, while paradigmatic thinkers prefer to make judgments based on logic and analysis. These interpretations, combined with the 16 types of creative thinking styles, provide a nuanced understanding of how individuals approach creativity and can be particularly useful in educational settings to tailor instructional methods and more effectively foster creativity in students.

3.3 Curriculum Structuring with CTSI

Building an academic curriculum requires careful planning and organization to ensure that students acquire the necessary knowledge, skills, and competencies in a logical and coherent manner. In the following four steps, which are fundamental to curriculum planning, learners will organize themselves into teams based on the CTSI and gain a clear sense of their own and their teammates' creative tendencies.

1. Learning goals and objectives state what learners should know, understand, and be able to do by the end of the entire course. They should be specific, measurable, attainable, relevant, and time-bound (SMART), and understanding learners through the CTSI has the advantage of clarifying goals and achievable roles in collaboration, not only for the instructor but also for the learners themselves.
2. Content sequencing is the determination of the order in which content is presented to learners after learning objectives have been identified. Starting with basic concepts and skills and moving to more complex topics, the logical progression of ideas and concepts is considered, ensuring that each concept builds on the previous one. Based on the CTSI, each learner recognizes his or her own creative tendencies, so there is no need to determine roles in the research and analysis phase as in the past, and there can be tacit agreement on each role naturally.
3. The curriculum, which organizes the content into units or modules, can also be determined by the learners themselves. When the curriculum is divided into units or modules based on thematic or conceptual groupings, each unit focuses on a specific topic or set of related topics, and activities such as Ideation and Conceptualization can be used to guide teams in scoping their projects. In this activity, teams can be divided into innovative and adaptive groups and encouraged to play to their strengths to achieve results. Organizing teams for collaborative creativity by dividing them into innovative and adaptive groups can create synergies that leverage the strengths of each group to achieve optimal results. The division of group composition for collaborative creativity is ultimately a refinement of the process of learners recognizing their strengths and pursuing their perspective roles.

Table 1. Comparing the concepts of Innovative Groups and Adaptive Groups.

	Innovative Groups	Adaptive Groups
Core Description	Innovative groups are characterized by their ability to generate novel ideas and explore unconventional solutions to problems.	Adaptive groups focus on refining and implementing ideas effectively.
Theoretical background	According to Amabile's Componential Theory of Creativity (Amabile, 1983), innovation is fueled by creativity, and innovative groups excel at generating creative ideas through divergent thinking and experimentation.	They excel at problem-solving within constraints and optimizing processes for efficiency and effectiveness. This aligns with the concept of adaptive management, which emphasizes learning, flexibility, and responsiveness to change (Holling, 1978).

4. In the process of developing learning activities and assessments, a variety of learning activities and assessments will be designed to engage students and measure their progress. At this stage, learner initiative and creative synergy can be at their highest. The two groups that have been active in each of the previous phases will be able to consult with each other to drive the final outcome. Synergies resulting from the interaction of the two groups include:

- Complementary strengths: By combining innovative and adaptive groups, organizations can leverage the complementary strengths of creativity and practicality. This synergy enables the generation of bold ideas and their effective implementation.
- Dynamic Collaboration: The interaction between innovative and adaptive groups fosters dynamic collaboration and cross-pollination of ideas. This collaboration creates opportunities for creative solutions to be refined and put into practice.
- Resilience and Agility: The combination of innovative and adaptive approaches increases organizational resilience and agility. Innovative groups drive change and adaptability, while adaptive groups provide stability and continuity during transitions.
- Feedback Loop: Adaptive groups provide valuable feedback to innovative groups, helping to refine and scale promising ideas. In turn, innovative groups inspire adaptive groups with new possibilities and stretch goals.

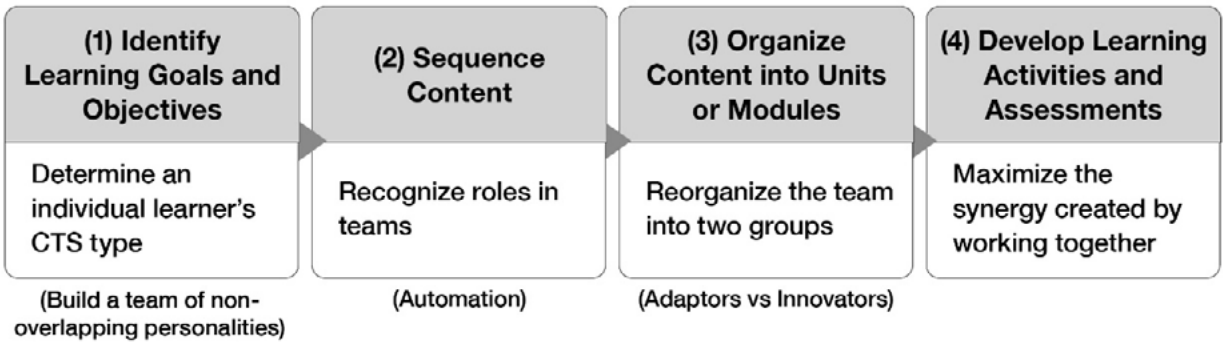


Figure 5. Utilizing CTSI across curriculum phases.

To summarize, engaged learners are aware of their own creative tendencies, which naturally consists of role awareness. Furthermore, organizing teams for collaborative creativity by dividing them into innovation and adaptation groups can optimize the innovation process and create synergies that drive organizational

success. This approach can leverage the strengths of each group while fostering collaboration, resilience, and agility in the face of complex challenges, and most importantly, all of these activities can be voluntary and the learning content can be learner-driven.

3.4 Proposing the New Design Education Model to Promote Collaborative Creativity

In the collaborative process of a design project, the meanings that individuals attach to objects may be different, and integrating them requires mutual understanding among actors. Forming and maintaining mutual understanding is essential because it is at the heart of intersubjectivity, and the goal of collaborative creativity is the formation and integration of knowledge (Kleinsmann & Valkenburg, 2008). CTSI helps to visibly form a congruent meta-perspective between oneself and others. This is because, as emphasized by Corti & Gillespie (2016), the meta-perspective contributes to achieving common ground in the context of the interaction, rather than just what the parties agree on.

The step-by-step learning of the design process, coupled with a structured training curriculum, facilitates the spontaneous interaction of participants that is necessary for collaborative creativity to flourish. As in any social activity, the development of mutual understanding is an important factor in the collaborative process. The design education model that is needed in this era is one in which the subjectivity of the creative process is mutually agreed upon and aimed at reaching the optimal conclusion, not the best outcome.

4. Conclusion and Avenues for Future Research

The design industry of the future will not be a simple process of problem solving, which is why design education is emphasizing collaboration and convergence more than ever before, redefining the concept of design education. Creativity is more valuable when the thought processes of many people are combined than when one person thinks alone. However, in design education of Korea, creativity has been focused on individual competencies, which has hindered the ability of students to work in teams and accomplish tasks through collaborative relationships. The CTSI promotes collaborative synergy among learners through self-assessment, was useful as a basis for the new educational model proposed in this study. In the new design education model, it is necessary to propose specific measures for structuring and phasing the curriculum before providing topic-oriented learning, because collaboration in the design learning process is possible when a group has a common purpose, and synergy within a group can be strengthened by the consensus or disagreement of participants, and higher learner-learner synergy can be expected when learners understand their own thinking tendencies.

This study is significant in that it provides a new direction for design education based on a comparison of theories and authors' previous research on creative thinking style. However, it should be acknowledged that this paper is based on qualitative interpretation and is still subject to much debate. In the future, the challenge will be to provide an education that enables students to actively think and form their own personalities by breaking away from the existing knowledge education in the regular college classroom. The authors are working to apply CTSI in the classroom based on this educational model and will continue to prove the value of using CTSI in the undergraduate level through more sophisticated and quantitative experiments in the future.

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P/REFERENCES OF DESIGN

TRANSFORMATIVE STORYTELLING DESIGN: FROM INDISCIPLINARITY TO EMPATHY.

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ABSTRACT | The current era's social, environmental, and economic challenges necessitate a strategic, holistic approach to address their complexity (Cerruti, 2018). Simultaneously, there is a growing need to develop a de-structured and fluid mindset to counteract the trend of increasing specialization and compartmentalization within scientific, educational, and modern project environments. Addressing crises like climate change, social and cultural issues, economic downturns, and the digital divide requires strategic projects with real impact: although current emergencies are daily highlighted by a vast amount of news and scientific research (Buzzi, 1984), effectively sensitizing - and even before that, stimulating - public consciousness and opinion is particularly complex. This contribution aims to analyze the importance of strategic connections between seemingly distant disciplines to work on effective and unconventional communication design that goes beyond simple dissemination and is able to initiate a process of identification that triggers empathy mechanisms in the face of contemporary challenging issues, giving rise to a new field: Transformative & Immersive Storytelling Design (TISD). Following the theorization of this new field, it introduces an innovative approach that merges Design, Performing Arts, Digital, and Social sciences to overcome traditional discipline boundaries. Design's unifying role and Performing Arts' deconstructive capacity encourage a deeper understanding of reality, advocating for an "indisciplinary" approach for a successful communication (Nicolescu, 2014; Mitchell, 1995). To this end, two projects of a marked transdisciplinary nature, EMOTIONAL and INSIDE-ACT, are presented. The first is directly dedicated to TISD, and the second to the need to implement a training path for the profession of Immersive Storytelling Designer (ISD). In conclusion, the research approach leverages the diverse complexity of disciplines to foster a disruptive communication (TISD) and train a new professional figure (ISD), skilled in creating strategic, effective, and empathetic communication.

1. Introduction

We live in an era characterized by unprecedented complexity, intersections, and dynamics in constant change, which require the creation of cohesive strategic initiatives (Cerruti, 2018) that have the primary objective of effectively addressing the challenges of sustainability – encompassing environmental, social, cultural, economic, and digital dimensions. If we analyze the major crises of our time: the climate crisis, characterized by the increase in climate temperatures; the social and cultural crisis with issues related to identity and the increasingly regular episodes of violence (European Institute for Gender Equality, n.d); the economic crisis - transversal to all the previous ones - and finally the one produced by digitalization and the impact that this transition is having also in terms of digital divide. To bring about positive transformations, clearly communicating the issues and enhancing audience awareness is crucial. Thus, a proficient path may be discovered through the profound efficacy of emotional storytelling. Despite the consistent spotlight on current crises through various information channels and academic studies (Vaughan et al., 2022), the task of raising collective consciousness and significantly shaping public opinion remains fraught with challenges. Within this context, the role of immersive transformative storytelling assumes pivotal significance.

The introduction of the term "Storytelling" in the field of Communication Design emphasizes the fundamental importance of transforming information, visual messages, and scientific data into engaging stories that can leave a lasting impression (Ke, J. & Yoon, J. (2020). Storytelling, throughout history, has served as a conduit for the transmission of wisdom, values, traditions, and insights, often wielding persuasive influence. Aristotle, in his Poetics, astutely recognized the persuasive potency of narrative, positing that well-crafted stories possess the capacity to evoke emotions and engender receptivity to messages (Aristotle, 330 BC/1987). Stories can more or less subtly influence the understanding of the world, conveying ideologies and cultural values, thereby molding perspectives, influencing decisions, and compelling specific actions (Barthes, 1977) that resonate with the audience's experiences and beliefs (Fisher, 1984). Effective Communication Design can indeed transport the audience to another world, make them reflect or encourage action, communicating complex messages through a combination of meaningful elements capable of evoking emotions and creating deep connections with the end user in an effective and transformative manner, making storytelling a tool of impact for current and future scenarios.

From the perspective of innovative communication, design - and particularly Storytelling Design - assumes a pivotal role as a catalyst for change thanks to its ability to stimulate positive behaviors, ignite action, and foster participation. By encompassing both the transformative and narrative components, we could thus define the Transformative Storytelling Designer as a practitioner able to convey contemporary values and challenges, thereby fostering enduring positive behavioral changes. This approach stands out for its innovation, as the power of storytelling and dissemination has the capacity to influence by "awakening minds through the power of storytelling" (Kerrison, 2022), producing not only a strong emotional suggestion in the user but mainly contributing to actively engage them in more conscious and caring actions. In this scenario, design cannot take an isolated role; on the contrary, it is essential that it promotes, thanks to its fluid and critical nature (Bovo, 2022) and the ability to materialize (Faccin, 2017), a mixture of strongly interdisciplinary knowledge, for example:

- The ability of Communication Design to work closely with sociology helps to understand the social and cultural dynamics that influence the perception and interpretation of messages;
- The synergy of many disciplines - including those of main interest for the contribution are Design, Psychology, and Performing Art - with advanced digital technology (especially Extended Reality) allows to exploit of the latest innovations, ensuring cutting-edge and evolving needs of society, without losing the critical and ethical approach with which they must be used;
- The possibility for psychology to work on the impact of immersive digital tools by assessing their effectiveness and the related risks.

As stated by Papanek (1971), design has the task not only to create but also to understand, collaborate, and plays a significant part in shaping a society that is more inclusive and geared towards sustainability.

Design, due to its varied and complex nature, becomes a perfect candidate for mediating different areas of knowledge and conveying wisdom. Therefore, while on one hand, Communication Design facilitates the understanding and adoption of new ideas and innovations, on the other, it encourages imagining new possibilities and becomes a compass capable of navigating the complexity of the present and future.

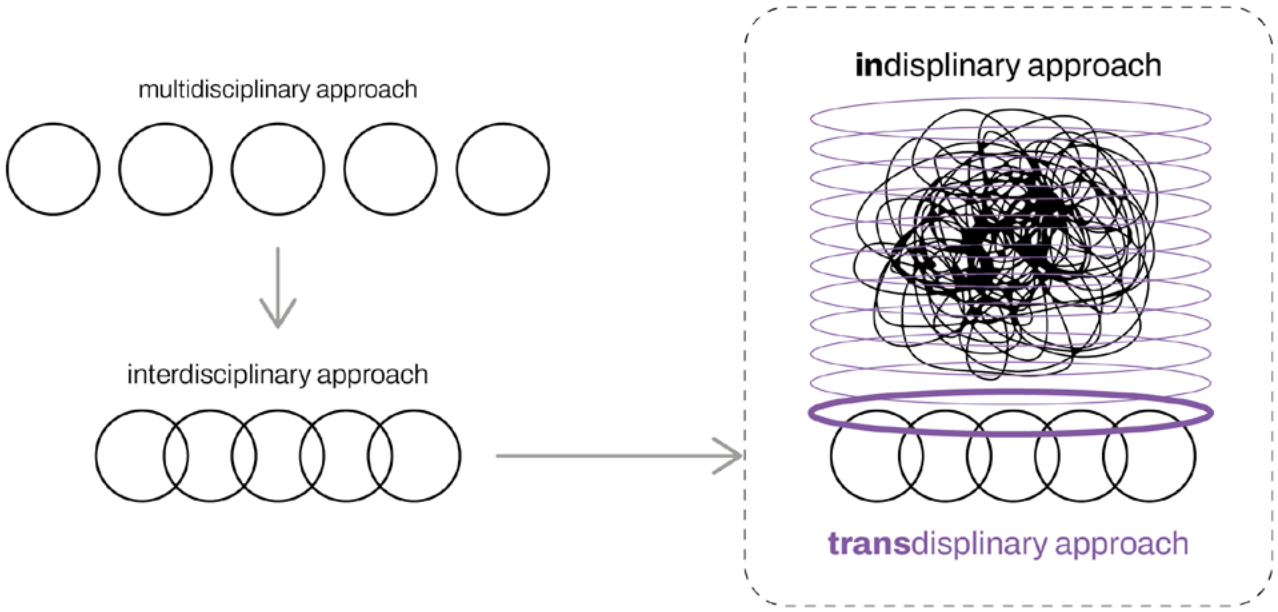


Figure 1. Indisciplinary approach.

2. Methodology

In this scenario focused on behaviors and awareness, transdisciplinarity emerges as a fundamental concept since emergency communication requires solutions that go beyond the conventional limits of disciplines, moving from the previously discussed interdisciplinarity which, although borrows methods and approaches from various fields, stays restricted to the confines of specific disciplinary boundaries.

As Nicolescu (2002) observed, transdisciplinarity should not be understood only as a methodology, but as a future perspective that recognizes the interdependence and connection between various fields of knowledge. Thanks to this systemic vision, it emerges how design must be placed within a fluid context in which to make its skills available. This context has been defined as DASD, as it hybridizes in an unconventional approach the disciplines of Design, Performing Arts, Social Sciences, and Digital. These four disciplines represent the 4 main pillars for the development of a Transformative & Immersive Storytelling Design (TISD). The collaboration between disciplines that seem so distant from each other can indeed give life to the design of immersive storytelling that is an excellent candidate for the development of transformative experiences, in which each of the involved disciplines can effectively impact based on their peculiarities:

- **Advanced digital technology (XR)** has been included in the research because, when well designed, it is capable of offering new possibilities for interaction, immersion for the design of transformative experiences that go beyond traditional boundaries. By immersing individuals in a reality different from the physical one, it is possible to allow transformative experiences that break the constraints of physical reality and open new possibilities for exploration and self-

discovery and of the other, allowing a greater sense of involvement and presence. These technologies transport individuals into virtual worlds, simulated and interactive environments that allow a greater sense of immersion. By immersing individuals in these digital realms, technology indeed enables transformative experiences that break the constraints of physical reality and open new possibilities for exploration and self-discovery.

- **Social sciences**, and particularly psychology and sociology, foster potential for behavioral transformation as they can analyze changes by studying, according to Grof (2000), the alterations of the normal stable structure of the mind and the "quantum change" (Miller & De Baca, 2001). Such transformation consists of a breaking point in which an individual would undergo a radical and irreversible change that can have both a primarily cognitive and emotional nature. Moreover, digital and new technologies are becoming increasingly pervasive to the point of becoming, in everyone's eyes, even invasive. For this reason, today it becomes essential to question especially the social repercussions that these tools have through the direct and active involvement of psychology and sociology, crucial actors capable of analyzing their impacts.
- **Design** plays a pivotal role in shaping the transformative experience, serving as an orchestrator that synthesizes insights from diverse fields to create and forge cohesive and impactful experiences. Designers apply their creative skills to translate psychological, sociological, and technological concepts into tangible, engaging, and, above all, impactful experiences. Design can at the same time unfold to interesting future scenarios thanks to its inherent ability to foresee and understand, for example, the strategic importance of new technologies, without limiting itself to technical aspects, but opening up to contamination and sharing with other disciplines for the development of high-value content.
- **Performing Art**, and particularly theater, is a fundamental discipline for the construction of such experiences. Although very distant from the use of advanced digital technologies (Dixon, 2006), it represents the possibility of exploring different roles, behaviors, and scenarios in a theatrical experience that by its nature is immersive. Performing Art allows the development of skills related to communication, empathy, and collaboration, aiding the process of identification, providing unconventional tools and skills. Through Performing Art, individuals can explore different roles, behaviors, and scenarios, putting themselves in the "shoes of others" (perspective-taking). Performing Art fits into this scenario by also strongly contributing to the development of a critical and interpretative attitude thanks to the solid cultural base inherent in the nature of the discipline. Furthermore, within the world of art, there is a fundamental aspect through which it is possible to increase empathy and implement immersive digital communication, making it even more effective through the concept of identification, typical of acting work. This sector, although usually distant from the use of new technologies, plays a crucial role in DASD thanks to such a significant approach to identification.

In the DASD framework, Performing Art - and specifically theater - assumes an exceptionally powerful "disruptive" role. This form of art, for its inherently deconstructive nature and free from schematic constraints, allows overcoming the traditionally disciplinary vision of contributions, thereby offering an "indisciplinary" approach that disrupts established norms and transcends traditional limits, questioning standard practices and beliefs. Consequently, it becomes clear that to create transformative communication, a deep alliance between different disciplinary fields is necessary. Through this "indisciplinary" approach, it is indeed possible to enrich the entire design process, taking into account different perspectives, hypotheses, and insights, overcoming the boundaries of sectors, and favoring a holistic vision that achieves as impactful results as possible. Although based on methods and tools from different disciplines, it is essential to detach from rigid models that do not reflect the fluidity of reality, capable of adapting and evolving in response to emerging and continuously evolving variables, facilitating processes of learning and active participation. Storytelling design, and particularly its ability to stimulate emotions and wonder, has the great ability to explore the transformative potential of experiences with a strong impact on society with particular reference to the stimulation of proactive behaviors of users

(Gaggioli, 2015) to the point of considering such transformative experiences when, in agreement with Kitson et al. (2019), they can reshape the individual vision and change their perspective and identity. Transformative storytelling design thus represents an important testimony of the role of transdisciplinarity and collaboration between very different disciplines, thanks to the possibility of drawing on the principles of psychology, sociology, theater, technology, and design. The integration of these disciplines recognizes a central role of design as a catalyst for design, able to foster connections, exploit the limits and opportunities of all the disciplines involved, and orchestrate experiences that evoke emotions, inspiring personal growth and stimulating reflection with the ultimate goal of strategically and functionally contributing to forming a society as attentive and empathetic as possible in the face of the critical issues that are affecting us. What is, however, fundamental to consider is that emotion can be evoked not only by the project itself but also and above all by the relational meaning of the experience linked to social implications (Desmet & Roeser, 2015) and personal associations trying to contribute to some positive behavioral trends, even reducing aggressive behaviors (Yang et al., 2016) and promoting, among others, ecological consumption (Wang et al., 2019).

3. Projects

Faced with this theoretical context, it was determined to begin a direct and substantial investigation, carrying out tangible projects at both the national and international levels, implementing both national and transnational projects of a marked transdisciplinary nature, such as the EMOTIONAL and INSIDE-ACT projects, where the first focuses on the Transformative & Immersive Storytelling Design itself (TISD), and the latter addresses the need to develop a training package for cultivating the profession of Immersive Storytelling Designer (ISD).

3.1 Emotional

The EMOTIONAL project, namely Experience Made in Italy: Immersive Storytelling Design for Contemporary Values and Sustainability, was born within the PNRR, the National Recovery and Resilience Plan, a crucial initiative for Italy for the relaunch and modernization of the country in response to the economic and social crisis triggered by the COVID-19 pandemic. The EMOTIONAL project aims to enhance "Made in Italy" through the use of immersive storytelling, emphasizing the quality, innovation, and sustainability of Italian products in order to valorize the cultural, creative, and manufacturing heritage of "Made in Italy" and promote sustainable consumption practices. The goal of the EMOTIONAL project is to explore the use of immersive technologies and storytelling to effectively communicate the tangible and intangible values of "Made in Italy" products and services, focusing particularly on sustainability and innovation. It involves designing immersive experiences that valorize the Italian cultural and manufacturing heritage, improving knowledge and action regarding sustainable and circular production practices, implementing sustainable design strategies, and responsible consumption behaviors. To achieve this goal, the project conducts a series of studies and research to better understand market dynamics and consumer expectations, collaborates with companies and institutions to test and implement the proposed solutions, and finally focuses on the development of immersive narrative content that exploits advanced technologies such as extended reality (XR). For this purpose, the project involves multidisciplinary public and private partners to combine diverse and complementary skills for the realization of the project's objectives. The partners involved are: University of Florence (project leader), Polytechnic University of Bari, University of Bologna, Polytechnic University of Milan, Polytechnic University of Torino, University of Brescia, University of Padova, Interior and Design District (DID), and companies from the Tuscan manufacturing sector. Therefore, the aim is to create immersive experiences that enhance Italian cultural and manufacturing heritage, improving understanding and action regarding sustainable and circular production practices, and promoting sustainable design strategies and responsible consumption behaviors. Specific objectives include strengthening the competitiveness of Italian businesses through the adoption of new technologies, promoting a cultural shift towards sustainability, and increasing global awareness and appreciation for the value of Made in Italy. To achieve this goal, the project focuses on a range of practical and methodological

activities, including the development of immersive and narrative content utilizing technologies such as Extended Reality (XR), analysis and research to better understand market dynamics and consumer expectations, as well as collaboration with companies and institutions to test and implement proposed solutions. The aim is to create an ecosystem of cooperation among research entities, businesses, and cultural organizations to foster innovation, technology transfer, and the enhancement of Italian cultural and productive heritage. The project design process of EMOTIONAL, currently underway, comprises the following 6 macro-phases:

- Baseline project definition and data analysis: this phase centers on analyzing the Made in Italy phenomenon, with particular emphasis on humanities analysis (historical, social, and cultural); sustainability analysis; analysis of digital media and new technologies; social perceptual analysis and evaluation; territorial analysis; identification and selection of the most successful companies within the production system to depict with a perspective aimed at disseminating the values of Made in Italy.
- Designing the new "Generative Made in Italy Identity": this phase encompasses the vision and design-driven strategy with the design of the most effective immersive storytelling model in terms of transformative design.
- Research on design processes, technologies, and tools for immersive narration (XR), focusing on identifying those most effective for the intended type of narration and storytelling, along with the subsequent implementation of immersive experiences.
- Executive design of immersive digital simulator development.
- Validation of the Proof of Concept: analysis and development of criteria for validating emotional parameters in relation to digital tools for immersive storytelling and social impact.
- Identification and valorization of other relevant Italian industries through focus groups, design-driven strategy guidelines, and toolkit development for capacity building, experiential testing of final immersive experiences, and the development of a corresponding toolkit.

Each of these phases represents a fundamental building block in the design process, working synergistically to achieve the objective of valorizing Made in Italy through immersive experiences. The project aims not only to disseminate and foster appreciation for the values of Italian excellence but also to stimulate positive and enduring change in the production and consumption sectors by specifically combining design, social sciences and advanced digital technology (XR). The goal is twofold: on one hand, to celebrate and share the cultural richness and distinctive quality of Italian products; on the other hand, to serve as a catalyst for the adoption of virtuous models reflecting the high standards of sustainability, innovation, and social responsibility that Made in Italy embodies. This holistic approach aims to influence the global production and cultural ecosystem, promoting a new awareness and appreciation for conscious consumption and qualitative excellence.

3.2 Inside-Act

The INSIDE-ACT project idea, on the other hand, emphasizes the importance of targeted training that has led to the design of a training package within the new field of transformative storytelling design. The design of the INSIDE-ACT training pathway was developed based on a framework of specific needs identified at three different levels related to the increasing demands from the labor market in relation to: i) the introduction of a new professional figure for advanced strategic-digital immersive communication; ii) the lack of integrated DASD (Digital, Arts, and Social Sciences) competencies; iii) the absence of a targeted training pathway to address current gaps and to train the required new professional figure. These needs were extrapolated from an analysis of quantitative data from European, national, and global labor market reports, scientific literature, and trends identified through formal and informal interviews conducted during the research process with leading entities in the immersive communication sector. The INSIDE-ACT training package aims to shape a new generation of professionals from different disciplinary fields and is the result of an in-depth analysis of recent digital market trends (OECD, 2023), the increase in the need for

digital communication skills, and the urgency to respond to current social, environmental, and economic challenges. INSIDE-ACT was written and conceived through a synergistic collaboration between various European partners (University of Florence (Italy), Elisava (Spain), Catholic University of Milan (Italy), Valahia University of Târgoviște (Romania), GOLD Production (Italy), GLUK (Lithuania), KOSMOS (Lithuania), ESPRONCEDA (Spain), FEST (Belgium), DID (Italy), AMBIT (Spain), CPI (Slovenia), ROGEPA (Romania), each of which brought interesting perspectives, through their own experiences and knowledge. This collaboration was fundamental to ensure that the training program could cover all the essential aspects of Transformative & Immersive Storytelling Design. The core of INSIDE-ACT is, in fact, the training of a new professional figure – the Immersive Storytelling Designer (ISD) - designed to meet the needs of a continuously evolving communication market, where the ability to tell stories in a new and engaging ways is increasingly demanded. The primary goal of INSIDE-ACT is to create the qualified profile of an Immersive Storytelling Designer (ISD), capable of integrating the knowledge of Design, Performing Arts, Social Sciences, and Digital (DASD) to realize immersive and strategic digital communications (XR), heighten the consciousness of recipients regarding contemporary European values and challenges. The INSIDE-ACT training program intends to combine theoretical teaching with experiential and practical learning, involving not only academic and training institutions but also cutting-edge companies in the field of Transformative & Immersive Storytelling Design. This enriches the learning experience, providing a real context for the development of tangible projects. This training model, in conjunction with all activities undertaken within INSIDE-ACT, provides insight into the transformative potential inherent in strategic immersive storytelling. Its objective extends beyond the dissemination of awareness regarding contemporary challenges and their ethical underpinnings; it also aims to cultivate virtuous behaviors within the community. At the core of this initiative lies the development of the professional profile of the Immersive Storytelling Designer (ISD), recognized as a catalyst for fostering sustainable, inclusive, and critically approaches who, positioned innovatively within the evolving landscape of the European labor market, symbolizes a dedication to facilitating positive societal change. The INSIDE-ACT training package is conceived as an intensive format consisting of 5 theoretical/experiential modules + 1 intensive practical laboratory module, aimed at creating concepts for immersive experiences that stimulate empathy, for a total duration of 3 weeks. The first two weeks are dedicated to completing the initial 5 modules, while the last, more intense week will focus on the final and practical laboratory module. Each training module will have a specific overarching theme: Digital Perception, Performing Design, Emotional Business, Extended Performing Art, and Immersive Storytelling Design.The objective is to connect various project areas, highlighting their common aspects and potentialities through the mutual recognition of strengths, to align and amalgamate them. The INSIDE-ACT project is structured as follows:

- Digital Perception (Digital + Social Sciences): this module focuses on the intersection between digital technology and social sciences, exploring how human perception is influenced and shaped by advanced digital technologies such as Extended Reality (XR). Topics covered may include user experience psychology and, notably, how digital interfaces influence behavior and social perception, highlighting their benefits, limitations, and opportunities.
- Performing Design (Performative Art + Design): In this module, students understand how to integrate principles of performative art into design. This may include designing interactive experiences, artistic installations, and environments that encourage active participation and performance. It is an approach that blends artistic and design creativity to create immersive and engaging experiences even without the use of advanced digital technologies.
- Emotional Business (Social Sciences + Business): the module emphasizes the need to evoke emotions through corporate communication that transcends traditional marketing, focusing instead on narrating the values and ethical initiatives adopted by companies. The goal is to use emotional strategies to promote understanding that goes beyond product details or technical aspects, aiming instead to express the principles and ideals pursued by the organization. This approach aims to actively involve employees in the communication process, emphasizing both

internal (employees) and external (customers and community) storytelling, presenting a corporate image that reflects values and ethical commitment.

- Extended Performing Art (Performative Art + Digital): this module explores the expansion of the boundaries of traditional performative art, incorporating innovative digital technologies to enrich it with new languages and artistic expressions, for example, through the use of Extended Reality (XR), which opens up new perspectives in performance creation, transcending conventional limits. Through this integration, performative art transforms, offering more immersive and multidimensional experiences that blend the real and the virtual to create radically new and compelling artistic forms.
- Immersive Storytelling Design (Design + Digital): in this module, the focus is on designing engaging stories through the use of advanced digital tools. This allows experimentation with interactive storytelling techniques, harnessing the power of digital media to innovate narrative modalities, intertwining storytelling and technology with the aim of generating immersive and captivating narrative experiences.

The final module of the course, namely the Workshop Immersive Experience Design for EU values, represents the phase in which participants of the training pathway engage in the design of immersive experiences with the aim of narrating stories capable of promoting and disseminating European values. In this case, students are called upon to experiment with the diverse knowledge acquired during the theoretical/experiential modules, synthesizing and appling the skills acquired in the previous theoretical/experiential modules in a practical context final module is therefore an operational training experience (learning by doing), characterized mainly by the direct interaction between trainers, companies (traditional, digital, and creative), and students. The aim is to stimulate interaction, even within the educational community, in a non-hierarchical manner, equating the roles of student and trainer: for this reason, each module includes a "design appointment" phase - during which small laboratories related to the reference module will be carried out - allocating a work session, thus increasing the percentage of hours dedicated to dialogue and exchange of experiences and knowledge.

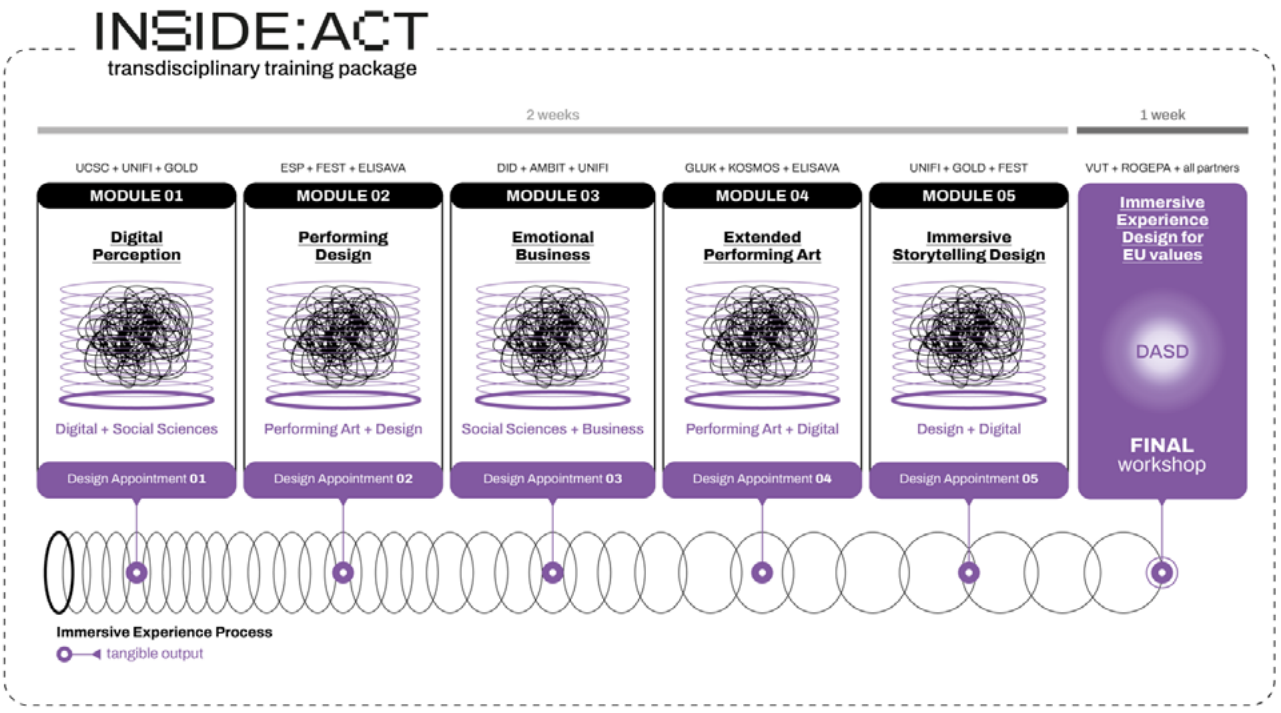


Figure 2. INSIDE-ACT training package structure.

4. Conclusion

In conclusion, Transformative & Immersive Storytelling Design emerges as an evolving field crucial for fostering awareness of present and future challenges. It seeks to elicit profound emotional responses from users, fostering introspection, personal development, and behavioral shifts in response to the complexities of contemporary and prospective issues. Through the interdisciplinary approach described earlier, which amalgamates methodologies from Performative Art, Social Sciences, and immersive technologies, transformative design offers a framework for fostering empathy and deeper connections with the presented complex framework, facilitating meaningful exchanges between individuals and their environments. In this context, the designer's role extends beyond merely creating functional objects or services to becoming a facilitator of transformative experiences capable of shaping the perception, attitude, and behavior of individuals. This requires a deep understanding of emotional dynamics and the ability to design with a clear intention to stimulate positive change. To fully realize the potential of transformative and emotional design, it is crucial to promote "indisciplinary" collaboration, leveraging the knowledge and skills of various fields to create solutions that are forward-thinking and ethically responsible. The "EMOTIONAL" project in the context of transformative design underscores the crucial importance of an approach that goes beyond functionality and aesthetics to touch the most intimate chords of human experience, promoting significant change through emotional connection.

Transdisciplinarity, then articulated in a subsequent "indisciplinary" approach, as above-mentioned, thus emerges here as a key element to inform and transform, adopting an ethical and responsible perspective, representing an invitation to explore new frontiers of design, where emotions are seen not as a secondary aspect but as the central core of the design experience and communication. This pioneering methodology, foundational to the INSIDE-ACT training project, underscores the significance of embracing disciplinary diversity to stimulate upskilling and reskilling, overcoming the limitations of professional backgrounds. The overarching objective is to cultivate Immersive Storytelling Designers (ISDs) capable of crafting strategic, effective, and empathetic communications, thereby contributing to the development of professionals equipped to face contemporary challenges through a transformative and immersive storytelling approach. In conclusion, the research and practical experimentation outlined depart from the intricate diversity of disciplines to blur their boundaries, endeavoring to cultivate a disruptive, effective, and empathetic storytelling design approach. The intersection of disciplines in Transformative & Immersive Storytelling Design, as exemplified in the paper, mirrors a paradigm shift towards more holistic approaches to problem-solving and innovation. In an era characterized by interconnected challenges, such as sustainability, social justice, and technological disruption, the ability to transcend disciplinary boundaries becomes increasingly crucial, especially in Communication Design but not only. This investigation serves, in fact, as a microcosm of this larger trend, showcasing how collaborative efforts across diverse fields can yield novel insights and solutions that resonate far beyond the confines of a single academic conference. Thus, while the immediate impact may not be readily apparent, the implications for interdisciplinary collaboration and holistic problem-solving are expected to be far-reaching.

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P/REFERENCES OF DESIGN

HYBRID ECOLOGICAL NETWORKS: DESIGNING RELATIONAL AND RECEPTIVE LEARNING.

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ABSTRACT | In the rapidly evolving landscape of learning network design, there is a critical need to construct networks that are at the same time resilient and adaptable, equitable and accessible, authentically engage the human and more-than-human and can address the increasing complexity of seemingly intractable global socio-ecological challenges. This paper proposes a reimagined network design by integrating principles from movement ecology, corridor ecology and new materialism, all of which engage the complexity, interactivity, and adaptability inherent in natural ecosystems. Such a design subverts traditional network relationships such that each node in a network can be seen to actively and equitably participate in the learning process. Hybrid ecological networks challenge conventional hierarchies, de-institutionalise learning and platform more resilient, adaptable, participatory and interconnected structures and organisations. The paper adapts the concept of permeability from corridor ecology to describe knowledge and experiential flows through a network. A learning network designed for high permeability encourages the unfettered and efficient exchange of ideas, akin to ecosystem scaffolding for a decentralised and fluid movement of species. By weaving together the principles of new materialism, movement ecology and corridor ecology, the paper shifts the narrative from networks as static constructs to ones that are dynamic, adaptable, and resilient and invites a whole-systems re-imagining of learning networks to support a regenerative future for education.

1. Introduction

Within the dynamic and ever-shifting terrain of higher education, there is an increasingly critical need to co-create networks that are at the same time resilient and adaptable, equitable and accessible, and authentically engage learning communities with the complexity of seemingly intractable global socio-ecological challenges. This paper reimagines learning network design by integrating principles from movement ecology, material ecology, corridor ecology and new materialism, each of which contributes to disrupting the fixedness of linear, static and anthropocentric organisational constructs by interweaving the complexity, interactivity, and adaptability inherent in the intersection of human and more-than-human ecosystems. *Hybrid ecological networks* challenge conventional hierarchies and binaries, deinstitutionalise learning and platform more resilient, adaptable, participatory and interconnected structures and organisations.

In a process-based and movement-centred network paradigm, information (defined here as *integrated experience, knowledge* and *skills*) moves, evolves and interacts with the nodes and edges it encounters, much as species migrate and interact with/in/across ecological systems. This conceptualisation of *networks as movement* is a foundation of the hybrid ecology view of networks as vibrant, living ecosystems. Just as migratory patterns are not purely linear but are influenced by various environmental (and increasingly economic and political) factors and an organism's own agency, the flow of knowledge, experience and ideas within networks is not merely dictated by existing network structures but is also influenced by the behaviour of the information itself, the context within which it operates, and the nodes and edges with which it interacts.

Focusing on movement as a core element of network design acknowledges that movement is itself an actor, and process a central agent, thus underscoring the *agency of information exchange* (leading to the potential of data autonomy within an object-oriented ontology (Harman, 2018)). Recognising movement as central (Nail, 2018a) situates the relational element of networks – the edges rather than the nodes – as an undulating meshwork on which meaningful learning experiences can be co-created to address the demand for more resilient, adaptable, and interconnected learning structures and organisations. For instance, some pieces of information might migrate quickly across the network due to their relevance or urgency, while others might move slowly or even become dormant. As we will see in the discussion of *ecological corridors* (below), the process of movement that this information embodies can be seen as *habitats* that may alter the information, hold onto it temporarily or help it evolve or develop further.

Thomas Nail postulates that society is essentially constituted by movement, with entities (be they beings, objects, or ideas) constantly in flux (Nail, 2018a). Applying a movement philosophy to network design can reframe the way we conceptualise the flow of information and ideas within networks. Rather than viewing data as static entities being transferred from *point a* to *point b*, Nail's articulation of *Movement Ecology* encourages us to see information, experiences, and ideas as migratory entities. In his reading of Lucretius', for instance, Nail re-interprets Lucretian atomism to emphasise that "one never finds a [singular] corpora, but only an infinite corporeal flow as the material condition of any discrete or composite thing" (Nail, 2018b, p.12). In this view, it is clear that relationality, receptivity, and process must be fundamental to any learning network that hopes to meaningfully engage with the dynamics of complex socio-ecological systems.

Hybrid ecological networks are *hybrid* on multiple levels: In their interweaving of site-based and practice-led learning with accessible online spaces to facilitate the exchange of reflection, experience, and knowledge; in their fostering of interspecies collaborations; in their explicit interrogation of boundaries, binaries and borderlands; and of our "interdependence and the mutual construction of . . . subjectivities" (Nasrullah Mambrol, 2016) in understanding cultural and socio-ecological contexts and engaging in the work of democratising and decolonising learning.

Interweaving Nail's articulation of *Movement Ecology*, socio-ecologically situated learning paradigms, and a processual and relational new materialist perspective on network evolution empowers a shift from building networks as static to foregrounding agential imperatives with/in the fluidity of receptive learning. The

integration of these ecologies invites a radically open approach to network design that leverages the complexity, interactivity, and adaptability found in more-than-human ecosystems to disrupt the sedimented conventions of disciplinary thinking and educational linearity. In this model, each node — whether an individual, an ecosystem, a more-than-human actor, a group, or an automated system — actively engages in the learning process. Learning as "knowledge transfer" thus evolves from a unidirectional process to a continuous cycle of interaction, adaptation, and evolution of lived experience. The theoretical imperative of the hybrid ecological network draws from the same critical enquiry with which Karen Barad and Daniela Gandorfer ground their conversation in "Political Desirings":

> "How can we think ontology in a way that opens up different concepts and practices of thought and being, or, to put it more precisely, what are the *onto-epistemological conditions* that allow you to imagine a different mode of doing theory?" (Barad & Gandorfer, 2021, p.16)

Hybrid ecological networks insist upon an onto-epistemological (or indeed *ethico-onto-epistemological* (Barad, 2007)) shift into new terrains of fluid and transdisciplinary thinking and demonstrate how insights from diverse fields can converge to innovate established paradigms. By considering the application of contemporary philosophical frameworks and living-systems thinking to learning network development, this paper proposes a holistic revision of learning network design — one that embraces complexity, cultivates receptiveness, and ultimately can form a pathway toward a more regenerative, ecologically and ethically grounded and resilient model of learning for the future.

2. Refashioning Relationality

Imagining, and then enacting, a different mode of doing — whether theory, learning, practice, relationality, or network development — becomes ever more critical as the crisis of education is layered with mounting socio-ecological polycrises. There is little doubt that we are engaging daily in a shared and compounding polycrisis — recently described by Adam Tooze as "so disorientating is that it no longer seems plausible to point to a single cause and, by implication, a single fix" (Tooze, 2022) and recognised even by the World Economic Forum as when "concurrent shocks, deeply interconnected risks and eroding resilience are giving rise to the risk of polycrises – where disparate crises interact such that the overall impact far exceeds the sum of each part" (WEF, 2023, p.9). Timothy Morton's articulation of this as a not-quite-yet postapocalyptic manifestation of *hyperobjects* that are so complex — dislocated, out of time ("massively distributed in time and space" (Morton, 2013, p.48), and deeply interwoven — so as to be nearly unfathomable and untenable.

Given the escalating complexity of global ecological and social challenges, the demand for more resilient, adaptable, and interconnected learning networks is paramount. *Hybrid ecological networks* propose a dynamic revision of network design — one that embraces complexity, cultivates receptiveness, and advocates for continuous adaptation and learning. This transdisciplinary approach insists upon reimagining traditional boundaries and dualistic thinking, fostering dialogue and collaboration across different areas of expertise and highlighting the potential for innovation.

Framing a learning network as relational can radically open learning to the complex web of interdependencies that exist among teachers, students, institutions, ecosystems, cultures, experiences, and indeed all parts of a learning network. In the context of practice-led learning, such networks underscore that learning is a shared endeavour grounded in authentic relationship – often through community practice, service, or shared activity inclusive of a full diversity of stakeholders that allows learning to be a cooperative evolving process co-created by multiple actors.

The combination of relational and receptive network ontologies offers a potent theoretical structure for understanding and promoting a reimagined learning paradigm that foregrounds relationship, receptivity, co-creation and collaboration in an authentically distributed framework. Acknowledging learners' interconnectedness, agency, and their openness to a diversity of knowledge and experience allows the co-

creation of inclusive and participatory educational spaces. By adopting this perspective, a distributed and deinstitutionalised learning network can foster an environment that promotes active learning, collaboration, and critical engagement. Specifically, it can empower new learning frameworks in the following areas:

2.1 Distributed Agency

Agency can be distributed among all nodes – student, teacher, human and more-than-human, treating each as a valid and capable participant. Whereas existing traditional learning architectures, "our fragmentary and linear approach to systemic problems leads to inadequate solutions and causes social, political, economic, and psychological crises" (Solonen, 2023, p.621), a revised learning approach can translate into a network where participants are not just passive receivers and providers of information, but active participants that engage and shape the network in unique ways. Beyond an emphasis on nodes, the *receptivity* of such a network would give equal agency to connections and relationships as to objects in relation. Practical applications include:

- Recognition of more-than-human agency
- Ethical frameworks for more-than-human participants
- Dynamic role allocation
- Interactive and responsive environments
- Integration of indigenous knowledge systems
- Adaptive learning pathways
- Empowering through technology
- Robust network feedback mechanisms

2.2 Collaborative and Co-creative Learning

A relational and distributed learning network emphasises collaborative, experiential, and embodied learning. The network could facilitate interactive experiences, encourage peer-to-peer learning, and even integrate with physical or augmented reality environments to support embodied learning experiences. Practical examples of co-creative learning include:

- Community engagement and service learning
- Community-based research
- Internships, externships, placements, practicums
- Project-based learning
- Global learning, partnership and networked learning - local, regional, bioregional, and global
- Living labs - partner-based living-learning communities
- Interspecies collaboratories
- Action learning
- Full learning community engagement in strategic planning, decision-making, process learning (including staff, students, trustees, directors, volunteers, external stakeholders)

2.3 Fluid and Dynamic Structures

Such a network can also have a fluid and dynamic structure, reflecting the constant flux and change of ecological complexity. Rather than being fixed and static, the network continually adapts and evolves in response to the actions and interactions of its participants – human and more-than-human (from *Aardvark* to *Albedo* to *AI*). Practical applications include:

- Adaptive learning models
- Decentralised decision-making
- Flexible organisational structure
- Peer-to-peer learning
- Modular course design
- Hybrid, blended, off-site practice-led learning
- Distributed programme development and delivery

2.4 Ethical and Inclusive Design

A key element braided together within an authentically de-institutionalised distributed network model is a foundation of ethical, inclusive, accessible and equitable design principles. The network is designed to inclusively evolve, giving all nodes a voice in shaping network changes, and ensuring that adaptations don't disadvantage certain groups. New identities that blend definitions of learner, teacher, and co-creator roles are valued within the network and contribute to a diverse, vibrant learning ecosystem. Any accessible network also engages in what EF Schumacher described as "appropriate technologies" (Schumacher, 1973), here in the context of minimal computing to empower "students to be their own arbiters of engagement" (Bessette, 2023). Practical applications include:

- Participatory design
- Universal design
- Cultural competencies
- Eco-literacy
- Ethical technologies
- Data privacy, autonomy, and security
- Continuous feedback and adaptation
- Robust systems to support whole community access

2.5 Development of New Network Identities

Finally, such a network (inspired as it is by the work of Karen Barad, Felix Guattari, Bruno Latour, Thomas Nail, Rosi Braidotti, Jussi Parikka and others) breaks down barriers between node and relationship; between human and more-than-human; between learning and experience. A receptive relational network could yield an evolution in network identities, an "ecology of practices" that "opens up a world: a world of relations, abstractions, spaces that turn into movements and it becomes an onto-epistemological framework" (Parikka, 2018, p.45). Practical applications include:

- Transdisciplinary programme architectures
- Holistic and whole-systems learning spaces
- Mentorship and partnership
- Collaborative and co-creative workshops across identities
- Transmedia storytelling
- Process-led curriculum design
- Networked performance
- Agential realism workshops
- Performativity workshops

Inroads into the development of distributed and relational learning are not entirely uncommon; however, engaging with dynamic learning networks to implement the elements above, particularly in the context of institutional frameworks can prove challenging. Nonetheless, there are huge opportunities for the co-creation of innovative network ecologies if learning is to continue to develop as a meaningful way to engage in the global ecological and social challenges that increasingly come to define this century.

3. (Re)imagining Materiality

Pioneering work in *Material Ecology* by Neri Oxman and her teams both at the MIT Media Lab and at Oxman Architects is an exceptionally helpful material-led framework for conceptualising relational nodes within hybrid ecological learning networks. Each node, akin to a unique material entity in Oxman's schema, possesses inherent characteristics that enable complex interactions and gives each node a unique material identity (*material ontology*) that reflects a symbiosis between the human and more-than-human worlds. Material ecology integrates design and computational biology with traditional fabrication and building processes, and emphasises materials are not simply passive substances used to build objects; they participate in the ecological systems in which they're situated. Oxman frames her work in material ecology in the principles of her *nevalogue*:

- Nature as Client;
- Growth over Assembly;
- Integration over Segregation;
- Non-human-centred Design;
- Difference over Repetition;
- Decay over Disposal;
- Activist Design;
- System over Object;
- Technology over Typology;
- Process over Product;
- Heterogeneity over Homogeneity;
- Scale over Size. (Antonelli and Burckhardt, 2020, pp.20-37)

Applying these principles to learning network design, nodes in the network can be viewed no longer merely points of connection; instead, they become unique material entities possessing distinctive characteristics that influence their interactions and behaviour within a network and create a latticework which enables us to manifest that "knowledge can no longer be ascribed to, or produced within, disciplinary boundaries, but is entirely entangled" (Ben-M 2020). In a *hybrid ecological network*, material characteristics manifest in multiple ways — a node's connectivity to other nodes (its positionality within the network), its ability to process and generate information (its capacity for computational or knowledge/experience/skills exchange), and, importantly, its resilience in the face of disruption.

Taking inspiration from Oxman's nevalogue enables a reframing of design from object-oriented to systemic through a process of organic growth where networks can themselves become activist through an integrative and mycelial embrace of a (new)material-led design where contextual flows and relational difference become a new design paradigm. Thus design sets a living and adaptive foundation for a reimagining of possible educational futures as decentralised, student-led, displaced, and deinstitutionalised. Educational thinkers have begun to acknowledge, "the increasingly corporatised, target-driven, and stressful nature of modern academic life far exceeds reasonable human limits. This leaves most of us with no energy to engage with the

greatest challenge of our time – tackling the climate crisis." (Urai and Kelly 2023: 1). Further, Dan Fitzpatrick offers, "in 2043 school will likely be a concept rather than a place where our children go to learn. Systems of education led by governments will not be able to keep up with innovation, and a decentralised offering will be where most parents go to educate their children" (Fitzpatrick, 2023, p.30).

Maggie Favretti asks toward the end of her book, *Learning in the Age of Climate Disasters*, "what if the purpose of school was actually to engage people of all ages in the co-creation and tending of interrelated, living communities of coherence, belonging, and agency?" (383) Favretti's positive vision of possible learning futures resonates with the work of educational futurists including Fitzpatrick (2023), Urai and Kelly (2023),

Alexander (2020), and more) who see the potential of a regenerative pathway despite the continued financialisation of student enrolment, unethical international student fees in the UK and US, and a general "[m]arketization of international higher education [that] exacerbates issues of educational inequity" (Tannock, 2013) that further distances learners from being full participants in a whole-systems approach to education.

We need a more nuanced understanding of learning networks and their design and an understanding of the urgency of re-thinking learning structures: "To remove … barriers to action, we need to rethink academia" (Urai and Kelly, 2023, p.1). Acknowledging the inherent variability and dynamism of network participants (nodes), can empower the design of more flexible, resilient networks that can adapt to changing circumstances and (re)generate solutions.

4. (Re)/(Dis)locating Pathways: Corridor Ecology

One example of extending a *Material Ecology* grounded design paradigm explicitly into the more-than-human world is through *Corridor Ecology*, an interdisciplinary field including biodiversity corridors and landscape linkages, which lends principles crucial to designing pathways within networks. One can frame hybrid ecological networks as enactive relational spaces through the lens of *ecological corridors* (also known as biodiversity corridors or wildlife corridors). Of the hundreds of corridor projects active worldwide, there are many successful corridor and linkage projects across human and more-than-human relationships across a range of scales and geographies addressing the needs of a diversity of species.

Seeing network pathways as analogous to ecological corridors can open our perception of them as dynamic conduits that facilitate the flow of information and interactions, much like how ecological corridors facilitate species movement. They are not just passive infrastructure but active and vital parts of the network that can adapt and evolve over space and time to better serve the network's needs.

Ecological corridors are essential for connecting fragmented habitats, allowing species to move and interact — often over multiple generations — thereby enhancing biodiversity, resilience and integration with the surrounding environment. Similarly, in a network context, these "corridors" or pathways can connect different nodes — individuals, groups or systems — and allow for steady, organic evolution of connections between nodes that might otherwise remain siloed from one another. They invite the transfer, mixing, and evolution of ideas and knowledge and foster intellectual diversity and innovation.

By designing pathways that facilitate diverse interactions, we can create networks that are not only more cohesive but also more resilient. These networks can better withstand shocks (such as the loss of a node or disruption to network connections) and are more adaptable, capable of evolving based on the needs of their nodes and the environment.

In addition, the concept of corridor ecology introduces the idea of *permeability*, which refers to how conducive a landscape is to species movement. In network design, this would translate to how easily information and ideas can flow through the network. Designing a learning network with high permeability would mean creating pathways that enable the smooth and efficient flow of knowledge and ideas. Integrating corridor ecology principles enables a transition from a perception of networks as static, rigid structures to an understanding of them as dynamic, adaptable, and resilient systems, much like ecological landscapes themselves.

Multi-scale learning networks are always/already in the process of co-becoming, manifesting a world in which human and more-than-human organisms communicate always in an unfinished processual dynamic. For example, large-scale ecosystem corridors known as landscape linkages allow for the movement of a diversity of both plant and animal species and are designed for multi-generational movement and flourishing of species *within* the linkages themselves. Following the recognition of transboundary (transnational, intercultural, interspecies) linkages, a globally distributed site-based experience can build a

far more resilient learning network than existing site-based, online, or hybrid higher education allows. A hybrid ecological network emphasises the interconnectedness of global partners to integrate site-based and community-centred learning around the world and interweaves it in a multi-species transdisciplinary cross-cultural approach to build a resilient, adaptive, and multi-scale curriculum (Bailey, 2021).

Annika Keeley of the Center for Large Landscape Conservation explains that to address changing habitats and migration patterns resulting from climate change, wildlife "corridors can also incorporate climate refugia. Examples are canopy cover, deep snowdrifts, valleys where cold air pools, northward facing slopes, and areas near or in large deep lakes or oceans." This often incorporates "modelling current species distribution and their future distribution, using climate change projections, and then designing corridors linking current and future habitat patches". (Keeley, 2022) Corridors are as much about the interrelatedness of the network partners as they are about inhabiting the space between the network nodes.

Keeley notes, however, that "corridors should be part of larger ecological networks" and will ultimately only be successful when paired with "measures to reduce human population and consumption, while increasing access to resources" (Hilty, 2019, p.275-6), thereby underscoring the need for a broader systemic approach — in and of themselves, ecological corridors — and connectivity initiatives of all kinds — will only succeed if actively and fully embedded in a holistic approach.

Much as flows of more-than-human species across networks need not have rigid connections, but rather flexible, permeable, organic and regenerative connections that evoke and engender flourishing tendrils of new and sometimes unexpected growth. The very movement of species within corridors is itself a dynamic of inhabitation, often with multi-generational and inter-species frameworks, where the static fixedness of 'being' gives way to the relationality of 'becoming' and the "notion of 'animaling' can also shift perspective from animal essences to a study of the material-semiotic performativity of human/animal relationships". (Birke et al., 2004, p.169-170)

Drawing on these fields as well as on communicative ecologies and hybrid or gradient epistemologies (see Altheide, Oxman, Haraway, Tsing, Morton, Witzagal, Crabtree and Rodden, for example), there are ample models for inhabiting the permeability of network edges to engage in the cultivation of further connection and partnership development. It is useful here to draw on the foundational framing of these fields (demonstrated tangibly in the work of Oxman and others) in the articulation of *assemblage* in the work of Deleuze and Guattari and subsequent posthuman articulations. They write, "an assemblage is precisely [an] increase in the dimensions of a multiplicity that necessarily changes in nature as it expands its connections. There are no points or positions in a rhizome, such as those found in a structure, tree, or root" (Deleuze and Guattari, 1987, p.8). Their emphasis on defining the rhizomatic roots of assemblage in movement, action, and transfer underscores the processual underpinnings of active distributed networks in which the nodes themselves recede and "there are only lines" (Deleuze and Guattari, 1987, p.8).

Neri Oxman's work on (often experimental) hybrid ecological architectures foresees a future in which "material property gradients may be programmed across space and time" (Oxman, 2024) that explodes our current binary paradigm of place-rooted vs distributed and affords entry to a hybrid network model that becomes the meshwork (Morton 2013) for a relational gradient of knowledge and experience exchange. It is useful here to draw on Arthur Koestler's work, particularly in *The Ghost in the Machine* where he scaffolds emergent systems and complexity theory by balancing his concept of the *holon* between part and whole. Koestler resists a complete holism – what Morton might describe as "some vague sludge of Anaximander's *aperion*" (Morton, 2013, p.119) or Thales' *arche* before him – in favour of an almost fractal nesting of interrelated parts, wholes and sub-wholes. He describes "organisms and societies [that] are multi-levelled hierarchies of semi-autonomous sub-wholes branching into sub-wholes of a lower order, and so on" wherein "'wholes' and 'parts' in [an] absolute sense just do not exist anywhere" (Koestler, 1967, p.56-58). Koestler's holon and the accompanying notion of holarchy offer a lens through which to view the interconnectedness and interdependence of entities in both biological and social structures, suggesting that the nature of reality is neither fully reducible to its parts nor entirely explainable as the sum of its parts. Instead, it proposes a dynamic, integrative view of systems where both *partness* and *wholeness* are

essential for understanding the organisation and functioning of complex systems.

Further, Ervin László built upon Koestler's concept of the holon to assert that "consciousness is not produced by the brain, and is not confined to the brain. It is a fundamental phenomenon" that exists everywhere (László, 2017, p.3). This robust form of extended cognition and "active externalism" (see Clark & Chalmers, 1998) reaches into the *alive-space* of human and more-than-human interconnectedness, where "all spheres of consciousness partially overlap… [And] the overlapping part of the spheres of consciousness forms the world that is common to all". (Schrodinger, 1956, p.9) The complementarity of *part* and *whole* held in a permanent state of (co)becoming can empower a shift from hierarchical, pre-structured educational models to fluid, process-oriented, and relational models that prioritise practice-led and experience-based learning networked through a rhizomal architecture, thereby offering a transformative vision for 21st-century education.

5. Unsettling the Classroom

The writer and activist Gloria Anzaldúa describes the experience of inhabiting borderlands as *nepantla*, a Nahuatl term meaning *in-betweenness* or *ambiguity* (Anzaldúa, 2015, p.127). Nepantla captures the complex and often contradictory nature of identity formation within borderlands, where individuals navigate between multiple cultural, linguistic, and social contexts. In this liminal space, Anzaldúa argues, new forms of identity and consciousness emerge, challenging traditional binaries and hierarchies — between cultures, gender identities, nation-states, human and more-than-human communities, and between ontology and epistemology.

Anzaldúa writes "you're not contained by your skin—you exist outside your body and outside your dream body as well. If the body is energy, is spirit—it doesn't have boundaries. What if you experienced your body expanding to the size of the room, not your soul leaving your body. What if freedom from categories occurs by widening the psyche/body's borders, widening the consciousness that senses self". (Anzaldúa, 2015, p.134-35) As they explore the "enfleshed geneological sensiblities" embodied in the linguistic and cognitive dance between Anzaldua's experience and her readers, Nancy Tuana and Charles Scott, point to blurring of place, where, "Enfleshed genealogies remember the reciprocal vulnerability of things in the making. Not my body, your body, but the complex imporings of environments, institutions, norms, sensibilities, elements". (Tuana & Scott, 2020, p.118)

In this *alive-space,* where ultimately, "corporeality is a nexus of flux" (Tuana & Scott, 2020, p.118), place itself can be critically unmoored from romantic conceptions separating terrain from its context; Cecil Goodman underscores that "sense of place is a social construction that builds on a socio-cultural context, which includes spatial memory, experiences, and social world relationships" (Goodman 4) and further enriches this discourse framing hybrid ecological networks, advocating for a learning model that is de-institutionalised, distributed, and deeply entwined with socio-cultural and ecological contexts. Arizona's Prescott College, "a leader in experiential and collaborative education" ("Mission, Vision & Values"), demonstrates, for instance, that "reframing recreation *on*, to one of relation *with*, may help to challenge this paradigm and requires the re-learning of Indigenous wisdom erased through the pursuit of western values of escapism and conquest" (Greeson at al., 2022, p.10). Advocating for practice-led, community-centred and ecologically focused education not only challenges but also dismantles romanticised separations between place and context, advocating for a justice-centred education system that mirrors the resilience and adaptability of ecological networks and invites a radical reimagining of place, learning, and community in a way that fosters a regenerative, interconnected educational ecosystem, reflective of and responsive to the complex web of relations that define our socio-ecological landscape.

In the practice-led processual classroom, learning is itself "an iterative process… growing from reflexive positionality, entangled empathy, and involving earth-based ways of knowing and indigenous cosmologies… Such learning is modelled on resilient ecological systems, recognition and celebration of diversity, collaboration, reflexivity, emergent understanding, and individual responsibility and

accountability" (Greeson, 2019). The enfolding of diverse externalities within the curriculum, and indeed modelling the learning framework on an active regenerative paradigm situates learners in an active relationship with process and experience, rather than with siloed knowledge transfer that re-inscribes hierarchical anthropocentric paradigms within and beyond the classroom.

The MA *Movement, Mind and Ecology* at Schumacher College in South Devon, England, now in its third year, provides additional context within a transdisciplinary environmental humanities course focused on exploring and interrogating interrelationships, communications, and performative practices between human and more-than-human participants around the world. The programme's four taught modules are built upon concepts of out, to use embodied practice, ecological thinking and environmental philosophy to explore the alive-space between human and more-than-human communities, taking as one of its foundations the assertion that concepts "are not descriptive but *performative*. … calling into question of the presumed separability of epistemology, ontology, and ethics". (Barad & Gandorfer, 2021, p.25) In the final module, *Performing Place*, students embody their experience in the course and develop meaningful public and community-facing practices that can move both conversation and action forward, inhabiting what Elizabeth St. Pierre describes as an "ontology of immanence, [where] one becomes less interested in what is and more interested in what might be and what is coming into being". (St Pierre, 2019, p.4)

Movement, Mind and Ecology is delivered both onsite in England and online for students across multiple time zones, ecosystems, and cultures and thus presents a tangible opportunity to explore and assess the manifestation of interspecies collaboration, cooperation, and communication in site-based and online contexts. In my (far too) occasional seminars on the course, I would challenge students to consider what happens to a network model when we focus exclusively on the connections over the nodes, and how we might use such a relational framework to reimagine the process of learning through experience. It is precisely this sort of reworking of networks with the motion and movement of experience through the network corridors – rather than fixing on the nodes of the network themselves, that speaks clearly to the need to diversify, decolonise, and democratise the development of learning networks by taking a decentralised view of network development. If we decentralise network architectures and establish a framework based on the active sharing of experience that validates the authentic experience of site-based participants, then we have come a long way indeed toward a democratic & ecological relational network.

Foundational for such an innovative approach to learning — often more apparent in curricula of small progressive colleges and universities (including Schumacher College (UK), Prescott College (US), Sterling College (US), Green School (Bali), Black Mountains College (UK), College of the Atlantic (US), MOME University (Hungary), the international UNDP Conscious Food Systems Alliance (CoFSA) and others) is that "thought cannot get outside itself in order to compare the world as it is 'in itself' to the world as it is 'for us'". (Meillassoux, 2009, p.3)

6. Conclusion

Whether grounded in knowledge exchange, distributed approaches to practice-led learning, or other, "the problem remains … that organised networks do not yet exist as recognised actors either within the stratum of policy discourse or as concrete-potentialities". (Rossiter, 2006. p.34) It is clear that in the context of network identity and data autonomy, looking through the lens of dislocated (Morton 2010) interspecies inhabiting, "inclusivity can also enhance innovation" (Chiles et al., 2021: 956), the role of the network itself as an actor within a framework of agential realism that seeks to disrupt "the sedimented assumption in Western philosophy that holds that ontology is strictly a matter of being". (Barad & Gandorfer, 2021, p.17)

A hybrid ecological network re-frames institutional learning through a deterritorialised epistemic ontology that invites critique of fixedness inherent within and outside of institutions. In this era of polycrises (among which is a fundamental crisis in education), we need to interrogate existing learning paradigms to challenge the notion of institutional fixedness and construct authentic theoretical and practice-led frameworks for de-institutionalised learning. Such a framework invites an inhabitation of an *alive-space* at

the intersection of human and more-than-human identities and encourages a refashioning of how learning communities are formed, how knowledge is engendered and shared amidst these communities, and how the process of learning unfolds in non-hierarchical, open-ended, and interconnected ways.

Hybrid ecological networks open a collaboratory space for a new philosophy of de-institutionalised learning that transcends the conventional boundaries between teacher and learner, formal and informal learning environments, and online and offline educational experiences. Within and around de-institutionalised models, learning unfurls through non-linear, assemblage-driven entanglements. Thus reimagined, learning is less paradigm or framework and more a dynamic, ever-evolving network of relations, where knowledge is not transferred, but emergently co-constructed through the intricate interplay of experiences, practices, and relational engagements.

The openness of distributed learning networks subverts bounded, discrete and siloed learning "centres" that gatekeep and disseminate "knowledge" across a centralised institutional network apparatus. As Anna Tsing offers, "assemblages are open-ended gatherings. They allow us to ask about communal effects without assuming them. They show us potential histories in the making". (Tsing, 2021, p.22) It is these potential histories – learning unfixed and always in process, that is at the heart of unfinished network assemblages.

Hybrid ecological networks, in their emphasis on relationality and process for learning insist upon transformative action for education and advocate for resilient, adaptive learning networks that integrate human and more-than-human interactions with/in socio-cultural and ecological contexts. Distributed networked learning calls for dismantling hierarchical educational structures in favour of participatory, interconnected learning networks. These networks can shift the future of education from seeking to sustain an unsustainable status quo toward a flourishing, collaborative and regenerative future. When we recognise through relational networked imagining to authentic practice that "all that matters…is that the sensible *is* a relation, rather than a property inherent in the thing" (Meillassoux, 2009, p.2), we can better engage the dynamic interplay in the alive-spaces between human and more-than-human actors, aiming to address global challenges through a regenerative, inclusive, and ethically grounded paradigm. We are urged to embrace this model, fostering a collaborative effort towards sustainability and ethical engagement with our planet.

Collaboration is the foundation of a regenerative approach and helps us recognise that we are always in the process of evolving. It is through cultivating relationships across boundaries (with education providers, businesses, communities of practice, and human and more-than-human communities) and inhabiting both virtual and actual rhizomal or mycelial networks, that we can build a resilient and adaptive regenerative future for learning that explicitly integrates radical openness, interactivity, adaptability, and equitable participation.

There is no single solution to this crisis; however, "we must see academia not as a research-producing factory but as an organic, diverse, dynamic organisation. An organization where, in the right conditions, small seeds can grow into a diverse ecosystem". (Urai & Kelly, 2023, p.6) It will take different perspectives and many approaches, but critical will be an acknowledgement that it is through working together — by re-building our relationships with one another, that we can hope to shape a more regenerative future for higher education.

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P/REFERENCES OF DESIGN

PROBLEM-SOLVING APPROACH IN FASHION DESIGN EDUCATION: A CASE STUDY OF STUDENT PROJECT FOSTERING INCLUSIVITY IN FASHION.

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KEYWORDS | LEARNING & TEACHING APPROACHES, INCLUSIVE DESIGN PRACTICES, DIVERSE DESIGN APPLICATIONS, BODY FOCUSSED CLOTHING, PARTICIPATORY DESIGN

ABSTRACT | Fashion is a powerful tool for self-expression and empowerment. People with disabilities (PwD) however, are often excluded from fashion, as mainstream clothing is often not accessible or adaptable to their needs. The limited awareness surrounding disabilities specifically in fashion education does not help in fostering inclusivity and assimilation within society, which not only requires infrastructural adjustments but also innovations in adaptive clothing solutions. This challenge is particularly pertinent for educators in design disciplines, such as interiors or fashion, who must navigate the complexities of incorporating inclusive practices into their curricula. Design, inherently a problem-solving discipline, often overlooks this aspect when applied to fashion in particular, which instead gravitates towards the celebration of identity and clothing as a form of an artistic communicative language. Addressing this lacuna, the fashion department at a well-known design college initiated the "Body and Diversity" brief for second-year fashion students which delves into the human body as a composite entity, considering its diverse abilities as well as its limitations. Students engage with a spectrum of body types, gaining insights into factors that deviate from the norm. Adapting a personalised client study, students undertake rigorous research, including the collection of primary data and visuals from their clients (who may be PwD), analysis of diverse body requirements, and the subsequent development and delivery of tailored clothing solutions. This paper employs the "Body and Diversity" brief as a case study to elucidate the diverse design approach that can shed light on an innovative learning application.

1. Introduction

Fashion design, operating as both a discipline and a pedagogical framework within fashion education, embodies a multifaceted interplay of contextualisation, technical proficiency, industry orientation, and technological integration. Its dynamic nature necessitates constant innovation in both its approach and delivery. This presents a formidable challenge not only for fashion educators but also for fashion students. The focal point lies in equipping these students with future-proof skills while simultaneously grounding them in historical and cultural contexts. Contemporary discourse within the field emphasises not only the exploration of the "why" and "what" of fashion but increasingly interrogates the "how" of its various manifestations. As articulated by Steven Faerm (2017), this multifaceted inquiry underscores the evolving landscape of fashion education, demanding a nuanced understanding and response to its complexities.

Over the past two decades, fashion education has undergone significant transformation, spurred notably by the prevalent influence of social media. This medium has facilitated the rapid dissemination of ideas, fostering discussions that have propelled certain movements to global prominence. Among these, the notion of sustainability in fashion stands out as a salient example. The emergence of sustainability as a prominent concern within fashion design reflects a conscientious recognition of the industry's immense environmental impact. Various dimensions of sustainability, including recycling and upcycling practices, embrace of make-and-mend approaches, promotion of circularity, emphasis on local sourcing and consumption, appreciation of the value chain, and cultivation of craftsmanship, are being systematically integrated into design pedagogy across diverse educational institutions worldwide. Consequently, academic curricula are being restructured to embrace this newfound imperative, as educators seek to instil in students an ethos of sustainability vis-à-vis clothing and fashion.

The evolving landscape of fashion consumption has propelled an earnest shift in the role of the designer. While consumers continue to seek meaning and self-actualisation through fashion, Maslow's "Hierarchy of Needs" suggests that contemporary consumers, having had their primary needs met, now yearn for deeper forms of non-physical stimulation (Faerm, 2015, p.190-191). Consequently, there is a burgeoning demand for fashion offerings that transcend mere product functionality, eliciting deeper emotional resonance. As posited by Pink (2005, as cited in Faerm, 2015), the future trajectory of fashion design necessitates a departure from mere aesthetic appeal towards the cultivation of narratives that resonate with an increasingly discerning audience. Designers, positioned as creative innovators, are tasked with the pivotal role of “bridging the chasm between thinking and doing because they are passionately committed to the goal of a better life and a better world around them”(Brown, 2009 as cited in Faerm, 2015). In this vein, the design process transcends its conventional confines to emerge as a potent catalyst for societal health, economic prosperity, and personal fulfilment. As Brown (2009, as cited in Faerm 2017) further contends, the elevation of design within this broader paradigm holds the promise of enriching not only individual lives but also the fabric of our collective existence, inculcating it with deeper meaning and purpose.

The acknowledgment of the need for change within the fashion system and education has prompted critical reflection, yet few theorists have explicitly advocated for the integration of a problem-solving approach as a universal design principle within the discipline. This paper seeks to address this gap by providing insights into the potential benefits of incorporating problem-solving methodologies into fashion design pedagogy, thereby advancing inclusive practices in the field of fashion and clothing.
Utilising a qualitative, observational, and case study approach, this paper aims to present evidence of successful project delivery and student reflections that underscore the significance of adapting diverse problem-solving approaches within fashion design education. In doing so, it also aims to expand upon Steven Faerm's argument regarding the evolving role of the fashion designer in the contemporary knowledge-based economy. Faerm's (2017) proposition of the "Designer-As-Social-Scientist"(p.6) underscores the necessity for designers to transcend traditional boundaries of aesthetic creation and instead engage with the psychosocial needs and desires of their audience. By crafting narratives and design processes that strategically address both practical and emotional aspects of consumption, designers can better resonate with their target consumers.

2. Introduction of Facts and Figures of PwD and Diverse Body Types, Issues, Concerns: The Case of 'Why' This is Essential

According to UNDP (2018, p.3) 'Persons with disabilities are one of the largest minority groups in the world, estimated to represent over 15 percent (approximately 1.5 billion people) of the world's population. 3 out of 5 persons with disabilities are women and disability is more common among children and adults who are poor. 80 percent of persons with disabilities live in UNDP programme countries. Persons with disabilities face challenges to fully participate in society which is further heightened by discriminatory social attitudes – this culminates in marginalisation and significant barriers to their inclusion and participation in society and in development. The extent of inequalities experienced by persons with disabilities in all areas of development is often the result of shortcomings in the structural, social, political, and cultural environments in which they reside, including lack of accessibility to physical and virtual environments; institutional and attitudinal barriers; exclusion; and unequal opportunities.'

This demographic reveals the urgency for fostering inclusivity and assimilation within society, necessitating not only infrastructural adjustments but also innovations in spatial design and adaptive clothing solutions.

2.1 What Do We Understand by Inclusive Environments in General

When discussing an inclusive environment we take into consideration race, ethnicity, gender, sexual orientation, age, religion, disability, socio-economic status and how space (physical) and an environment (sensory and emotional included) is deemed fit and wholesome for every person who may inhabit that space. While inclusivity and diversity are outlined in various theoretical frameworks and government documents in most countries, the practical implementation often lags behind. Policies and documents advocate for equal opportunities and anti-discriminatory measures, yet the ground reality reveals persistent barriers. Addressing disability as a human-centric issue involves tackling spatial, accessibility, and clothing challenges. Across the world, efforts are being made to enhance infrastructure for better mobility, such as wheelchair ramps and accessible public spaces. Initiatives also aim to create awareness, dispel stereotypes, and foster a more inclusive mindset within communities. In the realm of clothing as well there is a growing realisation for the need for adaptive designs to cater to the diverse body requirements of PwD.

2.2 Bringing Focus to Clothing, Fashion and Fashion Design Education

Fashion is a powerful tool for self-expression and empowerment. People with disabilities, however, are often excluded from fashion, as mainstream clothing is often not accessible or adaptable to their needs. Adaptive fashion is clothing that is designed to be easy to put on and take off, and to accommodate the needs of people with disabilities, especially in the case of mobility concerns. It is an important part of creating a more inclusive and accessible society.

Fashion courses worldwide often prioritise trends and the pursuit of idealised body types, perpetuating a narrow definition of beauty. Within these courses, students are encouraged to explore the interplay between materials and forms, with an emphasis on innovation and the creation of unique designs. The curriculum typically revolves around techniques for enhancing the aesthetics of clothing, often overlooking the broader implications of design beyond mere appearance. There is a growing recognition of the need for inclusivity within the industry, spurred by awareness campaigns advocating for representation of diverse skin tones and body sizes. Despite efforts to diversify representation within the fashion industry, there is still a pervasive focus on conforming to traditional standards of beauty. This perpetuates an exclusionary environment that fails to celebrate the full spectrum of human diversity. While strides have been made in acknowledging the importance of representation, with the inclusion of dark-skinned and plus-size models, the overarching emphasis remains on materiality and form whereas true inclusivity requires a fundamental shift in the way fashion education is approached.

In her manifesto, ANTI_FASHION: A manifesto for the next decade, trend forecaster Li Edelkoort claims that most fashion institutions encourage student designers to become unique individuals who aspire to future roles as celebrity runway designers for luxury brands (Edelkoort, 2014, as cited in Sala, 2016). It would be fair to state that central to the teaching and learning of fashion is the cultivation of a discerning eye for aesthetics, serving as the cornerstone of the discipline. Within this realm, students are tasked with not only honing their ability to critically assess designs but also to recognize emerging trends and craft their own unique design aesthetics, drawing from their personal perspectives and experiences. While problem-solving skills are often emphasised in garment construction and form exploration, there exists a tendency to overlook the broader context of addressing functional needs of clients or real individuals, thereby neglecting to identify potential design gaps.

Sala (2016) in her paper further

> "discusses ideas of progress, innovation and possibilities for transformation present in fashion education practice and learning, specifically in reference to the fashion educator's role in enabling student designers to become critically aware of their place within the current fashion system. To transform ideas, to encourage or experience a shift in paradigm, requires the recognition and reinterpretation of what has come before".

(Williams & Askland, 2011, as cited in Faerm, 2015, p.197-198) have raised a similar point

> "To prepare their future graduates, many design schools are moving away from teaching to the mere 'artifact', into pedagogy that increasingly emphasizes the design process, the interrelationships between creator and audience, and the role of (often implicit) rules and boundaries. This is a more contextualist approach as it considers the interactive engagement between the individual and the social environment. The New Design Education, then, is one that encourages and facilitates partnerships between design and the social sciences. After all, design is, on many levels, a service to society and end-users."

Despite the presence of leading design schools and prestigious fashion programs worldwide, there remains a conspicuous absence of specialised courses catering to adaptive clothing, which is particularly noteworthy given the industry's obligation to inclusivity and accessibility. The dearth of focus on adaptive clothing within fashion education is not surprising, considering that fashion designers typically do not enter the field with the explicit intention of catering exclusively to individuals with disabilities. However, it is imperative to acknowledge that fashion design, as a subset of the broader design discipline, possesses inherent problem-solving capabilities and should be adept at addressing diverse societal needs.

2.3 What Does Design and Design Teaching Mean: Are We Applying the Same Principles of Design Pedagogy to Fashion as in Other Disciplines?

Early literature on design or the process of designing has laid the groundwork by proposing several definitions or approaches, each offering unique insights into the nature of design. Some of them as quoted below from Jones' book 'Design Methods' (1992, p.3) elaborate upon this very approach:

- "A goal-directed problem-solving activity (Archer, 1965)": This definition highlights design as a deliberate and purposeful endeavour aimed at solving specific problems or achieving predefined objectives. It underscores the importance of intentionality and direction in the design process.
- "The conditioning factor for those parts of the product which come into contact with people (Farr, 1966)": Here, design is viewed as a determinant of the user experience, particularly focusing on the aspects of a product that interact directly with individuals. This perspective emphasises the human-centered nature of design and its role in shaping interactions between people and products.

- "Relating product with situation to give satisfaction (Gregory, 1966)": Gregory's definition emphasises the contextual nature of design, highlighting its function in establishing a harmonious relationship between products and their intended environments. Design is seen as a means of enhancing user satisfaction by aligning products with specific situational requirements or contexts.
- "The optimum solution to the sum of the true needs of a particular set of circumstances (Matchett, 1968)": This definition underscores the idea of design as a process aimed at identifying and fulfilling the genuine needs of a given situation or context. It suggests that effective design involves finding the most suitable solution that addresses the inherent requirements and constraints of a particular scenario.
- "A creative activity - it involves bringing into being something new and useful that has not existed previously (Reswick, 1965)": Reswick's definition highlights the innovative aspect of design, emphasising its role in generating novel solutions that serve practical purposes. Design is portrayed as a creative endeavour that manifests new ideas into tangible forms, thereby contributing to the advancement of human knowledge and utility.

These early perspectives on design lay the foundation for understanding its multifaceted nature, encompassing elements of problem-solving, user experience, contextual adaptation, needs fulfilment, and creative innovation. Jones' statement "The objectives of designing become less concerned with the product itself and more concerned with the changes that manufacturers, distributors, users and society as a whole, are expected to make in order to adapt to, and benefit from, the new design" offers a profound perspective on the evolving role of design. While Jones's observations were originally framed within the context of architecture, engineering, or industrial design, they underscore a fundamental truth applicable to design across various disciplines.

Design, as a principle, should indeed be grounded in certain universal parameters and deliverables, irrespective of the specific field—its essence remains rooted in creativity and problem-solving. Therefore, while the objectives and focus areas of design may vary depending on the context, there exists a foundational framework that defines its fundamental purpose.

In the realm of teaching and learning within the visual arts and creative disciplines, there exists a notable emphasis on cultivating a rich contextual understanding and translating it into tangible outcomes through an exploratory process. The expectation is that students will become independent, self-analytical, critical thinkers that inform the entire period in higher education from the start of the course (Drew et al., 2002, pg 346). They have made a strong case of the role educational research can play in the development of thinking concerning pedagogical issues. Their approach to Martin and Saljo's (as cited in Drew et al. 2002) seminal work on deep and surface approaches in the visual arts, as well as their subsequent study (2002), provides valuable insights into effective pedagogical strategies within creative education. Among the four approaches identified, one stands out: a 'concept-focused strategy with the intention of developing the student's own response and ideas in relation to the project, ultimately a search for intrinsic personal meaning'. This approach aligns with the concept of cultivation of students' intrinsic motivation and personal engagement with the subject matter. Furthermore, it serves as a conduit for promoting the development of Personal and Professional Development (PPD) or Personal Development Planning (PDP) outcomes, underscoring the holistic nature of learning within creative disciplines.

> "When it comes to assessment as well, there have been criticisms in visual arts being subjective and lacking in rigour, where tutors usually arrive at grades after discussion with each other, in a process that is rigorous but socially negotiated and includes unwritten criteria. Further it is stated that 'In order for students to understand the assessment process and develop the capacity for effective self-evaluation and development, opportunities must be provided for them to understand assessment practices through formal explication and through social learning. This

> can enable students to benefit and learn from assessment rather than seeing it as something that is 'done to them'" (p.350).

In some cases of industry live briefs, especially in the higher levels and master's programs, this engagement most often takes place, but this is still via the understanding of fashion as the students know it. As a case in point, if fashion students were designing for a PwD and if this understanding was built around a problem-solving approach where student was designing for a real-life client, the feedback would be real time, in-person and objective, specific to the outcomes that were to be achieved. This approach is further elaborated in the specific case study below.

3. Body and Diversity: A Case Study of Students' Design Project Fostering Inclusivity in Fashion

Addressing this lacuna identified above, the Fashion department at the Indian Institute of Art and Design (IIAD) initiated the "Body and Diversity" yearly project for second-year (level 4) fashion students in 2017. Spanning 6-8 weeks, this project delves into the human body as a composite entity, considering its diverse abilities as well as its limitations. Students engage with a spectrum of body types, gaining insights into factors that deviate from the norm, including but not limited to body types, shapes & sizes, differently-abled, gender studies, etc. and their association with clothing and fashion. Emphasising on a personalised client study, students undertake rigorous research, including the collection of primary data and visuals from their clients (who may be PwD), analysis of diverse body requirements, and the subsequent development and delivery of tailored clothing solutions as a live project with a real-life client.

3.1 Details of the Project with Its Aims, Learning Outcomes, Objectives, Student Work, and Reflections Expanded Upon Below

Aims:

- To empathise with human needs and user focussed concerns (Process 1)
- To enable students to explore their own status as future design professionals (PPD 1)

Learning Outcomes:

- Analyse the relationship(s) between contexts & design outcomes (CONTEXT1)
- Identify the user needs through research and iterative design development (PROCESS1)
- Study diverse processes & agents of design realization within the relevant ethos (DESIGN OUTCOME1)
- Reflect on being aware & ethical students of design (PPD1)

Learning Objectives:

- Research: Conduct in-depth research into the experiences, needs, and preferences of PwD in relation to clothing and fashion.
- Ideation: Generate creative and inclusive design concepts that address the identified challenges and requirements.
- Prototyping: Develop toiles/prototypes of fashion designs tailored to the specific needs of PwD, incorporating feedback and iteration.
- Test fitting: Collaborate with PwD and relevant stakeholders to test and evaluate the toiles/prototypes in real-world settings.

- Learning and Reflection: Reflect on the design process, outcomes, and learnings, considering both successes and areas for improvement.

To explain the brief comprehensively, it is divided into 3 sub themes under the overarching theme of 'the Body' where a student's understanding is built with respect to the whole body, its physical, emotional and physiological attributes.

Body and diversity (overarching) is built around the wide spectrum of body variations: from varied body shapes and sizes to people with special needs, it could be people who wear prosthetics or people who identify with a different gender, etc. To further the understanding of the body, students look at the body through different lenses - from body as a form to finally interrogating the relationship between body and fashion, discussing both the historical perspective as well as present scenarios of how the body has been perceived. This would include covering *body* in the arts, in history, in clothing from the earliest time known etc. They question normative body ideals, and how the culture influences how we feel about our bodies.

Table 1. This segment is further divided into 3 subparts that are primarily based around class discussions and individual reflections.

Part I - Body as self and as the other, Vitruvian Man, Body as physical (torso, limb, face - senses & expressions), Body as an emotional being	**Part II** - Body in arts, sculptures, nudity, sexuality, armours, etc.	**Part III** - Ideal body image, mannerisms, body language & attitude, positivity, self-portraits, selfies, facial recognition

The next part of the brief focuses on understanding 'Body and gender' where the aim is to expose and sensitise students to gender studies and the social issues surrounding these. From looking at the body as a form to seeing the body as gender and then finally interrogating the relationship between body and fashion, discussing both the historical perspective as well as present scenarios they question how they feel about their bodies and gender. In the process of building a unique contextual narrative around the renewed understanding of gender, students chart out our own pathway by assimilating parallels between factors that have been defining gender till now, sieving through the newer viewpoints on the subject and by questioning the structures in the societies & within our own mindscapes. They methodically construct a curated context around the relationship between "Mind, Body & Gender". Within this they understand the difference between *Unisex* and *Androgyny* and what design approach they may have to undertake to design for either of the categories. Building a technical understanding of the placket, collar or yoke for example, and how its application shifts when addressing different gender types.

The last part of the brief is understanding 'Body and movement' and its role in a garment, for example - how different professions require different garments. Answering questions like 'Does movement play an important role in defining a certain occupation? Does the movement of a dancer and corporate employee differ? How does it affect their clothing? Ever wondered what costume designers keep in mind while designing for dancers and performers?' and then moving onto restriction of movements because of mental or physical ailments, as well as for differently-abled people or people with disabilities, and how these can turn into problem solving approaches for students of fashion. A masterclass and workshop on understanding anthropometrics and its relevance in this topic is integrated. They also understand how movement of body may be impacted if someone is physically challenged, or when the body is fit but the person is mentally not fully fit and what kind of interventions may be required in either case.

3.2 Deliverables

By culminating the above learnings, their main task (described below) is to identify a client who is facing challenges in movement or is PwD, or is struggling to identify with rigid gender norms. They look and seek within their surroundings - family, friends, immediate and close circle or through known contacts to build a prospective group of ‘clients’ from whom they then shortlist one that they will be designing for. They arrive at the 'design problem' in the way of this live client engagement and this sets a premise to base their design context and design process on.

The final deliverable is supported by lots of other supporting tasks and learnings (in addition to the core aims, learning outcomes, and objectives outlined in the project as stated above) to ensure a holistic and enriching educational experience for students:

- Client Profiling: Students learn how to conduct thorough client profiling, understanding the unique characteristics, preferences, and needs of the target audience, particularly Persons with Disabilities (PwD). This process involves gathering detailed information through interviews with the client and their families or support staff, observations, and research to inform the design process effectively.
- Context Building: Emphasis is placed on building a strong contextual framework to guide the design process. Students explore the broader societal, cultural, and environmental factors that influence fashion and inclusivity, enabling them to develop designs that are not only aesthetically appealing but also culturally sensitive and socially relevant.
- Iterative Process: Students engage in a rigorous iterative process to refine their designs and arrive at successful outcomes. This iterative approach involves continuous evaluation, feedback, and refinement, allowing students to address challenges, experiment with new ideas, and achieve optimal design solutions.
- Technical Construction: Students learn the technical components of garment construction, including pattern-making, sewing techniques, and fabric manipulation. Some are covered as charrettes and some as a continuation of design discussion, students also learn why volume, ease or other elements of addition may be required in the form. They look at pleats, tucks, shirring, gussets, godets, trims such as Velcro and snap buttons etc. to bring in required elements within their iterations.
- Representation Skills: Students acquire proficiency in representing their design concepts through various mediums, including hand sketches, computer-aided design (CAD) software, and body scanning technologies. This multi-modal approach enables students to effectively communicate their ideas and visions to stakeholders and collaborators.
- Soft Skills Development: Through interactions with clients and stakeholders, students develop essential soft skills such as communication, empathy, and active listening. They learn to engage in meaningful dialogues with clients, demonstrating empathy and understanding to address their specific needs and preferences sensitively.
- Reflection and Awareness: Reflective practice is integral to the learning process, with students documenting their progress, insights, and reflections through reflective logs. This process encourages introspection and self-awareness, fostering a deeper understanding of their creative process, as well as their physical and emotional surroundings.

By integrating these additional learnings into the project, students are provided with a comprehensive and immersive learning experience (figures 1-8) that goes beyond technical skills to encompass critical thinking, empathy, and cultural awareness. As a result, they emerge as well-rounded and socially conscious

designers equipped to make meaningful contributions to the fashion industry and society at large. All the above are covered via various teaching and learning methods such as lectures, small group discussions, large classroom discussions, panel discussions, peer engagements, masterclasses and guest lectures, in order to build a strong foundation for the design premise.

"The role of the future fashion designer, then, is not merely one of 'aesthetic provider' but as a practitioner who approaches the design process with deeper levels of empathy, sociological pattern-recognition, innovation, and big-picture capabilities" (Faerm, 2015, p.193). This brief compels design students to think beyond basics of form and material while really integrating a thinking and intervention possibility.

3.3 Example of Work

One student's work is presented below as an example of the brief culmination. There is an identification of a '*design problem'*, engaging with an iterative '*design process'* and thinking of possible *'design solutions'*. The initial context building and design development happens by hand. These are supported by many hand drawing sessions of 'the body' its movement, its gestures, curves, fold, wrinkles, skin colour etc. This is a final submission therefore does not capture an explicit design process however it does evidence a new design thinking approach (many journal pages and process sheets are omitted due to space constraints).

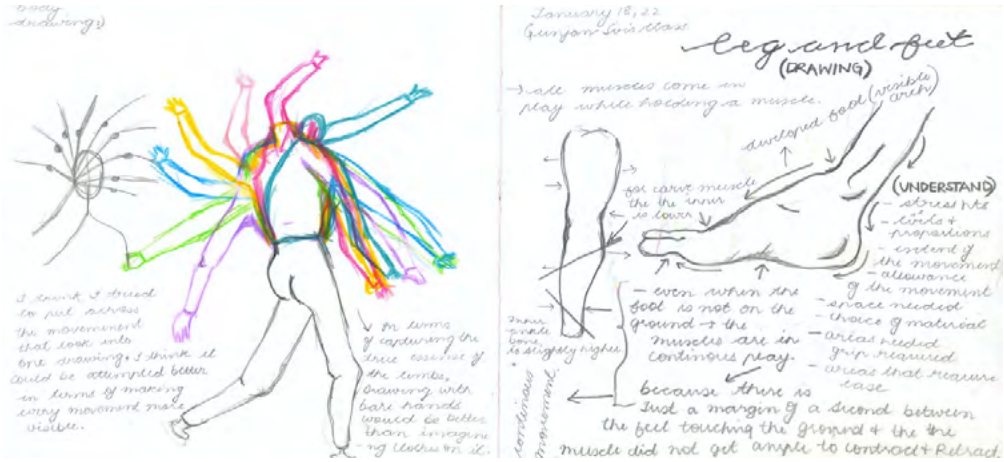


Figure 1. Journal entry, understanding the design problem – studying movement of the body.

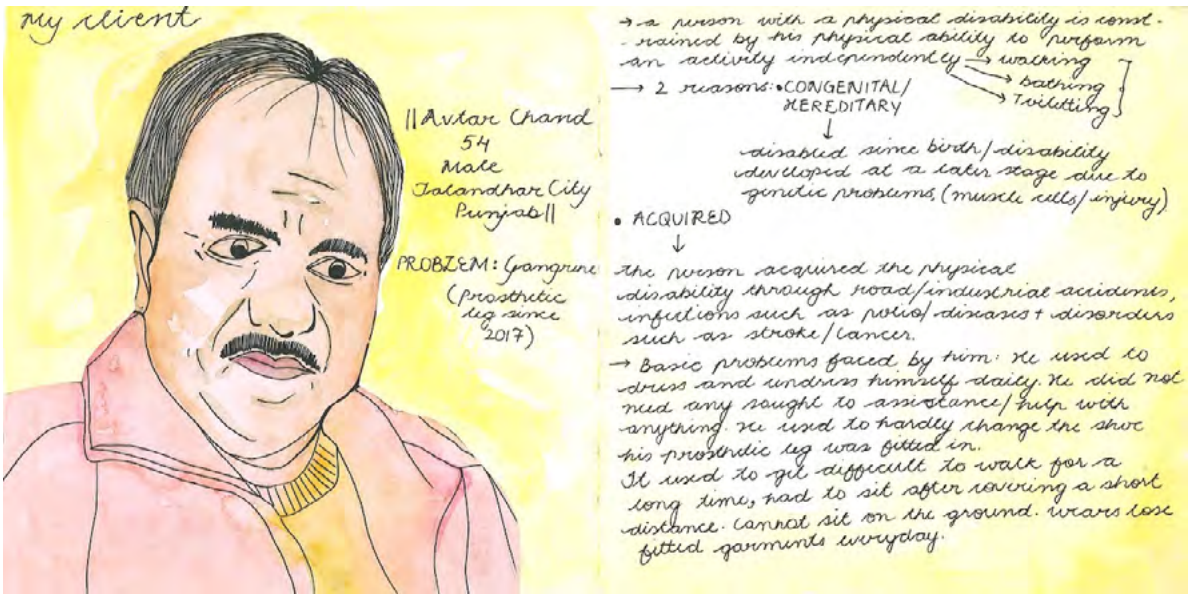


Figure 2. Journal entry, understanding the design problem.

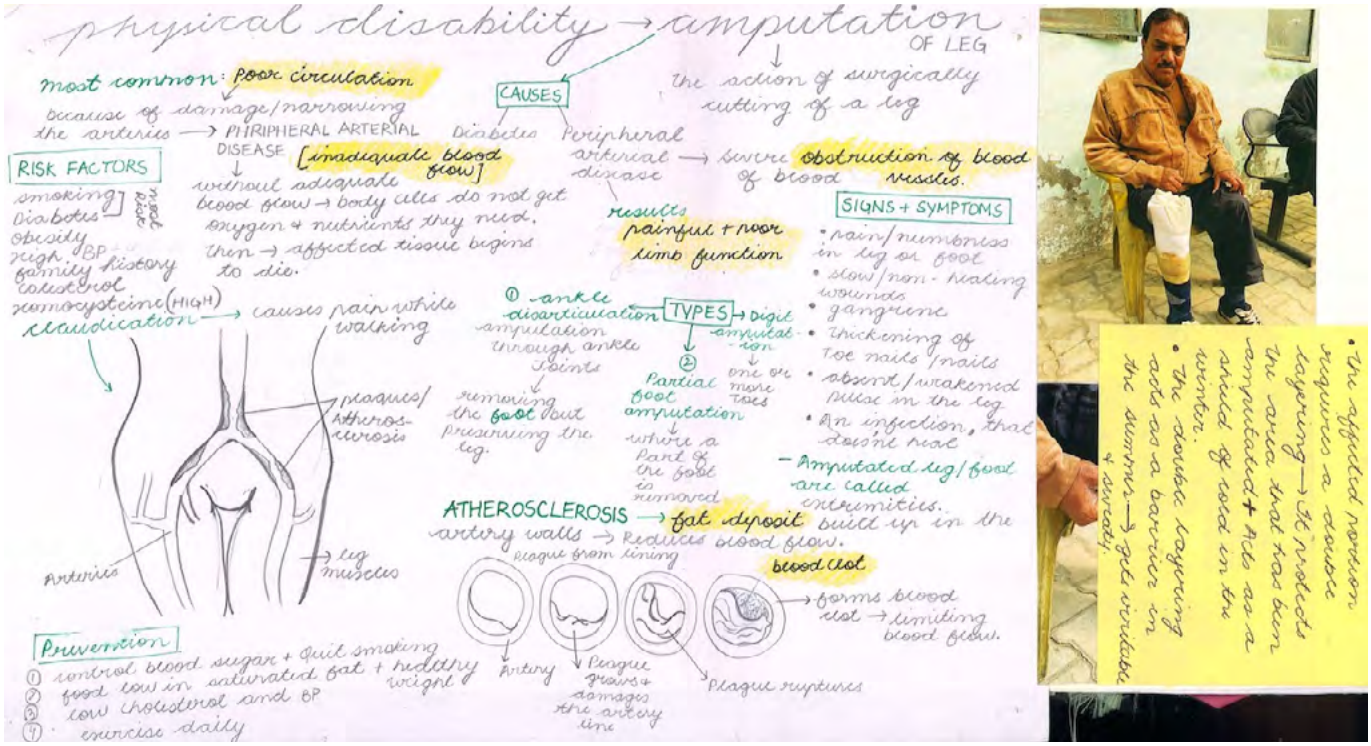


Figure 3. Journal entry, understanding the design problem.

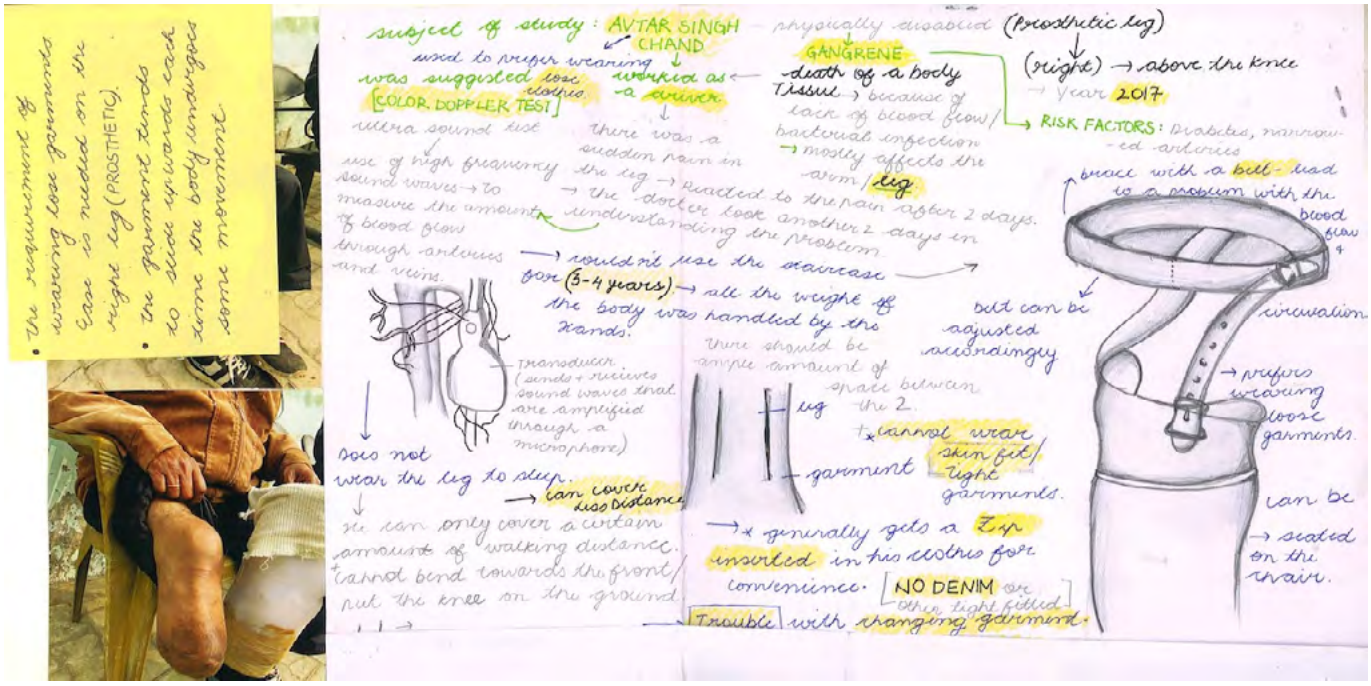


Figure 4. Journal entry, understanding the design problem.

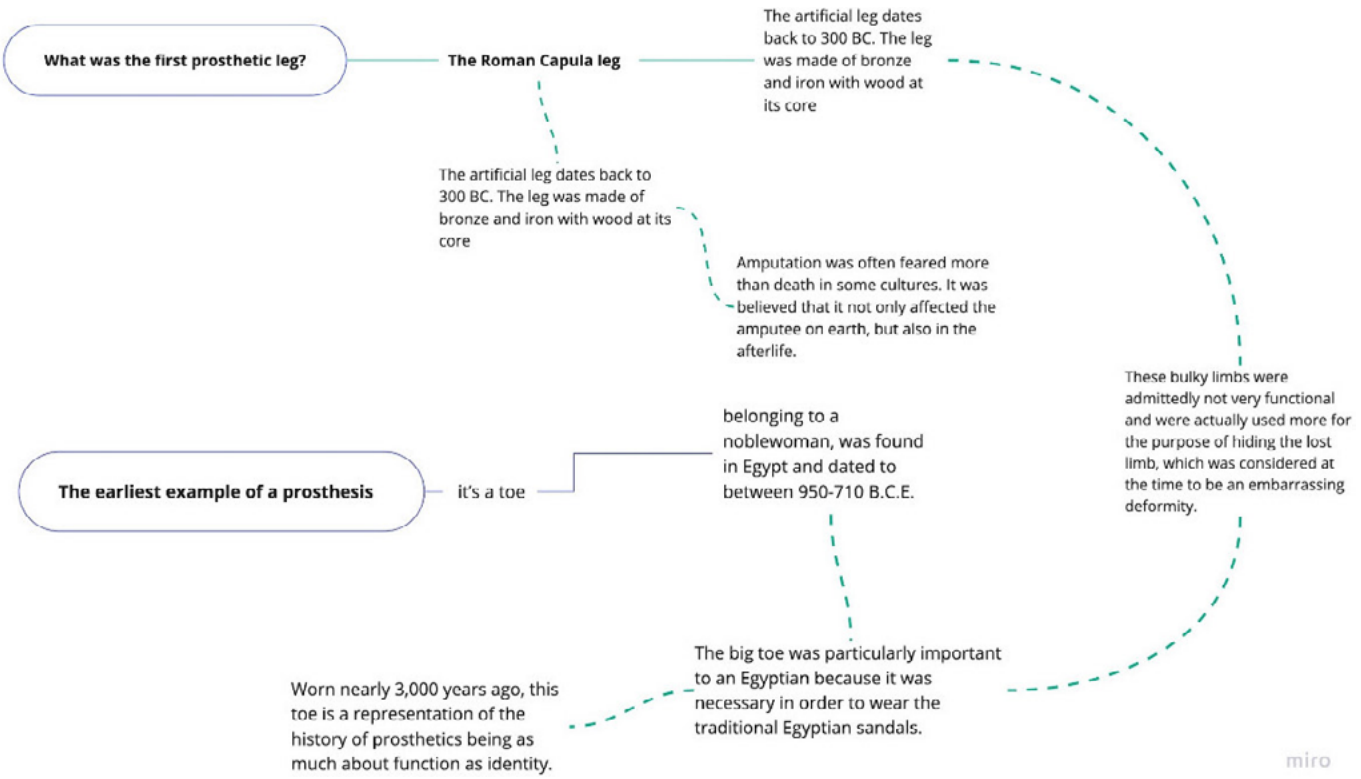


Figure 5. Online journal entry, research and analysis.

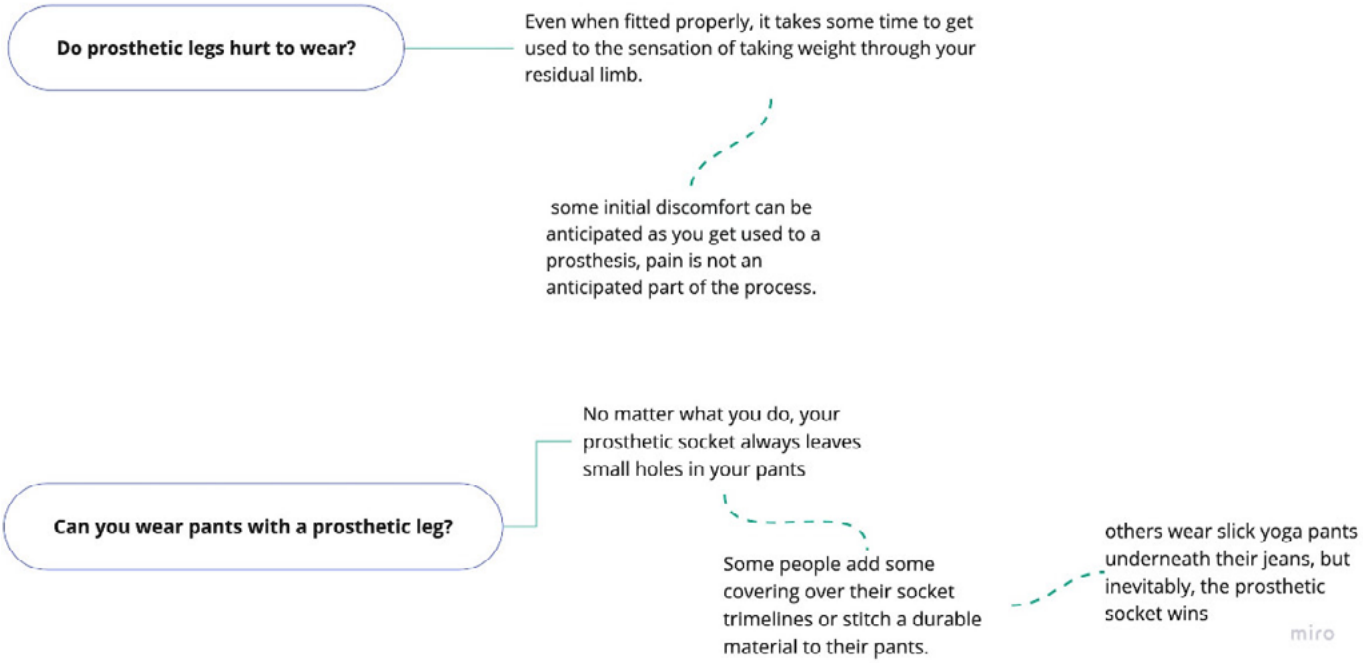


Figure 6. Online journal entry, research and analysis.

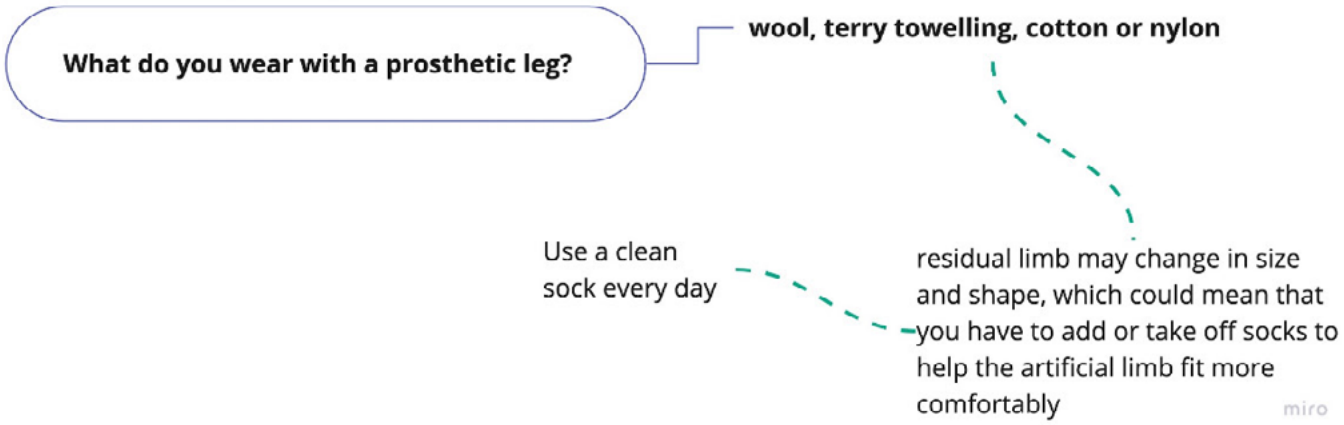


Figure 7. Online journal entry, *research and analysis*.

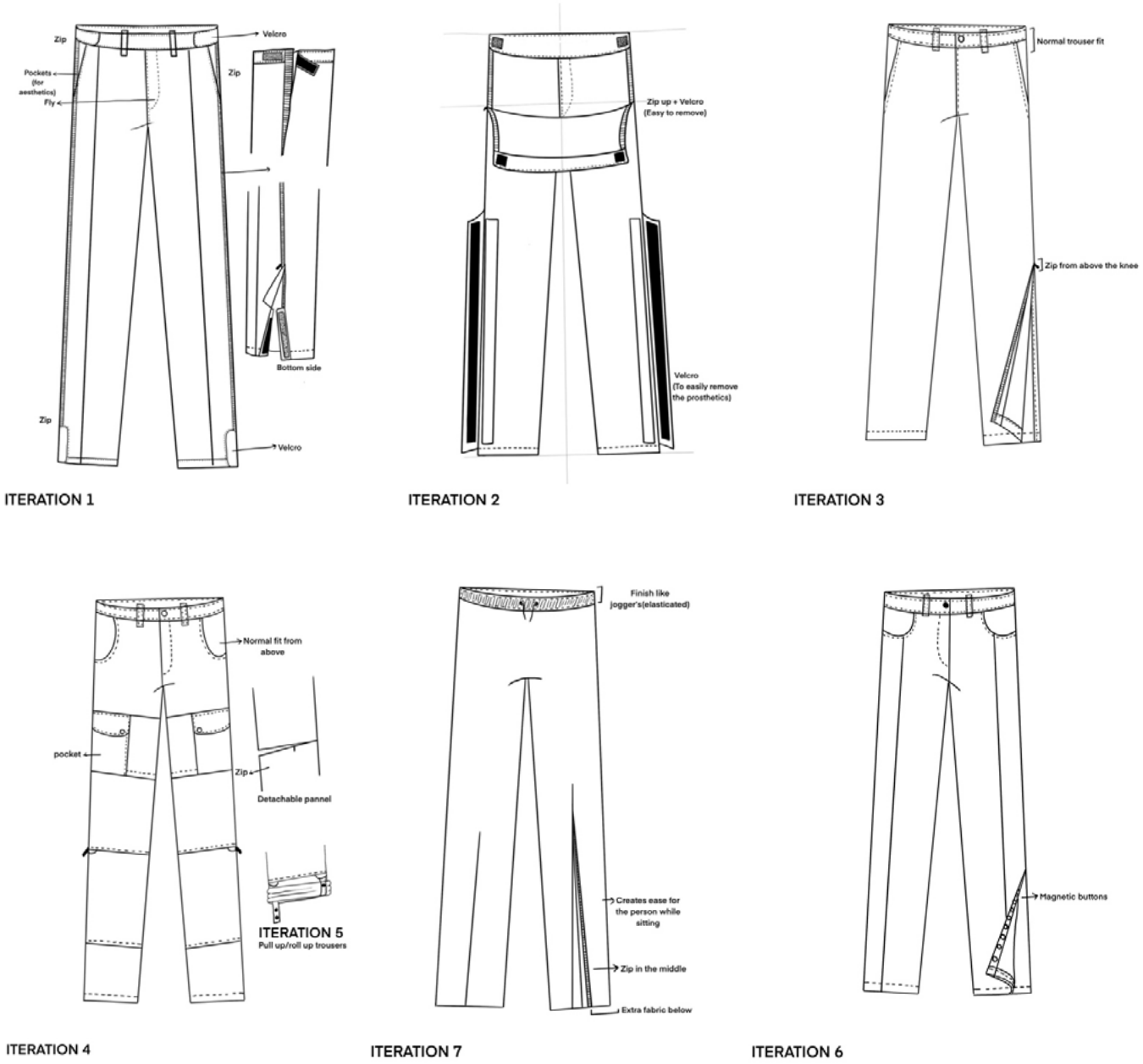


Figure 8. Finding a design solution – *iterations for the client.*

Student's self-reflection during the submission is quoted below:

> "Understanding body as a totality and understanding someone else's body was an interesting task to take on. From developing a basic framework in my head of what really is, the perspective did not remain constant at even one stage of the brief. My opinion kept shaping and changing from day to day. This brief was not just intuitive and sensitive towards certain topics but also helped us understand that vulnerability lies within us all. It was the most draining task to understand what really could be helpful for a man with prosthetic leg and how I could make his life simpler and also not make him feel excluded. I have gained so much through the course of this project and certainly think that my technical skills have improved because of making the final garment during this brief."

3.4 Student Survey and Feedback on the Brief

A survey was conducted with the L6 (final year) students who had attempted the brief when they were in L4. This cohort is now in their final graduation term (doing their MDP or Major design project) and now as independent learners they were asked to reflect on the brief. This was to assess if according to them the brief had been relevant, created value and if it is helping them approach design from a more robust perspective right now. It is pertinent to note here that while this brief was on, this cohort had struggled with the amount of primary and secondary research and data they had needed to collect in order to build their context. Keeping in mind this point, question 4 was added so one could get feedback on the brief within the curriculum as a whole and to assess if the students had changed their mind as they have become more 'seasoned designers'.

The questionnaire was as below:

1. Did you find the approach of body and diversity brief to be a problem-solving approach?
2. As a designer do you think the above approach equipped you with building a competence that would encourage you to take on difficult design problems in the future?
3. Did you find it challenging to engage with the context building because it required you to go in-depth into research and client engagement?
4. If you think this brief developed good understanding and wholesome learning and should stay as a part of the course, could you please elaborate on that as well?

Some of the replies received are presented below:

1. Did you find the approach of body and diversity brief to be a problem-solving approach?

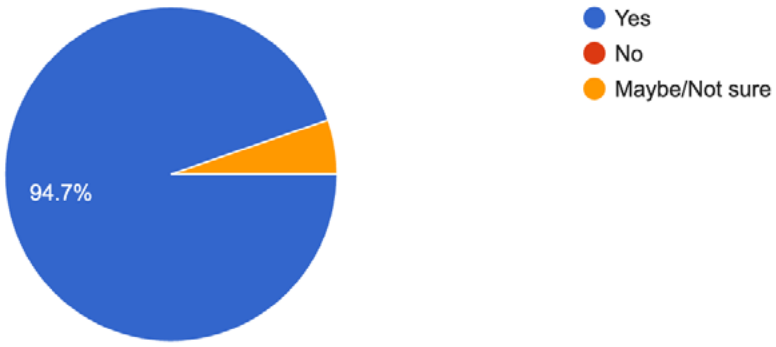


Figure 9. Gathered result from question 1.

2. As a designer do you think the above approach equipped you with building a competence that would encourage you to take on difficult design problems in the future?

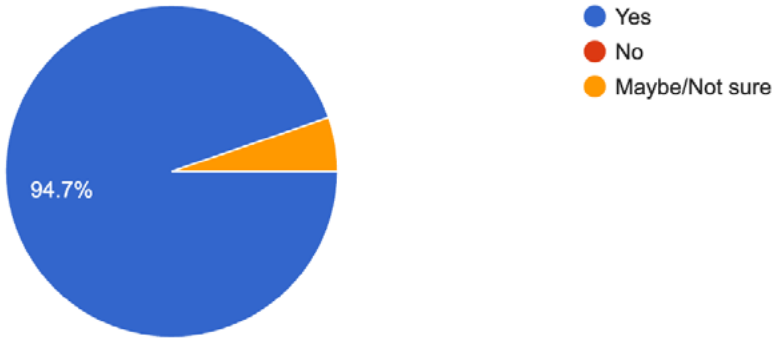


Figure 10. Gathered result from question 2.

3. Did you find it challenging to engage with the context building because it required you to go in-depth into research and client engagement?

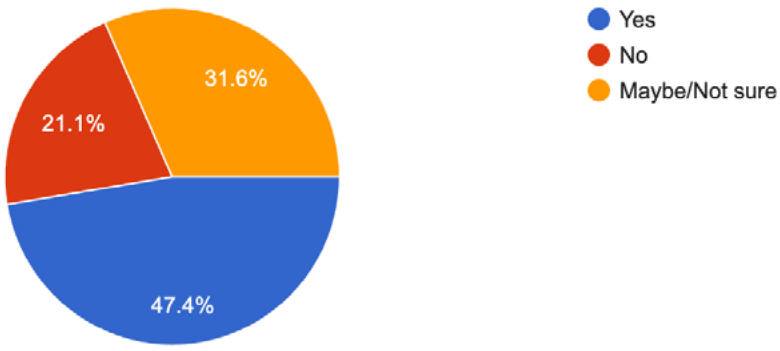


Figure 11. Gathered result from question 3.

4. If you think this brief developed good understanding and wholesome learning and should stay as a part of the course, could you please elaborate on that as well?

It is a good introduction to working with a real client for the first time in the course I, it is important since as designers, we have to cater to problems in the future and provide with what's needed.

Because by understanding bodies beyond the limited standard size helped me learn various design approach and solutions and also challenged me to create designs that are different, multi-functional and body inclusive. It also helped me understand the customer needs and how a garment could be playful yet functional for the wearer making their lives easier. I think it's important to know and learn about body/form, to be able to understand a garment as well or how one fabric falls different on different bodies that's were the learning started.

Figure 12. Gathered result from question 4 (contd).

I think it is necessary to know problem solving as a design practitioner and also the understanding of body is of the uttermost importance and should be there since L4. We see different boy types, structures daily but are not able to very exactly imagine garments on it because of the in-depth understanding of the body. Through my understanding of briefs in the past 2 years, I feel that the continuous sketching and understanding of body is important, for all briefs that line up after, even while the internship period. It makes planning the garment easier not just in terms of openings, closures, problem solving but most importantly understanding that every client is different.

As a designer we all have responsibilities. We are problem solvers but for a while fashion designers are only thought of beautification and making pretty dresses. But the responsibility reaches far beyond into having contributions in all sectors of life.

I didn't knew the right meaning of problem solving as a designer before this brief came up. It changed the way i used to think about clothing. A type of clothing which can actually make a difference in someone's life. I understood about consumer market and diversity of people who are in need for adaptive clothing. Interacting with a client was the major part of understanding someone's personal need that we wont get or understand through secondary research. Even the conceptual based designs became easy when I discussed with the client which helped me to get through the designing phase conceptually. Technical part was a bit difficult because making a shirt was a big task. Execution became quite easy because my ideology and purpose was clear.

Figure 13. Gathered result from question 4 (contd).

These type of projects are also important for fashion students because it help student to understand what people need from their clothes and help in practical application of what they have learnt. These projects help students to create garments that not only look good but also feel good to wear, comfort, better at problem solving thinking.

it's a requirement to understand how to do a project based on client needs as this will also widen the understanding and learning to working with clients as well as opening our minds and opportunity in adaptive clothing

As a fashion design student it is really important to understand a human body, the basis of our design and body and diversity as a project really immersed us into the understanding of it and creating design solutions to make it easier and accepted by the diversity in bodies around. To constantly evolve and upgrade these solutions.

I think a lot of learning about body and adaptive clothing begins with the help of this project.
A crucial part of this project is research which gets stronger in this project.
Introduction to clients and how to study them also adds to the learning which we don't do in other projects.

Figure 14. Gathered result from question 4.

4. Conclusion

This brief not only adds layers of complexity to students' thought processes but also cultivates empathy for diverse human experiences. It contributes to the creation of an inclusive environment within the academic setting and prepares students to tackle clothing challenges with a human-centric approach as future design practitioners and entrepreneurs. By expanding the scope of fashion education to encompass societal living and holistic design solutions, we can equip future designers with the tools and insights necessary to create meaningful and impactful contributions to the industry. Ultimately, fashion design should strive to bridge the gap between aesthetics and functionality, recognizing that clothing is not merely about "dressing up" but also about facilitating self-expression, comfort, and accessibility for all individuals.

As one of the student's reflection during the feedback survey (below) evidences the same:

> "Adaptive clothing is something that I got to know of from this project only. It has made me think of my future choice in this industry, which helped me to think how many people are suffering and still people working with fashion or clothing are yet not engaged enough with it. It is also about choice what a person makes and to continue with something that could mean everything to someone at a point of time. It is an emotional and strongest brief at the same time because you get to understand what the person has been through and how he is standing tough and dealing with those things both physically and mentally as well as spiritually. Every era that was taught and discussed at that time made me think about how a body figure that we know from Vitruvian man is now so diverse that we are now standing between GenZ and millennials. It's a lot to study and a very vast topic to undertand body and diversity."

There is a pressing need for fashion courses to place greater emphasis on diversity and inclusion as well as rethinking gender norms, both in terms of representation and design philosophy. This involves challenging existing norms and expanding the definition of beauty to encompass a wider range of identities and experiences. By doing so, fashion education can evolve into a more inclusive and equitable space that celebrates the richness of human diversity. "This also requires a shift in thinking from taking away from our world, community, economy, and environment to giving to it" (Doyon, 2016, as cited in Sala, 2016).

As educators and mentors in the field of fashion, it is incumbent upon us to integrate these critical conversations into our curricula and projects. By doing so, we can provide students with a more comprehensive understanding of the multifaceted nature of design and the role of fashion within it. It is essential for students to grasp that fashion encompasses more than just clothing; it is an expression of identity and inclusion that transcends gender, ability, and societal norms.
Through this exploration, the paper is attempting to illustrate how the incorporation of problem-solving approaches in fashion design education can stimulate alternative perspectives and nurture a more holistic understanding of the design process. If the aims and learning outcomes of the module state this is as a learning requirement, the approach of design pedagogy can cater to this existing need. Ultimately, this paper aims to contribute to the evolution of fashion education by advocating for a paradigm shift towards problem-solving-oriented pedagogy, thereby preparing future designers to meet the demands of an ever-evolving industry landscape.

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P/REFERENCES OF DESIGN

DESIGNING FUTURES: ASSESSING FUTURES CONSCIOUSNESS AND AI ATTITUDES IN AFRICAN DESIGN EDUCATION.

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KEYWORDS | FUTURES CONSCIOUSNESS, GENERATIVE AI, DESIGN CURRICULA, AFRICAN FUTURES

ABSTRACT | The COVID-19 pandemic has underscored the necessity for adaptable and innovative curricula in design education, particularly emphasising the integration of futures thinking to adeptly navigate the complexities of the modern era. This research, grounded in the South African design education landscape, investigates the confluence of futures consciousness and attitudes towards generative artificial intelligence (AI) among South African design educators. By leveraging the Futures Consciousness Scale and an adapted AI Attitudes scale, the study evaluates educators' preparedness to incorporate AI into their pedagogical practices, ensuring a balance between technological progression, cultural pertinence, and ethical considerations. Our findings reveal a nuanced understanding among educators of the complex systems shaping our world, coupled with a balanced anticipation of future possibilities. Notably, a statistically significant correlation was identified between educators' time perception and their positive attitudes towards AI, suggesting that a temporal understanding of past, present, and future influences receptiveness to AI in educational contexts. Despite the overall positive inclination towards AI as a driver for creativity and innovation, this enthusiasm is moderated by pronounced ethical concerns and a commitment to preserving cultural authenticity in design practices. This investigation enriches the dialogue surrounding the amalgamation of futures literacy and AI in design education, advocating for a curriculum that nurtures a forward-thinking mindset while sensitively navigating the socio-cultural nuances of the South African milieu. The insights garnered highlight the pivotal role of educator preparation in traversing the evolving design education landscape, advocating for the responsible harnessing of AI to cultivate an educational ecosystem that is both future-oriented and deeply rooted in cultural integrity.

1. Introduction

The evolution of education in Africa, particularly in the realm of design, is at a pivotal juncture, influenced by a rich historical tapestry and the pressing need for forward-thinking educational paradigms. The historical context of African education, marked by efforts to decolonise and localise curricula post-independence, sets the backdrop for our inquiry. However, the transition has been fraught with challenges, from pedagogical conflicts to resource constraints (Odoch Pido, 2014; Sawyerr, 2004). In South Africa, these issues are compounded by the legacy of apartheid, necessitating a nuanced approach to integrating new technologies and future-oriented thinking into design education (Heleta, 2018; Mampane et al., 2018; Mudaly, 2018). This research focuses on assessing futures consciousness and attitudes towards generative artificial intelligence (AI) among design educators in South Africa, a region with a unique educational landscape shaped by its colonial and apartheid past. Futures consciousness is crucial for nurturing the ability to anticipate and shape future scenarios (Lalot, Ahvenharju, Minkkinen, & Wensing, 2020), while generative AI represents a transformative force in creative disciplines, offering new possibilities for innovation and collaboration (Ooi et al., 2023).

The study aims to bridge the gap in understanding how futures consciousness and technological readiness intersect in the context of African design education. By exploring the attitudes of design educators towards the integration of generative AI into their teaching and design practices, we seek to uncover the potential for fostering a more adaptive and innovative educational environment. Our research is driven by the following objectives: to assess the level of futures consciousness among a sample of design educators in South Africa, to explore their attitudes towards the use and potential of generative AI in design education, and to understand how cultural and contextual relevance influence these attitudes. This exploration is set against the broader goal of enhancing educational practices to better prepare students for the complexities of the future.

The Futures Consciousness Scale (Lalot, Ahvenharju, & Minkkinen, 2021; Lalot et al., 2020) and an adapted AI attitudes scale (Schepman & Rodway, 2020) were used to gather data from design educators, providing a comprehensive view of their perspectives and readiness to embrace these concepts. In acknowledging the critical perspectives on technology integration, we emphasise the importance of cultural relevance and ethical considerations, ensuring that the adoption of generative AI in design education aligns with the principles of decolonisation and inclusivity (Adams, 2021; Mohamed, Png, & Isaac, 2020)). As we explore the intricacies of futures consciousness and AI attitudes, this study serves as a foundational step towards understanding the dynamic interplay between technology, education, and cultural context in shaping the future of design education in South Africa.

The significance of this study lies in its potential to ascertain the current state of educator readiness to incorporate AI into design education, based on their futures consciousness. By identifying key concerns and strengths, the study can offer insights into how design education in Africa can evolve to meet the demands of the future. By integrating futures consciousness and generative AI into the curriculum, educators can equip students with the skills and mindset needed to navigate and shape an increasingly complex world.

1.1 From Futures Consciousness to Futures Literacy

In the evolving landscape of design education, understanding the future is imperative. Futures consciousness refers to an awareness and understanding of the myriad possibilities that the future holds, serving as a foundational layer for perceiving, imagining, and understanding various future scenarios (Ahvenharju, Minkkinen, & Lalot, 2018). The five dimensions of future consciousness detailed in Figure 1—Time Perspective, Agency Beliefs, Openness to Alternatives, Systems Perception, and Concern for Others—encompass an individual's sense of efficacy and control over the future, optimism, capacity for critical thinking, tolerance of uncertainty, holistic and systemic thinking, eco-psychological self, and moral and communal considerations, all of which inform a person’s engagement with future possibilities (Ahvenharju, Lalot, Minkkinen, & Quiamzade, 2021).

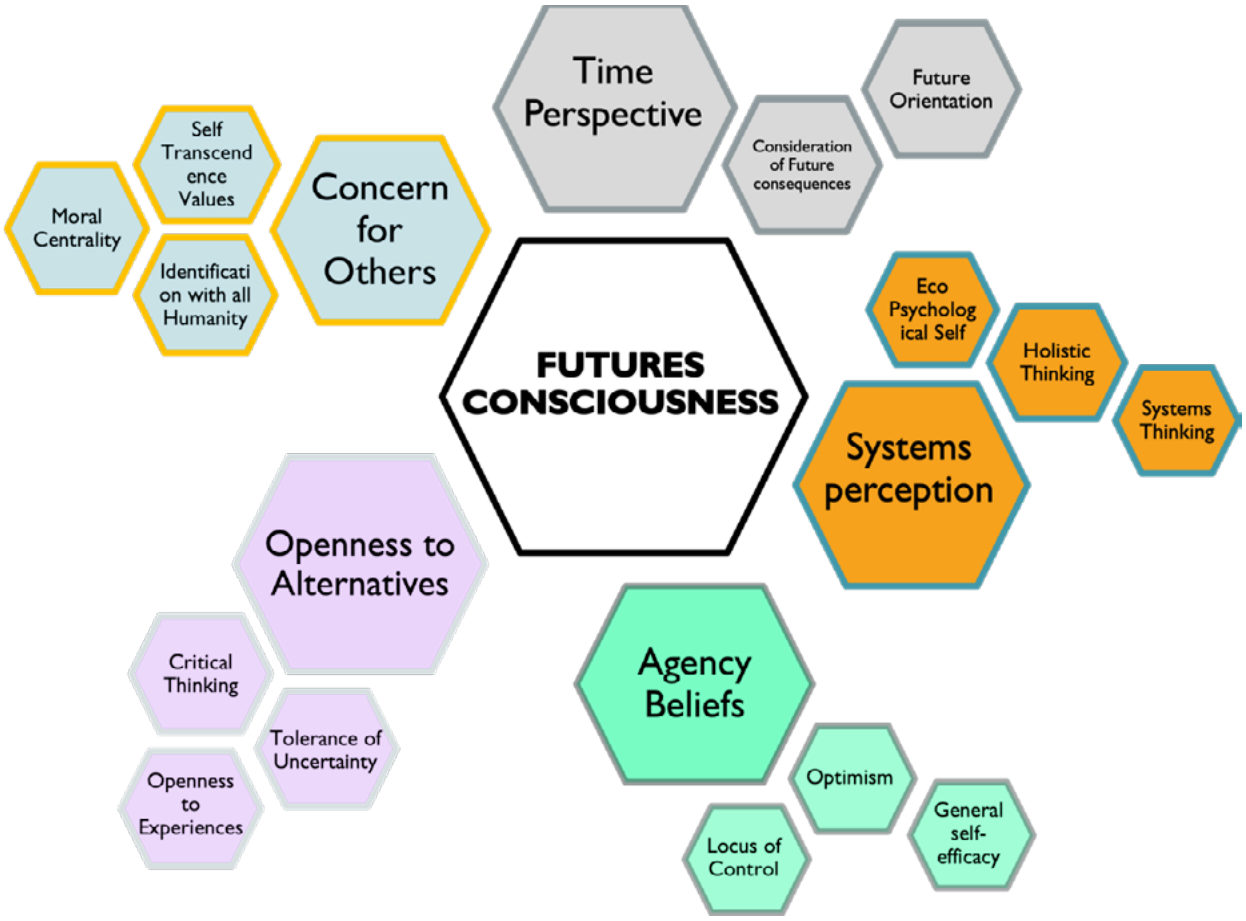


Figure 1. The five dimensions of futures consciousness (Finland Futures Research Centre, Ahvenharju et al., 2018).

Conversely, futures literacy builds upon futures consciousness, equipping individuals with the skills and methodologies to apply their orientation towards the future in practical decision-making and innovation, thus enhancing their ability to navigate and shape complex future contexts (Miller, 2015). Table 1 outlines the distinctions and overlaps between futures consciousness and futures literacy, highlighting their complementary roles. Understanding and engaging with future possibilities requires both, yet assessing futures literacy in educational contexts is challenging due to its broad and sometimes intangible skill set (Häggström & Schmidt, 2021; Mangnus, Oomen, Vervoort, & Hajer, 2021). Therefore, our study pivots toward exploring futures consciousness as a more accessible starting point for assessment in design education, using the Futures Consciousness Scale as our initial measurement tool (Lalot et al., 2021).

Table 1: Comparison of Futures Consciousness and Futures Literacy (from Ahvenharju et al., 2021, 2018; Facer & Sriprakash, 2021; Mangnus et al., 2021; Miller, 2015).

Aspect	Futures Consciousness	Futures Literacy	Similarities
Definition	Refers to an individual's awareness, attitude, and approach towards the future.	Involves the skills, knowledge, and abilities to effectively use information about the future.	Both relate to how people engage with and think about the future.
Focus	Emphasises psychological and cognitive dimensions, including beliefs, values, and emotions related to the future.	Focuses on the ability to analyse, interpret, and apply future-related information and scenarios.	Aim to enhance understanding and interaction with future possibilities.
Key Components	Time perspective, agency, open-mindedness, concern for the future, and participation in shaping the future.	Critical thinking, anticipation and scenario development, and the ability to apply these in decision-making.	Involve elements of forward-thinking and anticipation.
Educational Approach	Often developed through reflective practices, mindfulness, and emotional intelligence training.	Developed through educational programs that teach foresight methodologies, futures studies, and scenario planning.	Both can be cultivated through structured learning and personal development.
Application	Used to foster personal growth, resilience, and adaptability.	Employed in strategic planning, policymaking, and innovation to navigate future challenges and opportunities.	Both can enhance individual and organisational capacity to face future challenges.
Outcome	Enhanced personal well-being, a sense of purpose, and proactive engagement with the future.	Improved decision-making, innovation, and strategic outcomes by incorporating future insights.	Lead to more informed and considered approaches to future possibilities and challenges.

In African design education, the integration of futures consciousness and literacy is essential. Africa's journey through issues like climate change, rapid urbanisation, and socio-economic disparities calls for a forward-thinking approach to problem-solving and strategic planning (Cobbinah, Erdiaw-Kwasie, & Amoateng, 2015) Design educators have a responsibility to prepare students to create solutions that are not only innovative but also culturally and environmentally sustainable . By fostering futures consciousness, educators can encourage students to think beyond traditional design paradigms and consider long-term impacts and ethical implications of their designs. In the context of African design education, where unique socio-economic and environmental challenges prevail, such an approach is not just beneficial but necessary. The five dimensions of futures consciousness can serve as guiding principles for educators, helping to instil a holistic and forward-looking mindset in students. This is particularly relevant as they devise innovative and culturally relevant solutions to address issues like climate change, rapid urbanisation, and socio-economic disparities.

By prioritising the assessment of futures consciousness, we establish a baseline of future-oriented thinking among educators, which is a critical step toward enhancing futures literacy and fostering culturally and environmentally sustainable design solutions. The preparedness of educators is key to this integration, with support required to relate futures literacy to classroom practices effectively (Bateman, 2012; Slaughter Richard, 2008). Recognising futures consciousness as foundational allows for an inclusive development of futures literacy, which encompasses a wide range of adaptable methodologies. This approach ensures that futures literacy is informed by and respects diverse cultural landscapes, promoting a bottom-up approach where visions for the future are reflective of internal cultural landscapes, thus reducing the risk of cultural recolonisation.

1.2 AI and Design in Africa

That generative AI has had an impact on the design industry is undisputed (De Peuter, Oulasvirta, & Kaski, 2023, p. 85). These new tools are reshaping the workplace in many difference areas (Edberg & Beck, 2020). Digital design, a broad field that can be especially impacted by AI, includes professions that create and package graphic solutions used in “websites, mobile apps, video games, animation, and digital marketing materials” (Forsgren & Schröder, 2023, p. 6). The value to this industry of AI tools include time-saving, generating more options (such as colour palettes or layouts), possibly more creativity and reducing errors. Efficiency and innovation can be fostered using AI tools. Mundane and repetitive parts of the design process can be automated by AI, streamlining the process (Forsgren & Schröder, 2023, pp. 41–42). In fact, humans cannot compete in terms of speed of processing, prediction and project execution with automated systems or machine learning (Matthews, Shannon, & Roxburgh, 2023, p. 368).

While a variety of graphic design software was the first tool that revolutionised the creative processes, these increasingly include AI tools. In their 2020 study in the field of digital design, Edberg and Beck concluded that “AI has affected the nature of the digital design profession”, indicating a subtle yet significant shift in the design landscape that many practitioners may not fully recognise. Most designers, whether they realise it or not, engage with AI to some extent in their work, affecting the way they approach design problems (Edberg & Beck, 2020; Forsgren & Schröder, 2023, p. 41). This pervasive integration of AI invites scrutiny on its impact on employment and the potential for a homogenisation of design creativity (Forsgren & Schröder, 2023, p. 41).

Moreover, the integration of AI in the design process inherently involves the risk of perpetuating existing biases. Whether intentional or not, the issue of human bias and prejudice becomes part of the algorithms designed for AI, as seen in ”racist software” (Matthews et al., 2023, p. 374) . This highlights that a computer “cannot easily” develop a context appropriate response (Matthews et al., 2023, p. 372) and thus decolonialising AI is a concern amongst African design professionals and educators. The literature and discourse on decolonising AI emphasise the critical need to integrate decolonial theories to mitigate the complex risks AI technologies pose, particularly their potential to exacerbate vulnerabilities among marginalised groups.

Acknowledging these issues, Mohamed, Png, & Isaac (2020) advocate for a critical science approach that incorporates post-colonial and decolonial insights into AI development. They argue for the adoption of critical technical practices that are self-reflexive, recognise power imbalances, and incorporate learning from marginalised communities. These practices are aimed at reshaping educational methods to ensure AI development aligns with ethical standards and community-centric values.

At the heart of this new approach is a commitment to epistemic disobedience and border thinking, as conceptualised by Mignolo (2011). This involves challenging the dominance of Western knowledge systems and fostering a plurality of understandings that embrace the diverse "borderlands" of culture, thought, and knowledge production. By doing so, AI design can subvert traditional power dynamics and contribute to a design landscape that is not only inclusive and equitable but also rich with a multiplicity of socio-political, ecological, and economic perspectives.

This holistic view extends to the educational sector as well, where the decolonisation of AI is seen as a vital part of curriculum development. Zembylas (2023) underscores the importance of decolonial educational strategies that promote algorithmic fairness and counter digital neo-colonialism. The objective is to design and use AI in ways that foster decolonial futures and support equitable and just outcomes, particularly for communities that have been historically marginalised by colonial structures (Adams, 2021). Thus, the conversation about AI in design is not just about efficiency and innovation, but also about ensuring that these advancements contribute positively to all sections of society.

2. Research Methods

2.1 Participants

The study was conducted within the Applied Design department of a South African University of Technology (UoT). Participants were recruited through an electronic survey distributed to the department's educators, with an aim to capture a diverse representation of experiences and viewpoints. The survey reached 26 participants, which is approximately 65% of the department's faculty, ensuring a substantive sample for analysis. Participant demographics were recorded - encompassing gender, age, teaching experience, educational qualifications, and linguistic and racial background - to understand the diversity within the responses.

2.2 Instrumentation

The research instrument was a single, comprehensive, electronic questionnaire that amalgamated two scales and incorporated open-ended questions to capture qualitative data.

- **Futures Consciousness Scale (FCS):** The Revised Futures Consciousness Scale was used to measure the educators' future-oriented mindset across five dimensions. The scale is designed to be answered on a Likert scale, providing a quantifiable measure of each dimension of futures consciousness.
- **Adapted General Attitudes towards Artificial Intelligence Scale (GAAIS):** The GAAIS was adapted to specifically address attitudes toward generative AI within the design context. This adaptation included items that evaluate the perceived impact of generative AI on creativity, innovation, and educational practices in the South African design context.

The questionnaire also contained three open-ended questions aimed at eliciting qualitative insights into the participants' willingness to integrate generative AI into their curriculum, the perceived benefits of such integration, and their main concerns.

Data Analysis

Quantitative responses were subjected to statistical analysis to discern patterns and correlations within the data. Descriptive statistics illuminated the central tendencies and dispersions of the Likert-scale responses. Kendall’s Tau correlation coefficient (Salkind, 2007) was employed to identify relationships within the scales' dimensions and between futures consciousness and attitudes towards AI. Statistical software was used.

Qualitative responses from the open-ended questions were analysed thematically to extract deeper insights into the participants' perspectives, enriching the quantitative findings and providing a more nuanced understanding of the educators' stances.

2.3 Ethical Considerations

Ethical clearance for the study was obtained from the university's ethics committee, ensuring that the research adhered to the highest standards of academic integrity. Participants were informed about the purpose of the study, their right to confidentiality, and the voluntary nature of their participation. Informed consent was acquired electronically before the commencement of the questionnaire.

2.4 Limitations

Acknowledging the limitations inherent to electronic surveys and self-report measures, concerted efforts were made to mitigate bias and ensure the reliability of the data. To reduce self-selection bias, the study used targeted reminders to encourage a broad spectrum of participants to respond (Christensen et al., 2015), thereby aiming to secure a representative sample of the population. Despite these efforts, the potential for self-selection bias persists, as individuals who are more engaged or have stronger opinions may be more inclined to participate.

The study's generalisability is limited, as the participant pool was drawn from a single department of Applied Design, which may not reflect the diversity of design education settings across South Africa or other contexts. The findings, therefore, are not overstated and are presented as exploratory. This study serves as an initial foray into understanding the futures consciousness and AI attitudes within this specific educational context and provides a basis for future research that could expand to broader populations and regions.

3. Results

3.1 Futures Consciousness

In examining the data from our study, a pattern emerges regarding the participants' outlook on their influence over and understanding of the future. The dimension where participants rated themselves highest was *Systems Perception*, with a mean score of 4.19, indicating a strong collective grasp of the interconnectedness of various systems. On the other end, *Agency Beliefs* received the lowest mean rating at 3.44, suggesting a more moderate view of their ability to shape future outcomes.

The median scores in most dimensions lean higher than the averages, particularly in *Time Perspective*, *Openness to Alternatives*, and *Systems Perception*, hinting at an optimistic self-assessment among most participants in these areas. This is clearly visible in Table 2.

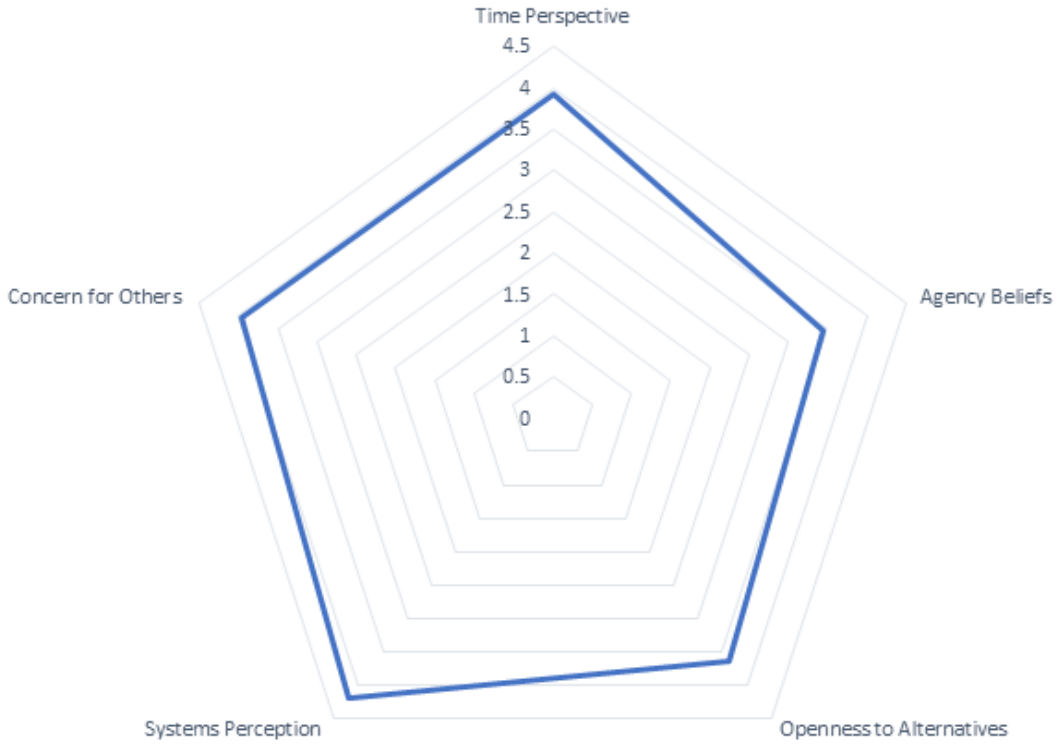


Figure 2. The mean results for the five dimensions of futures consciousness.

The standard deviation is relatively small across all dimensions, but it is narrowest in *Openness to Alternatives* (0.55), pointing to a high level of agreement in participants' willingness to consider different future possibilities. Although *Time Perspective* shows the widest spread in scores, its strong mean and median suggest that participants consistently consider the past, present, and future in their thinking. The similarity in scores for *Concern for Others* and *Openness to Alternatives* suggests a group that equally values the impact of their decisions on others and is open to new ideas.

Table 2. The mean, median and std deviation of results for the five dimensions of futures consciousness.

	Time Perspective	Agency Beliefs	Openness to Alternatives	Systems Perception	Concern for Others
MEAN	3,91	3,44	3,63	4,19	3,96
MEDIAN	4,00	3,50	3,75	4,38	4,00
STANDARD DEVIATION	0,80	0,69	0,55	0,70	0,61

Overall, the findings indicate a group with a shared and well-rounded perspective on futures consciousness, particularly marked by an insightful understanding of complex systems and a somewhat restrained belief in personal or collective agency.

3.2 AI Attitudes

This section presents responses from revised AI attitudes scale. The scale measured the perceptions of generative AI in the design field, particularly within the South African context. The responses are categorised into five options: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree. The data was analysed to understand the participants' attitudes towards the use of generative AI in design, its ethical implications, its impact on creativity and innovation, and concerns about cultural sensitivity and privacy.



Figure 3. Visualisation of Positive Attitudes to AI results.

The dataset (figure 3) offers a perspective on the South African design community's views towards generative AI, characterised by a mix of optimism and caution. Ethical worries are pronounced, with 30.8% expressing 'Disagree' and 46.2% 'Neutral' on the ethical deployment of generative AI by design organisations. The responses show a divided stance on employing generative AI for routine tasks, with responses spread evenly across all options, indicating no definitive preference.

Nonetheless, there is a noticeable optimism regarding generative AI's capacity to enhance creativity and innovation, with 38.5% 'Agreeing' and 11.5% 'Strongly Agreeing'. The capabilities of generative AI are particularly impressive to many, as evidenced by the highest 'Strongly Agree' rate (38.5%) in this aspect.

There's a robust interest in integrating generative AI into design practice and education, with both 'Agree' and 'Strongly Agree' garnering 30.8% each for practice integration. Similarly, positive responses are seen for its potential to improve educational outcomes (42.3% 'Agree', 19.2% 'Strongly Agree') and to stimulate development (30.8% 'Agree', 26.9% 'Strongly Agree').

Despite varied opinions on AI's efficiency for routine tasks, with 'Neutral' (34.6%) being the most common response, there is a belief in its beneficial applications in education (30.8% 'Agree', 19.2% 'Strongly Agree'). The responses are split on AI's capability to outperform humans in creative tasks, yet there is a cautious optimism about its wider benefits, with 'Neutral' (38.5%) and 'Strongly Agree' (23.1%) being significant. The eagerness to use generative AI in teaching is evident, with 26.9% 'Agreeing' and another 26.9% 'Strongly Agreeing', showing a readiness to embrace AI tools in educational settings.

In essence, the data depicts a community that is cautiously optimistic about the role of generative AI in fostering design creativity, innovation, and education, albeit with reservations about ethical issues and mixed views on its efficiency and creative edge.

Figure 4 depicts the sample’s concerns about integrating generative AI, with a focus on cultural and ethical implications. A significant portion of respondents, 57.7% ('Agree') and 15.4% ('Strongly Agree'), express apprehension that the unique cultural aspects of South African design might be lost with the increasing use of generative AI. Concerns about privacy and surveillance issues in design education due to generative AI are also prominent, with 50% strongly agreeing this could be a risk.

The fear that generative AI may not fully comprehend the cultural context of South African design is shared by 26.9% ('Agree') and 53.8% ('Strongly Agree'), indicating a widespread concern. Similarly, 50% ('Agree') and 23.1% ('Strongly Agree') find the use of generative AI in design concerning due to potential cultural insensitivity, suggesting significant apprehension.

The possibility that generative AI might overshadow traditional design methods, integral to cultural identity, is another major concern, with 57.7% ('Agree') and 23.1% ('Strongly Agree') reflecting a majority viewpoint. Ethical considerations are also paramount, with 34.6% ('Agree') and 53.8% ('Strongly Agree') wary of uncritical generative AI use leading to unethical design practices.

Additionally, there is unease about relying on generative AI for creative aspects of design, with 30.8% ('Agree') and 26.9% ('Strongly Agree') showing varied levels of concern, while 42.3% remain neutral.

In summary, the data highlights significant apprehensions about the impact of generative AI on cultural integrity, ethical practices, and traditional design methods. The potential for privacy and surveillance issues is notably alarming to half of the respondents, with broad concern also about generative AI's ability to respect and understand the unique cultural context of South African design.

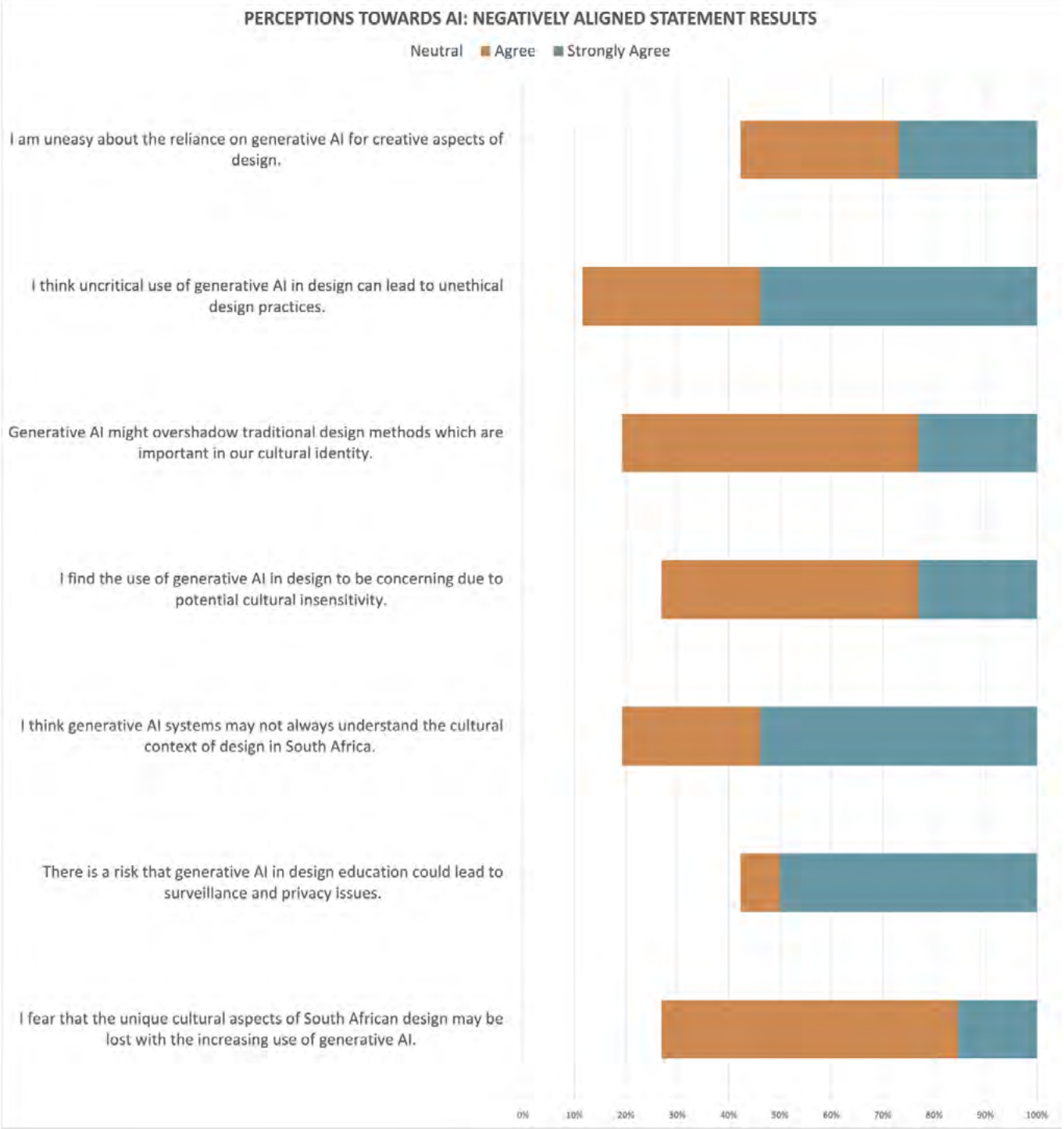


Figure 4. Visualisation of Negative Perceptions to AI results.

3.3 Correlation Between Quantitative Results

The Kendall's Tau correlation (Table 3) analysis conducted on the survey data from design educators revealed significant and meaningful relationships, underscored by confidence intervals that affirm the robustness of these findings. A significant positive correlation emerged between 'Systems Perception' and 'Time Perspective' (Tau = 0.461, with a 95% CI of 0.170 to 0.752, p = 0.003), suggesting a strong association between a comprehensive time perspective and an acute awareness of systemic interrelations. Correspondingly, 'Openness to Alternatives' showed a notable positive correlation with 'Agency Beliefs' (Tau = 0.475, with a 95% CI of 0.247 to 0.704, p = 0.002), indicating that educators who are more receptive to alternative ideas also tend to hold more potent beliefs in their efficacy to effect change. Moreover, a positive relationship was identified between 'Time Perspective' and 'POSITIVE' attitudes towards AI (Tau = 0.420, with a 95% CI of 0.178 to 0.663, p = 0.005), linking a forward-looking perspective with a propensity towards embracing AI in design education. These statistically significant correlations, bolstered by confidence intervals that exclude zero, provide a compelling narrative about the orientations of design educators, while also laying a foundation for subsequent studies to build upon and explore.

Table 3. Correlation of results for the five dimensions of futures consciousness and positive and negative attitudes toward generative AI in design.

Correlation

Kendall's Tau Correlations

Variable		Time Perspective	Agency Beliefs	Openness to Alternatives	Systems Perception	Concern for Others	POSITIVE	NEGATIVE
1. Time Perspective	Kendall's Tau B	—						
	p-value	—						
	Upper 95% CI	—						
	Lower 95% CI	—						
2. Agency Beliefs	Kendall's Tau B	0.181	—					
	p-value	0.231	—					
	Upper 95% CI	0.537	—					
	Lower 95% CI	−0.175	—					
3. Openness to Alternatives	Kendall's Tau B	0.251	0.475**	—				
	p-value	0.105	0.002	—				
	Upper 95% CI	0.581	0.704	—				
	Lower 95% CI	−0.079	0.247	—				
4. Systems Perception	Kendall's Tau B	0.461**	0.163	0.260	—			
	p-value	0.003	0.279	0.092	—			
	Upper 95% CI	0.752	0.489	0.571	—			
	Lower 95% CI	0.170	−0.162	−0.051	—			
5. Concern for Others	Kendall's Tau B	0.291	−0.129	0.032	0.258	—		
	p-value	0.057	0.392	0.838	0.090	—		
	Upper 95% CI	0.594	0.230	0.335	0.578	—		
	Lower 95% CI	−0.012	−0.488	−0.272	−0.061	—		
6. POSITIVE	Kendall's Tau B	0.420**	0.026	0.274	0.299*	0.056	—	
	p-value	0.005	0.858	0.068	0.044	0.703	—	
	Upper 95% CI	0.663	0.286	0.563	0.594	0.335	—	
	Lower 95% CI	0.178	−0.233	−0.015	0.003	−0.223	—	
7. NEGATIVE	Kendall's Tau B	0.184	0.110	0.055	0.031	0.162	0.121	—
	p-value	0.223	0.459	0.717	0.839	0.280	0.409	—
	Upper 95% CI	0.465	0.363	0.315	0.342	0.464	0.403	—
	Lower 95% CI	−0.097	−0.142	−0.205	−0.281	−0.139	−0.162	—

* p < .05, ** p < .01, *** p < .001

3.4 Qualitative Responses

The questionnaire asked three open-ended questions, and these reflect the perspectives of educators in the South African design education environment on three interrelated aspects: factors influencing their willingness to integrate generative AI into the curriculum, main concerns regarding the use of generative AI, and potential benefits of its integration. Across these responses, several themes emerged (Figure 5), encapsulating the complexities and nuances of introducing AI technologies into educational practices.

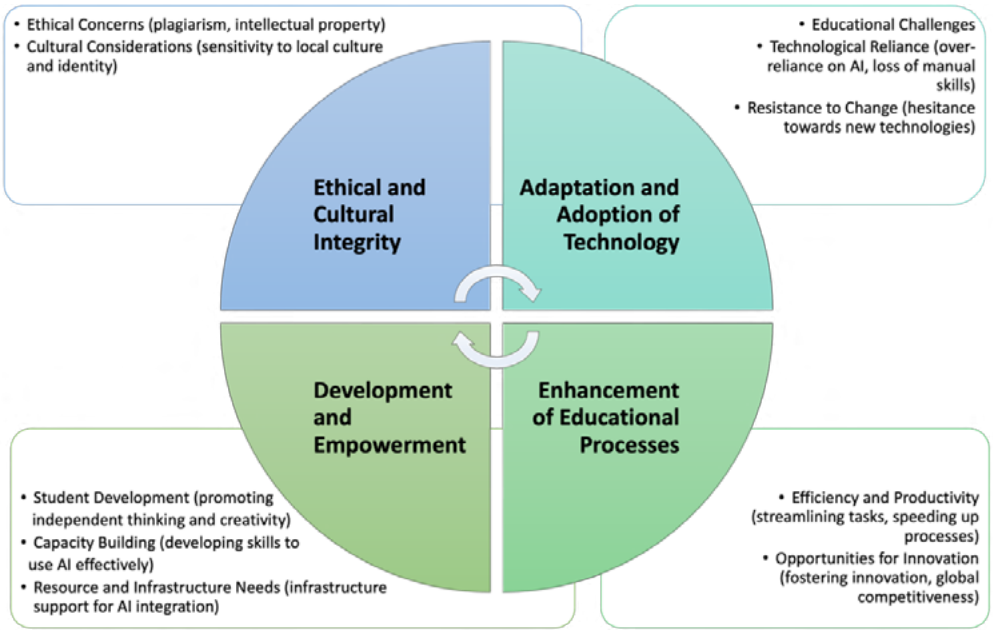


Figure 5. Considerations for introducing AI technologies into educational practices.

In the theme of *Ethical and Cultural Integrity*, educators express significant ethical concerns. Issues such as plagiarism and the safeguarding of intellectual property rights are at the forefront of the discourse. For instance, Participant 4 voices a critical perspective on the potential misuse of AI, underscoring the ethical dilemma with "Ethics in the use of/incorporation of the work of other designers." This concern is echoed by Participant 17, who stresses the systemic failures in the current educational milieu that might be exacerbated by AI without careful implementation. Simultaneously, an awareness of cultural considerations is evident. Participants are mindful of the need for generative AI to be sensitive to local culture and identity. Participant 24 articulates this by emphasising the need to "Guard against losing human touch that identifies us as South African," reflecting a desire to maintain the unique cultural fabric in the face of homogenising technologies.

Adaptation and Adoption of Technology is another overarching theme, where educational challenges such as updating curricula and teaching methods are considered critical. Participant 5 points out the risk of educational systems falling behind due to not keeping up with AI advancements. Further, technological reliance is a subtheme highlighted by Participant 15's concern about "Fear and not understanding the fundamental technology behind generative AI," illustrating the anxiety over an over-reliance on AI that may diminish manual skills and critical thinking. A resistance to change among academics was mentioned by Participant 19, who notes that "Academics hate change in particular certain groups more than others." This might point to inherent inertia in academic circles towards adopting new technologies. The potential for enhancement of educational processes is also recognised, for example participant 4 see generative AI as a means to eliminate mundane tasks for better use of time. This is tied to the prospect of opportunities for innovation, where generative AI could potentially keep South African design education on par with global standards, as per the hopes of Participant 26, who looks forward to "Integration that will keep us on a global par."

Lastly, the theme of *Development and Empowerment* the need for student development in the use of generative AI is noted, where fostering independent thinking and creativity is crucial, as Participant 7 fears the loss of originality and personal creativity. Capacity building is also underscored by Participant 31's mention of the "Lack of capacity building," indicating a need for skill development to effectively leverage AI. Resource and Infrastructure Needs, is also identified as a significant barrier by Participant 17, considering the existing "failed school education system."

These thematic insights reveal a complex and cautious optimism among educators, balancing the potential for technological empowerment with a commitment to maintaining ethical and cultural standards, and a cognisance of the significant systemic changes required for the successful integration of generative AI in design education.

4. Discussion

The integration of Artificial Intelligence (AI) into design education prompts a re-evaluation of pedagogical strategies and curriculum design to meet the demands of a rapidly evolving future. Our study has surfaced a key finding: the presence of a relationship between futures consciousness and attitudes toward AI among design educators, particularly within the dimension of time awareness. Educators with a deeper understanding of the interconnectedness of past, present, and future demonstrate more positive attitudes towards embracing AI. This correlation suggests that a nuanced perception of time might influence the adoption of future-oriented technologies.

Our investigation also reveals a general readiness among educators to integrate AI within design education, tempered by an understanding of the ethical considerations and a commitment to preserving cultural integrity, aligning with Adams (2021) concern for cultural integrity in technological adoption. This is also in line with Miller's (2015) notion of futures literacy, which emphasises the capacity to employ foresight and innovation within the context of one's culture.

However, our research also highlights critical areas requiring attention. The ability of educators to critically evaluate AI outputs for potential biases underscores the need for robust training programs focusing on AI ethics, culturally inclusive content, and the strategic use of AI in preserving cultural identity, aligning with Mohamed, Png, & Isaac's (2020) advocacy for decolonial approaches in AI development. Such educational initiatives are vital for fostering a futures consciousness that embraces the ethical dimensions identified by Ahvenharju et al. (2018), namely ethical pragmatism which emphasises practical wisdom and the integration of knowledge with ethical action, and an ethical concern for the future of others, highlighting the importance of values, morals, and ethical thinking in shaping futures.

Despite the optimistic stance on AI integration, the study confronts limitations due to its scope and sample size. The insights drawn from a single department at a South African University of Technology may not encapsulate the full spectrum of design education settings across Africa. Therefore, while the detected correlation between futures consciousness and AI attitudes is suggestive, it is not conclusive. The findings invite further inquiry into the diverse educational landscapes, cultural contexts, and design disciplines across the continent.

Considering these limitations, we conclude with strategic recommendations for advancing AI in design education. Curricula must evolve to integrate AI in ways that are consistent with decolonisation and inclusivity principles, reflecting the critical perspectives highlighted by Ndlovu-Gatsheni (2020). There is a clear imperative to close the infrastructure and resource gaps that hinder the full realisation of AI's potential in this field, as pointed out by Cobbinah et al. (2015). Moreover, the curriculum design must evolve to embed AI literacy, ensuring that students are equipped not just as users but as critical evaluators and ethical creators of AI technologies.

5. Conclusion

While the futures consciousness of our sample group appears relatively high, suggesting a forward-thinking mindset among educators, we recognise that futures consciousness alone may not suffice to navigate the rapidly evolving landscape of the design industry, especially with the advent of AI and other emerging technologies. This understanding serves as a critical starting point and a means to establish a baseline; however, the cultivation of futures literacy, particularly the cultural and ethical dimensions emphasised in Miller's framework, becomes imperative.

Miller's (2015) concept of futures literacy goes beyond mere awareness of future possibilities; it involves the ability to employ foresight and innovation within one's cultural context, thus enabling individuals to envision and shape futures that are culturally coherent and ethically sound. As echoed by insights from the All Africa Futures Forum (Karuri-Sebina & Miller, 2018, p. 166), capacity-building in futures literacy must engage with the rich tapestry of African culture and history. Findings from the forum concluded that "cultivating African Futures Literacy was seen as one mechanism for fostering identity precisely because it depends on a meaningful consciousness of heritage." This aspect of futures literacy is critical in design education where cultural relevance and ethical considerations are pivotal in the creation and implementation of design solutions.

To this end, our study underscores the importance of integrating futures literacy into design education to equip educators and students with the skills necessary to critically engage with AI technologies, assess their cultural and ethical implications, and apply this knowledge in their professional practice. The development of such competencies is essential for fostering a design education ecosystem that is not only technologically advanced but also culturally sensitive and ethically responsible.

Based on the study's findings, it is recommended to develop training programs focusing on AI ethics and to embed futures literacy within design curricula. Institutional support mechanisms are also suggested to aid in the ethical and culturally sensitive integration of AI in design education. These initiatives are vital for nurturing a futures consciousness that is attuned to the ethical and cultural dimensions of design practice.

Further research is needed to confirm the statistical correlation between time perception and AI attitudes, to explore the longitudinal impact of AI integration and to conduct comparative studies across different African cultural contexts. As we advocate for the integration of AI in design education, we must also champion the advancement of futures literacy as a key component of this transition. The journey towards a technologically enriched future in design education demands a concerted effort to uphold the rich tapestry of cultural diversity and ethical integrity that characterises the African continent. Our collective responsibility is to ensure that this evolution not only embraces technological innovation but also fosters an environment where cultural confidence and ethical considerations are at the forefront of educational endeavours. Educators play a pivotal role in shaping an educational ecosystem that embraces technology while staying true to cultural integrity. The importance of adaptability and responsiveness to technological advancements in education is emphasized, ensuring alignment with cultural values and ethical standards. Continuous research and adaptive strategies will be paramount in achieving a balanced integration of AI, where the future of design education is shaped by a harmonious blend of technology, culture, and ethics.

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P/REFERENCES OF DESIGN

TRAVERSING HISTORY: TRANSFORMATION OF INTERCULTURAL PRACTICE THROUGH THE SPATIAL EXPLORATION IN HARBIN BAROQUE ARCHITECTURAL AREA.

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ABSTRACT | In an era where social connectivity burgeons, cultural diversity has become a mainstay in the tapestry of modern existence. Intercultural dialogue encourages individuals with different perspectives to overcome cultural barriers, to embrace others' values, and to find their place in society. In art and design education, art focuses not only on decorative aesthetics but can also stimulate innovative thinking and critical reflection through a multicultural lens. This paper revisits the "Through History" art education workshop held in the Baroque Architectural Area of Harbin, Heilongjiang Province, China, exploring cross-cultural practice's transformative role and value in artistic creation. Students engage with the environment to explore the connection between space and culture. Guided by practical creation, students experience space, proactively and passively enter intercultural contexts, and promote the creative transformation of complex cultural backgrounds. Based on the interaction between the space and the individual, this critical transformation encourages students to perceive and understand the cultural layers behind architectural environments and urban landscapes. The workshop fosters delicate interregional dialogue through self-reflection and cultural participation, enhancing the cultural identity of individuals and the community while potentially influencing local culture.

1. Introduction[1]

As the interconnectivity between societies continues to grow, cultural diversity is recognized as an inevitable reality of modern life. UNESCO supports interculturalism as a practice and approach that can deepen understanding of others' global perceptions. Interculturalism allows participants with different views to communicate, promoting acceptance of others' values and contributing to the peaceful coexistence between different cultures and identities.

In higher education, intercultural themes are highly regarded by educational scholars. As Tonkin (2004) stated: "If our young people do not learn about other societies, they may well be unable to cope with their own complexities." Interculturalism provides effective solutions; it encourages students with diverse cultural backgrounds to learn to cross cultural barriers, communicate and collaborate in an increasingly smaller multicultural world, enhance communication, decision-making, and teamwork skills, and find their position in the complex work environments of the future.

In art and design education, art provides profound inspiration. Art is not limited to exploring form, resulting in shaping or mere "decorativeness." It also finds ethical ways to intervene between social humanities and technological development through understanding the art creation process and critical construction of imaginative and creative scenarios. In other words, through artistic, creative methods, cultural diversity becomes an essential catalyst for inspiring innovative scenarios and critical thinking. In the digital age, art helps to cultivate the core professional qualities of the next generation of creative and humanities industry practitioners (Eldridge, 2003).

This article will take an interregional art education workshop as an example to explore the critical transformation of intercultural practice. The workshop, titled Traversing History, held in the Baroque Architectural Area in Harbin, Heilongjiang Province, China, aimed at cultivating students' creativity and encouraged students to use themselves as research tools, focusing on the direct and indirect experiences of spatial information. It explores the relationship between spatial sites and psychological cognition in the context of cultural diversity. Students are guided through acts of artistic creation to actively or passively explore multicultural scenarios and reflect on the significance of complex cultural environments in stimulating individual creativity. Moreover, the article will discuss the contribution of the workshop, separated as educational influences and the potential impact of fostering creativity on the cultural development of the Baroque architectural area.

This article explores three parts:

The first part explores Harbin's urban history and the Baroque District's environmental changes. Cultural diversity and complexity construct the unique civilization system of Harbin, which provides an objective existence for exploring channels of communication and multicultural coexistence.

The second part discusses the transformation process of artistic methods in a cross-cultural context. In this part, the workshop promotes students' participation in regional cross-cultural narratives through teaching methods. It introduces visual arts practices after interacting with their multiple identities with environmental sites and knowledge information guided by practice.

The third part unfolds in three stages of discussion: Stage [i] explains the narrative logic of spatial sites, underpinning a theoretical base for the on-site exploration for the next. Stage [ii] concerns how art, as an educational method, guides students to dig out and translate local cultural information, train cross-cultural thinking, and cultivate creativity. Stage [iii] analyses the contribution to the educational environment and the indigenous culture.

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2. Background

2.1 Urban History and Baroque Architectural Complex

Harbin, located in the southeastern part of China's Heilongjiang Province, has a history that traces back thousands of years. However, its development as a city began from the late 19th to the early 20th centuries. In 1896, the Qing government, to accelerate the Northeast region's development, permitted Russia to construct a railway that would traverse the Northeast—known as the China Eastern Railway and the Bin Zhou Railway. With the construction of the railway, many Russians, as well as Han Chinese from other regions of China, moved in, spurring local economic development. Harbin gradually evolved into an important commercial center and transportation hub. Due to its strategic location and unique historical background, Harbin rapidly developed from a collection of villages into a major metropolis in the Far East (Clausen & Thogersen, 2016) (Wenzhuo, 2021).

At that time, China Eastern Railway divided Harbin into two parts: Daoli and Daowai. In Mandarin, "Dao" refers to the railway; thus, Daoli is the western area of the railway, and the central was known as “Bu Tou District”[2]. While Daowai, known as "Fu Jia Dian District" is the eastern area (Figure 1), and consisted of several villages that formed a settlement area for Chinese people.

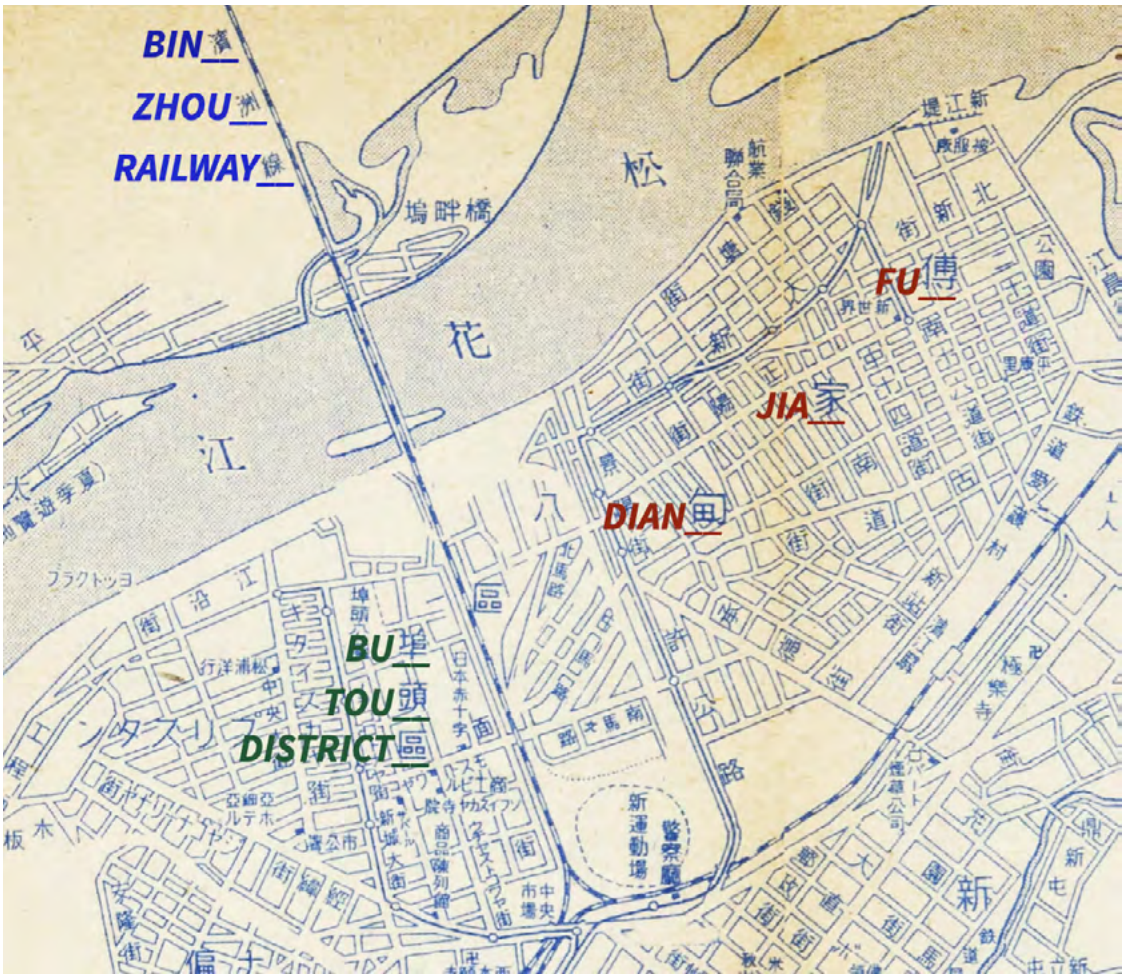


Figure 1. Partial street map of Harbin City, Japanese made in 1940.

[2] Daoli was separated in three parts by the Japanese military in 1932, Bu Tou District was the one of the three, see details: http://www.hrbdl.gov.cn/hebdlq/col6/202302/c01_862585.shtml.

Daoli and Nangang Districts were territories associated with Tsarist Russia. The foreigners led the large-scale urban construction - buildings featuring Art Nouveau, Baroque, Classical, Renaissance, and Eclectic styles appeared one after another. Among these, Chinese Street (now Central Street) is relatively well-known. In Daowai, Chinese national capitalists and immigrants acquired land in the hinterland of Daowai (Fu Jia Dian) (Figure 2). The enthusiasm and prosperity of Baroque architecture coincided with their desire to flaunt wealth, leading them to replicate the opulent Western-style buildings across the street. They employed symmetrical design to emphasize the centrality and balance of the buildings.



Figure 2. Historical street view: Chinese street in Daoli District and Zhengyang Street in Dowai District.[3]

Under the meticulous design and craftsmanship of Chinese artisans, architectural concepts influenced by Western systems harmoniously blend with the distinct socio-cultural characteristics of the local area. Across the facades of these buildings, one can witness the emergence of ornate Chinese motifs that symbolize good fortune and prosperity, such as intricately crafted bats, vibrant pomegranates, auspicious money toads, and delicate peonies. These decorative elements exude an aura of luxury and sophistication, elevating the aesthetic appeal of the structures.

Regarding their functional layout, the buildings in the Daowai area serve predominantly for commercial purposes. The front sections are designated as bustling shops in a cost-effective arrangement, drawing in customers and showcasing merchandise. In contrast, the rear sections are set as factories, serving as versatile spaces that accommodate living quarters and storage facilities. This clever utilization of space caters to the practical needs of the community while optimizing resources (Carter, 2000).

The convergence of diverse cultural influences has contributed to the development of a distinctive architectural landscape in the Daowai area. The fusion of Western-inspired architectural concepts with traditional Chinese decorative motifs has given rise to a unique architectural form and style.

2.2 Current State of the Baroque Area

In the 21st century, the economic development of Harbin still relies on traditional heavy industry and manufacturing, particularly in sectors such as aviation, aerospace, and automobile manufacturing, as the global financial market demands internationally shift. The singular industrial structure in Harbin is under significant pressure to transform.

Despite Harbin possessing some well-known scientific research institutions and higher education establishments, its innovative drive, oriented towards high-tech industries, is insufficient compared with its former industrial economic status and the innovative developments in China's southeastern coastal regions. The lack of innovation has led to reduced job opportunities, directly resulting in the outflow of the young population. This, in turn, has exacerbated the issue of an ageing population, with increased

[3] Source: https://kehilalinks.jewishgen.org/harbin/Sitsky_Postcards.html.

demands for medical care, pensions, and other social welfare needs. Consequently, this leads to slow economic growth and increased financial pressure on the government, particularly in maintaining infrastructural investment, which is reflected in the preservation of local historical buildings (Kirichkov & Levoshko, 2016).



Figure 3. Current street view: Baroque Architectural Area, Daowai District.

Due to the lack of economic impetus and unclear government policies, the Baroque Area needs more cultural maintenance after relocating its original residents. Many buildings have fallen into disrepair over time. Although the buildings have largely retained their original appearance, varying degrees of ageing and damage have appeared on the main brick and wood structures and exterior walls, with some walls showing fractures and partial collapse. In 2007, the local government listed the "Chinese Baroque District" as a critical project for protection and renewal, starting the restoration of the Chinese Baroque architectural complex. However, due to development constraints, the quality of these renovation and renewal projects was low, which showed an excessive homogenization of renewal, leading to a decrease in the regional cultural appeal (Figure 3).

The Baroque architectural area serves as a hub of integration for various cultures, positioned at the geographical crossroads of different cultural spheres and having experienced many economic shifts and political influences throughout history. The intersection of these two factors reveals how cultural diversity and complexity have evolved gradually in this region under the influence of diverse social forces. These evolutions have shaped the local social identities and cultural affiliations and contributed to the construction of Harbin's distinctive civilizational system. This scenario provides a tangible framework for exploring intercultural communication and the coexistence of multiple aspects of cultural context.

3. The Workshop on "Traversing History"

The "Traversing History" workshop was a 10-day immersive program designed for interdisciplinary education, focusing on exploring Harbin's Chinese Baroque Historic District under perspective fields such as facades, courtyard, and historical context. This unique workshop aimed to unite students and professionals from various disciplines, including architecture, intelligent buildings and construction, landscape design, digital media arts, trade economy, Chinese international education, and social service, to comprehensively analyze and creatively represent this architecturally rich area.

In addition to these explorations, participants engaged with literature on space and memory, seeking to broaden their thinking and connect with the multitude of cultures that intersect in the district through the tutoring of scholars. This challenge encourages breaking free from conventional environmental perceptions and constructing imaginative scenarios for the visual translation of poster design. The workshop culminates in an exhibition where these thematic pieces, rich with personal expression, are open to scrutiny from different perspectives of their peers. This fosters a critical understanding of one's views and those of others in the context of the shared spaces and nurtures an individual's poetic and sensory awareness.

3.1 Description

The discussion will be opened by the following three Tables (see Table 1, 2, 3). The workshop is structured into five phases, each designed to build upon the last, offering twenty-six participants a comprehensive and layered understanding of the subject matter. The second phase of the workshop is particularly intensive, comprising four separate tutorials that provide in-depth knowledge and hands-on guidance.

PARTICIPANTS AND THEIR INFORMATION *Participants' Age: 21-23

Participants	Nationality / Originate	Major
P1	**China**/Gansu Province Yinchuan	Architecture
P2	**China**/Guangxi Province Nanning	Architecture
P3	**China**/Hunan Province Shaoyang	Architecture
P4	**China**/Yunnan Province Chuxiong	Architecture
P5	**China**/Yunnan Province Honghe Zhou	Intelligent Buildings and Construction
P6	**China**/Henan Province Shangqiu	Intelligent Buildings and Construction
P7	**China**/Jiangxi Province Shangrao	Intelligent Buildings and Construction
P8	**China**/Hunan Province Loudi	Intelligent Buildings and Construction
P9	**China**/Heilongjiang Province Harbin	Landscape Design
P10	**China**/Heilongjiang Province Harbin	Architecture
P11	**China**/Heilongjiang Province Harbin	Architecture
P12	**China**/Heilongjiang Province Harbin	Digital Media Arts
P13	**China**/Shandong Province Heze	Intelligent Buildings and Construction
P14	**China**/Anhui Province Hefei	Intelligent Buildings and Construction
P15	**China**/Hubei Province Enshi	Intelligent Buildings and Construction
P16	**China**/Shanxi Province Xi'an	Intelligent Buildings and Construction
P17	**China**/Inner Mongolia	Architecture
P18	**China**/Guangdong Province Guangzhou	Architecture
P19	**China**/Yunnan Province Kunming	Architecture
P20	**China**/Shanxi Province Baoji	Trade Economy
P21	**China**/Shandong Province Taian	Chinese International Education
P22	**China**/Guangxi Province Chongzuo	Social Service
P23	**China**/Shanxi Province Xian	Trade Economy
P24	**Russia**/ Saint Petersburg	Architecture
P25	**Russia**/ Saint Petersburg	Architecture
P26	**China**/Anhui Province Liuan	Statistics

Table 1. Participants and their information.

CITY WALK PHASE 1

Participants	Fields	Perceptual Touchpoint
P1	Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context
P2	Facade/Yard	Damaged Part, Colour, Texture, Historical Context
P3	Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context
P4	Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context
P5	Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context
P6	Facade	Damaged Part, Colour, Texture, Historical Context
P7	Facade/Yard/History	Texture, Colour
P8	Facade/Yard/History	Texture, Colour
P9	Facade/Yard	Damaged Part, Texture, Historical Context
P10	Facade	Texture, Colour,Texture
P11	Facade/Yard/History	Texture, Colour, Texture
P12	Facade	Damaged Part, Texture, Historical Context
P13	Facade/Yard/History	Texture
P14	Facade	Texture, Colour
P15	Facade	Texture, Colour
P16	Facade	Texture, Colour
P17	Facade/Yard	Damaged Part, Colour, Texture, Historical Context
P18	Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context
P19	Facade/Yard	Damaged Part, Colour, Texture, Historical Context
P20	Facade	Texture, Colour
P21	Facade	Texture
P22	Facade/Yard	Damaged Part, Colour, Texture, Historical Context
P23	Facade/Yard	Texture, Colour
P24	Facade/Yard	Damaged Part, Colour, Texture, Historical Context
P25	Facade/Yard	Damaged Part, Colour, Texture, Historical Context
P26	Facade	Texture, Colour

AFTER THE TUTORING PHASE

CITY WALK PHASE 2

Fields	Perceptual Touchpoint
Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context, Authenity
Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context, Authenity
Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context, Authenity
Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context, Authenity
Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context, Authenity
Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context, Authenity
Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context
Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context
Facade/Yard/History	Damaged Part, Texture, Historical Context, Authenity
Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context
Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context
Facade/Yard/History	Damaged Part, Colour,Texture, Historical Context, Authenity
Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context, Authenity
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Facade/Yard/History	Damaged Part, Texture, Historical Context, Authenity
Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context
Facade/Yard/History	Damaged Part, Texture, Historical Context, Authenity
Facade/Yard/History	Damaged Part, Colour, Texture, Historical Context, Authenity
Facade/Yard/History	Damaged Part, Texture, Historical Context

*P1-P4, P9-P11, P12, P17, P18, P24, P25, They have a more comprehensive experience and understanding of the architectural environment through the two City Walk Phases.

Table 2. Participants with their perceptual touchpoint during city walk phase 1 and 2.

CITY WALK PHASE 1: Leading by Local Harbin Scholars

City Walk Phase 1 is a unique educational experience designed to immerse students in the rich cultural and historical tapestry of Harbin. Students are required to conduct **immediate observational recordings** to capture and retain the depth of their engagement with the architectural heritage in Baroque area.

TUTORING PHASE

SECTION 1: Introduction
Students & All Tutors
The introduction section is designed for students to communicate and share what they recorded during City Walk Phase 1, as well as to get to know one another's backgrounds in the presence of all tutors. This initial interaction will establish a collaborative learning environment and enable everyone to build upon the diverse experiences and insights gained from the first phase of our exploration.

SECTION 2: Facade
Tutors (British art scholar lead)
In architecture and city planning, a facade is the exterior front face of a building that is one of the most important architectural elements, as it sets the tone for the building's design and the surrounding environment. In this section, students are encouraged to observe the design elements, and stylistic features through an artistic and poetic way.

SECTION 3: Courtyard
Tutors (China Harbin-based literary scholar lead)
Yard refers to the grounds surrounding a building or a communal space within an urban setting. In Harbin, yards might be a part of residential complexes, public spaces, or historical sites. This examining yards section teaches students to understand how these spaces are used by residents, their role in community interactions, and their significance in urban design and planning.

SECTION 4: Cultural study
Tutors (UK London-based art & design scholar lead)
The historical component of this section focuses on the way Harbin's past shapes its present. This involves examining the city's development over time, the influence of various cultural and political forces, and the preservation of historical sites. As well as understanding the importance of creativity through the transformation of visual design practice.

CITY WALK PHASE 2: Leading by British art scholar

City Walk Phase 2 enriches the initial experiential layer established in the first phase by incorporating additional scholarly dimensions—namely, the analysis of architectural **facades**, **courtyards**, and **historical evolution**. During this stage, an art scholar from the UK engaged with the locale for the first time, leading two academic readings as part of the walk. The initial reading was sourced from the 2016 article "Tourist Quarter 'Chinese-Baroque' of Dao Wai District in Harbin City: Experience, Problems, and Perspectives of Renovation," which examines the preliminary stages of the district's urban renewal. The ensuing discourse was based on Wenzhuo Zhang's 2021 paper, "Renovation, Gentrification, and Revitalisation of the Chinese Baroque Area in Harbin: Lessons Learned from a Heritage-Driven Urban Development Project." The introduction of this work delineates the derivation of the 'Chinese Baroque' concept, with Zhang referencing Yasuhiko Nishizawa, a Japanese architectural historian, to illustrate the area as a testament to intercultural architectural practices. This phase's objective is to re-evaluate and deepen the understanding of the immediate urban environment by juxtaposing the established local knowledge shared by regional knowledge with the fresh perspectives brought by international scholars. This integrative approach aims to foster a comprehensive re-examination of the urban experience through a multifaceted academic prism.

CREATIVITY PHASE (SAMPLES FROM 5 STUDENTS)


P22


P13



P12



P19



P24

EXHIBITION

Table 3. The workflow of the workshop.

Participants are engaged in city walks for the initial phase and again in the third phase. These city walks serve as practical settings where attendees can directly observe and interact with the subject of their study - the Harbin Baroque Architectural Area. The first city walk is a quick-look exploration and observation, allowing participants to familiarize themselves with the area and its unique characteristics. Following the initial city walk, participants engage in the second phase with scholars who provide valuable insights and theoretical frameworks relevant to the district. This learning phase is critical as it equips participants with the necessary tools to analyze and interpret their observations. After introducing the participants and scholars, they had an initial impression of each other. Then, the third phase sees another city walk, but this time with a more analytical lens. Participants are encouraged to apply the knowledge gained from the scholarly tutorials. They compare and contrast their initial recordings and impressions with a more informed perspective. This juxtaposition aids in understanding the evolution of their perceptions and the depth of their learning.

Notably, the tutoring phase has one introduction section and three sections in facade, yard, and history perspectives led by three scholars. This structured approach allows students to delve deeply into their subject matter, preparing them to undertake their second city walk in phase three with a more critical and informed eye (Figure 4).



Figure 4. City walk phase 1 and 2.

Participants also have the opportunity to synthesize their observations and insights in the creativity phase. They engage in collaborative projects that challenge them to represent their understanding of the Chinese Baroque Historic District through various forms of visual communication. The final phase culminates in a showcase where participants present their projects. This phase is designed to foster an environment of peer review and open dialogue, allowing for a rich exchange of ideas and feedback. It is an opportunity for participants to display their work and reflect on their growth and the collective knowledge they have built throughout the workshop, contributing to the existing method of education.

3.2 Significance

The workshop's significance is deeply rooted in its structured approach, which integrates classroom learning with experiential activities by combining tutoring (Figure 5) and city walk phases.



Figure 5. Tutoring phase.

As the Table 3 shows, the Tutoring Phase is fundamental in laying the groundwork for a multifaceted exploration of culture and creativity. The diversity acknowledged in the self-introduction session celebrates variety and strategic recognition of the rich tapestry of experiences that can inform and enhance learning. The students were exposed to a spectrum of perspectives, from the Baroque-inspired works of Pablo Bronstein to Julia Cameron's insights into creativity (Cameron & Bryan, 1993).

This phase is significant because it primes students for a transformative journey, urging them to step beyond their comfort zones and habitual perceptions. Another one is the City Walk Phase, which is crucial in embodying the learned concepts and transitioning from theoretical instruction to tangible, real-world engagement (Bradfield et al., 2022).

The dual-part structure of the walks - from local insights to an external academic lens - enhances the learning experience by contrasting and complementing local knowledge with broader, philosophical interpretations of space, as inspired by thinkers like Gaston Bachelard (2014). The evolution of student perception from an aesthetic appreciation to a deeper contemplation of authenticity and cultural narratives illustrates the profound impact of active, observational learning.

The workshop's holistic approach signifies a powerful educational paradigm where the integration of stimulating classroom discussions and direct observation leads to rich, contextually grounded creative expressions. This methodology promotes cultural intelligence and sensitivity, equipping students with the necessary skills to produce culturally meaningful and impactful work. As they transition from passive learners to active creators, they engage in a deeper dialogue with their subject matter, resulting in a more comprehensive understanding of intercultural art education.

3.3 Creativity Outcomes

In the creativity phase, post-tutoring, students were tasked with transforming their sensory abstractions into visual forms within an educational setting intentionally crafted to disrupt the norm. The instructors galvanized students to venture beyond the typical, urging them to rethink and reshape standard visual interpretations and representations, resulting in pioneering and unorthodox visual creations. The following images (see Figure 6-10) are of the students' works, along with five students' feedback.



Figure 6. Students' practices part 1.

Student P2: The inspiration for the work stemmed from a city walk along the Chinese Baroque-style street. At that time, the entire street was undergoing restoration and renovation of dilapidated buildings, thus intertwining traces of new and old architectural context were visible, alternately revealing a sense of historical depth and vibrant life. It felt like with each step, one might step into a different era. One could

only measure it step by step. As a result, I combined the photos I took at the time with historical photos from the historical era to create a collage poster. This poster is intended to express the feeling of traversing through time and space and hopes to remind people to protect historical architecture and to appreciate the enduring charm of Harbin, which remains even after dramatic changes over time.



Figure 7. Students' practices part 2.

Student P5: "Behind the Window" captures the visage of women from the historic Chinese Baroque district using a two-dimensional composition. Wandering through the Chinese Baroque streets, I came to realize that it once harbored the marginalized, including many deaf-mute women, who had lost their agency in life, their traces are now scarcely discernible in contemporary documents. "Behind the Window" seeks to preserve their narratives.

In the piece, Baroque window designs are merged with the traditional peony motif, symbolizing the women's view of the outside world; while the courtyard staircases represent the cyclical and confined lives within the 'front shop, back factory' layout. "Behind the Window" serves both as a tribute to these women and a poignant reflection on that era.

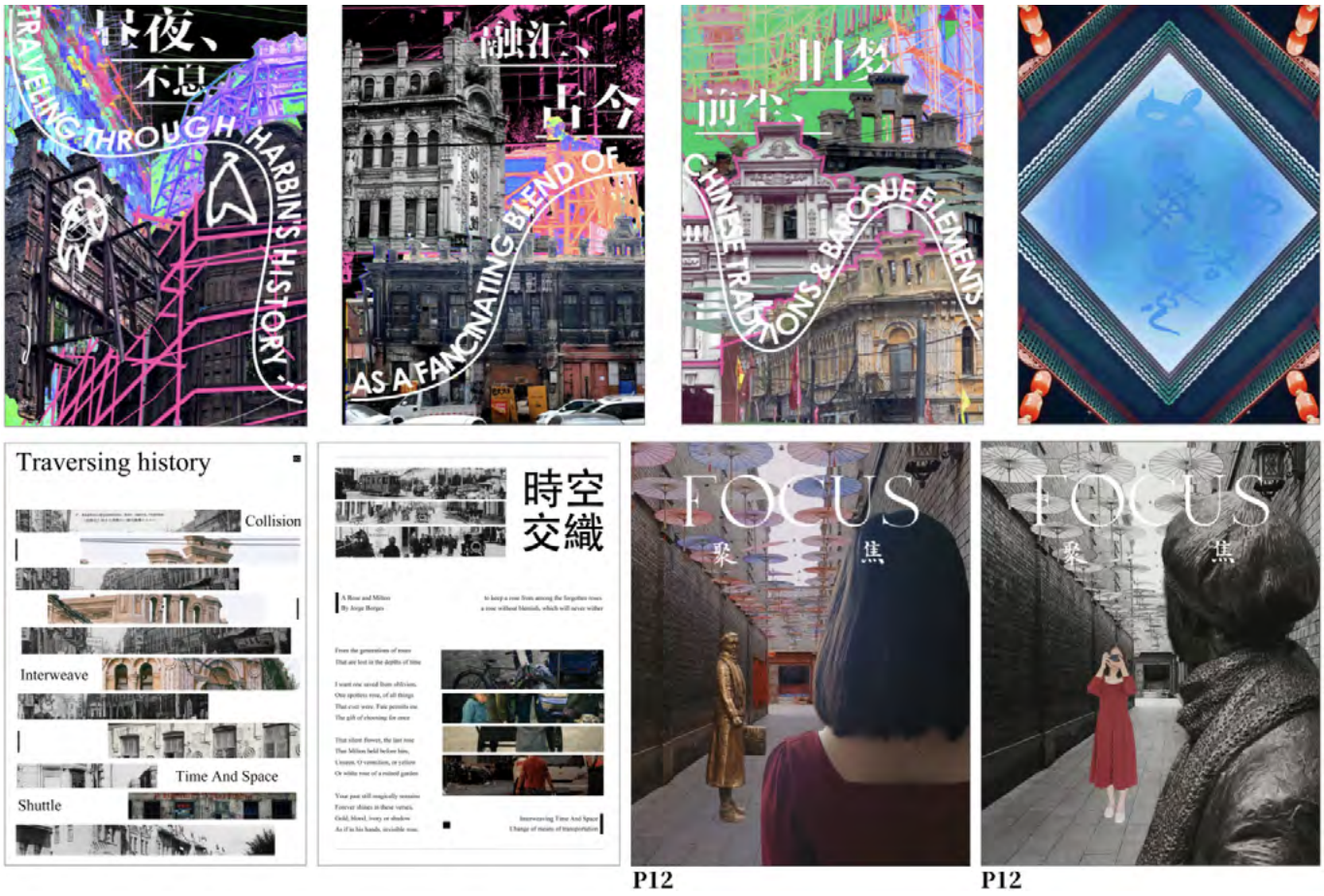


Figure 8. Students' practices part 3.

Student P12: The "Focus" series posters showcase the historical depth and modern vitality of Chinese Baroque streets. The two posters depict a girl and a statue of Xiao Hong (1911-1942, a female writer born in Heilongjiang Province), gazing at each other, seeking a connection between history and the present, and exploring their implications for the future.

The first poster features the image of a modern girl representing the present, with the statue representing history. The red color in the poster, inspired by the little girl in the red coat from the film "Schindler's List," symbolizes the power of life and the longing for the future. In the second poster, the girl is seen with her back to the camera, looking towards the statue that symbolizes history, representing reverence for the past and anticipation for the future. The blending of red and gold hues emphasizes the vitality of life and the significance of history. The statue of Xiao Hong not only commemorates this literary master but also serves as a bridge between history and modern times, inspiring us to draw strength from stories to move forward.



Figure 9. Students' practices part 4.

Student P13: The Baroque district under renovation is draped with a fabric-like protective cover, and even the broken mesh cannot hide the variegated walls sculpted by time. The once-magnificent decorations are gradually falling away. Visitors stop to ponder over the concealed future-a dazzling whiteness that will shimmer in the sunlight. I wish to capture this moment of transition, to document the neighborhood's story as it steps from the old into the new.



Figure 10. Students' practices part 5.

Student P22: Lacking a background in art, I have used a handwritten diary to reflect my personal contemplations and understanding of the Baroque district. How have Chinese architects integrated traditional eastern thought into Baroque style while ensuring the continuation and enhancement of its culture? Delving into the architectural details, I noticed that elements of Chinese blessing culture, such as pomegranates and grapes symbolizing fertility and good fortune, are prevalent, resonating with the meaning behind the character "福fú" (fortune). Western Baroque, by contrast, employs angels and eagles to represent glory and strength. Both styles express their cultures' emotions and values through architecture. Despite its Western facade, decorative façade, still reveals the essence of Chinese culture, reflecting the wisdom of craftsmen and the flexibility of the culture.

This process of creating posters was underpinned by a strong focus on critical evaluation of one's work and that of peers, fostering a more profound connection with their subjects and a more nuanced conveyance of intricate concepts through their art. Students were encouraged to channel their distinct experiences into their work, infusing their visual output with deep personal meaning and symbolism. They were also steered to contemplate the complex interplay between their mental constructs and artistic expressions. This practice refined their capacity to manifest abstract ideas visually and deepened their comprehension of the interdependence between conceptual thought and creative actualization.

3.4 Key Findings

The workshop's initial phase of spatial exploration set the stage for participants to develop a fundamental grasp of Baroque architecture's intricacies. A notable observation was made by an international architecture student from Russia (e.g. P24), who approached the study focusing on the primary spatial forms, and also expressed an interest in Chinese typography. This approach allowed for a comparative analysis of architectural styles, highlighting the distinctive differences between Russian and local Baroque edifices. Such insights reveal how cultural and geographic backgrounds influence the initial engagement with and interpretation of architectural styles.

Students with a more diverse academic palette, including those from architecture (e.g. P19) and digital media arts (e.g. P12), demonstrated a broader and more integrated understanding of their surroundings. Their observations transcended mere structural analysis, delving into history, memory, and the literary aspects of the Baroque environment. This group's balanced approach underscored the value of interdisciplinary perspectives in grasping the full spectrum of the cultural and aesthetic significance embedded within architectural spaces.

On the other hand, those with a background in intelligent architecture (e.g. P13), whose studies typically lean towards engineering and data-focus, exhibited a markedly different cognitive orientation. Their understanding of the environment is more direct, and their analysis process is more structured, prioritizing practical logic over abstract aesthetic factors. Additionally, after their initial walk, they develop a sense of disregard towards the aging structures. Students not trained in art and design (e.g. P22), they often require guidance from scholars to delve into the understanding of cultural and human narratives, and to build confidence in aesthetic expression.

Despite these initial inclinations, the tutoring phase of the workshop facilitated a shift in understanding across the board. After engaging with the second, third, and fourth modules, the students began to appreciate the purpose of their observational walks. Their understanding evolved to encompass abstract interpretations of the environment, especially within the Baroque context. Yet, even with this newfound appreciation, remnants of skepticism persisted, particularly regarding the efficacy of walking as a method of knowledge expression. This skepticism is influenced by their diverse backgrounds, hinting at the entrenched educational paradigms that shape their approach to learning and knowledge articulation.

Additionally, compared to educational impact, the influence of geographical factors seems to be weaker, which may be attributable to the smaller data volume that doesn't allow for more definitive conclusions. However, these initial data also indicate that in the era of informatization, the intensity of Interregional (partly international) cultural exchange and communication has reached a new height, rendering geographical distance no longer an effective barrier to cultural exchange.

3.5 Communication and Feedback at the Exhibition Site

Upon the workshop's conclusion, an exhibition was chosen as the preferred medium to display the students' artworks at the site they visited. However, due to construction inside the building, the students displayed their works by affixing them to the walls inside the courtyard. This seemingly compromised choice transformed this outside space as an exhibiting realm, while showcasing the architectural characteristics, also displaying the reality of the building.



Figure 11. Exhibition event.

The curating of the show aligns with the sentiments of authors Susan Liggett and Mike Corcoran (Liggett & Corcoran, 2018), who argue that exhibitions, due to their open, creative, and engaging nature, serve as an effective means of communication situated at the nexus of diverse audiences. They further assert that exhibitions play a significant role in overcoming challenges associated with interdisciplinary communication. The culmination of these meticulously orchestrated experiences produced a compilation of visual imagery that was multifaceted, innovative, and deeply interconnected with the individual's cognitive processes. Consequently, the exhibition transformed into a pivotal platform, operating as a visual language that encapsulates the essence of the ideas, concepts, and emotions that the students sought to convey (Figure 11).

The exhibition space in the Baroque Architectural Area fosters a dialogue between the viewer and the exhibited works. The on-site exhibition transcends a mere showcase of the students' creative outcomes and is a robust medium for communication and knowledge dissemination. In conjunction with the exhibition, presentations profoundly influenced this cross-disciplinary educational process. This approach transformed the display from a mere exhibition into a dynamic discourse within the public space, engendering a collaborative learning culture and shared understanding. This engagement nurtured a multicultural community ethos and facilitated an open dialogue surrounding the designs. Each exhibited piece initiates a conversation, fostering a deeper understanding and appreciation of the students' visions and the subject matter explored during this workshop.

The workshop successfully established an environment of cultural integration deeply rooted in the local community's culture, customs, and everyday life, nurturing a harmonious coexistence based on mutual respect and symbiosis. Against this backdrop, not only was there a respect for local traditions but also an infusion of new ideas and innovative inspiration. The exhibition drew a continuous flow of visitors to the courtyard, engaging in meaningful interactions with students to explore the event's substance. Residents participating in the exhibition responded enthusiastically, looking to this platform to promote their native culture and hoping for it to gain wider recognition and preservation. Moreover, we aimed to avoid collecting data on-site to preserve the relaxed atmosphere of community interaction. Therefore, we relied on local media's online coverage to gauge the event's impact, with readership data from news pages indicating that the activity had reached a substance.[4]

3.6 Problems and Improvement

The workshop's exploration phase highlighted the influence of individual cultural and academic backgrounds on the perception and analysis of Baroque architecture. Students with interdisciplinary studies showcased a deeper, more integrated understanding of the Baroque environment, suggesting that a diverse academic palette may enhance the comprehensiveness of analysis. This inclination towards the structural at the expense of the historical and cultural suggests a potential disconnect the workshop's design may need to address.

Meanwhile, encouraging students to incorporate personal meaning into their art was commendable. Yet, critiquing and refining these expressions requires further elaboration to ensure that students can effectively evaluate and improve their work. The further incorporation of guided techniques for visual representation and structured critique sessions would likely enhance the learning outcomes of this phase. We aim to involve a more detailed strategy for engaging the audience and a systematic method for collecting feedback. This would significantly bolster the exhibition's role as an educational tool and a medium for interdisciplinary dialogue.

[4] The event was reported by an local online media news, with a readership reaching 8,176 views, up to 31th March 2024. Source: https://zmt-m.hljtv.com/news_details.html?from=wap&id=819789&timestamp=1707800454893.

4. Discussion and Future Work

By the preceding text, the discourse is sequentially delineated across three distinct phases. Initially, the discussion examines the impetus behind student engagement within architectural environments, investigating the presence and underlying logic of narrative elements within these spaces and delineating the interplay between the spatial constructs and the participants. Subsequently, the conversation pivots to how such interplay might be harnessed and transmuted into a pedagogical strategy, aiming to augment the students' competencies to interact with and comprehend the intricacies of cross-cultural narratives. Conclusively, the treatise probes into the potential ramifications of such pedagogical interventions on the autochthonous culture prevalent within the Baroque area.

4.1 The Phenomenon of Spatial Position

The entire process of the workshop was concentrated on the experiential aspect of the spatial environment, and what follows will discuss the fundamental framework of this theory. Langer and De Certeau(1988) referenced the theory of walking in the city to characterized Manhattan as a space constructed for life, where the complex grid of the city manifested a kind of syntactic logic similar to that of a literary text. Here, the "text" differs from the text in actual language; it is composed of the volumetric system of the urban landscape, edited for experience.

Through his perspective, the regularity of the city is transformed into a specific spatial language or code. Individuals navigate the city based on the physical clues of their surrounding environment. In the context of the Baroque area of Harbin, this means interacting with the rich architectural details that tell of the city's multicultural past, thus developing a dynamic urban experience. Maurice Merleau-Ponty (2002) proposed that space is an immersive experience transcending the physical environment. Walking through this historical complex validates this concept, where the spatial system constructed by the architectural facades is not just objective but an all-encompassing state.

Norberg-Schulz (1979) also wrote that the definition of space contains dual dimensions: one is geometrical, and the other relates to the cognitive "perceptual field." Space intersects these dimensions, where geometric complexity overlaps with cultural significance and links with participant interpretation. This linkage constructs a composite information, a process of individual thinking stimulated by the spatial environment to turn back to the space itself. The ensuing personal experience opposes purposeless imagination, instead searching for clues about the things themselves (Cody & Siravo, 2019). Thus, the experience is a perceptual response that evokes personalized and rich cognition, emphasizing the interaction between the architecture's physicality and the participants' subjectivity. This theoretical reflection supports the activities in the Baroque architectural scene, where cross-cultural thinking and the multicultural background of the regional environment interact, intertwining physical and abstract spaces and thereby sparking individual experiences and thoughts.

4.2 Art as Methods

Neri Oxman's Krebs cycle of creativity (Figure 12) is an interdisciplinary design methodology that links art, design, science, and engineering. It is inspired by the Krebs cycle in biochemistry, which is a fundamental process of energy transformation within cells. In the realm of design, Oxman's Krebs cycle of innovation draws on the concept of this biological cycle to advocate for a cyclical approach to innovation and collaboration among art, design, science, and engineering (Oxman, 2016).



Figure 12. Krebs cycle of creativity.

In this cycle, art is explored for its decorative aspects and as a catalyst for innovation. Art fosters the development of innovative thinking through personalized and autonomous expression, as well as a critical attitude, creating scenarios filled with new ideas and imagination. This, in turn, establishes connections between societal needs and technological advancements, leading to the development of new designs and solutions (Blacklock, 2024) (HadaviBavili & İlçioğlu, 2024).

The intercultural emphasized in this paper is understood as an operational method that encourages students and practitioners to enhance their perception of cultural diversity through the practical activities of walking, observing, and reading. Furthermore, in image translation, practitioners are encouraged to cross cultural barriers and, by establishing a critical viewpoint, to more clearly recognize how their work translates environmental and cultural information. They are also encouraged to understand their position in this translation process and become aware of the skills that match this position (Roguska-Németh, 2023) (Gros, 2014) (Slak et al., 2023).

Translating cultural information trains each student in cultural sensitivity and autonomous critical capacity. Cultural sensitivity (Alam, 2020) allows for recognizing cultural differences. This cognitive ability is the foundation of independent criticism because practical critical thinking requires respect for the cultural content to be analyzed and its interpretation from multiple perspectives. Consequently, this process actively or passively trains the ability to convert structured thinking into abstraction, establishes unique perspectives, and enhances independent creativity. Furthermore, the artistic scene constructed by the entire exhibition serves as a contemplation and protest against the disappearance of regional cultural values.

4.3 Contributions

This event adopted a relatively conventional approach in its teaching methods. Still, its uniqueness lies in establishing direct connections with the region, creating a context for cross-cultural studies, and sparking dialogue and collaboration among participants to explore the potential influences of cultural diversity on regional development. Therefore, the discussion of the contributions can be divided into two parts: firstly, it is centered on the educational environment; secondly, it pertains to the potential impact on the Baroque architectural region.

Impact to the Educational Environment:

The ways of training the individual creativity were promoted by a collaborative learning technique in the workshop. The process, known as peer review in the classroom (Pirttinen & Leinonen, 2022), prepares students for future career-related assessments and collaboration (Le Sueur et al., 2020). Through this activity, the teaching module of peer review in the classroom has made the following three aspects of education:

First, facilitating active learning: Each student brings a unique perspective of knowledge. In explaining concepts to peers and providing constructive criticism, they immediately express and give feedback, evaluate arguments, identify strengths and weaknesses, and understand high-quality work standards.

Active involvement in the learning process through peer review promotes a deeper engagement with the material. Students are not passive information recipients but active learning environment contributors. When classroom peer review is well-structured and guided by clear objectives and standards, it can significantly enhance the educational experience. It supports a dynamic learning process in which students actively receive and provide feedback, making the educational journey more engaging and effective.

Secondly, increasing engagement and responsibility: Knowing that peers will review their work can motivate students to exert their most significant effort. Moreover, being responsible for providing high-quality feedback to classmates can create a sense of accountability.

Furthermore, encouraging a community of practice: Classroom peer review fosters collaboration with the broader community. Students engage in mutual learning and support each other's academic growth, leading to a more active and inclusive classroom environment.

Potential Impact to the Local Context:

The impact of this workshop event on the culture of the Baroque area is transient. In the long term, similar activities are a dynamic development process, and their changes will be subject to various objective factors that constrain and influence them. This will lead to the topics it triggers being broad and complex. In this teaching session, after the research, observation, and evaluation conducted jointly by teachers and students, individual creativity will potentially impact the historical architectural area in the following aspects.

First, establishing cross-cultural dialogues with an interregional perspective provides opportunities for interaction between local cultures and other cultural groups. Workshop participants, through multi-angle learning and diverse interpretation of the indigenous region's cultural arts, historical traditions, and values, can help the area's local people recognize the importance of individual thought. It enables them to rediscover their cultural interests from a broader perspective, to appreciate their cultural heritage, and to enhance their sense of identity and artistic confidence. Secondly, against the backdrop of continued economic downturn. Cross-cultural activities centered on art education potentially encourage local people to re-express the cultural value of regional architectural resources through artistic means, creating new economic growth points through cultural innovation. Furthermore, from an interregional perspective, the activities are driven by both cultural resources and economic transformation, enhancing the recognition of the importance of architectural culture and the awareness of the protection of the Baroque architectural complex.

5. Conclusion

The informational essence of this particular architectural complex transcends mere physicality. The material properties embody a confluence of diverse elements, serving as a direct expression of both historical context and regional cultural characteristics. The expression of personal practices requires a foundation of confidence. This confidence is deeply rooted in the student's cultural experiences and ability to project these onto the regional culture.

Therefore, this engagement with the built environment offers a unique perspective through which students can interpret and interact with their surroundings. Through this lens, they learn to see the layers of history and culture that buildings, spaces, and cities embody. When students approach their creative practices with a robust sense of self, informed by an intimate understanding of their cultural narratives, they are better positioned to contribute authentically to the regional cultural milieu. This interplay of self-awareness and cultural immersion ultimately cultivates a rich, nuanced dialogue between the individual and the region. This exchange can enrich both the personal and collective spheres of cultural expression.

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P/REFERENCES OF DESIGN

INTEGRATING PERSONAL DEVELOPMENT, VALUES, AND SELF-REFLECTION IN DESIGN EDUCATION: A HOLISTIC APPROACH FOR CREATIVE EXCELLENCE.

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KEYWORDS | DESIGN EDUCATION, PERSONAL DEVELOPMENT, VALUE & PURPOSE DRIVEN, SELF-AWARENESS, GROWTH MINDSET

ABSTRACT | In the dynamic landscape of higher design education, the traditional emphasis on technical skills and theoretical knowledge often overshadows the essential role of personal development, individual values, and self-reflection. This paper advocates for a paradigm shift towards a more holistic approach, contending that integrating these elements into the curriculum not only enhances the overall educational experience but also cultivates well-rounded, socially conscious designers.

Our reasoning is explained and explored with reference to three aspects, which we believe are essential for creative excellence within the context of design education. Firstly, personal development is integral to nurturing creativity and innovation. By allocating dedicated time to foster self-awareness, resilience, and emotional intelligence, students can harness their unique perspectives and experiences, thus enriching the creative process. This approach empowers students to navigate the complexities of the design world with confidence, adaptability, and a heightened sense of purpose.

Secondly, incorporating core values into design education instills a sense of ethical responsibility and social consciousness. By exploring and understanding individual and collective values, students can develop a framework that guides their decision-making process, ensuring that their designs align with principles that prioritize sustainability, inclusivity, and ethical considerations. This integration not only contributes to responsible design practices but also prepares students to address the societal challenges of our time.

Lastly, self-reflection serves as a crucial tool for continuous improvement. By encouraging students to reflect on their work, experiences, and evolving perspectives, design education can foster a habit of critical thinking and adaptive learning. This reflective practice enables students to refine their design processes, identify strengths and areas for growth, and ultimately evolve into designers capable of making meaningful contributions to their field.

Besides theoretical deepening, the above aspects are also evaluated in teaching practice. This paper describes 3 concrete initiatives within the Product Development programme at the University of Antwerp in which Personal Development was integrated into the curriculum:

- Skillslab, which focuses on the development of supporting and soft skills for designers with the aim of helping them grow as a person, and thus as a designer.
- My designers' values project (pilot), where we integrated a workshop on what values drive you as a designer in an existing design assignment.
- Design professionalization as a separate learning path, from 1 Ba until 2 Ma, in the curriculum, where there is room for self-exploration.

In conclusion, higher design education must evolve to accommodate personal development, values exploration, and self-reflection and foster a more holistic learning experience. This approach not only prepares students with the technical expertise required by the industry but also cultivates empathy, social responsibility, and a commitment to sustainable practices in design. Meeting this challenge requires ongoing innovation, adaptable teaching strategies, and a dedication to collaborative learning. Despite the complexities and demands of the educational landscape, the focus on personal and professional development in design education offers a pathway to cultivating designers who can shape a more inclusive and sustainable future.

1. Introduction

In order to enhance personal growth, improve communication and gain trust when collaborating, educators should foster and stimulate students' interpersonal awareness, identified by Luft and Ingham in the Johari window framework as the arena (Luft & Ingham, 1955). The more people know about themselves and others, the more open and trusting their relationships become. They will be more productive, cooperative and effective when working in a team.

The Johari window framework can be instrumental in integrating personal development, values, and self-reflection into design education. By using this framework as an underlying foundation, educators can create a more holistic and inclusive learning environment that fosters creativity, collaboration, and self-awareness, which are essential for deepening learning (Maher & Root, 2014). This approach aligns with the shift toward a more comprehensive and human-centered paradigm in design education, where students are encouraged to explore their inner selves while engaging with the broader social and ethical context of design.

A range of studies have explored the integration of personal development, values, and self-reflection in design education. Rivard (2012) underscores the significance of reflexive learning in the context of design education to enhance creativity and self-leadership in design practice and positioning it as a pivotal aspect of the learning process.

In the exploration of pedagogical frameworks within design education, Shim (2018) contributes insights into an inclusive framework that can be further enriched by the integration of personal development and self-reflection. This approach aims to foster a more comprehensive and participatory educational experience for students.

Additionally, Tracey (2018) sheds light on the pivotal role of reflective writing in helping students explore their beliefs and experiences. The act of reflecting in writing serves as a mechanism for designers to articulate and refine their evolving professional identities.

Collectively, these studies underscore a shared perspective on the imperative for a holistic approach to design education. This approach, integrating personal development, values, and self-reflection, emerges as a vital framework for nurturing a well-rounded and reflective educational experience within the field of design.

The traditional focus on technical skills and theoretical knowledge in higher design education has been critiqued for overshadowing the importance of personal development, individual values, and self-reflection (Salmon, 1992; Peruccio, 2019; Doorn, 2008; Meyer, 2020). These elements are crucial for cultivating well-rounded, socially conscious designers. Salmon (1992) and Peruccio (2019) advocate for a more holistic approach, emphasizing the integration of liberal arts, social sciences, and transdisciplinary knowledge into the curriculum. Doorn (2008) and Meyer (2020) further stress the need for the development of designers' attitude and the inclusion of practical, real-world experiences in design education. These perspectives collectively support a paradigm shift towards a more comprehensive and inclusive approach to higher design education.

Research consistently supports the idea that personal development is crucial for nurturing creativity and innovation. Stolk (2009) and Hargrove (2012) both emphasize the importance of self-directed learning and metacognitive abilities in fostering creativity. Danko (2003) and Ulibarri (2014) further highlight the role of emotional intelligence and resilience in this process, with Danko specifically noting the use of narratives to enhance emotional development. These findings collectively underscore the need for dedicated time to develop self-awareness, resilience, and emotional intelligence, as these are key factors in harnessing unique perspectives and experiences to enrich the creative process.

Design education plays a crucial role in instilling ethical responsibility and social consciousness in students, as it equips them with the skills and mindset needed to address societal challenges (Zande, 2011). This is

particularly important in the context of design responsibility and sustainability, where students are encouraged to adopt sustainable design thinking (Ashour, 2020). The integration of core values into design education is further enhanced by the incorporation of scientific knowledge, which enriches the design process (Zubrowski, 2002). This approach is exemplified in the Industrial Design Program at the University of New South Wales, where students are immersed in projects that highlight design's potential as a catalyst for social change (Ramirez, 2011).

As design education navigates the complexities of the 21st century, the OECD Future of Education and Skills 2030 initiative offers a visionary blueprint. At its core lies the Learning Compass 2030, a guiding framework that underscores the multifaceted nature of learning.

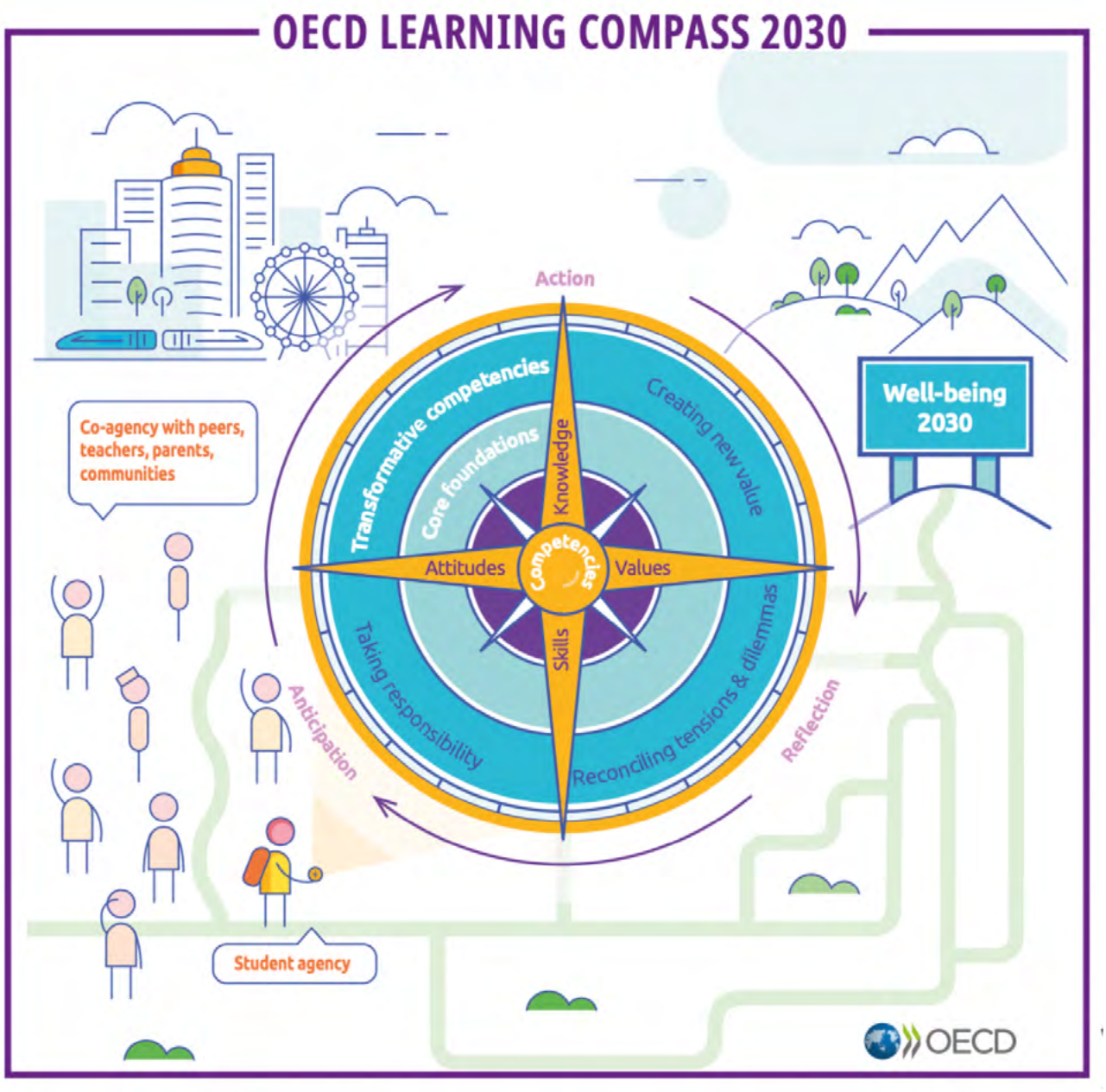


Figure 1. The Learning Compass 2030, a guiding framework that underscores the multifaceted nature of learning. (OECD, 2023).

The Learning Compass 2030 (OECD, 2023) underscores the importance of fostering values as one of the key domains alongside Knowledge, Skills, and Meta-Learning. The integration of values in education aligns with several crucial aspects that are relevant to personal development:

- **Ethical Decision-Making:** Values are foundational in cultivating ethical decision-making skills among learners. The Learning Compass 2030 acknowledges the significance of values in shaping attitudes and behaviors. By instilling a strong ethical foundation, education contributes to the development of responsible and conscientious individuals capable of making ethically sound decisions in diverse contexts.
- **Social and Emotional Competence:** Values are integral to fostering empathy, cooperation, and cultural understanding. Education that incorporates values contributes to the creation of socially aware individuals who can navigate and contribute positively to diverse social settings.
- **Global Citizenship:** Values are central to the cultivation of global citizenship. In an interconnected world, learners must develop values that promote tolerance, respect for diversity, and a sense of global responsibility. The integration of values in education aligns with the vision of producing global citizens capable of engaging with and contributing to the international community.
- **Lifelong Learning and Adaptability:** The Learning Compass 2030 places emphasis on Meta-Learning, which involves learning how to learn and adapt. Values such as curiosity, resilience, and a growth mindset contribute significantly to an individual's ability to navigate lifelong learning. Integrating values into education promotes a holistic approach, preparing learners not only with knowledge and skills but also with the values that foster adaptability and continuous self-improvement.
- **Personal Development and Well-Being:** The OECD Future of Education and Skills 2030 recognizes the importance of holistic development, including well-being and personal fulfillment. Values play a crucial role in guiding individuals toward a sense of purpose and fulfillment. Education that integrates values supports learners in developing a strong sense of self, contributing to their overall well-being.

Values are not just a component but a cornerstone in the development of learners who are not only knowledgeable and skillful but also ethically grounded, socially aware, and prepared for a future characterized by complexity and rapid change.

One dominant theme surfaced in the Global Youth Talks report, conducted by Higher education for good in 2022 is the emphasis young people are placing on understanding, debating, and prioritizing values and virtues. They want this to be core to the education they receive, which is quite different from what they are currently getting (Higher education for good, 2023). Youth Talks is the largest-ever global consultation inviting people aged 15-29 to share their opinions, concerns, and aspirations for the future. 45000 participants in 212 countries and territories participated.

In a survey conducted among graduates of the Product Development program at the University of Antwerp, encompassing Personal Development in 2020 (N=282), participants suggested that our attention should be directed towards the following areas:

- 86% on soft skills (like communication, teamwork…);
- 86% on sustainability;
- 82% on systems thinking;
- 77% management and entrepreneurial skills.

Note that they could select from a list of themes and more than one selection was possible.

When asked if they would choose the same program again, 89,7% responded with “Yes”. The main reasons why mentioned for this were:

- The versatility;
- The generalistic character;
- The multidisciplinarity;
- The atmosphere of one big happy family;
- The balance between theory and practice;
- It enabled and strengthened their problem-solving and pragmatic approach;
- The different profiles emerging from our program;
- The emphasis on the role of bridge builder that we cultivate in the program.

Which implied that we should not loose these aspects when reforming our curriculum.

This was confirmed by a focus group of 15 Alumni in 2023, who added leadership, ethics, lifelong learning, and a holistic approach to the list of themes that our product development program should prioritize.

This culminated in the creation of 3 initiatives: Skillslab, My Designers' Values Project, and the Professionalization Learning Path. These 3 initiatives, which we believe are essential for creative excellence within the context of design education, highlight our ambition for the integration of personal development, values exploration, and self-reflection in our educational model,

1. SkillsLab: Via extracurricular workshops we aim at cultivating soft skills align with the Johari Window framework (Luft & Ingham, 1955), where greater interpersonal awareness leads to improved communication and collaboration. This initiative supports students' personal development and promotes self-directed learning, as advocated by Stolk (2009) and Hargrove (2012). By fostering skills such as communication, teamwork, and emotional intelligence, SkillsLab contributes to expanding self and interpersonal awareness, creating an environment conducive to effective collaboration and a stronger sense of community.
2. My Designers' Values Project: This initiative, part of the Sustainable Design course, encourages students to explore their values and reflect on the question, "Which designer do I want to be(come)?" This aligns with the emphasis on self-reflection and personal development in design education discussed by Rivard (2012) and Shim (2018). By integrating reflective writing and values exploration, as noted by Tracey (2018), this project facilitates students' personal growth, ethical decision-making, and commitment to sustainability. It also contributes to building a sense of identity and purpose among design students, promoting a more comprehensive approach to design education.
3. Professionalization Learning Path: Running across five cohorts, this initiative helps students grow in a structured manner, promoting continuous improvement and adaptability. The framework aligns with the OECD's Learning Compass 2030, emphasizing lifelong learning and adaptability, as well as Maher & Root's (2014) holistic approach. This learning path encourages self-awareness, ethics, and (self)leadership, connecting with the focus group feedback from alumni in 2023, which emphasized these themes for a successful career in product development.

Together, these three initiatives illustrate a multi-faceted approach to design education, incorporating personal development, values exploration, and self-reflection to create a collaborative and innovative learning environment. By embracing these elements, educators can foster well-rounded, socially conscious

designers equipped to address the complex challenges of the contemporary world. We believe this initiative will deepen the close connections we have with our students in the Department of Product Development. We anticipate that it will enhance their confidence, encourage greater boldness, foster a visionary mindset, and promote ownership in their design processes. This initiative should also support the transdisciplinary bridge-building role our graduates play in the job market. Most importantly, we believe it will contribute to their overall well-being.

2. Initiatives

2.1 SkillsLab

2.1.1 Setup

Commencing in 2020, the Department of Product Development within the Faculty of Design Sciences at the University of Antwerp made a strategic decision to intensify its emphasis on cultivating supporting soft skills and to proactively engage students in their personal development and growth trajectory. This initiative involves affording students the opportunity to choose, acquire, and apply various supporting skills, thereby augmenting the richness of their educational journey, elevating their academic outcomes, and bolstering their employability prospects.

Within the first year, the SkillsLab sessions are structured as concise, hands-on modules scheduled during the lunch break. Each session has a duration of 90 minutes, comprising a 20-minute introduction followed by interactive and practical exercises. The session's format is tailored to meet its specific objectives. Typically, 6 to 8 students gather around a table, forming a group that encourages peer learning dynamics among individuals from both similar and diverse academic cohorts.

Illustratively, the interactive session centered around 'giving and receiving feedback' adopted a speed date format. In this configuration, each participant engaged in giving and receiving feedback on a design project within the allotted timeframe. The initial 20-minute introduction clarified the guidelines and best practices for effective feedback exchange.

Notably, one weekly session has the capacity to engage an audience of approximately 400 students, spanning three Bachelor and two Master years. The workshop accommodates a maximum of 25 students per session, ensuring an optimal balance between interactive engagement and effective facilitation.

2.1.2 First Observations and Evaluation

Within the academic year 2021-2022, we conducted a voluntarily survey among our students. The participating students (N=87) exhibited high enthusiasm and regarded SkillsLab as a valuable resource providing practical insights and skills for their personal development. The workshops received positive evaluations for being clear and tailored to participants' needs, maintaining a well-balanced mix of theory and practice. The average score, based on a ten-point scale, was 9,05 (Van Dyck, Mestdagh, Vaes, & Jacoby, Van Dyck, H. Mestdagh, E., Vaes, K., & Jacoby, A.2022). Starting in 2022, we rescheduled all courses for all students, allocating free time to enable participation in SkillsLab on Tuesday afternoons. For 2nd and 3rd-year Bachelor students, we we introduced a requirement for three mandatory SkillsLabs to actively engage more students and enhance awareness across all students. By applying a pass rate based on their attendance, we uphold a safe and conducive trial and learning environment within the SkillsLab format.





Figure 2, 3. A SkillsLab about the basics of brainstorming. Figure 2 shows random stimulation technique. Figure 3 shows an energizer.

The inception of the SkillsLab program involved a meticulous delineation by the faculty, seeking advanced themes aligning with one of the five foundational pillars: teamwork & leadership, creativity, self-management & well-being, communication, and the application of supporting tools & techniques.
A pertinent topic for inclusion in the program is one that is extracurricular and amenable to introduction within the interactive context of a 'SkillsLab setting,' affording students the opportunity to experiment and swiftly assimilate knowledge following a brief introduction. In instances where relevance dictates, a supplementary SkillsLab session may be devised to build upon preceding sessions, enabling a more profound exploration of a specific topic. The overarching objective is to facilitate the internalization of these specific learnings by students during their routine curricular project work.

2.2 My Designers' Values Project

2.3.1 Setup

To commence our designers' values project, we sought to implement a modest experiment within a design exercise. This approach ensured the experiment's manageability and immediate applicability, avoiding unnecessary complexity. During the academic term of 2023-2024, specifically in the Sustainable Design course (3 ECTS, spanning 6 weeks) of the 2nd year (2Ba), we embarked on our first exploration of the question: 'Which designer do I want to be(come)?'.

Aligned with the theme of sustainable design for the year 2023-2024, focusing on climate action, students were tasked to select a small-scale, targeted climate action in everyday life. Their objective was to design a product facilitating this chosen climate action.

Upon receiving the design brief, we introduced the concept of “my designers’ values”. We prompted students to reflect on their aspirations as designers and emphasized the significance of contemplating this aspect early

in their academic journey. We showcased exemplary and suboptimal designs, manifestos, and instances illustrating the driving forces behind a designer's work, highlighting the enduring impact on their identity, whether consciously acknowledged or not.

Following this introduction, students were provided with a set of values (Brown, 2020). They were tasked with selecting values that resonated with them and then organizing these values based on their interconnections. This mapping process facilitated the identification of core motivating values, providing a foundation for their design principles. Students were encouraged to delve deeper, selecting 1 to 7 values—considered 2nd tier values—and ultimately narrowing down to 2 primary drivers shaping their designer identity.

2.3.2 First Observations and Evaluation

Three weeks after the unveiling of my designers’ values, students were invited to voluntarily participate in a questionnaire. Out of the 90 students, 56 engaged in the questionnaire. Analysis of the responses revealed that 60.7% of the participating 56 students perceived the introduction of my designers’ values as an added value, with 21.4% expressing a desire for adjustments (table 1). Notably, 76.8% successfully identified personal values through the value exercise (table 2), and 30.4% referenced these values while working on the sustainable design assignment (table 3). An insightful observation emerged, as one student acknowledged that the questionnaire served as a reminder to revisit her listed values.

The open-ended query addressing potential areas for improvement unveiled recurring suggestions related to the physical setting. A notable proposal was to relocate the exercise to a more "open" space or an outdoor environment, emphasizing the significance of the exercise's context. Multiple respondents highlighted the spatial aspect, reinforcing the idea of enhancing the exercise's effectiveness through a different and more conducive location.

Table 1. Did the introduction of the designers' compass during the introductory days add value to you?

Answer	#	%
Yes	22	39,3
Yes, subject to adjustments	12	21,4
No	22	39,3
Total	56	

Table 2. Were you able to determine some values for yourself during the values exercise?

Answer	#	%
Yes	43	76,8
No	13	23,2
Total	56	

Table 3. Did you refer to the values or designers' compass while working on your sustainable design assignment?

Answer	#	%
Yes	17	30,4
No	39	69,6
Total	56	

2.3 Professionalization Learning Path

2.3.1 Setup

Within the Product Development program at the University of Antwerp, a comprehensive framework for Personal Development is established through the incorporation of six distinct learning paths spanning five academic years. These learning paths include:

- Design
- Research
- Economic sciences
- Human sciences
- Technological sciences
- Professionalization

A learning path, also referred to as a learning journey or educational pathway, is meticulously designed to provide learners with a structured and sequenced series of educational experiences. These paths guide students from initial points of knowledge acquisition to the mastery of specific competencies. They serve as a systematic approach to enhance the cohesiveness and purposefulness of the educational experience, ultimately optimizing the learning process.

Over the past five years, a dedicated curriculum committee and working groups for each learning path have collaborated to refine and optimize these learning experiences. Initially, the professionalization learning path was perceived as a collection of residual components that did not neatly align with other paths. Courses such as Portfolio & Orientation, Minors, and Professionalization in 3Ba, along with the International Design Workshop Week in 1Ma, were the primary components. From 2016 we added a 10-week internship in 1Ma. However, there was a limited presence of activities within this learning path for 1Ba, 2Ba, and 2Ma, apart from portfolio development. This was not considered problematic, given the primary focus on training designers for their professional careers.

To address this, the learning path was rebranded as the self-development path and underwent expansion to become a more comprehensive and mature learning journey. The refined structure includes:

- **1Ba**: Introduction of the 16personalities.com test to form diverse groups for the Product & Analysis design assignment. This test is closely linked to The Myers-Briggs Personality Type Indicator (Briggs, 1995) and serves to categorize individuals into 16 distinct personality types.
- **2Ba**: Introduction of the designers' values within sustainable design, fostering personal and professional growth.
- **3Ba**: Introduction of a new merged course called Portfolio & Professionalization (6ECTS), encompassing portfolio creation, self-exploration, and the development of the first version of ‘my design compass’. Additionally, students educate each other on themes such as ethics, self-

awareness, ownership, agility, and resilience, … while exploring the three minors offered in the master's program: Interactive, strategic and technology-driven design, in order to make a choice that suits the student best.

- **1Ma**: Through a group Product Service System (PSS) design assignment, students explore their group dynamics and preferred roles. Reflections are facilitated using Aalto's reflection cards, and a 10-week internship emphasizes reflective reports.
- **2Ma**: The master thesis becomes the focal point for second-year masters, preparing them for the professional environment. An innovation week and a portfolio course further encourage students to update their portfolios.

2.3.2 First Observations and Evaluation

The introduction of the 16personalities test in 1Ba helps the students to get to know themselves better and form groups based on their different profiles. This approach enables them to appreciate their differences right from the beginning when collaborating. The self-development learning path is still evolving, and the first edition of the Portfolio & Professionalization course is scheduled for the upcoming semester, starting February 2024.

The incorporation of the 16personalities test during the 1Ba design assignment facilitates a deeper understanding of oneself among students, enabling them to form groups characterized by diverse personality profiles. This intentional grouping strategy fosters an early appreciation for individual differences, laying the foundation for collaborative efforts within the cohort.

The self-development learning path is currently in a developmental phase, marked by ongoing refinement and expansion. An inaugural iteration of the Portfolio & Professionalization course is slated to commence in the upcoming semester, commencing in February 2024. This course represents a significant stride in the maturation of the self-development path, emphasizing the integration of portfolio creation and professionalization components into the educational framework.

In addition to these structured components, design educators are encouraged to incorporate reflection into their deliverables. Students are motivated to engage with SkillsLab and attend Inspirational Sessions (InsPO's), where alumni share insights into their professional experiences, offering a realistic view of the possibilities post-graduation. This comprehensive approach ensures that the educational experience extends beyond traditional boundaries, nurturing holistic development and lifelong learning skills.

3. Conclusions

3.1 SkillsLab

Although SkillsLab is a tremendous success, continuous improvement is essential. Therefore, conducting surveys on a regular base is relevant to identify needs and opportunities.

Encouraging active participation in SkillsLab poses a challenge for first-year undergraduate students who are navigating the initial stages of their academic journey within the faculty. The demands of mandatory coursework can be overwhelming for these newcomers, making it challenging for them to prioritize additional sessions. Establishing heightened awareness among other students within the academic community may, over time, positively influence the engagement of first-year students, fostering a more inclusive and supportive environment. Awareness of SkillsLab among practicum teachers can acts as a catalyst to alert first-year students, of a specific SkillsLab that might be relevant to them, which results in an increase of 1Ba participants.

Similarly, students in the second year of the master's program, immersed in the demands of their master's thesis, display a tendency to be less involved in SkillsLab sessions. A thorough examination is required to discern strategies that could motivate their participation in the future, as their involvement is perceived as integral to the peer learning process. Identifying the factors influencing their engagement and tailoring interventions accordingly will be instrumental in enhancing the overall effectiveness of SkillsLab sessions for students at different stages of their academic journey. Since 2022, we have established some SkillsLabs exclusively for 2Ma students, focusing on subjects relevant in time and subject to their master thesis which has resulted in filled sessions. For example, topics include "How to facilitate a brainstorm with your target audience or stakeholders?" and "Systemic design deep dive: how do I move from systemic analysis to the design phase?".

SkillsLab significantly enhances the establishment of a cross-year community among students in the department. In conjunction with various initiatives led by both students and staff, this project uniquely fosters connections among students in a relatively novel learning environment. Moreover, it introduces additional avenues for cross-year collaboration within the framework of design projects.

We are actively pursuing fresh collaborations with our student and alumni association to elevate this project in the upcoming academic year. Simultaneously, we are exploring the possibility of extending session accessibility to alumni. Recognizing the increasing demand for specialized skill development in the professional arena, particularly in addressing larger, more intricate, and frequently intangible tasks within the future landscape of design (Swanson, 2020), we aim to tailor certain SkillsLab sessions to accommodate broader applications across various departments or faculties. This endeavor involves investigating opportunities to forge connections and collaborations with other educational programs.

3.2 My Designers' Values

The integration of my designers' values will be a recurring element in the Sustainable Design course for 2nd-year students specializing in product development at the University of Antwerp in the upcoming academic year. To enhance the effectiveness of this exercise, there is a deliberate decision to allocate more physical space and time.

Building upon this initial exposure, students will delve deeper during their 3rd year (3Ba) in the Portfolio and Professionalization course, crafting the first version of their individual design compass. As they embark on the search for a suitable internship in their 1st master's year (1Ma), my design compass (version 1.0) will serve as a guiding tool. It will aid them in choosing and reflecting upon their internship experiences, acting as a North Star aligned with their evolving design aspirations.

As the current 2nd-year students progress into their 2nd master's year (2Ma) in the academic year 2026-2027, they will be invited to revisit and update their portfolio. This process will involve the creation of my design compass 2.0 within a similar portfolio-focused course.

The overarching objective is to seamlessly integrate this exercise into their educational journey, encouraging regular engagement. By maintaining this connection throughout their academic endeavors, we hope that students will continue to reference and derive value from their design compass in their professional work, providing a consistent guiding framework for their ongoing development.

The conceptualization of 'My Design Compass' as an instrument for aiding personal development, evolving in tandem with a designer, will be subject to further research.

3.3 Professionalization Learning Path

To reinforce the self-development and growth dimension of SkillsLab, we aim to investigate (software) tools that both students and coaches can utilize for tracking individual competence development. The selected tool should empower students to take charge of their growth process, fostering essential self-reflection and self-understanding to discern a personalized direction. This capability will be a valuable asset in structuring and advancing the SkillsLab workshop program and enabling a student to create their own design compass to navigate the future.

3.4 The Evolving Role of the Educator

The evolving role of educators involves acknowledging personal development and values exploration as integral components of design education. Educators are called upon to guide students in self-discovery, helping them identify their values, aspirations, and ethical frameworks that will shape their design philosophies.

The holistic approach in design education aligns with the broader societal shift towards sustainability and inclusivity. Educators play a pivotal role in instilling in students a sense of social responsibility, empathy, and an understanding of the environmental impact of their designs that is no longer optional.

The Educator's Evolving Role:

- **Facilitator of Holistic Learning:** Educators are transitioning from traditional instructors to facilitators of holistic learning experiences. They guide students in integrating technical skills with personal development, fostering an environment that nurtures creativity and self-discovery.
- **Mentorship in Values Exploration:** Educators serve as mentors in values exploration, encouraging students to critically examine their beliefs, ethical considerations, and the societal implications of their designs. This mentorship extends beyond the studio to prepare students for their roles as socially responsible designers.
- **Navigating Interdisciplinary Collaborations:** The evolving role involves navigating interdisciplinary collaborations to expose students to diverse perspectives. Educators facilitate collaborative projects that challenge students to consider the broader societal and cultural contexts of their designs.

More than ever, it is imperative that educators step out of their silos and consult and align sufficiently as a team to create the ideal climate in which students can discover and flourish. Continuing education and even retraining of educators, lifelong learning is key.

Day (2000) and Domik (2011) both stress the importance of investing in teachers' intellectual and emotional well-being, with Domik specifically highlighting the need for transdisciplinary collaboration and the development of lifelong learning skills.

Learning can no longer be dichotomized into a specific place and time designated for acquiring knowledge, such as school, and another place and time solely for applying that knowledge, typically the workplace. In the contemporary educational landscape, it is imperative to recognize that educating students extends beyond this traditional demarcation. To truly prepare students for the challenges of the future, we must go beyond imparting information; we must equip them with opportunities and essential soft skills that cultivate the mindset of lifelong learners.

In this context, educators must continue investigating how to evolve the learning experience. This entails creating dynamic educational environments that transcend the boundaries between academic settings and professional contexts. By integrating opportunities for continuous learning and emphasizing the

development of soft skills, we empower students to adapt and thrive in a world where knowledge acquisition and application are seamlessly intertwined. The goal is not just to provide them with knowledge but to instil the capacity for ongoing self-directed learning, fostering a commitment to knowledge acquisition and application throughout their personal and professional lives, aligned with their values and desires.

In forthcoming research endeavors, our aim is to continuously advance awareness, foster soft skills, and actively involve students in their journey of personal development and growth by empowering them. Through student agency, we provide them with significant autonomy to determine what and how they learn.

In the upcoming academic year, we will plan a study day to disseminate the insights gleaned from Portfolio & Professionalization, and to collaborate with educators and researchers in co-creating initiatives for other courses. This approach seeks to enable students to assume control of their developmental process, fostering vital self-reflection and self-awareness to chart their individual paths.

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P/REFERENCES OF DESIGN

INWARD A DEMONSTRATOR: EXPERIMENTAL STUDY TO REACH DESIGNER'S INNER CONVERSATIONS THROUGH INTERNAL FAMILY SYSTEMS.

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KEYWORDS | TACIT KNOWLEDGE, DESIGN RESEARCH, INTROSPECTION, DEMONSTRATORS, INACCESSIBLE RESEARCH

ABSTRACT | Design research is developing swiftly, adopting a lot from the scientific approach. However, rationalistic methods tend to limit their discoveries to ungeneralizable situated knowledge and lead to the separation of practice and theory, leaving unaddressed the tacit knowledge that design massively relies on. In this paper, an experimental tool is developed and tested that allows using design skills to explore their design decisions inward. During the design process, designers tend to adopt multiple perspectives of, for example, a client, a user, and a producer, and quickly switch between them looking for the best solution that suits everyone. We believe introspective methods are important for design researchers as they provide a better understanding of tacit principles guiding these shifts. The Internal Family Systems (IFS) approach suggests that as human beings, designers also have a set of personal perspectives, which might interfere with their design decisions and cause frustration. To reach them, an experimental card-sorting workshop was held with a designer who was still disturbed by one of the demonstrators he designed despite the time passed. Preliminary data was collected by interviewing the stakeholders and used to prepare the topics guiding the discussion. The workshop, guided by IFS techniques, revealed conflicts in the roles the designer plays as an executor, a company owner, and a private individual, which seem to be common in design practice. Further development of the tool might unfold a promising direction in design research towards bridging the gap between theory and practice, as well as design and research skills.

1. Introduction

Design research is developing swiftly, adopting a lot from the scientific approach. However, rationalistic methods tend to limit design research discoveries to ungeneralizable situated knowledge. This, in turn, leads to the separation of practice that is rapidly expanding into new domains and theory that is unable to follow it. Moreover, it leaves unaddressed tacit knowledge of design practice, that is often inseparable from the personality of a designer.

During the design process, decisions are often made by designers intuitively, even if they are based on solid ground of experience (Albers and Wiedner, 2011). Chow and Jonas noticed that keeping a distance from the studied object will never let the researcher fully comprehend the relationship between the designer and the design system (2008). Designers, however, have the necessary skills to position themselves inside it and obtain knowledge through practice. Furthermore, this perspective identifies a missing piece of design research — studying a finished project after being a part of it, or research AS design (or inward or inaccessible research) (
Figure 1).

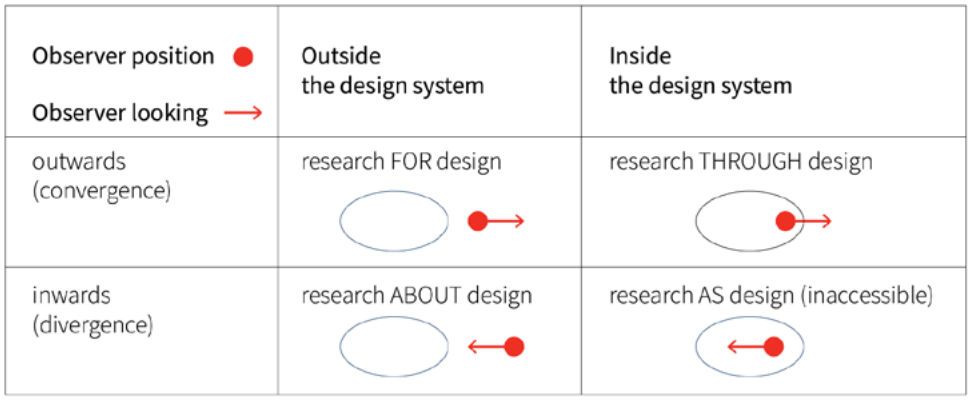


Figure 1. The concepts of research in design according to the observer position (see Chow and Jonas, 2008).

Moreover, the complexity and abstractness of design solutions are rapidly increasing. As opposed to the scientific approach that aims to reduce this complexity, design research thrives on it (Grand and Jonas, 2012). Therefore, to enhance the quality of the research skills of intuition and empathy inherent in designers should be mastered. Inaccessible otherwise, tacit bodies of knowledge can be accessed with the assistance of tools based on those skills. As a starting point of our study, we choose a demonstrator that has a richer soil for conducting such research (Sviridova *et al.*, 2022a).

In this paper, we develop and test an experimental tool allowing a designer to examine, report, and appraise their thoughts and experiences. The study is based on a case of a demonstrator, whose author claims to feel frustrated with it and still does not know why it was designed this way. To uncover usually tacit guiding principles, a series of interviews with all parties involved in the project-creating process were conducted. Based on the obtained knowledge, an experimental card-sorting workshop was held with the designer. According to the working hypothesis, during the design process, designers tend to adopt multiple perspectives of, for example, a client, a user, and a producer, and quickly switch between them looking for the best solution that fits everyone. To reach these perspectives of a completed process a combination of guided introspection methods with the Internal Family Systems approach elements was used. The researchers prepared cards with words that represented categories of possible reasoning based on the analysis of the interviews to guide the designer's inner conversations. The workshop revealed conflicts in the roles the designer plays as an executor, a company owner, and a private individual. These conflicts seem to be common in design practice and studying them might unfold a promising direction in design research towards bridging the between theory and practice. Moreover, a further development of the tool might help design research uncover guiding principles that are normally tacit such as designers' value

systems, enablers, drivers, or limitations.

2. Background

The ideal tool for conducting inwards research should be suitable to be used by designers in their practice, helping them identify and locate design rationale and strategic reasoning. However, as it deals with extremely vague matters, developed skills of reflection and introspection are required. As this study only describes the first attempt at developing such a tool, it was designed to be used with a researcher as an assistant. Otherwise, the data obtained might have been too unreliable for the rigor analysis. To acquire the necessary skills, researchers are suggested to use methods of guided introspection and the Internal Family Systems (IFS) approach. As domains of sociology and psychology have great experience in studying how people think and behave, the adaption of their practices seems to be promising for helping designers reconnect with their work.

2.1 Guided Introspection

The skill of reflection allows experienced designers to form a dialogue with the design process of constantly growing complexity and take the potential unintended consequences of their actions into consideration (Schön, 1984). It helps guide the process toward the best possible result, however, it does not aim to investigate subjective experiences for insights or knowledge generation. Introspection, however, involves deeper examination with an intention to explore 'what' and 'why' of one's own thoughts. Although, the literature suggests seeing introspection as a process (Gould, 1995), in this study we mainly focus on its efficiency in studying a project that was made a long time ago.

Reflection is used to adjust rational decision-making steps on the way to the result (reflection-on-action and even more responsive reflection-in-action according to Schön), while introspection addresses individual experiences when the result is achieved (Figure 2). In addition, reflection works with memory that fades with time, while introspection addresses the mental images, feelings, and sensations that can be recreated vividly if using appropriate tools. Therefore, methods of introspection suit better if the question aims to uncover the reasons for made actions.

Xue and Desmet differentiate between two scopes of the conception: the researcher's self-introspection, characterized by the unity of the researcher and their subject, and guided introspection, when the researcher only guides the subject to introspect. The last method focuses on assisting the subject in examining and reporting their experience and does not involve the researcher's introspection (2019). In this study, we choose to assist the designer so that he would not need additional training and could focus better on the process of reconnecting with their work.



Figure 2. The difference between reflective and introspective approaches when studying the decisions made during the design process.

2.2 Application of Internal Family Systems (IFS) in Design

During the design process, a designer intuitively shifts between several roles to get a better perspective of each of the stakeholders. These roles can be simply a client, a user, or a manufacturer of the product, however, with the increasing complexity of challenges, they are becoming more complex. Marmo points out how contemporary designers communicating on contextual, communal, and organizational levels become more of 'translators' between making, researching, and facilitating modes (2017). Meehan notices the tension caused by the confusion between having different functions within specific roles and the growing expectations to fulfill them. Depending on which mode and in what context they are in, roles

define what tasks they need to perform, while functions are about the responsibility they take on a general level (Figure 3). The interplay between these entities demands constant adaptation, making designers flexible and quick learners (Meehan, 2018). However, the process of switching between the modes as well as choosing the current most relevant one remains unclear. We believe that if designers could consciously reconnect with these modes, they could discover a lot about their own design process.

To try to address them methods of Internal Family Systems (IFS) were used during the study. IFS is an integrative approach to individual psychotherapy developed in the 1980s by Richard Schwarz. The basic assumption of this transformative evidence-based model is that the human mind is subdivided into indeterminate inner parts that are united and led by Self. In balance, this 'family' develops a complex relationship, where each part adds something positive for the individual. However, as a reaction to stress, they might try to draw attention to the problem by destructive and counterproductive actions. For example, as a reaction to a childhood trauma, a part can turn into an exile and take over Self in a similar situation, causing the feeling of vulnerability and fragility to protect the individual's consciousness from pain. In practice, it might look like avoidance or denial, and even lead to self-harm (Schwartz, 1995). The goal of IFS is to reconnect with the parts and 'unburden' them, restoring the cooperative and trusting relationship. It is important to notice, that parts are not created by experiences but can be affected by them. There are no 'bad' parts and thus, no need to eliminate them, but instead help them return to their non-extreme roles (IFS Institute, n.d.). The approach is relatively new and not applied much in domains other than psychology, therefore its adaptation to the design research purposes happened intuitively and was not supported by the literature.

2.3 Case Selection: Of Instruments and Archetypes

Demonstrators can be described as tangible objects, combining engineering, design, and art to communicate a certain, usually abstract and complex, message to their audience (Sviridova *et al.*, 2021). Although the process of designing them has received some attention in the literature, it is mostly focused on scientific demonstrators intended to bring research from the laboratory to the market (Moultrie, 2015; Stelvaga and Fortin, 2022). This study focuses on a demonstrator made in a small design studio: it manifests the result of the research personal to the designers without the influence of a client, a manufacturer, or a customer (Sviridova *et al.*, 2022b). Therefore, we believe the approach we propose should be fruitful in this case as most of the decisions were made intuitively and could not be articulated by the designers or reached with analytical research methods.

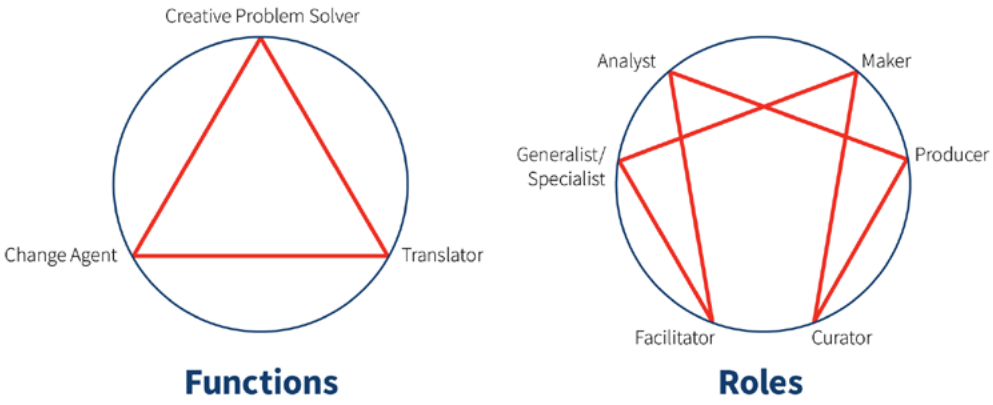


Figure 3. Visualization of probable functions and roles of a modern designer based on the visualization of an enneagram (see Meehan, 2018).

The selected project, 'Of Instruments and Archetypes' explores the relationship between physical and digital user interfaces by uniting measuring and making. It consists of a set of measuring tools and a screen displaying a 3D model. The user does the measurements and it immediately affects the parameters of the 3D model. When they are done the result can be printed. The project brings the making back to the maker, in the form of a physical embodiment of parametric CAD modeling (Figure 4). According to the designers,

the appearance of the tools is intentionally archaic to provoke people who are too used to digital interfaces (Unfold Design Studio, 2014).

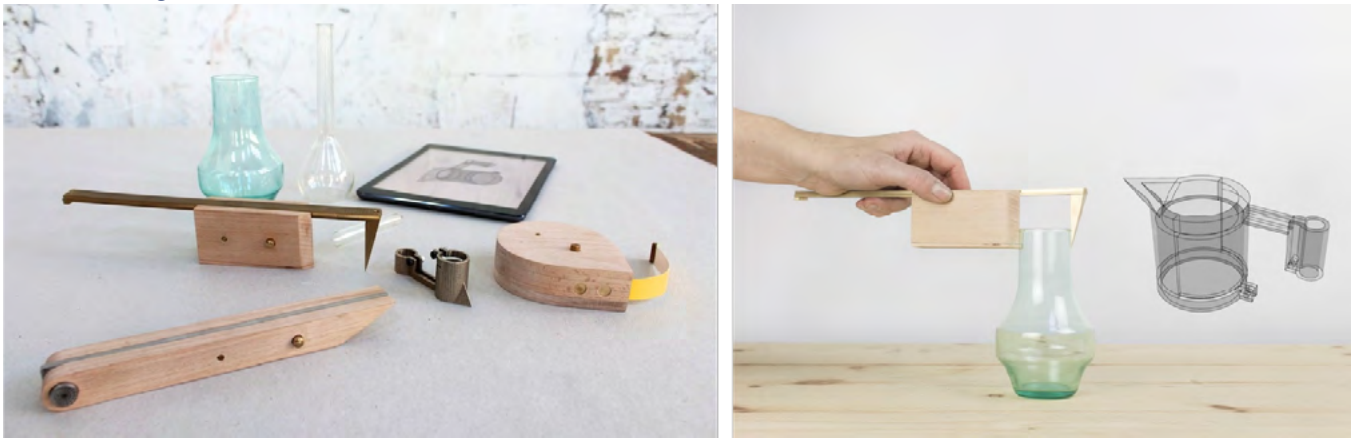


Figure 4. Of Instruments and Archetypes by Studio Unfold (Unfold Design Studio, 2014).

This project was chosen for the study as it still causes frustration to one of its creators almost ten years later after it was built. The designer claims that this project is the most unusual in his practice because he still does not know why they did the project the way they did it and why they decided to do it in the first place. In the interview, he clearly states their intention to bring the digital functions of the 3D-modeling tools back to the physical world, however, the frustration stays. Thus, it correlates with our statement that the problem that initiated the design was so implicit to grasp, that the path to the solution was guided purely by the designer's intuition and hence, needs a special tool to be unraveled.

3. Method

To help the designer answer the question of why he did the project 'Of Instruments and Archetypes', a special tool was developed first. It was designed to help him locate the relevant tacit knowledge zones and introspect them looking for the reason for frustration. To identify these zones, methods of Internal Family Systems were used. The algorithm for guiding the discussion was provided by a psychologist with experience in using this technique. In a nutshell, it consists of preliminary focusing and work with unwanted behavior. First, inner parts need to be identified and described, then asked how they feel in general and regarding the project. The number of parts can be established by asking direct questions or noticing which words the person uses when talking about the problem. The introspection process was supported by the conceptual card-sorting technique as guidance for the participant during the sensitizing process (Sanders and Stappers, 2012).

To pinpoint the key concepts for the cards, the researchers interviewed the people involved in the design process. Additionally, the context of the project in the studio history was framed using the materials from their website. The concepts represented categories of possible reasoning derived from the analysis of the interviews and researchers' assumptions. They were supposed to act like anchors and guide the participant busy with interacting with his inner Self about abstract problems. IFS was used to help the participant identify his inner actors, while cards helped him describe them and their needs while exploring the structure of their relationship.

4. Results

4.1 Interviews

Three people worked on “Of Instruments and Archetypes”: the designer, the second founder of the studio, and the intern. At the moment there was also the second intern, but all the parties agreed, that her contribution was mostly the details, as the core decisions about the idea, concept, software, and funding were made by the aforementioned people. Thus, the study consists of three interviews with them, an analysis of the project in the context of the studio history, and the results of a workshop with the designer.

The interviews were semi-structured and took around an hour. Two of them were held online, the one with the designer — in person. Questions focused on the timeline of working on the project and on the reasons for making it. The main parts of the project were elicited from the transcripts of the interviews’ recordings and explained the distribution of work (Figure 5). To find out what caused the designer’s frustration about the project, decisions that were made during the process and reasons for making them were coded and analyzed. Cards for the card sorting part of the workshop were made based on this data. The further analysis focused on contradictions in the participants’ words.

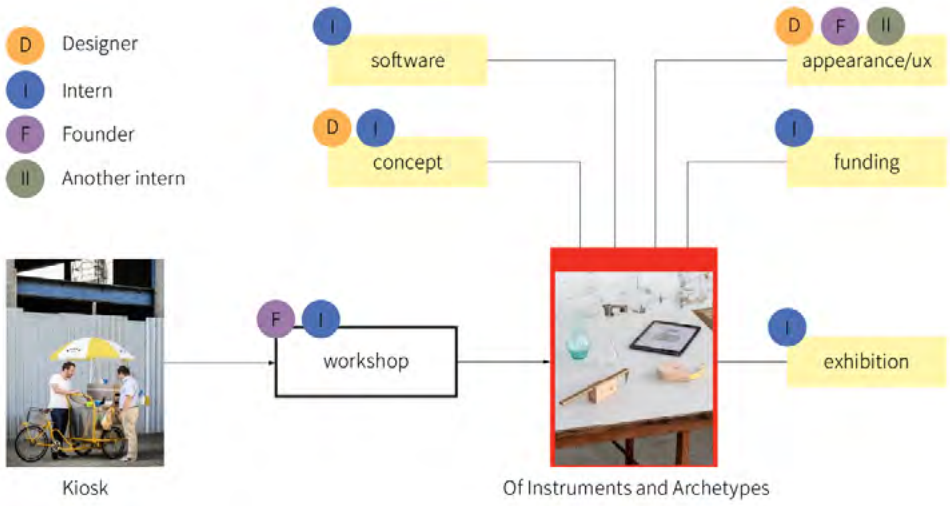


Figure 5. Roles on the project according to the interviews.

All three participants corroborated the roles they (together with another intern) played during the work on the project. The founder and the intern came up with the initial idea while conducting a workshop related to their previously done project, Kiosk — a mobile stall where people could print a custom detail. During the workshop, a discussion started with the participants about digital copying, and the idea of a tool that could take measurements directly on the screen arose. The intern was the main driver of the idea, and eventually, he obtained a grant that allowed finalizing the work after the concept development. He also organized the exhibiting of the project.

The founder said she did not feel any frustration regarding ‘Of Instruments and Archetypes’ and that according to her vision, the project showed well what the studio does. She explained that especially in the earlier days they liked to envision scenarios of the near future and illustrate them with tangible interactive objects. They were never interested in bringing them to the market and, therefore, she never felt any frustration about this project, nor questioned why they did it in the first place. However, two other participants still feel it and we believe, the reason lies in the aspect of commercialization.

The intern said during his interview that he started this project as a development of democratic design ideas.

By that, he understands the approach when designers provide customers with the possibility to make a product instead of the product itself. According to this, 'Of Instruments and Archetypes' should have become part of the easily accessible production facility, and the tools should be able to be bought in a hardware store or found on the street and used to create a chair, a table, or anything. Soon he realized, that this idea was impossible to materialize and he could only reach the demonstrator stage. However, he believed that the designer pushed the project to become a real product, something that could be produced and sold.

On the contrary, according to the designer's interview, the problem was that "if you want to make an impact, you have to complete the project instead of making it a kind of inspirational thing". He claimed that during his studies he was taught to work with concepts and museum installations, never considering the potential business model or the way how to commercialize his design. To him, 'Of Instruments and Archetypes' was more of a reflection point of what it was supposed to be and what it should be, where lies the fine line between a materialization of a concept to inspire others and a prototype for potential production.

Therefore, we concluded that the reason for the designer's frustration lies in his attempts to define what he as a designer should do: pursue commercialization like what a product designer is supposed to do or stop at the conceptual phase like he was taught at the design academy and what he prefers better. This version seems even more plausible if look at the studio projects' timeline: before 'Of Instruments and Archetypes' their work looked like prototypes of products that only needed one more step to be brought to the market, while afterward, they switched to demonstrators illustrating their ideas and research, and later, even to movies as a medium that communicates their stories more clear (Figure 6).

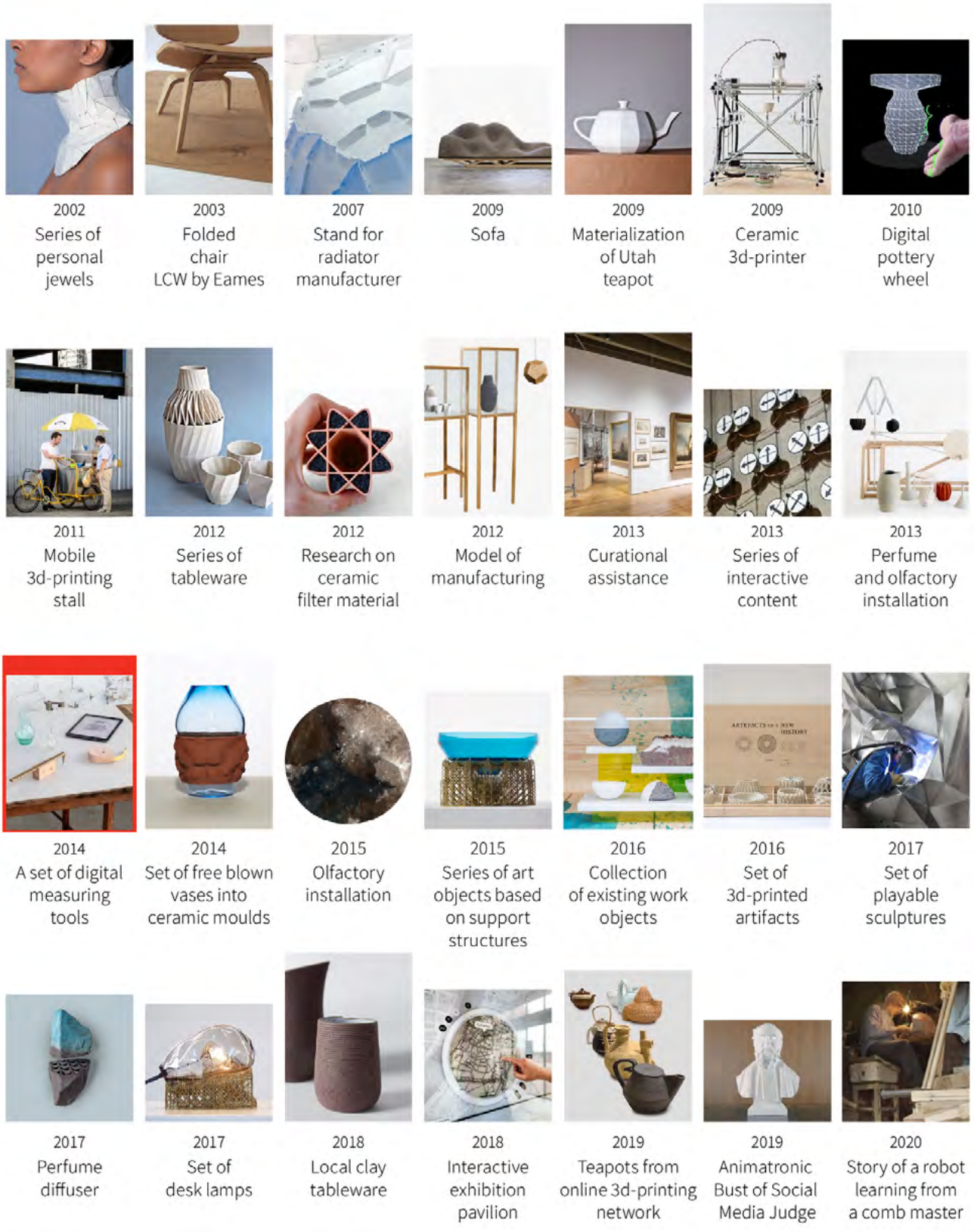


Figure 6. Timeline of all the projects done by the studio so far. In the top part, projects have the potential to be brought to the market, in the bottom — the focus is switched to the stories that the objects represent or even the videos.

4.2 Workshop

To test the hypothesis about the conflict between a concept-maker and a commercial product designer, and to see if there were other conflicts, a workshop with the designer was conducted. It was held in person and took around 90 minutes. The participant was briefly introduced to the procedure, the timeline, and the concepts written on the cards. The first half was based on techniques of IFS, while the second was the work with two sets of cards. The concepts written in the first one are meant to guide the discussion and help the participant describe his inner parts together with some blank pages left to add something if needed. The second set had potential frustration reasons based on the analysis of the interviews and the researchers' assumptions (Figure 7, left). During the first half, two main inner parts of the participant were identified: a curios challenge-seeking part enjoying problem-solving and making things, and a sustainable business-oriented part, who seems to have a conflict regarding earning money/sustaining the studio and exploration of design/envisioning the future. We assume that the discussed project was the one where the conflict took place for the first time.

To guide the discussion, questions from a list provided by the IFS expert were asked in an appropriate order (Table 1). The parts were directly asked what makes them happy or frustrated (Table 2). Then they were asked to focus on the 'Of Instruments and Archetypes' project and describe how they feel. Surprisingly, the sustainable part was happy about the project because "that story works". Being pragmatic, it enjoyed developing the concept of how consumers work together with designers in the future. At the same time, these aspects caused the frustration of the curios part — it did not have "a lot of plays" as the concept was quite specific. However, if the curious part gets its freedom, the sustainable one faces eternal questions of how to fit the project into their studio's strategic evolution. The designer notices that "the desirable situation would be that companies pay you to be the curious hacker and the future envisioning", yet he admits that it is a dreamland, and other studios he knows have the same struggles balancing between the need to produce things that can be sold and aspirations to research and explore.

Table 1. Questions to identify the inner parts and work with specific ones adapted from the IFS approach.

Focusing Self on one of the inner parts:
• At which part would you like to first pay attention? Which part would you like to talk to first? What does it look like? • What thoughts can you notice when focusing on this part? What feelings do you have towards this part? • Are there other parts? What other parts can you notice/observe/hear?
Work with a specific part:
• What story does this part want to tell us about itself? What is important for this part to tell us? When did it appear for the first time? How old is it? • What does this part do for you? What does it take care of? What are its intentions towards you? • When did it start doing it? • What did it feel when it started taking care of it? Does it like this job and the way it does it? • If it did not need to do it, could it give this job to Self? What would it prefer to do instead? • What is the attitude of Self towards this part? What does <another part> think about this part?
Changing focus to a specific part:
• Do I understand it right that one of the parts is now reacting to this? Who is talking right now? • Could you please ask it to step aside for a bit? Does it agree? If not, what reasons does it have? What can we do for it to step aside for a moment? • When you hear the voice of//observe this part, what else do you notice? • Could I please speak to <another part>?

These perspectives are quite contradicting, nevertheless, the designer believes the parts understand that they are “two sides of the same coin” and that having the sustainable one is “a necessary evil” for the curious one. It is confirmed by the card-sorting exercise: the participant arranged the concepts so that they better represent these parts, however, with time they blended (Figure 7, right). He admits that although each of the parts finds much fun in the other’s activities (for example, the curious part is interested in learning how business works), it is the sustainable one that bears the most frustration as it has “to think about efficiency and the bank account” when the curious part does not worry about these things and can cut the frustration loose. Meaning, that keeping one part happy causes the frustration of another:

> “They are mutual. You can switch them because without one there's no other and without the other, there is no one. So you cannot pinpoint which of the two is frustrating you. … But the frustration is universal. That is a lack of having the means to do what you like to do or having a lot of means to do something that's different than what you want to do”.

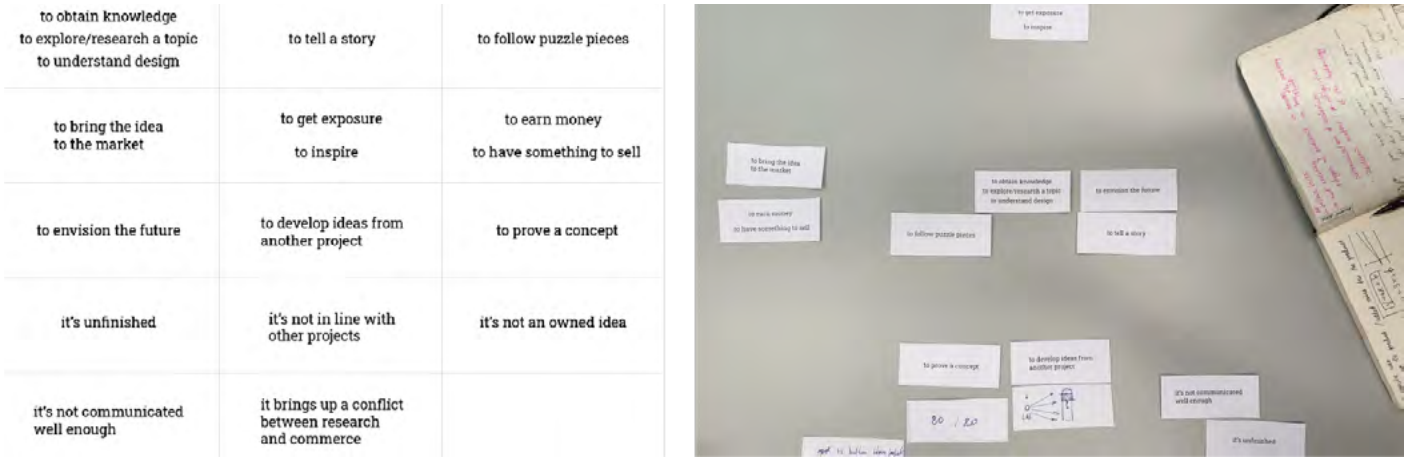


Figure 7. Premade concept and possible frustration reasons cards (left) and the results of card-sorting exercise supported by methods of guiding introspection clustering the concepts as more inherent to one or another inner parts (right).

The two inner parts of the designer were in constant conflict as they also represent his rational studio owner part opposing his irrational designerly one. Although he admitted the reasons for his frustration became clearer, the designer could not find a connection to why this particular project caused this emotion. The analysis, however, showed that ‘Of Instrument and Archetypes’ was the key project that changed the direction of the studio from potentially producible products to demonstrators, significantly shifting the emphasis to the research part, and later even abandoning the presentation of its results in a tangible form. The frustration arose as the intern who initiated this project represented the opposing views, in other words, the process of working on this project coincided with the designer’s inner conflicts. The designer did not come up with this interpretation during the discussion, however, he did not contradict it either. Although the participant denied the reason for doing the project came clear to him during the study, he agreed with the researchers’ version brought to his evaluation at the end of the workshop:

> “Honestly, I think I understand very well, but I'm just not comfortable, really. So maybe … that's also why I brought this project up, because I know that it's kind of … the end of something and the start of something else”.

The proposed tools worked as planned, however, the efficiency could be better: the participant could not always distinguish between the parts, and sometimes the guidance from the researcher was more confusing than helpful. Additionally, they focused on personal inner parts and could not locate the designerly inner parts. However, they might be tightly connected, especially in small independent design studios where designers have more authorship of their work. The collected data can be useful to refine the tool but it also highlights the potential direction of further research, which is a conflict of inner parts of a designer. The potency of it is proved by the participant claiming that many of his peers are experiencing the same.

Table 2. Reasons when two parts identified by the designer are feeling frustrated or happy.

	Curious challenge seeker/ creative problem solver/ explorer and maker of new things	Strategic future thinker/ business-oriented/ sustainable
Frustrated	- The longer you have your own studio, the more you involve people, the less you can get involved in that fun part (making things) - It's frustrating that I'm teaching here, while people in the studio are playing with stuff and making things - If you only try to be efficient and solve the problem, then you stop at the point where you start to be curious. - I think the core frustration where you feel like (the other part) is really happy - (this part) wonders how can I earn a sustainable income without having to make this vision as a startup	- The frustration is that it doesn't know what it can be or what is the format of that - It worries about how to get resources - from the outside it looks like (other studios) can finance kind of the curious, inquisitive meta story design work. But then later you talk to them, … and there is no magical solution - How can such activity sustain itself? How does it make an impact?
Happy	- I like to understand things - Two parts … are not meant to go together, but let's see what happens when we put that together. I think that's the fun of creating hacking	- It would want that he can fund the work properly: from a client, or public or private funding, or from limited edition objects

5. Limitations

It was the first time when the researchers used the Internal Family Systems technique and the lack of experience led to sometimes redundant guidance that, in turn, caused the participant to go in circles. Nonetheless, the result can be considered positive based on the participant's reactions: he managed to distinguish and switch between the parts and referred to them separately when answering questions. Sometimes, unwanted parts joined the conversation, it was clear as the participant's voice and even mimics changed. With guidance, however, they were properly addressed and asked to wait, while giving the space to the parts that were of the study's interest. Additionally, this approach deals with one individual, and no matter how complex one human being could be, a designer might have several personalities intertwined, such as user, client, or manufacturer whose opinion they take into consideration. It might decrease the accuracy of the tool; however, we believe it can be mitigated with the level of its development.

As both methods used in the study are based on subjective experiences, the tool might be limited to projects where the researchers have access to the involved parties. Meaning, that it could be less effective to use with secondary data. Although the tool is capable of being used for projects designed decades ago, and the feelings and emotions can be recovered almost as vividly as they are, the memory fade might still be a reason for concern.

6. Discussion and Conclusions

An experimental workshop was designed as a first attempt to develop a tool to reach tacit knowledge that designers produce when working on demonstrators. To identify and reconnect with his designerly inner parts, a designer who claimed he still does not know why he did one of his projects ten years ago was asked to introspect on his experience while sorting cards. The process was guided by questions based on the

Internal Family Systems (IFS) approach when the concepts on the cards were based on the analysis of the interviews of all involved parties together with the context in which the project was carried out. The direction of the tool design has proved to be successful as it allowed the participant to reconnect with the project he worked on more than ten years ago. Two inner parts of the designer were elicited: a curious problem-solver and a sustainable strategic future thinker. In a conversation with them the designer identified what aspects of his work make them happy or frustrated and realized that they contradict each other: if one inner part is happy, the other one is frustrated. The 'Of Instruments and Archetypes' project apparently coincided with the designer's realization of the fact that he will always have to invent new ways how to sustain his studio if he wants to work only with conceptual design. It means prioritizing the well-being of one inner part at the expense of another.

As the use of IFS is expanding to other domains such as marketing and branding, the proposed tool can be potentially adapted for multidisciplinary use. The method to locate the inner parts was based on the one that therapists use in their practice so it was not pre-adapted to the design context. However, if a person with no prior experience managed to use it (it could be seen by changes of voice and vocabulary selection of the participant when an inner part that did not want to talk interfered with the conversation), the efficiency of the method can be enhanced in the future. It might be used in research of design rationale and strategic reasoning of designers given the necessary modifications (that are also to be discovered).

In his essay 'The Author as Producer', Benjamin discusses the necessary changes in the political and economic environment that can grant the author the freedom to write what he pleases (2018). The social situation, however, is not inclined to give him such autonomy and will inevitably force him "to decide in whose service he wishes to place his activity". Benjamin talks about the potential impact of technological advancements and their ability to redefine both authorship and labor and gives an example of Brecht's theatre, where he alters "the functional relationship between stage and audience, text and production, producer and actor". Almost a hundred years later we witness his predictions come true. Today it is barely possible for intellectual workers to not be involved in their actual production process: designers must learn how to design, develop, and market their content to be sustainable. The Author has become much more multidimensional — yet, this advancement has also brought conflicts. The increasing number of roles and functions designers have to perform today might result in a lack of *design* in their practice and cause psychological frustration. For design research, it means that studying design is inseparable from the personality of the designer and to advance they also need to expand their palette of tools, functions, and roles.

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P/REFERENCES OF DESIGN

CONTRIBUTION TO THE DEFINITION AND STATEMENT OF PERFORMATIVE DESIGN: RELEVANCE TO DESIGN TEACHING.

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KEYWORDS | PERFORMATIVE DESIGN, CRITICAL THINKING, PEDAGOGICAL PRACTICES, DESIGN, PARTICIPATORY

ABSTRACT | In the expanded field of design science, performative practices emerged in the 1960s with the "experiential turn" concept to instrumentalize space and the body, trigger experiments with the public, explore the language of design, and invoke the various concepts that today are scientific instruments in design and elevate design to a multidisciplinary dimension. Performative Design (PD) transcends conventional boundaries by integrating experiential elements into the design process, emphasizing the importance of audience experience, human interaction, and the emotional resonance of a design. PD is a transformative act, where the designer becomes a curator of their methodology as an experience rather than just creating a product. There is a sociological impact that PD introduces into the scientific frontiers of design, especially when combined with other processes, such as participatory design, co-design, critical design, fictional design, and speculative design. This process involves a dynamic interaction between the physical and digital domains, challenging designers to consider the entire lifecycle of a design – from conception to fruition. This article proposes a teaching model based on the instrumentalization of design methodology as a medium to establish the interaction between: (a) the mediator - signifier, igniter, and activist; (b) with space - private space, public space, and nonspace, and (c) the Public - audience, participatory and observer. The authors applied this model in a Curricular Unit in the third year of a Communication Design degree in Portugal. In this article, they share the first results of this CU, where the student reflects on the design process as an exploratory means that continues after a functional consequence of a commercial product.

1. Introduction

This paper aims, first and foremost, to explore different approaches to design practice, with a profound recognition that the expanded field of design brings to the discussion the opportunity to explore new borders. In the expanded field of design science, performative practices emerge to instrumentalize space and the body, trigger experiments with the public, explore the language of design, and invoke the various concepts that today are scientific instruments in design and elevate design to a multidisciplinary dimension. Performing arts enunciated an artistic transformation in the 1960s with the "experiential turn" concept, which introduced experience as a complementary element to the different dimensions of creative practice, with the performative bringing contingency and illusion to situationism through a space and a discursive context, establishing a relation with the public. Designers have also appropriated these dimensions, bringing to the design context: (a) a transformation in practice through the power of event intervention and (b) the aesthetics of experience and construction through the creative narrative approach. Correlating embodiment, enactment, and staging with private space, public space, and nonspace, and the different types of audience, participatory and observer, PD projects emerge, which even transform the borders for domains already characterized as performative language and performative artifacts.

Nowadays, PD transcends conventional boundaries by integrating experiential elements into the design process, emphasizing the importance of audience experience, human interaction, and the emotional resonance of a design. At its core, PD is a transformative act, where the designer becomes a curator of their methodology as an experience rather than just creating a product. Designers such as Tereza Ruller - The Rodina (2021), Amandine Alessandra (2021), Benjamin Santiago, Hella Jongerius, and Louise Schouwenberg (2017), among others, have outlined through their work the sociological impact that PD introduces into the scientific frontiers of design, especially as other concepts can be enunciated in this practice as participatory design, co-design, critical design, fictional design, speculative design, among others. PD thrives on embodying ideas, where concepts are translated into experiences. This process involves a dynamic interaction between the physical and digital domains, challenging designers to consider the entire lifecycle of a design – from conception to fruition. The Designer "The Rodina" has demonstrated through its work that the physical and digital dimensions through immersion in augmented reality open new ways of experiencing, bringing the design closer to fruition.

Methodologically, the goal is to contribute to the PD statement and definition through intensive research focusing on a literature review and an academic understanding of reference designers working in this field, analyzing, and characterizing their methodologies and contexts. What we found most prevalent in the extended field is the structuring element of their practices or the instrumentalization of design methodology to establish the interaction between their work, the space, the public, and the anticipated outcomes. Based on this conceptual framework, the authors created a teaching model - Performative Design Experiments Generator Model (see figure 1), to facilitate the design process students used to develop the design challenge pedagogically supported by a project-based learning approach in a Curricular Unit in the third year of a Communication Design degree in Portugal.

This reflection presents and discusses the first results of this CU, where the student looked at the designer as an exploratory means that continues after a functional consequence of a commercial product. Thus, it also allows young future designers to understand design knowledge and intervention through interdisciplinary collaboration, bringing together experts from different areas to converge PD and design science in a fertile ground for innovative and holistic design solutions.

2. Performative vs Performance

It is essential, first, to identify the difference between the terms "performance" and "performativity," which are ambiguous and have varied meanings and implications in various situations and fields. As a result, opinions about how performative reenactment differ significantly among practitioners and in depictions of it in academic and media contexts. (Johnson, 2019)

Performativity, which means "the quality of being performative," has been employed in various contexts and occasionally in specific ways. The most well-known usage of the term was in Judith Butler's (1988) argument that gender is produced through the verbal and physical acts that impose social norms. Associated with this definition is also the performative language, defined by Austin (1962), which is the capacity of some forms of language to act - not only to describe but also to effect social action by accomplishing a statement.

The clarification in the arts field, specifically with the distinction of performative arts, allows us to characterize the difference and application in the context of PD. The distinction happens genetically; "theater" and performance usually refer to scripted works centered around (verbal) dialogue, story, and a character or characters in theater, performance studies, and the cultural industries. On the other hand, performative refers to a change in focus from the effects and sensations a piece generates to what it shows and represents—or, in a simple understanding, from what it "says" to what it "does." (von Hantelmann, 2014)

The performative, in theory, causes a methodological shift in our perception of any creative work and the meaning-making process. When interpreted in this light, it does provide a fascinating and thought-provoking change of viewpoint. (von Hantelmann, 2014) The performative idea puts into perspective the illusive and contingent world of impact and effect that creativity produces, both relationally—concerning a viewer or public—and situationally—that is, in a particular spatial and discursive environment. (von Hantelmann, 2014)

Von Hantelmann (2014) applied this change with *experiential turn.* This term changed the creative environment, especially in the arts, when in the 60s, with the expanded field (Krauss, 1979) turned toward the production of experiences, creating and molding experiences became a crucial component of the idea behind the artwork. The potential of art to elicit this experimental self-relation is what has an aesthetic influence that communicates not with the artist's sensitivity or subjectivity, as we could when we consider other works of art, like drawings, but with ourselves and other people who share our experience. (von Hantelmann, 2014) In this perspective, the author focuses on a purpose for the performative definition, where the object, traditionally the protagonist of meaning production, becomes a device for engaging in an experimental relationship with oneself and others. (von Hantelmann, 2014)

PD incorporates concepts into the design process in various fields, including interactive media, architecture, and design. It includes research on how people, situations, and surroundings can be actively interacting and shaped by design mediation. Functionality, economy, sustainability, user experience, social impact, and more are the criteria for creating designed artifacts, environments, and experiences. But mainly the commitment to the active engagement of participants, the exploration of liveness and presence, and the potential for transformative encounters between creators, audience engagement, and the world around them. The concept of the performative puts into perspective the illusive and uncertain domain of effect and impact that brings about both situationally — that is, in a given spatial and discursive context — and relationally, about a viewer or a public. (von Hantelmann, 2014)

According to Smith, G. (2006), Ervin Goffman defines that not only an actor or a performance artist, but every individual in his day-to-day interactions with others, is using a surface, and they must deliver a performance to influence the other. It transforms this perception into a continuous framework for interaction; that is, performativity is no longer made possible by framing the social scene. (Rullerova, 2015)

Performative Experience Design is a proposal defined by Spence, J. (2013, 2016) as a methodology, a field, and a paradigm for comprehending technology-mediated encounters where the system, gadget, or circumstance presents a chance for the "user" to perform for others. In the author's definition, Performative Experience Design draws our focus away from a technological tool or even the user's interaction with it and instead highlights the significant psychological and social shifts in perception that result from showing others how we interact with technology and from making ourselves appear to others as social beings using it.

In this paper, we intend to characterize the purpose of this (PD) proposal as a more expanded scope that is not defined by the technology or techniques but by the potential of the PD as a field for the public to interact in and with design, applying the fundaments in ephemeral practices, with flexible structures, instrumentalized by the narrative developed and embodying the designer as a mediator and with emphasis on the public participation as being part or as observers of the performative context. It is based on this conceptual extension connected to performative art that we develop the model and apply it in the teaching context to explore the expanded field of design, where nowadays it allows this dialogue with the viewer in areas such as critical design, speculative design, transformation design, among others.

3. Literature Review

This literature review researches the perspectives of performative designers within design theory and practice, being the timeline between Bauhaus and the Fluxus to Contemporary. While primarily based on scholarly journals, our focus is on understanding the viewpoints, methodologies, and contributions of designers who prioritize the performative aspect of their work. Through a comprehensive analysis of existing literature, this study aims to provide insights into the evolving landscape of PD and its implications for design theory and practice. The methodology employed in this literature review involved a systematic search and analysis of relevant scholarly journals within the design field. Keywords such as “performative design,” “embodied interaction,” and “design theory” were utilized to identify pertinent literature. After identifying relevant articles, a thorough examination was conducted to extract insights related to PD perspectives.

Revisiting the principles of the Bauhaus, one of their many concerns was to create fresh, cutting-edge teaching strategies that allude to the movement's past but are also pertinent to the discussion about design and design education. In this ambition of Bauhaus, Brejzek & Mayer (2019), identity articulation in objects and buildings, as much as in performances, choreographies, textiles, and paintings, texts, and manifestos, seemed to us to lie distinct links to today's concerns about design education and the role of the designer in society. Performative activities, like the well-known Bauhaus performances by Oskar Schlemmer (1924), were seen as a social and pedagogical aspect of the Bauhaus philosophy, further encouraging masters and students to interact, with invitations frequently extended to the general public. Costumes were based on order, law, and precise structures, incorporating new materials and technologies, fusing technology and human creativity to create futuristic-looking, sculptural figurines that interacted with the public—Applied Bauhaus pedagogies by design principles, methods, and social organization and activities. The preparation for each performance followed a similar pattern, beginning with the abstract symbols, designs, geometric formations, and predetermined linear pathways produced as paintings. These ideal abstract conceptions were practised in real life by collaborating with the dancers performing on stage (Nechvatal, J., 2017).

After Bauhaus, the Fluxus is the movement that embraces and brings to light this convergent approach to breaking boundaries. Emerge in the 1960s started with an interdisciplinary and experimental approach to the creative process, blending different media and breaking down traditional dogmatic views on the creative field for a more open mind, creating controversial work, converging disciplines for the same context, and engaging audiences in interactive experiences. From composers and poets to artists, architects, and designers: John Cage, George Brecht, Dick Higgins, Allan Kaprow, George Maciunas, and others define the need to conduct experiments using different disciplines in the learning process inside de classroom (Higgins, 2003).

From the book "*Information and Experience*", van der Bijl-Brouwer & Malcolm (2020) stated that it is possible to identify different approaches operating with diverse experiential frameworks characterized by the dissolution of boundaries, beneficial cross-fertilization, experience of context, and learning for a rethinking of wither education. Another recent change is using design methodologies, such as systemic design, to address societal issues through transdisciplinary collaborations. Academic and societal stakeholders must work together to fully understand and address the complexity of major societal concerns like digitalization, rising inequality, and climate change (Tejedor et al., 2017). Transdisciplinary collaboration holds the potential to integrate academic and contextual information, enabling the creation of treatments by leveraging diverse viewpoints (Lang et al., 2012).

Design is frequently promoted as a viable method of collaborating that may unite various parties and professions. However, sometimes, how it accomplishes this needs to be clarified. This research aims to elucidate design's role in transdisciplinary settings by challenging and expanding on this viewpoint. How can and ought design to position itself, we wonder? Is "the solution in itself" design? (cf. Dorst, 2019) or is its contribution more nuanced and humbler than often claimed? The most well-known design aspect is its generative powers, which enable it to produce aesthetically pleasing goods and seamless services. Nevertheless, there has been a greater focus on the ethical, political, and societal ramifications of design in recent years. Approaches such as speculative design (Dunny & Raby, 2013), adversarial design (DiSalvo, 2012), and value-sensitive design (Friedman et al., 2002; 2017) highlight these developments. In the meantime, there is a rising number of inter- and transdisciplinary collaborations due to the growing complexity of scientific and societal concerns. Issues like global migration, climate change, and digitization are examples of "wicked problems." Buchanan (1992) encompasses a broad spectrum of professional fields, scientific specialities, and cultural settings, necessitating a comprehensive strategy to handle the complexity and multidimensionality of the situation effectively. Such an all-encompassing strategy is the goal of transdisciplinary collaboration. According to Lang et al. (2012), transdisciplinarity is "a reflexive, integrative, method-driven scientific principle aiming at the solution or transition of societal problems and concurrently of related scientific problems by differentiating and integrating knowledge from various scientific and societal bodies of knowledge." (Lang et al., 2012). There is an understanding of the rationale for the perception of design as a prospective ally in transdisciplinary cooperation. The intricate, unrestricted, unclear, and interconnected character of contemporary issues provides opportunities for design and its innovative drive to use its proficiency in comprehending many disciplinary frameworks and stakeholder viewpoints (Buchanan, 1992; Dorst, 2015; Meija et al., 2018). Furthermore, tolerance for ambiguity, solution-driven attitudes, and comfort in framing and reframing the problem—all fundamental characteristics of design—are required due to the complexity of societal concerns (Dorst, 2015; Meija et al., 2018).

According to Minder, B. & Lassen, A. H. (2019), the designers have increased their capability through methodologies of user-center design, co-participatory or co-design, instrumentalizing multidisciplinary in a more flexible and experimental dimension, assuming the role of facilitator or mediator, and allowing the designer for develop skills that have interventions and the transformative power of a creative narrative approach.

3.1 Learning from Performative Designers

An example of this multidisciplinary acting is the work developed by Tereza Ruller, "The Rodina", in which she proposes the PD as a practice to effect social change. The design is a practice that carries out an action, signifies the happening of an event, integrates time and space, and has a connection to both an audience and a performing group. Rullerova, T. (2015) also states, "I understand performativity also as a concept and method of performance." The designer argues that the performance is unique; it takes place through the designer's action, the interaction with the public, and the experience and relation established in that moment. In her, performativity is also a concept and method of performance, and she complements it by reinforcing that, on the contrary, to performative art, the process can create an artifact or a "fetishized" material memory. Expanding this theoretical perspective, Rullerova, T. (2015) defines *artifacts* as a medium

of the intent to instrumentalize the relationship and information for the user. An example of this vision is her exhibition *Keep Smile*, performing the role of designer, Banská Stanica, 2014. “The Rodina” takes her vision to a different level, using the expression of surface as a border between objects and outside, which, with technology, enhances the relation with surroundings and simultaneous presentation of information. She exemplifies with the work of speculative design studio Metahaven that as the capacity to transform values, it is defined as a place where the material properties of its material do not have their properties. The PD *Accidental Geopoetics* (2019) is an intervention embracing the complexity of revealing rather than hiding. To visually support such a narrative, Rodina designed geo-ponchos – costumes for roleplay – through which human bodies connect to the planetary one. Performers were carrying 'geoglyphs'– a system of signs inspired by mining infrastructures as a unique navigation system guiding the museum visitors. *Elements of Style* (2020) is a performance that exposes the paths used by editors, curators, designers, artists, and producers to create publications. The completion of the magazine is achieved through the application of immaterial, intangible labor procedures. These are etched into the big map, which turns into a curtain that never goes away (Rodina, 2019).

Another Performative Designer, Lauren Grusenmeyer, is interested in creating graphic design, performance, illustration, and design exhibitions with a discourse involving staging, dialogues, costumes, and graphic identities. To the designer, "performance is a complete design in which both the intention as the character, attributes, and gestures are designed in the format of a university" (Stone, 2017).

Looking at Stefan Sagmeister's most well-known works, *The Happy Show*, is the outcome of a study on happiness that lasted more than ten years. The show transports us inside Sagmeister's head and his inventive yet approachable ideas about happiness through a combination of comedy, provocation, and interactivity, together with video, infographics, sculptures, and interactive installations. It also suggests that, like our bodies, happiness may be trained; thus, a more active role in pursuing it is called for. Sagmeister ignites the limits between design and art or between science and popular culture, breaking down all barriers by using incredibly emotive graphic design to connect with people (Sagmeister, 2018).

Amandine Alessandra is a graphic designer and researcher who developed through collaborative remote workshops offered in academic contexts, primary and secondary schools, and cultural institutions, but also diasporas looking at reconnecting through a punctual, creative participatory event; she creates typographic performances exploring togetherness in a post-Covid 19 world within the TAO lab. Her study also explores fun ways to write instruction centered on performance and group practices, working with trainee teachers and Didactics students. In between Raphael's cartoons, the Victoria & Albert Museum hosted this public multimedia typographic performance in 2014 and 2015. The liminal area of interaction that results from people constantly switching between virtual and real locations is examined in *One Word At A Tim.* With the proposal *Typographic performance: Message as Flux,* only by capturing screenshots of the photos from a public webcam—which shows the famous Abbey Road crossing—onto a computer was this typographic performance captured on film. A fraction of a second appears to be added to the CCTV's 4-second real-time image display every 4 seconds to accommodate the image refresh time. It is interesting to note that using a public camera to broadcast a message significantly increases its reach. This public performance aims to make people feel the weight of time passing by, symbolically stopping traffic, and using ephemeral typography to achieve this (Alessandra, 2015).

For Benjamin Santiago (2019), the performance *Spaundou*, is a constructed language of his design, based on recreating the experiences of being half-Filipino and half-Puerto Rican but without speaking either language. Santiago takes the form of semi-participatory musical performances, pamphlets, installations, and karaoke-style videos.

The Studio Åbäke is a collective where visitors are welcomed by hired performers and storytellers. Exhibited ephemera and other printed graphic items catalyzed personalized narratives. The studio is a transdisciplinary designer collective that focuses its work on the social aspects of graphic design and strives to make room for multiple perspectives by integrating curating, teaching, and publishing activists that use the participatory space as an instrument for experimentation within a framework of social practice, "*...play with instructions, taking turns, participation, and interaction.*"

A further example is Studio Moniker, which used various media to investigate the social implications of technology and how our everyday lives are impacted by it. They fostered works that unfolded and blossomed like plants, exposing their internal organizational mechanisms, and they actively involved the public in their efforts. The studio focused on print, video, interactive, performance, and physical installations. The Red Follows Yellow Follows Blue Follows Red, is a participatory performance. Here, each participant was given a

red, blue, or yellow cape with headphones and instructed to follow the directions. Those wearing red were instructed to "follow yellow but avoid blue," and those wearing blue capes were instructed to "follow red but avoid yellow." Even though there is no computer involved, the project shows how crowd behavior and what structures do to us—it is like social programming with instructions that work like an algorithm (Boddington, 2020).

Analyzing different contexts in areas of critical design, speculative or design futures, it is possible to identify a mediation with and through design artifacts that, for example, the work of Kristina Niedderer, performative objects, that function does not equal form, nor is it entirely observable in the form, even though the material form is one way that function becomes obvious. When it is in use, the second mode of an object is when its function is most clearly evident. The concept strongly emphasizes function as an immaterial attribute tied to an object's dynamic use (Niedderer, 2004).

With all these examples of PD, the emergence of "performative curation" offers an area where experimental approaches to meeting design concepts are being attempted instead of displaying completed works or artifacts. In this case, the curator's job is to establish a shared space of encounter with audiences rather than to act as a "custodian" or "expert" (Watson, 2021).

4. Performative Design Model

Based on the analysis and synthesis of the research information, the authors created the Performative Design Experiments Generator Model. The model aimed to be a classroom methodology to be implemented in a curricular unit, "Performative Design," in a Communication Design degree. The purpose of this approach was to bring to the students an expanded perspective on Design action and intervention, especially with a focus on the participatory aspect, where the dimension of the public as a participant can be instrumentalized through the conception of the design process itself. By exploring different dimensions of the performing arts and different ways of exploring interaction through the discipline of design, students will understand and apply critical concepts for the conceptualization and design of a project, which, through different means, has its primary objective of involving the passive viewer or active to achieve a specific goal. Interaction and experience are some of the models used by multidisciplinary artists; the field of PD makes room for the construction of another way of communicating, reaching audiences, and creating memorable experiences and sensations, being an exploratory field for multidisciplinary designers.

Through the teaching methodology, the student is intended to develop projects that promote the instrumentalization of all the knowledge acquired throughout the course. This experimentalist exploratory unit raises the student's rationale to a dimension of expanded design practice. The student will be able to explore different fields in a self-reflection on the different design domains and their area of expertise in the professional field. As an area in development, the exploratory factor will be pedagogically an opportunity for students to structure critical thinking about the design discipline. Identify areas of intersection and

convergence/divergence that demonstrate this space of interaction and dialogue between the agent and audience, changing their position from observer to participant. Students were challenged to create their models of PD, guided by the exploration of pre-existing concepts, but above all, to identify different areas of action in which design is the mediator of this relationship between participation and experience—observing, research, understanding, critical thinking and building a proposal.

The students must define the topic through a problem-based learning approach, which the students could define during the research. After contextualizing the performing arts and the main concepts that this context brings to design, students should understand through the analysis of PD projects to complement the research. After comprehension of the model, the student can combine the information, mainly define the project's purpose for engaging with the audience, and design the interaction and the experience.

The starting point is the model developed is the intersections between 3 axes:

- SPACE (a sense that can be private, public, and nonspace);
- PUBLIC (audience, participatory, and observer);
- MEDIATOR (that can be a signifier, igniter our activist).

In the crossing of these three axes, we have a result:

- Between SPACE and PUBLIC, the construction of a PERCEPTION;
- Between PUBLIC and MEDIATOR, the ARTIFACT that can be an object, word, or media, among others;
- Between a MEDIATOR and SPACE, the SITUATION.

The crossing results are the EXPERIMENTS concepts:

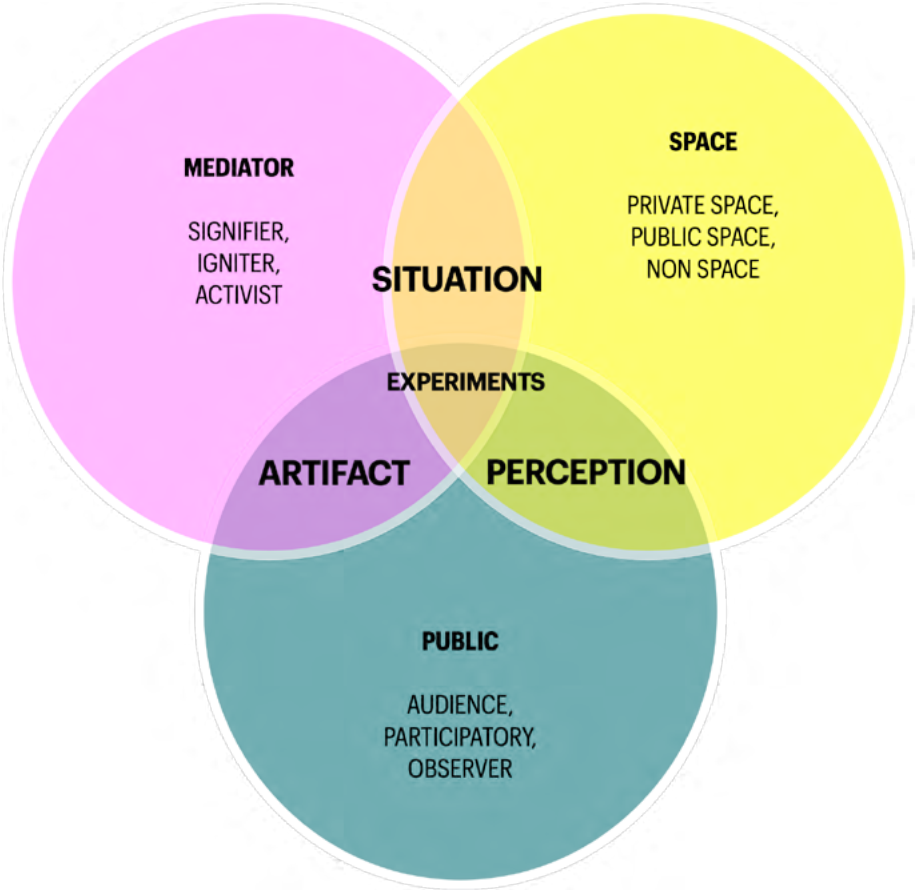


Figure 1. Performative Design Experiments Generator Model.

This experience allowed students to develop other dimensions, especially personal interest, and critical thinking about societal, environmental, political, or complex contexts. The projects presented in this article are a small sample of the results obtained, with the curricular unit being in existence for three years. There has been a constant update of the pedagogical approach and the model itself over these three years, as this area of PD has evolved as it has been appropriated by more Designers, even established designers as we presented in the literature review.

Three student projects were selected, representing the diversity of applied contexts:

Project 1: Focusing the Consumer Consciousness

"*Mind the Food*"
The project aims to raise awareness of the importance of sustainability in the context of food and reflect on the impact of our choices, "*Mind the Food*" looking for conscious and creative alternatives in the territory (Algarve). In a public space, the performance begins with each person taking out a card, where they can find a drawing of a typical food from the Algarve region or the village of Burgau and a word from a group of topics about endogenous, traditional and problematic issues from the region. Then, as a group, they will prepare a creative recipe where dialogue and debate will be promoted, raising questions like the lack of water in the south of the country, gentrification due to tourism, or excess fish consumption in the region.



Figure 2. PD work developed by the students Palma, Agostinho, Silva, Freitas, and Ferreira.



Figure 3. PD Title: *Mind the Food*, developed by the students Palma, Agostinho, Silva, Freitas, and Ferreira.

Project 2 and 3: Focusing the Political Consciousness

"*DemoDrama*"
The project aims to raise awareness of the importance of political consciousness in Portugal, considering informed critical thinking about politics and the role of citizens when making decisions and elections. "DemoDrama" is an experience through gamification on the concepts of Democracy and Citizenship in a dramatized way. According to Salvador Sandoval, political consciousness consists of understanding the eleven interrelationships between the psychosocial dimensions of meanings and information that allow individuals to decide how to act in political contexts and specific situations. Starting from the question: "Is democracy a regime of trust?" the participant takes a route that validates or invalidates their conviction, with a complex system of questions designed to interact with the visitors until a final moment of characterizing the visitor's mindset.



Figure 4. PD Tittle: *DEMO DRAMA*, developed by the student Crisostomo.

"*Ensaio sobre a verdade*"

"Ensaio sobre a verdade" another student defined the essay on truth, in which throughout the exhibition, the visitor would be confronted with questions about national politics so that the interaction with the pieces designed by the designer, with one intention to be part of a collective experiment and which will result in a sense of awareness of the truth or lie about the topics questioned. The images at the end will illustrate this controversy, inquiring about the level of belief in national political parties.



Figure 5. PD Tittle: *Ensaio sobre a verdade*, develop by the student Cordeiro.



Figure 5. PD Tittle: Ensaio sobre a verdade, develop by the student Cordeiro.

4.1 Results Discussion

Ultimately, we apply a group dynamic of self-assessment and evaluation between peers to understand the forces and weaknesses and breeding suggestions to understand students' training for this practice and a more expanded design field. Compared to design challenges with project-based learning methodologies, i.e., presentation of a challenge in this area of PD, the introduction of this pedagogical model is effective in

understanding the project SCOPE and this practice because it brings specific axes of Research and searches for solutions through the expanded field of design. Thus, the results indicated:

Forces:

1. Students indicate that the model leads the sequence of straightforward actions that allows guidance in all phases of the project, in an area that is more complex for them because it brings many languages and codes different from their essence, theory, and practice of learning in the design that is used to;
2. It allowed learning of complementary areas to design, such as performance arts, facilitating applicability of this knowledge and practices to the field of design based on the model axes;
3. The perception of students that PD allows them to bring themself and their statements to a more direct dialogue with people.

Weaknesses:

1. Students have indicated that they still have some difficulty integrating some of the concepts;
2. In the final solutions, it is not easy to get out of traditional models and results, i.e., the tangibility of design in an innovative way with new assumptions.

Improvement suggestions:

1. Students suggest the creation of more sub-phases of the model that allow them a deeper exploration of the PD;
2. Suggest that the model indicate some experimental fields for project implementation to leave traditional models.

5. Conclusion

Our literature review demonstrated that we are still at the beginning of the theoretical and methodological modeling of the integration of Performative into the models, processes, and tools of design science. This field is still very connected with production and a design orientation toward Art. Therefore, we resorted to analyzing authorial works to better understand how this fertilization between art and design occurs.

The conceptual model present intended to consistently bring the performative to the classroom in a design degree to systemize the process, integrating the aspect of pure creative and performative exploration with the rationale of design processes. The authors sought to integrate the performative aspect with the essence of research, focus, and objectification in creating artifacts by harmonizing the subjective and experimental with the materialization and concretization inherent to the design project that directs its production to something or someone. Therefore, this article contributes to the construction of scientific knowledge for this expanded field of design action, both in its foundations and the possibilities of new outcomes.

This exploratory approach and medium are fundamental to the design scene, between the dimension for exploring the new conceptual artifacts that question different contexts and social drivers that bring further questions for communication. The projects developed over the last three years provide the opportunity to reflect on several issues, namely the continued loss of culture and critical thinking on the part of young people, where their convictions and practices remain at the level of pragmatism and the function of design. The PD model crosses three axes that do not constantly interact directly with the designer. Therefore, future design professionals must understand that we all have roles, and their work intersects all these axes, whether in an experimental or practical field. The discomfort of mediating or creating artifacts that intercept the space and the public is disinhibiting the construction of new opportunities for experiments and, in turn, future ideas for design.

Fundamentally, the aim was to develop design skills in our design students, focusing on a more experimental process with an expanded intervention vision. We found that to obtain the desired learning results, it was essential to use a model that allowed students to explore other design dimensions, more interrogative, introverted, and activist. This elevated the intervention of Design beyond the dimensions of form, function, aesthetics, or even marketing. The results presented in this article, through student work, demonstrate this.

The PD model allows the students to learn complementary areas of design, such as performance arts, facilitating the applicability of this knowledge and practice to the field of design and allowing them to bring themselves and their statements into a more direct dialogue with people. Further model development needs to integrate more profound concepts and get the student out of the standard design field, mainly to segment and narrow the model for a more guidance structure.

Finally, we will say that we also need more significant discussion among peers about how to build and develop these fundamentals and practice, essentially by modeling, systematizing interventions, and sharing tools and results.

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P/REFERENCES OF DESIGN

THE CONCEPT OF 'EQUALITY, DIVERSITY, AND INCLUSION' IN DESIGN EDUCATION: OVERVIEW AND DIRECTIONS.

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ABSTRACT | The need to align teaching and learning practices to concepts that are conformed to the evolution of contemporary society, so that students can gain higher confidence in addressing the instances of future markets, requires Design universities to review their curricula. Equipping future designers with updated cultural and design frameworks is an imperative and strategic mission. Among innovative concepts that can advance Design Education and the development of soft skills in learners, 'Equality, Diversity, and Inclusion' (EDI) is today considered paramount to reorienting teaching and learning practices toward holistic educational patterns. This would allow students to gain more confidence in designing enabling products and services for all consumers, including vulnerable ones. However, EDI is an evolving and complex concept, sometimes hard to grasp. Moreover, potentially biased contents could limit its correct adoption. This work explores the concept of EDI in Design Education; it provides an overview of principal concepts and shows promising trajectories for Design studies. It follows a four-step process comprising a literature review, case study analysis, data synthesis and classification, and a discussion on promising research trajectories.

1. Introduction

The contribution of Design to the progression of global markets is today apparent (Boztepe, 2007). Only in the European territory, the Design industry significantly contributes to economic development by generating an annual turnover of circa 35 billion Euros (over 5,5% of the European business service sector) and the number of designers working in the creative industry exceeds 500.000 units (BEDA, 2018). Several authors (e.g., Cross, 2001; Lyon, 2011; Herrington et al., 2014; Noel, 2022) stated that the contribution of undergraduate and postgraduate Design programmes is paramount to empowering future generations of designers to gain novel soft skills needed to interpret present societal phenomena so that final consumers can adopt more sustainable and inclusive ways of living (Amrita & Aaron, 2021; Rieger & Rolfe, 2021). Accordingly, the Design discipline operates beyond styles and aesthetics interweaving strong ties between societal stakeholders, consumers, and economic actors (Meyer & Norman, 2020).

In recent years the raising of societal issues influenced the cultural and technical components of Design Education (Zimmerman et al., 2011). Along with sustainability, which contributed to improving the field since the '90s, issues related to the way people experience everyday life have become a grassroot from which to think about prosperity, fairness, and justice (UN, 2015; 2019). However, this culture was not only driven by theoretical speculations, but it mirrors clear market trends (e.g., Fondazione Symbola, 2023). Overall, the social dimension of the design practice is an aspect that all designers, including students, are asked to confront with because their actions determine some forms of social effects.

Among innovative social concepts that foster progressions in the body of knowledge used for skills development, 'Equality, Diversity, and Inclusion' (EDI) is today strategic to orient teaching and learning practices toward novel patterns enabling the design of products, services, and systems of solutions for all potential consumers, including vulnerable ones (Garay-Rondero et al., 2020; Amrita & Aaron, 2021). As the world becomes increasingly diverse and interconnected, the concept of EDI gains significant traction in various design fields, such as product design, service design, graphic and digital design. Accordingly, spreading the EDI concept in Design Education is vital to produce consistent and effective impacts on economies (Donovan, 2020), and this concept will be much more relevant in the future. Consistent with the vision of the Design Council in the UK (202-), to be inclusive, the Design discipline must reflect society's rich diversity and enable people from diverse backgrounds and worldviews to thrive, including people of various ages, disabilities, ethnic, social, life experiences, or cultural backgrounds.

In relation to Design Education, EDI is hinged around three relevant and clear concepts that are approached holistically regarding design practices. 'Equality' involves the conditions of fairness as well as the opportunity for groups of people to access enabling solutions that don't produce harmful conditions, or that such artifacts don't produce any disadvantageous conditions during and after their daily use (Garay-Rondero et al., 2020). Therefore, an imperative for any designer is the design of solutions that, regardless of their nature, are accessible in terms of purchasing power but also that individuals who may be disadvantaged have the resources they require to have the same, equitable possibilities as their peers. The concept of 'Diversity' strongly implies confronting with psychophysical, cultural, social, and economic differences of users that will access solutions to design (Lorentzen et al., 2018). This also accounts for the environment where actions are performed due to an 'inclusive' effect being experienced in a living context. In terms of designs, this requires designers to promote design processes by considering consumers' background, mindsets, and cultural habits to empower, even when liaising with manufacturing companies, an empowered culture of creativity and invention that recognized diversities as a value. Finally, 'Inclusion' entails setting up environments in which people feel fully appreciated, and therefore creating solutions that produce an engaging and inclusive atmosphere with solutions designed for them, regardless of their race, age, gender, psychophysical abilities, or disabilities (Holmes, 2018).

The value of promoting EDI in Design Education lies in its ability to foster inclusivity and celebrate diversity, which is an asset that expresses great potential in terms of curricula enhancement by enabling students to reduce market gaps and improve attainment. Universities can play a key role in training, facilitation, and

guidance. Hockings (2010) defines inclusive educational design as the design, planning and evaluation of programmes, courses, and modules in terms of learning outcomes, content, pedagogy, and assessment, and how they engage and include the needs, interests, and aspirations of all students. It becomes a pivotal concept through which future designers can shape prosperity for all by design (Garay-Rondero et al., 2020). By modeling inclusive behavior and instilling empathy values of EDI in students, design educators are asked to contribute to the creation of a more socially conscious society (Cho et al., 2013). This can be done at the product, service, and system level.

2. Aims and Methodology

In Design Education, EDI can produce significant progressions in terms of teaching practices and learning curves at all levels. This means that adequate programmes and contents on how to properly deal with EDI-related notions must enable learners to get higher confidence in a variety of subjects that the market is now demanding. Moreover, educational pathways on Design studies have the power to situate students into controlled experimentations that may produce first-hand experiences for learners (Hitch et al., 2016; Rieger & Rolfe, 2021); they can simulate real-life projects by working with first-hand data depicting societal outlooks. However, EDI involves complexity, due to its multidimensional nature that links technical, social, and economic spheres. Proper explorations on the ties between Design Education and the concept of EDI would help design practitioners in getting higher confidence in this complex cultural context.

This work aims at describing the main features of the concept of EDI in Design Education, to provide a disciplinary overview of concepts and to trace promising cultural directions to invest on.

In terms of methodology, this work is structured into four phases:

1. Literature review of topics linking EDI concept and Design Education, to provide a framework for phenomenological discussion within Design studies.
2. Case study analysis on examples developed within educational environments, to discuss how the inclusion of EDI into Design curricula enhances the attainment of students' soft skills.
3. Data synthesis and empirical classifications, to articulate taxonomies and to describe how the concept of EDI is holistically merged in Design Education.
4. Discussions and recommendations for promising educational models suggesting ways to correctly include EDI into Design curricula.

3. Literature Review

A literature review process (Cardoso Ermel et al., 2021) was used to develop the analysis of contributions matching EDI and Design Education. The analysis led toward the creation of three discussions: a) EDI culture in Design, b) Teamwork practices, and c) Empowerment of soft skills. Overall, these indicate that EDI is considered as necessary not only to promote a fair and more inclusive cultural environment, but also to create original projects whilst improving learners' relational skills.

3.1 EDI Culture in Design

In Design Education, several authors debated on the value that a design culture is fundamental to inspire students in shaping a better world. Indirectly, these echoed EDI. For example, cultural intersections between design, human ecology, and social change are proposed by Victor Papanek (1971) when he challenges that conventional design practices need to foster responsible approaches and impacts into society; Victor Margolin (2005) argues on how an effective design culture can trigger strategic forces needed to produce an opening toward the ethical sides, as a reaction to consumerism and exclusivity; in terms of enabling scenarios, Ezio Manzini (2016) discusses the concept of 'emerging design' as a design-led cultural

reaction that leads toward responsive designs; finally, an approach for "doing design otherwise" is offered by Carl DiSalvo (2022) who recommends that designers must supply novel contributions to local democracy by drawing together theories and practices.

Examples developed in academic contexts provide a better phenomenological understanding of how the EDI culture can enrich the teaching and learning practices. For example, Asojo (2001) discusses the need to introduce students and educators to different cultural settings to promote transformational approaches to EDI that raise awareness and strengthen abilities. Sohoni (2009) advocates the need to enhance the EDI culture by drawing on the experience of diverse cultures as part of the learning processes. On the other hand, O'Sullivan & Hakaraia (2018) prioritize the need to develop a culture of diversity as a pedagogical component that invites students to overcome cultural barriers, so that an enrichment is made through the appreciation of student cultural acumen. About educational settings, Lee et al. (2021) argue for the need to improve teaching and learning environments in terms of cultural perception, so that diverse student cohorts can be included. Finally, Albert et al. (2023) reflect on the need to generate an EDI culture by linking design practices to emotions, skills, and intercultural intelligence to engage students in active learning experiences related to a variety of issues.

3.2 Teamwork Practices

In an educational environment like the one promoted by Design studies, the term 'teamwork' immediately depicts the studio environments where both students and teaching staff are involved in developing projects and real-life simulations. However, several studies have discussed the value that a cooperation environment shows in terms of improvement of effective pedagogies on EDI (e.g., teaching and learning curves). Working in a group is an essential practice and provides momentum for the simulation of a professional environment. Within an EDI framework, this practice is essential and defines the daily basis around which to ask learners to confront, negotiate design decisions, and generate new knowledge.

Friis (2015a) describes how to impart the value of variety in innovative teamwork practices; given the rising prevalence of diverse teams in professional design work, diversity is a critical component of Design Education. In another work (2015b), she also provides an interesting analysis of dichotomous aspects of diversity in Design Education that evokes both creativity and conflicts among peers; the author finally states that despite inherent contradictions, diversity is capable of producing transformation at three levels: individual reflection and practice, the relationships and ways of working in the team. Mateus-Berr et al. (2020) provides an interesting analysis of dominant models of ability and (dis)ability, made with international teams of scholars and students; they claim that education for the future is made when professionals and people with disabilities work together. Fathallah (2021) reflects on the students' inherent competitiveness within Design studies, which often lend toward individualism and lack of collaboration; she advocates that projects must be organized by design educators to encourage inclusive group dynamics and democratic team engagement. Finally, Nae and Smith (2023) affirm that an inclusive foundation in Design Education is essential to engage mixed cohorts of students, and this can trigger modalities for social and professional cohesion among peers that ultimately instill cohesion and will to achieve outstanding results.

3.3 Empowerment of Soft Skills

Studies reveal that the EDI produces significant impacts on Design Education. Therefore, the empowerment of soft skills such as decision-making, higher awareness of EDI-related topics, confidence in the use of digital skills, and improved knowledge of methods and tools is a direct consequence of exposure to complex topics. Often, synergies between sustainability and inclusivity are seen as powerful drivers to expand the value of design practices toward holistic teaching and learning models that provide momentum to reflective creative practices.

Studies included in the literature review depict a multifaceted set of topics that are considered relevant to better reinforce the understanding of the contribution of EDI to Design Education and the empowerment of skills. For example, Tan (2019) affirms that creative investigations increase designers' skills to deal with interdisciplinary projects. The contribution of external bodies and people, as well as the direct exposure to on-site experiences, is discussed by Mensing-De Jong et al. (2021) as critical elements to promote inclusivity. Amaral et al. (2023) affirms that the ability to think beyond barriers is an essential quality of future designers in order to tackle difficult problems and have an influence. Different authors (Dias et al., 2015; Mateus-Berr et al., 2020; Oleson et al., 2023) encourage the combination of different disciplinary and interdisciplinary approaches to produce consistent progressions in skills development. Overall, there is consensus that the use of participatory design and research approach as well as collaborative design practices enables learners to get higher confidence with novel skills (Thieme & Van Boeijen, 2011); and this later produces progressions in the creation of a multidisciplinary inclusive educational framework (Kee & Lai, 2022).

4. Case Study Analysis

In the landscape of Design Education, the principles guiding EDI have emerged. This case study analysis (Yin, 2009) delves into the intersection of EDI and Design Education and explores challenges, strategies, and transformative potential inherent in the creation of inclusive learning environments. The aim is to unpack the multifaceted dimensions of topics to provide a synthetic examination of experiences found in the literature. Specifically, the case study analysis is developed around four domains: a) Cultural diversity, b) Empathic design, c) Authentic learning, and d) Human Factors and Ergonomics (HFE). The following sections contain an analysis of an emblematic case study representing each pre-identified domain.

4.1 Cultural Diversity

The relevance of cultural diversity in Design Education, as a fundamental aspect inherently driving EDI, is discussed in several studies (e.g., Sohoni, 2009; Lee et al., 2021; Georgiadou, 2021). However, the one presented by Hassin (2013) provides interesting discussions. The study aims to explore various perspectives on how Design Education can provide enriching experiences to cultivate designers capable of navigating the dynamic interplays between social change and human-environment interaction.

Design Education is claimed to demand inventive talents, social responsibility, and an awareness of human behaviors in both two- and three-dimensional contexts. The emphasis is on blending formal design components with socio-behavioral issues, as well as developing students' cognitive capacities to do successful design research. However, traditional Design Education, based on historical models, is mostly concentrated on formal characteristics that show little regard for cultural and social factors. The growth of cultural variety and socio-physical changes in modern cities needs a paradigm shift in Design Education that incorporates cultural components into teaching. Innovative design pedagogy methods, such as participatory design, have been put forth to solve these challenges. In the design process, this method places a strong emphasis on user involvement, cultural sensitivity, and cooperative problem-solving. This study finally concludes that Design Education must evolve to meet the demands of a rapidly changing society by embracing participatory approaches that promote social and ethical responsibility. Designers may successfully respond to social objectives and human needs by incorporating consumers in the design process and interacting with a variety of cultural views.

4.2 Empathic Design

Empathy is commonly recognized as one of the driving forces to empower dynamic connections with a culture on EDI and it can be found in different works (e.g., Joyce et al., 2011, Altay et al., 2016; Altay, 2017; Cordan et al., 2020). Enabling designers in shaping environments for diverse user groups is crucial for enhancing the quality of life and social participation, and this can properly be done by using empathy, though constraints often limit participatory practices. However, the work of Altay & Demirkan (2014)

provides a fundamental example on the use of empathy in Design Education. Specifically, the study analyzes activities conducted in an academic course focusing on inclusive design and highlights the importance of empathic understanding in Design Education through empathic modeling.

The project intends to provide relevant analyses on improving students' cognitive abilities, from simple to complex creation, as well as the hierarchical development of emotional behaviors and values. Thus, students engaged in a variety of activities, such as evaluating how accessible their homes were, acting out users with varying abilities, and creating posters to reflect on their experiences. Posters were intended as tools for critical reflection on technical and design issues; these later were evaluated in relation to changing attitudes toward inclusive design. Discussions included in the study are useful to highlight the need for empathetic modeling in advancing inclusive Design Education. Inclusive Design is discussed to improve students' understanding of strategic challenges faced by diverse users and to foster empathy.

4.3 Authentic Learning

Authentic learning is an educational practice often used in design modules due to the opportunity to experiment with real-life situations in a studio environment (Rossi, 2021). It emphasizes real-world relevance, complex problems, collaboration, and student reflection, which are key elements to promote active student engagement. Accordingly, early works demonstrate that authentic learning can promote deeper explorations and empathic understanding of issues related to EDI. In terms of case studies, two works are interesting for the aim of this paper.

The work of Rieger & Rolfe (2021) investigates the efficacy of authentic learning in Design Education, particularly in fostering inclusive design practices by engaging students with real clients with varying abilities. Traditional design education often relies on stereotypes or fabricated personas in studio projects, hindering students' understanding of inclusive design principles. Therefore, the authors employ authentic learning frameworks with a cohort of second-year architecture and interior design students in Australia, over a year-long period. The work concludes that integrating authentic learning frameworks into design education can empower students to become empathic and socially conscious designers, contributing to a more inclusive and equitable built environment.

The work Miceli & Zeeng (2017) propose IAES, a four-stage engagement process for students (Investigate, Apply, Explain, and Share) to overcome inherent biases found in design practices, such as lack of research, academic rigor, and stylistic imitation. The authors also remark the need to shift from a product-centric design culture to a process-led one.

4.4. Human Factors and Ergonomics

Several authors (i.e., Tosi, 2020; Attaianese et al., 2021) are considering Human Factors and Ergonomics (HFE) as a strategic research field to progress the value of EDI as well as the development of teaching and learning and design methodologies useful to design enabling solutions for all. However, the novelty and the complexity of this research angle produces a fragmented knowledge framework that results in an extremely little number of case studies. Among these, the work proposed by Dias et al. (2015) seems to be relevant for the aim of this paper.

The study examines the integration of HFE into Design Education, and emphasizes its significance in creating inclusive and usable products and spaces, particularly on shifting towards a new industrial model focused on social and ecological restoration. The work highlights the role of Design Education in imparting knowledge about human limitations and capacities in design practice, and the need to optimize human well-being and system performance through accessibility principles. Specifically, authors discuss the contribution of HFE in a Portuguese higher education institution. Discussion and results provide recommendations to integrate HFE modules earlier in the academic curriculum, or to teach concurrently with design studio courses to enhance students' application of HFE principles to produce socially

sustainable solutions. Authors ultimately recommend to include HFE principles into Design Education to enhance the inclusivity of products.

5. Data Synthesis and Classification

Sections 3 and 4 provide a description of main available sources discussing thematic foci of EDI in Design Education and examples made in a university context in relation to four knowledge areas. However, a holistic overview of what these sources suggest can provide better understanding to explore inherent dynamics within teaching and learning practices, and generally to evaluate students' skills development.

A process of data synthesis is operated to develop knowledge clusters depicting main influences of EDI in Design Education (Table 1). Conceptually, this classification follows and interprets the structure proposed by the Winterhouse Institute's Social Design Pathways (2015) that puts in place ranges of expertise, cultures, skills needed to address complex problems at various levels and scales, design methods, etc.

Table 1. Influence of EDI in Design Education: Knowledge clusters.

EDI	Design Education		
	Design Culture	Design Methods and Approaches	Teaching and Learning Practices
Equality	Commitment to breaking down systemic barriers. Improved ethics and awareness. Higher knowledge on sociological conditions of users. Focus on accessibility and rights. Ability to assess users (design, and T&L practices). Better use of open philosophies. Improved skills on social research. Autonomy in decision making.	Better use of social Design Methods to understand contextual features and users. Improved skills in translating sociological aspects into design practices. Improved skills in translating market data into design practices.	Introduction of new design topics from society. Compliance with emerging trends in Design studies. Consistent learning curves. Involvement of real users and/or stakeholders in T&L practices. Better adherence to real life situations.
Diversity	Commitment to breaking down systemic barriers (user level). Improved ethics and awareness. Use of unbiased contents in Design. Higher knowledge on psychophysical conditions of users. Focus on the quality of human-artifact interactions. Ability to engage with different user groups (design, and T&L practices). Ability to deal with multiculturalism and internationalization. Improved leadership for product and service innovation.	Higher use of goal-oriented design strategies. Better use of HFE methods to assess the quality and performance of products and services. Confidence in the use of tests with final users. Improved skills in opening toward diversity-oriented markets. Use of specific research methods for social investigations. (required) One-to-one design approach. Improved skills for design and innovation (product level).	Introduction of new core knowledge and design topics from society. Compliance with emerging trends in Design studies. Consistent learning curves. Involvement of real users and/or stakeholders in T&L practices. Better adherence to real life situations. Professionalization and improved marker readiness. Improved autonomy (i.e., students as knowledge producers).

Inclusion	Commitment to breaking down systemic barriers (group and society levels). Improved ethics and awareness. Use of unbiased contents in Design. Higher knowledge on the economic, social, and relational conditions of users. Focus on the social impacts. Ability to involve different groups (design and T&L practices). Higher awareness about nondeterministic design processes. Improved leadership for system innovation for social change.	Higher use of goal-oriented design strategies. Better use of Co-Design to involve final users into processes. Improved analytical methods for inquiry. Confidence in the use of tests with relevant stakeholders. Use of a goal-oriented mindset (from product-centric to EDI-driven approach). (desired) One-to-many design approach. Improved skills for design and innovation (system level).	Introduction of new core knowledge and design topics from society. Compliance with emerging trends in Design studies. Consistent learning curves. Involvement of real users and/or stakeholders in T&L practices. Better adherence to real life situations. Professionalization and improved marker readiness. Improved autonomy (i.e., students as knowledge producers). Research-through-design, or other immersive practices.

Previous studies discussed in sections 3 (literature review) and 4 (case study analysis) provide a phenomenological representation of the EDI concept in Design Education, and articulate the different aspects composing it in different teaching and learning areas. However, in these sections, only factual discussions have been reported, and most of them were presented at the phenomenological level due to sources used for the analysis; accordingly, these provide consistent descriptions of thematic analytical lenses used but do not show a qualitative emphasis on relevant aspects like impacts into teaching and learning.

Essentially, impacts are considered as qualitative or quantitative metrics to assess the results of an action within a setting. In the cases considered, impacts produced by EDI concept in Design Education can only be evinced at the level of cultural speculations. However, the quantification, or the qualification, of impacts produced by novel teaching and learning practices is strongly recommended by standard frameworks – see for example Advance HE (2023; 202-a); particularly, see Advance HE (202-b) for EDI-related topics. Therefore, to provide a contribution to the debate around the impact of EDI in Design Education, Table 2 proposes a detailed list of elements that are considered as promising in terms of impacts into teaching and learning practices. This contribution is provided at the learner, staff, and module and programme level.

Table 2. Impacts of EDI in Design Education.

Learner Level	Teaching Staff Level	Module and Programme Level
Develop reflective creative practices.	Improving the effectiveness and the consistency of T&L strategies.	Opportunity to develop new modules and programmes.
Develop critical thinking, autonomy, and decision-making skills.	Use of new design methodologies.	Modernization of T&L practices.
Improved marker readiness.	Opportunity to deliver updated contents.	Better reputation and promotion.
Better engagement and understanding of real-world problems.	Opportunity to adopt holistic and interdisciplinary contents and topics.	Active involvement of companies and organizations in T&L activities.
Opportunity to develop student-led projects.	Opportunity to move from content-based to goal-oriented and opportunity-driven T&L practices.	Introduction of a transformation culture (e.g., system design).
Better confidence in dealing with complex data/situations.	Fostered cooperation with other modules and disciplines.	Enabling teaching and learning environments (physical, digital, blended).
Better individual and teamwork skills.	Improved innovation-based culture (e.g., product and service design).	Increased enrollment and mitigation of drop out (long-term goal).

6. Discussion

Previous sections portrayed the complexity of the EDI concept in relation to the Design Education domain. The variety of data extracted from different sources provided relevant information in terms of cultural theories, themed discussions, and examples developed within educational contexts. This part of the work introduces discussions and recommendations for promising educational models and suggests ways to include EDI into Design curricula. It also tries to propose future trajectories to progress the debate in the area of Design studies. Accordingly, four discussion topics are proposed: a) Improving current educational models; b) Connecting student's soft skills with relational attitudes; c) Introducing inclusive criteria in curricula development; and d) Holistic trajectories for future studies. Brief notes on converging bodies of knowledge and the revaluation of values are discussed at the end.

6.1 Improving Current Educational Models

It has been said that higher education institutions can significantly benefit from the introduction of EDI concepts into undergraduate and postgraduate modules. In Design Education, wide improvements can be made in various aspects, such as novel contents, design challenges, studio practices, and live activities with real users. The use of immersive and empathic modalities to engage with students and stakeholders can benefit the overall learning curves so that a higher awareness on EDI-related topics can be produced (Rossi, 2021). The introduction of novel tools is also crucial to overcome biased notions (Rossi, 2023). However, EDI also triggers students' cultural progressions and enhancement of confidence about social components, which ultimately can reduce gaps in training while increasing students' readiness to enter in professional markets.

The improvement of current educational models can be promoted and supported by:

- Exposing students to real-world challenges and engaging with diverse communities. Real-life problems stimulate students' empathy and inclusivity in design practices. Authentic learning modalities are therefore favored.

- Encouraging collaborative projects that reflect the diversity of society. Teams of students from varied backgrounds can lead to innovative solutions and foster a deeper understanding of different perspectives.
- Developing curriculum components that aim at enhancing students' empathy towards diverse user groups. Empathic modeling and participatory design practices are favored.
- Consistent use of HCD principles and practices ensure that students are more capable to design accessible, usable, and inclusive solutions that emphasize the well-being of all potential users.

6.2 Connecting Student's Soft Skills with Relational Attitudes

Students' soft skills are at the core of educational models and require institutions to comply accordingly. In Design Education, soft skills are defined as the set of interpersonal, social, and emotional skills used in a design practice (De Freitas & Almendra, 2021). However, it has been shown that the EDI concept stimulates students to overcome traditional teaching and learning models based on the development of hierarchical soft skills (i.e., full confidence with problem solving, systematic thinking, teamwork, etc.) (Dong, 2010) by embracing longitudinal patterns more tied with relational attitudes.

The connection of student's soft skills with relational attitudes can be supported and promoted by:

- Engaging with diverse communities of users, even marginalized ones, and focusing on inclusive design practices to cultivate empathy and a deeper cultural sensitivity.
- Fostering team-based projects so that diverse cohorts of students can benefit from enhanced communication, negotiation, and collaboration skills. This ultimately can prepare learners to address multifaceted dynamics of the professional world.
- Addressing real-world challenges through reflective creative practices. This eventually encourages critical thinking and complex problem-solving skills when considering various factors and stakeholders.

6.3 Introducing Inclusive Criteria in Curricula Development

EDI stimulates significant shifts in the design and delivery of modules (Dong, 2010), and improvements can involve a wide range of topics such as contents, topics to discuss in seminars and tutorials, groups of users to involve, design methods, etc. This means that EDI directly impacts the inclusion aspects of curricula since the beginning of their conception. Eventually, this may produce reflections on different aspects that entail daily

routines with students. Interesting dynamics can be observed when incorporating inclusive criteria into teaching and learning practices, and these can produce benefits to actors, instructional components, and studio settings. Improvements in branding and the design of themed programmes can also be the result of a systemic change when properly supported by a shared culture on EDI.

The introduction of inclusive criteria in curricula development can be supported and promoted by:

- Embedding EDI principles across all aspects of Design curricula, including the creation of theoretical modules delivering unbiased notions on EDI and the creation of studio projects hinged around EDI-led authentic learning. Ensuring a holistic approach to inclusivity reflects inadequate training of staff.

- Ensuring that Design curricula reflect a wide range of cultures, identities, and perspectives. This can prepare students to design for a global audience and instill confidence into positive perspectives and actors.
- Prioritizing accessibility and usability in all aspects of Design Education. This promotes flourish environments where students are enabled to create products and services that are inclusive for all users.

6.4 Holistic Trajectories for Future Studies

Alongside educational features of EDI in Design Education, studies considered in this work provided rooms for considerations on the value of research in the field. It is essential to recall that research experimentations are essential to advance Design Education and its body of knowledge. Therefore, investing in holistic research and novel studies on EDI is paramount to advance the whole sector of Design Education. Constant sharing of knowledge flows is the basis for a consistent improvement.

Holistic trajectories for future studies are essential in Design Education, particularly when it comes to EDI. These can lead toward:

- Longitudinal studies on outcomes produced by informed EDI teaching and research practices. The attention is on the investigation of long-term impacts of EDI-centered curricula on students' outcomes, their professional practices, and potential societal contributions in the long run.
- Cross-disciplinary approaches to Design and EDI. The attention is on the exploration and the integration of EDI principles with other disciplines, such as technological, digital, and engineering ones, but also economic and social, that ultimately foster innovation in design solutions as a whole.
- Global perspectives on Design and EDI. Conducting comparative studies on the implementation and outcomes of EDI-based issues in Design Education across different cultural and educational contexts is essential to identify best practices and areas for improvement. Therefore, sharing of knowledge can be the consequence of a collective learning process involving both students and institutions.

6.5 Brief Notes on Converging Bodies of Knowledge and the Revaluation of Values

In Design studies, EDI calls for an in-depth examination and revising of established references, challenging the body of traditional cultural standards that are frequently associated with reflective creative practices – Who do designers design for? How can teaching staff equip future generations of designers in addressing present and future challenges? How can designers enable people to live sustainably and inclusively? etc. It is well established that Design, as a profession firmly rooted in societal structures and cultural settings, has the ability to impact perceptions, behaviors, and interactions. Thus, reevaluating design ideals becomes critical in resolving issues of inequity, lack of diversity, and exclusion. At the same time, notions like those mentioned by EDI-wider conception allow creative thinkers to consider good possibilities that are fully inclusive of all individuals. This indeed stipulates critical reflections on the values commonly passed on by staff to learners and promotes stronger convergences among knowledge areas.

At the level of design ethic of scholars involved in the progression of the body of knowledge, EDI can trigger reflections on the following aspects:

- On the concept of 'Equality', design researchers can shed light on gaps in representation, recognition, and access to resources within design education, practice, and discourse. By questioning established conventions and pushing for more inclusive design practices, researchers help to revalue values in the area of Design studies, resulting in more fair and just design ecosystems.
- On the concept of 'Diversity', design researchers can emphasize the contributions of marginalized groups, question monocultural design norms, and push for greater inclusion in design education and practice. By challenging prevailing design narratives, prejudices, and exclusionary practices, researchers pave the path for a more varied and culturally rich design environment, furthering the revaluation of values in Design studies.
- On the concept of 'Inclusion', design researchers can emphasize the importance of creating with, rather than for, marginalized or underrepresented populations, allowing people to construct their own settings and narratives. By questioning conventional concepts of authorship, competence, and authority in Design studies, researchers contribute to more inclusive and democratic design processes, supporting a revaluation of values that prioritize equality, diversity, and inclusion in design research.

7. Conclusions

This work discussed the complex explicit and hidden dynamics that subtended the integration of EDI in Design Education. Studies and examples discussed, as well as novel classifications inferred via qualitative interpretations of findings highlight the need for a significant change in academic methods and cultures to fulfill the progression of teaching and learning apparatus needed to address the issues of present society.

The literature review provides important insights about the symbiotic relationships between EDI and Design Education. From this, three critical conversations can be proposed: the growing of an EDI culture in design; the value of teamwork modalities; and the empowerment of novel sets of soft skills into learners. Altogether these dialogues highlight the need to incorporate EDI at a higher level; these do not only foster equitable and inclusive cultural environments, but also the improvement of students' ability to put creativity whilst enhancing their abilities to address social issues.

The value of a culture on EDI imposes the need of accepting different viewpoints that reflect into multimodal design processes. Various scholars advocate that infusing design culture with a sense of responsibility when addressing societal issues is a strong plus. They suggest that direct exposure to various social contexts elevates students' awareness while reinforcing their capabilities to meaningfully navigate into different subjects and environments. About teamwork, Design Education acts as a microcosm within which cooperation is extremely important. Studies highlight the transformative power of varied groups to cultivate creative thinking and social and collective development. Teaching staff are advised to develop inclusive dynamics by promoting equitable participation and democratic engagement. The empowerment of soft abilities arises from direct exposure to EDI-related subjects. Improved decision-making, digital literacy, as well as a deeper understanding of interdisciplinary approaches are mentioned as a result of such immersive pedagogical environments. Additionally, synergies between sustainability and inclusivity fuel holistic teaching and learning models, moving into innovative reflective creative practices.

On the other hand, the analysis of case studies portrays an interesting set of topics dealing with both rhetorical and operative levels. Scholars rely on participatory design methods and interdisciplinary cooperation to nurture students' self-confidence, skills, and abilities. Educators use multidisciplinary frameworks as grassroots to produce inclusive academic settings that promote innovation, enable to address modern challenges, and increase confidence with design practices.

The inclusion of EDI principles in Design Education at the teaching and learning levels generates a sense of inclusive culture across many fields. Growing with an inclusive culture, cultivating cooperative skills, and encouraging students in taking controlled risks while getting confidence with novel soft skills, are longitudinal assets that produce benefits at the module, course, and programme level. These also improve students' market readiness and inherent social aspirations. Accordingly, educators can prepare future designers to navigate the complexities of a varied and rapidly evolving world. This holistic approach not only enhances the academic experience, but also equips students with the right operative and cultural attitude required to establish favorable modifications within their communities and beyond. The value of cultural diversity, empathic design, authentic learning, and the use of HFE in shaping inclusive design practices are widely recognized as a plus to shape designers with a social consciousness. Synthetically, inclusive cultural components promote combinations of formal design aspects with socio-behavioral factors that ultimately reinforce students' cognitive abilities in addressing social complexities; empathy stimulates alternative viewpoints and social engagement, whilst enabling the design of inclusive solutions; experiential discovers operated by promoting empathic understanding of topics provide consistency to authentic learning methodologies and drives into the enhancement of intrinsic predispositions to be later translated into engaging design practices; finally, HFE enhances holistic understanding of human well-being, system efficiency, and diversity.

Overall, EDI produces arrays of benefits in Design Education, and this can be found at different levels such as the progression in the design culture, the improvement of design methods and approaches, and the consistency of teaching and learning practices. This leads to discussing beneficial impacts, which are clearly observable at the learner, staff and organizational level. Around impacts, some relevant research lines can be proposed to reinforce the convergence of initial topics found within studies that can be considered as promising working lines for future explorations.

In a strategic sense, EDI concept also aligns with sustainability; and this aspect is directly evinced from both the literature review and the case study analysis. Particularly, strong links can be found when comparing EDI to the Sustainable Development Goal (SDG) No 4 – 'Quality Education' – since it states the commitment to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all (UN, 2015). Therefore, it can be affirmed that EDI is a foundational concept for any educational framework, the studio culture related to it is a key successful driver to generate long-lasting sustainable behaviors into learners (Dong, 2010; UN, 2015). To conclude, this work depicts the complexity of a fast-growing cultural driver capable of generating cascade impacts into many educational fields. EDI nurtures curiosity while promoting the advancement of novel theoretical and procedural apparatus that are considered relevant today in Design Education.

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P/REFERENCES OF DESIGN

FUTURE ART SCHOOL TRENDS UK (FAST UK).

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ABSTRACT | Scenarios for envisioning future thinking in arts education are typically constrained by perceptions of contemporary circumstances as immutable, despite political fluctuations across the Global North: determined by culture 'wars,' socio-economic, and ecological crises. While the future of art and design education cannot be predicted, we can help shape it by joining forces across/beyond borders (disciplinary, institutional, geopolitical) to create more horizontal hierarchies of knowledge tested through participatory discovery and discursive research methods. Drawing on the Learning Platform of ELIA: FAST45 (Futures Art School Trends 2045), FAST UK is introduced as an emergent nexus of British educators, student collectives, and third-sector partners. We actively embrace diverse stakeholders in the public domain as a socio-conceptual space for formulating an equivalent Pedagogic Futures Research Lab in the UK. This experiment in future thinking is devised as a catalyst for more robust multimodal bodies of knowledge employing discursive and empathic approaches to co-construct pragmatic and theoretical new methodologies, more porous academic boundaries, and future visions for the (British) art schools of tomorrow. Art school traditions, models, and methods are unpicked as a part of this process to sift best practices from habits/norms and familiar formulae through the lens of the possible, probable, potential, plausible, preferable, or even utopian futures for the sector. New forms of art practice, generative AI, radical pedagogies, performative practices, and hybrid technologies are synthesised in a convergence of knowledge. FAST UK is conceived of as a means of anticipating and shaping our collective futures by utilising the inherently imaginative, intellectual, and creative resources (human, strategic, methodological) nurtured and developed in our art schools at a local, regional, inter/national, and global scale.

1. Introduction

Shaped by the cultural and socio-economic climate of our time, the art school is situated in an uncertain position as a state-funded institution producing creative innovations and new knowledge, contributing significantly to economic growth in the UK. Its popular (historical) status as an emancipatory site for creative and intellectual freedom, innovation and imagination, radical thought and action, integrated with a pragmatic preparation for professional practice in the service of industry, has led to fluctuating socio-cultural values and industrial allegiances. Over a century since the official opening of the Bauhaus in Germany (1919 – 1933), UK-based foundation arts education programmes remain significantly influenced by historical modernist principles of progress and production, achieved through a synthesis of form and function in the pursuit of a better tomorrow. In addition to the modernist pursuit of a new lived environment through art, architecture, and design, future-thinking has developed as a core characteristic of HE arts institutes that challenge students to shape their future through new cultural resources, anticipating future techno-social worlds. Academic course and module descriptors frame the future of creative work as full of possibilities but also uncertainty, as evidenced by the common refrain that many jobs in the future do not yet exist (it is students that will create them). Yet, what was imagined as an invocation to revolutionise the future of design work and fine art practices has become constrained by the immediacy of urgent climate and energy crises, socio-economic inequalities, funding cuts to the arts, cultural sector, and education in the context of political short-term thinking and turbulence. At a time when local councils in the UK have made 100% cuts to support for the arts and creative subjects have been systematically underfunded and diminished in their academic, social-cultural, and economic value from school to Higher Education levels, radical collaborative proposals are needed to reposition art and design pedagogy, research and practice at the forefront of socio-political action.

Arts education is framed in this paper not as a 'reflex' of the labour market or the knowledge economy but as an act of critical agency and transformation through the collective actions (Giroux, 1985: xi) of a transdisciplinary group of British arts educators, students, and local community groups. Following in the footsteps of the cultural legacy and educational significance strategically built by Bauhaus tutors and students in a collective act of self-actualisation through published manifestoes, pamphlets, exhibitions and catalogues, lectures, and media campaigns, FAST 45 calls on arts and design academics to be at the forefront of envisioning future scenarios for the art school. Walter Gropius' radical pedagogic vision for the Bauhaus converged theory and practice and unified the applied and fine arts within an interdisciplinary programme facilitated by the architectural site of the art school as a 'home' for future thinking and making. The *gesamtkunstwerk* (synthesis of diverse art forms) was characterised by an absence of ornamentation in an embrace of objectivity and rational design on the one hand and post-war optimism and radical experimentation on the other.

Future Art School Trends (UK) or FAST UK is introduced as a nascent collaborative arts education futures project instigated and co-constructed by a collaborative team of interdisciplinary educators from Kingston School of Art (London) and Nottingham Trent University in the UK. The critical context of UK-based arts and design Higher Education provides the focus and context for FAST UK, but this is not intended to delimit its research findings on a more global scale, nor is it framed as an exclusive internally facing project. On the contrary, its generative nature, collaborative structure, and porous edges are symbolically and practically designed to form discursive intersections with diverse partners and contributors. As such, this paper is presented as an open invitation for creative input and exchange, adaptability, and mutability, framed by the conference theme of converging pedagogic knowledge. The initial inspiration and catalyst for creating FAST UK was the FAST 45: Futures (Un)Known conference in Brussels (6 – 7 December 2023), at which participants (predominantly arts and design educators from Europe and the USA) were invited to join forces to "imagine and promote a future in which the arts and arts education plays an integral role in a world radically reshaped by the 4th industrial revolution, globalisation, and climate change" (FAST45, 2023, *np*.). We met at the conference as strangers, discovering a common passion for collaborative discourse around arts and design education. The conference call to collaboratively reflect on and reimagine art's role in envisioning and shaping our collective academic and professional futures represented a productive

provocation for a more expansive and generative thought experiment in future thinking. As the website states, Future Art School Trends 45 (FAST 45) aims "to imagine, map, and shape a higher arts education landscape where participation, research, and education in the arts play a crucial and integrated role within the sector and society as a whole" (ELIA: FAST 45, 2024, *np*). The convenors of the FAST 45: Futures (Un)Known conference made it clear to attendees that the learning tools (Learning Platform) co-created by the research participants could be used and adapted by all arts/educational institutions who are seeking to anticipate unknown futures and actively shape them. With this collegiate spirit in mind, we left the conference having agreed to form a distinct but aligned future art school research group.

FAST UK is presented to the Cumulus community as a statement of intent and an invitation for collaborations across borders and disciplinary boundaries to join and enrich this discursive convergence of knowledge through tangential insights, oppositions, and synergies. The FAST UK pedagogic research group aims to empower arts educators through a spirit of convivial exchange rather than competition to not only anticipate possible futures for the arts but also to be co-leaders of future thinking.

2. A Reflective Overview of FAST 45

Launched in 2022, Future Art School Trends (FAST 45) takes a futures-thinking approach to imagine the educational landscape of 2045 as the year when those born in 2022 might apply to study a degree-level arts discipline. What socio-cultural, strategic, pragmatic, or symbolic role might the art school institution of the future offer prospective students? The Futures (Un)Known conference formed part of a programme launched in 2022 across several European arts institutions from Belgium, Estonia, Switzerland, the Republic of Ireland, Germany, Spain, and the Netherlands, as well as non-academic partners such as the School of Commons. FAST UK was conceived as a direct consequence of in-person attendance at the Futures (Un)Known conference: its aims are closely aligned but distinct due to the socio-economic and political circumstances of contemporary Higher Education in the arts in the UK. We have identified a need to place UK educators at the heart of discourse to actively shape the future of our institutions in a pedagogic exchange. The FAST 45: Futures (Un)Known (ELIA, 2023, *np*.) home page presents participants and audiences with a challenge:

> "Close your eyes. Picture the arts in higher education in 2045. Imagine multiple futures and how working practices will change while dealing with global uncertainty. Is it possible to map unknown futures today? What structures do we need to create the sustainable and desirable futures our art students deserve?" (FAST 45, 2023, *np.)*

A research-in-action and knowing-in-action approach that draws on Donald Schön's (1987) conscious engagement with mutual dialogue as a method of developing new forms of understanding and action lends a more reflective evaluation of the research process in future thinking. For Schön, the alert participant in dialogic future research consolidates the methods of discovery and knowing as a part of the active process of thinking about the research while actively engaged in it. The FAST 45 workshop techniques and methods employed during the conference to explore certain aspects of future arts education are thus incorporated and adapted into FAST UK as core methods of exploring future pedagogies and practice research. For example, four scenarios have been developed by FAST 45 to act as adaptable "tools that will empower arts institutions to not only anticipate an unknown future but to actively shape it" (FAST 45, 2022, *np.*). They include:

- Scenario 1: Open Spaces: hubs of artistic ingenuity, encouraging creativity and collaboration, addressing the complex problems of society and the planet.
- Scenario 2: Slow Eco-life: Slowness and degrowth are seen as catalysts for creativity, while resource scarcity is integral to artistic growth.
- Scenario 3: Phygital Frontiers: fresh perspectives and legislation are needed to navigate the ethical challenges of technology-driven art.

- Scenario 4: Profitable Endeavours: To thrive, artists and institutions must adapt, forge alliances, and embrace alternative networks that foster inclusivity, artistic freedom, and diverse perspectives.

FAST UK seeks to triangulate future thinking, the Learning Platform tools of FAST45, and a diverse coalition of art and design school stakeholders in a new synthesis of theory and practice, media and methods, community and academia, co-created by those currently studying and teaching in the UK. FAST UK will also embrace and develop the spirit of convivial participation designed for participants of the Futures (Un)Known conference as a human-centred method of collaboration, incorporating interactive media, prompt cards, speed dating, Q&A sessions, data gathering, analysis, mapping, and knowledge creation in multimodal discourse. Experimental modes of research and engagement, including performance poetry and sound works, will also be adapted from FAST 45 as alternative future-thinking approaches to workshop construction and deployment. FAST UK is, thus, framed in this paper as an emergent nexus of educators, students, and third-sector partners co-constructing strategies for a radical reappraisal of arts education and new configurations of the art school itself within urban, suburban, and rural locations. This experiment in future thinking is devised as a collective rather than competitive approach to innovation – joining forces across disciplines and institutions to make new networks of shared knowledge for, with, about, and through art and design education. The FAST UK collective is conceived of as a means of anticipating and shaping our collective futures by utilising the inherently imaginative, intellectual, and creative resources nurtured and developed in our art schools at local, regional, national, and European levels.

3. UK Art school visions of the future past

Art school myths persist as institutional prospectuses and promotional platforms attest by claiming that art school teaches you to rethink and reshape the world in a crucible for original thinking, risk-taking, and critical thinking (Tickle, 2013). Within the duration of three-year (BA) or one-year (MA) programmes, art students are tasked with addressing urgent (vast and complex) global challenges, from climate and energy crises to health and well-being, to ethnic and gender equality, in the form of cutting-edge designs and inspirational art forms that will simultaneously contribute to economic growth. These achievements are sought while simultaneously succeeding at the highest level (there is no alternative level) of attainment (assessment grades), leading to a lucrative position in one of the ‘creative industries’ (to pay off student loans and concurrent debts), winning design awards, being selected for exclusive exhibitions and building a significant following on social media.

Corporate branding and design agencies promote visions of art education as a force for social good but also individual self-actualisation in a competitive global market. That art schools have the strategic and structural capacity to fulfil these obligations is not in question, but in current and future visions of academia, what needs to be addressed is the role of the art school itself as an idea, place, and community of practice which is instrumental in the conception and construction of future visions. This paper seeks to go beyond the current UK Education policies, which, even in 2013 (when fees were increased to £9000 per year), were “driven by an overarching political view of how the world should work. A sense that [the] government sees every aspect of cultural life purely in terms of its economic utility” (Guardian, 2013, *np.*). While the images and nomenclature employed by art schools in their designed visions and mission statements have adapted to new challenges (e.g., decolonising the curriculum, increased equality, diversity, and inclusivity in curricula) and labour markets, this paper argues that a new collective convergence of knowledge is urgently required from students and tutors, technicians, librarians, and researchers within Higher Education (HE) to reimagine art school futures. In the age of AI and machine-led knowledge production, social and ecological crises, and global conflict, there is more urgency than ever to rethink our models of education, drawing on diverse voices.

Beyond the neoliberal affordances of the UK's vibrant arts education sector, future thinking is inherent to art and design practices, giving form and credibility to new ways of living, working, and being in the world. As Ramia Mazé (2019) argues, in the process of conceiving and producing visions of the future, artists, educators, students, and designers give form to possible, plausible, or preferable scenarios, visualised by Voros (2015) in Figure 01 below. Futurists use the plural of 'futures' because the master concept of the futures field is that of the existence of many potential alternative futures rather than simply a single future (Voros, 2022). Futures studies are the systematic study of possible, probable, and preferable futures, including the worldviews and myths that underlie each future vision – alert to the methodologies or mechanisms that don't change as well as those elements that do differ. What is considered an advancement, a progressive vision? And who for? Who benefits from the future vision for the arts and arts education? Dominated by technological determinism, such visions often fail to make explicit the shifts in the social imaginary, labour, and policy required to instigate critical shifts to "gender norms, socio-ecological practices, and power structures" (Mazé, 2019, p.23).

Future visions of art school education are thus approached as a fundamentally social discourse embracing diverse positions to strategically and productively coalesce new models and methods drawn from a wide range of re/sources and stakeholders. As discussed with attendees at the conference, future curriculum planning needs to consider the urban and suburban creative practices of local communities as a divergent embrace of DIY coding, graffiti, and music production, the theatre of the street, and performative communication.

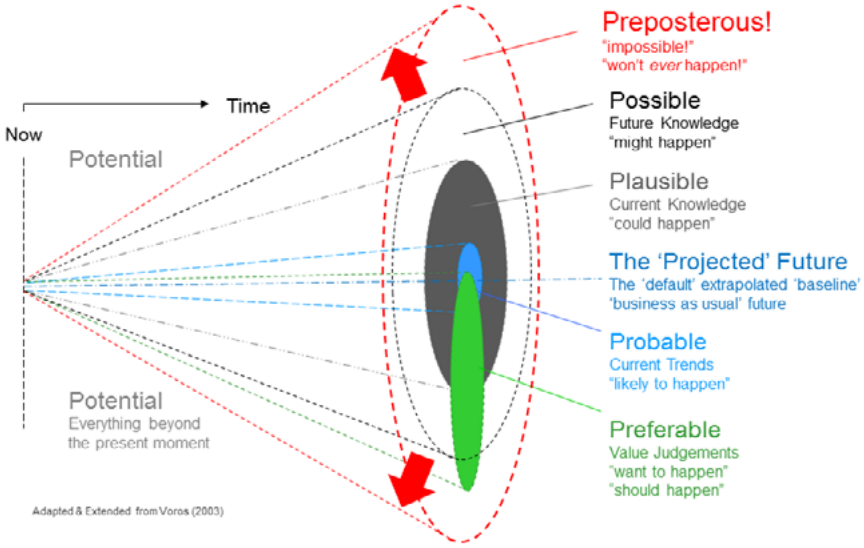


Figure 1: The Futures Cone, adapted and extended from Voros (2015).

'Art school' is employed as an overarching umbrella term coalescing broad concepts of art and design education to purposefully invoke examples of symbolic art institutions of the past (Bauhaus, Ulm, Black Mountain College). Art school is often framed as a crucible for such future thinking in action, although as the queer, intersectional, feminist platform Futuress (2024, *np.*) argues, "common design practice, its history, pedagogy, and institutions remain predominantly Western, white, privileged, cisgender, and able-bodied." The mythical concept of art school may have survived as a backdrop to contemporary arts education in the UK, but the internal power structures and neoliberal ideologies of competitive individualism are at odds with the traditional values of collaboration, transformation, creative discovery, and freedom. Decades of underfunding in the UK threaten to undermine the learning experience offered to students as the often reductive nature of how art and design education is described by government ministers and media alike is determined by market forces and a recent rise in media references to 'culture wars.' Arts educators are thus consistently asked to do more with less or to paraphrase the British BBC TV comedy series WC1A (BBC, 2014 – 2017) 'More of Less Initiative' described by one character in this way: "The fact is, this is about identifying what we do best and finding more ways of doing less of it better"

(Wollaston, 2017, *np*.).
Historically, British art schools, such as St. Martin's School of Art (UAL) or Hornsey College of Art (founded in 1880), have accumulated an image of counter-cultural rebellion (Tickle, 2013), a transformative discovery of the self and the world. However, the plethora of free schools, alternative universities, self-organised collectives, and courses that have expanded in recent years in the UK as well as in Europe suggests that the current state-sanctioned provision is not meeting the needs and ambitions of young people (Kosmaoglou, 2017). What the expansion of newly formed alternative art schools reveals is the need for ownership and engagement in the form of arts education, which eschews the hierarchical structures of modules, fixed curriculum, assessment, standardisation, and constant measurement. The conventional teacher-student power relationship (derived from the historical master-apprentice model) of the classroom/studio is disrupted in a more collective embrace of learning and experiencing arts education for all. These alternative art schools feature collective strategies for engaging students in the possibilities of their own learning experiences beyond the neoliberal framework of more established validated institutional systems. Indeed, as more collective arts, architecture, and design collectives emerge from the transdisciplinary social opportunities of studio-based art school study, perhaps the first change in the future art school model must be in a collective alternative to the predominantly individualistic assessment criteria. The impulse to collaborate rather than compete in contemporary arts education programs and practices suggests a transitional moment is at hand for course leaders, teachers, students, and external partners.

With the rapid and increasing emergence and availability of AI software as an embedded tool for the creation of artworks and artefacts, the traditional certainties of knowledge transference between experienced teacher and pupil are called further into question. When a student, born in 2022, can produce, direct, change, merge, and edit their creation alone in their bedroom through machine intelligence, what role does the art institution play in teaching those nuanced skills? The creation of an artwork (in collaboration with AI) necessitates the questioning of values - what is the value of this work beyond Walter Benjamin's notion of aura (Benjamin, 1936)? What is the intent of the student? What do they understand about the context of the composite ideas and images and the nature of the collaboration? What does this say about being human?

4. Future Studies Futures Thinking

In his essay, 'A primer on Futures Studies, foresight and the use of scenarios ' Joseph Voros (2022) highlights the broad field of future thinking which goes by a variety of names, including: "'futures research,' 'futures studies', sometimes 'futures analysis,' 'futurism,' 'futuristics', or even 'futurology'" (Voros, 2022). Many have negative connotations. As such, a research framework for future thinking within academic contexts may suffer from the ambiguity or topicality of its nomenclature. Voros adapts three 'laws' of futures from Roy Amara (1981) to establish a conceptual foundation for the futures field:

- the future is not predetermined
- the future is not predictable
- future outcomes can be influenced by our choices in the present

Higher Education might be framed as a programme of preparation for future practices in which curricula are designed to meet the challenges of today and anticipate the needs of tomorrow, responding to real-world problems in a hopeful projection of art and design's power to have an impact on the world. As educators, we help students give tangible form to speculative future scenarios as a means of better understanding the link between action and impact – social, ecological, economic, political, and cultural – on a local and global scale. Future skills (Kingston University, 2022) such as adaptability, collaboration, collective resilience, relationship building, and critical thinking are identified by businesses as necessary thinking tools to meet the challenges of tomorrow in civic and corporate contexts. To this list, we might add future thinking as a means of reconfiguring the reactive approach to contemporary local and global crises and adopting a more proactive position for the arts, culture, and education in future thinking. Art

school is (or has represented) an ideal environment for such skills to be developed and in a process of transformation through learning, for innovative modes of creative thinking and problem-solving to be applied and integrated into everyday experiences. As Ramia Mazé argues, "designed visions of the future, along with their preferences, norms, and ideals, shape policy planning, market economies and cultural imaginaries" (Mazé, 2019, p.24). But how can we approach a future unknown with heuristics to create change when the parameters for creative practice are so ill-defined?

On MA Graphic Design (Kingston School of Art), responsible approaches to visualising future scenarios are applied to future thinking in a reflective process of analysing historical images of our future lives. In these scenarios or tableaux, the (male) workers may be observed flying on jet packs to the sleek shiny office, while the domestic sphere remains depressingly familiar in its division of labour and gender bias. The shapers of our cultural horizons must be fully conscious of what we allow to change (travel, climate, work) and what remains the same (social, ethnic, and economic inequality) in our future imaginings. Critical reflection is therefore essential to underpin the principles and methodologies of imaging our future world through 'Futures thinking,' 'speculative' and 'critical design,' and 'design fiction' if we are to avoid reinforcing the stereotypes and inequalities of contemporary life and work.

> "Speculative design asks questions about the future and offers some alternatives that are essential for the world of today, but more importantly, the world of tomorrow… the speculative design approach expands the critical practice towards imagination and diverse visions of possible future scenarios." (Mitrović, 2016, p.69).

Who gets to decide what the future looks like? Or how connected we are through social and or technological networks? How much of our cultural heritage do we bring to our future selves? Art and design's (modernist) claims for a universal language, the globalisation of the arts, cultural capital, and the enfolding of commerce and common culture arguably frame 'the future' itself as a design problem (Mazé, 2019; Reeves, Goulden, & Dingwall, 2016). And it is often a singular future that is sought, following time's chronological arrow in a logical progression from *the* past through the murky waters of the present to *a* future. Designing for a future art school education is a political act. Indeed, despite the initial intellectual and critical opportunities for design practice enabled by speculative research, its 'flaws' were soon exposed, as Francisco Laranjo argues, as 'critical design' became interchangeable with speculative as an ambiguous and unaccountable doctrine "synonymous with a vague 'what if' mode of design predominantly practised by white, middle-class Europeans" (Laranjo, 2024). The aphorism-cum-heuristic of "the purpose of a system is what it does" from the cybernetician Stafford Beer (2002) still provides a useful beginning frame from which to proceed. What does the art school *do* currently, and what do 'we,' as participants, labourers, co-constructors, and stakeholders, want it to do? How can Futures Thinking be used as a method for opening-up visions around this while taking on board such criticisms as those posed by Laranjo and Futuress?

As a crucible for the possible, art schools are ideal environments in which to problematise future thinking and to instigate alternative mindsets and methodologies through scenario-building. Scenarios can provide focused frameworks for research and thought experiments as an exercise in critically identifying an ideal socio-political location for an art school demonstrated at the design educators' conference in the UK (GDEN, Ideas of Revolt, 2017). In this context, alternative socio-political scenarios (utopia, dictatorship, monarchy, communism) were examined in an action-based workshop on the speculative possibilities of art school – as a concept and place of revolt. Scenarios were devised, deconstructed, and critically interrogated on a sliding scale from the speculative to the pragmatic (Ellis, 2017) as a means of thinking beyond the parameters of the now. Voros' (2022) Futures Cone enhances scenario building through the lens of future thinking in an embrace of the possible and impossible in a more pluralistic mode of critical thinking. Through four scenarios, described next, FAST UK's critical and speculative approach to envisioning future art schools thus seeks to harness inspirational thinking and radical pedagogies. Underpinned by criticality and convivial collaboration, the scenarios seek to decolonise academic conventions and expand the boundaries of the academy to embrace local communities in a more proactive and collective exchange of ideas and interests to provoke socially engaged art practices and action.

5. FAST UK – a new convergence of knowledge

Some of these questions have been tackled by organisations such as AdvanceHE, a member-led charity which aims to 'shape the future of HE' by addressing "systemic inequalities and advance education to meet the evolving needs of students and society" (AdvanceHE, 2024). Other national networks for arts education in the UK, such as the Group for Learning in Art and Design in Higher Education (GLAD) established in 1988, work towards pragmatic discussion about 'best practice in developing the student experience' with a focus on teaching, learning, and assessment "in the context of increasing student numbers and reductions in staffing" (GLAD, 2024, *np*.). More discipline-focused groups such as the Graphic Design Educators' Network (GDEN),

Illustration Educators, National Association for Fine Art Education (NAFAE), or EDI (equality, diversity, and inclusion) networks such as Fashion Academics Creating Equality (FACE) seek to re-establish the purpose and value of a given subject of study or field of the arts and to challenge the lack of Black, Brown, and POC academics in the HE system, for instance. No equivalent future-focused multi-disciplinary arts pedagogy research group such as FAST 45 currently exists in the UK.

In response, as coordinators of FAST UK, we propose a parallel set of scenarios to those established by FAST 45, which seek to identify and celebrate best practices drawn from British HE arts institutions while creating intellectual and discursive spaces for new knowledge methods and configurations of arts education to be interrogated. FAST UK has strategically expanded in its scope, incorporating third-sector groups such as The Community Brain (Community Brain, 2024a), student-led autonomous art schools such as the Offshore Art School, and self-organised alternative art schools such as Open School East. By integrating a broader spectrum of stakeholders in the arts and art and design education, FAST UK seeks to cement the core qualities and values of the arts into everyday discourse beyond the academy and within the social imaginary (Castoriadis, 1975). The social imaginary is framed as a social network negotiated between members of an (academic) arts community which anticipates a synthesis of the real (today) and the future-possible (tomorrow).

FAST UK is presented as an expansive forum for debate, an open invitation for participation at this conference, which is ideally placed to exploit the community of art and design educators and researchers drawn from 730 member institutions across 69 countries. Cumulus thus provides a unique itinerant context for and means of exchanging/converging knowledge to elevate "the positive role of designers and artists in creating sustainable and humane futures for all" (Cumulus, 2024). The collective context of the Cumulus forum "represents a dynamic ecosystem for internationalization and global mobility, knowledge exchange, and collaboration in art and design pedagogy, research, and practice" (Cumulus, 2024). The wealth of pedagogic experiences, diverse epistemologies, and methodologies brought to Cumulus conferences is sought to strengthen the emergent research model of FAST UK. The four research scenarios proposed by FAST UK include:

- Student Voice & Alternative Art Schools
- Art School: the role of the institution
- Decolonising the Curriculum
- Civic/social responsibility: third places / third spaces / third sector.

Student voice & alternative art schools — Those studying art and design are rarely asked for their visions of the futures of their practice, or when asked, their visions are diluted or overwhelmed by the avalanche of competing interests and economic forces within arts institutions. This Pedagogic Futures Forum is proposed as a student-led, inter-disciplinary, and inter-institutional space in which current students can meet to discuss the future directions, modes, spaces, and aims of art school/HE in the UK. It builds on previous Alternative Art School collectives (Gale, 2017) and current student-led groups such as the Offshore Art School at Kingston School of Art. As a mode of research-in-action, tests in gallery foyers, publications,

talks, and workshops (Festival of Futures, June 17 – 20, Kingston-upon-Thames, UK), these autonomous student forums are connected and sustained through Instagram and accessible digital platforms enabling diverse voices and suggestions to be added to the mix. The members of the itinerant art school model collaboratively conceive and configure their own new power structures to facilitate accessional interventions, provocations, and contexts (for a more expanded historical or global sphere of possibilities).

The Anti University, *Blueprint for Counter Education* (Stein & Miller, 2016), and Black Mountain College provide a backdrop to the emergence of free or collective self-managed arts schools such as the School of the Damned, the Islington Mill, Open School East, and The Margate School in the UK, and the Parallel School or Maumaus in mainland Europe. Representatives from these schools and intra-institutional schools-within-schools such as the Alternative Art School (Gale, 2017), Offshore Art School (Gale, 2014), Department 21, and Splinter will be invited to speak to the concept of art school from beyond academic boundaries, module systems, curricula, and assessment processes. These self-organised (co-operative and collective) schools are cited here as examples of previous or alternative models that can be analysed and evaluated as spaces from which to learn or to build other practices. Such models face challenges in terms of resources and financial capital but are gaining in popularity due to the high degree of collective ownership amongst the participants, the freedom of pedagogic processes, and a focus on the core value of art practices. They can be susceptible to the aforementioned hierarchies, privilege, and structural challenges that formal institutions battle but offer another position.

Art School: the role of the institution — Art school has a heritage of rebellion, a healthy counter-cultural critique of societal norms and political positions expressed through the visual and performative tools of the arts. Alternative Art Schools, as listed above, are examples of additional and parallel spaces through which students can channel creative activity and thinking, and we can usefully draw on these examples through a contemporary lens to imagine models for the future. Students who are undertaking a formal education in a formal setting are still able to continue discourse and conversation in a variety of spaces outside of the

A formal institutional framework but a less measured, less assessed, and more convivial context for such dialogic practice is made possible. With the impact of generative AI working collaboratively with students (robot and human) and the advancement of computational practice and machine-led making and learning, where does this leave the institution? If what students need to learn is ‘intent’ and to understand bias, AI references, and context, perhaps the institution itself becomes the hub of human-centred learning. We propose that this necessitates an urgent need to reframe the institution as the mediator of these, thinking through this history of Art Education in order to position ourselves in a future space of critical relevance.

Decolonising the Curriculum — From reading lists to interrogating and dismantling hierarchies of power in contemporary institutions, decolonising the curriculum represents a shift in motion within UK art schools. Whether systemic changes rather than superficial name changes are a result may depend on the leadership and inclination of each institution, but good examples can be found in several colleges and current courses. Understanding history from the position of now and learning from the recent proliferation of curatorial platforms and biennales celebrating non-Eurocentric practices and voices that would once have been silenced offers reassurance. But there is still a long way to go. Sustainability, not as popular rhetoric for a poster campaign but rather an integral philosophical agenda, is a key component in establishing a balance between human and non-human cultures. The Western art world (as just one part of a broader network of consumption) has not held sustainability as a core value until relatively recently, with organisations like Julies Bicycle helping arts institutions to work better (or to help make things ‘less worse’). It is the responsibility of art schools and institutions to help shape a community of practitioners and makers who consider the future and the origins of the materials they use.

Civic/social responsibility / third places / third spaces / third sector — Reconfiguring and relocating the art school beyond the ‘bubble’ or ivory tower of the art school/academy FAST UK seeks to integrate discourse and knowledge with the local communities in (their) third spaces (neutral community spaces such as cafes, bars, village halls, libraries). By repositioning the forum for debate and action from the academic institution to the spaces that belong to the community, opportunities to meet new audiences on

their terms are enabled. Such collaborative discussions and joint activities have already been established with The Community Brain (2024a) in the Kingston/Surbiton area of southwest London. Such partnerships and Knowledge Exchange collaborative projects provide opportunities to test the value of arts education methods and social interventions in context. Collaboration and communication with charities / third-sector organisations are featured as a means of grounding ideas in relation to local environments and meeting the needs of local people in the civic sphere. Including and empowering local people through a convivial exchange of creative transferable skills extends the edges of the art school itself to encompass a new dialogue of collective potential.

6. Summary

While we can agree with the Erasmus+ funded FAST 45's claim that the world of 2045 – or indeed tomorrow – might look very different and that the future is unknown, the coalition of contributors from arts education and business propose that we take a more proactive role in shaping the future landscape of higher education. In a participatory approach to mapping, imagining, and interrogating future scenarios for the arts and culture sectors, FAST 45 has built a substantial body of research material which they have sought to share within the wider arts and design educational community. The invitation to participate in the project of empowering arts institutions through the diverse stakeholders engaged directly or tangentially with its production and delivery struck a chord with us, the instigators of FAST UK. As a small group of UK-based educators from graphic design, fine art, and film, we were inspired by the inclusive approach of the conference leaders and the inclusive nature of problem-finding and debate. Inspired by the optimistic attitude of those attending the event, FAST UK was conceived of as a means of anticipating and shaping our collective futures by utilising the inherently imaginative, intellectual, and creative resources (human, strategic, methodological) nurtured and developed in all art schools, whether at a local, regional, inter/national, and global scale.

The urgent need to remind arts and design educators of their inherent yet overlooked and undervalued ability to explore ideas and visions of the possible as part of an interdisciplinary and international coalition of creative thinkers comes at a time of crisis in the UK. The need for new ideas and methods in and for the arts, culture, and education sectors in the UK and more globally is laid bare in this paper, as the political climate in post-Brexit Britain has seen the value of arts education dramatically decline in recent years. What FAST UK aims to instigate is a UK-wide collective research community of inter-connected stakeholders in arts and design education futures thinking for and with arts educators, students, and (local) communities. Research collaborations have already been established within the neighbourhood surrounding Kingston School of Art (The Community Brain, 2024b) facilitated by Dr. Gale's membership and role as Professor of Ludic heterotopias in the semi-fictional Free University of Seething. Drawing on the transdisciplinary skills and experiences of the current FAST UK team, each member is reaching out to connect with communities of practice to build scenarios for testing radical pedagogies and expanded notions of practice in the arts and Higher Education.

The small team (collective) of UK-based educators who present this paper were inspired by the rigour and creativity of the FAST 45 initiative and resolved to create an aligned but distinct thought experiment in arts education futures for the UK, as no such group currently exists. FAST UK draws on areas of local expertise and academic progress made in recent years, such as in embedding EDI (Equality, Diversity, and Inclusion) into curricula and establishing respectful forums for Students' Voices. FAST UK is envisioned as an agile research project that speaks to the common concerns and proposals emerging from the FAST 45 Learning Resources and extends threads of enquiry to incorporate unexpected insights and future unknowns. The FAST UK team is seeking a community of practice through the Cumulus conference in Budapest this year as an opportunity to converge the rich knowledge resources available at this global meeting of educators, students, and researchers. We have the ambition, with your support, to anticipate and shape our collective futures by utilising the inherently imaginative, intellectual, and creative resources nurtured and developed in our art schools at a local, regional, national, and global scale.

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About the Authors:

Dr. Cathy Gale (MA: RCA / SFHEA) is Course Leader MA Graphic Design at Kingston School of Art (London), a research-led educator and graphic artist specialising in critical performative approaches to design as a (collective) social praxis with diverse communities of practice.

Max Ryan Max Ryan is a designer, developer, researcher, and educator. His practice explores techno-social systems through the use of tools, workshops, and digital mediums. He operates an independent practice working with organisations such as Common Knowledge, Novara Media, and Ecological Citizens.

Annie Watson has been the Deputy Head of Department for Design and Digital Arts since November 2022, a role that includes strategic vision as well as operational expertise. Prior to this role, Annie worked as a film editor, fiction film writer/director, and director of pop videos, where she won international awards.

Dr. Emily Strange is the Course Leader of BA Fine Art at Nottingham Trent University. Her PhD explored drawing as a vehicle for utopian design and proposition. The research project was practice-led, and drawing was treated as a channeling tool for Ernst Bloch's original theories of utopia, by testing, editing, and appropriating paper architecture.

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P/REFERENCES OF DESIGN

TRANSCENDING BOUNDARIES - DESIGN EDUCATION FOR SOCIAL INNOVATION.

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DOI: 10.63442/TVZE7221

KEYWORDS | TRANSDISCIPLINARY, DESIGN EDUCATION, PEDAGOGY, SOCIAL INNOVATION, CLIMATE CHANGE

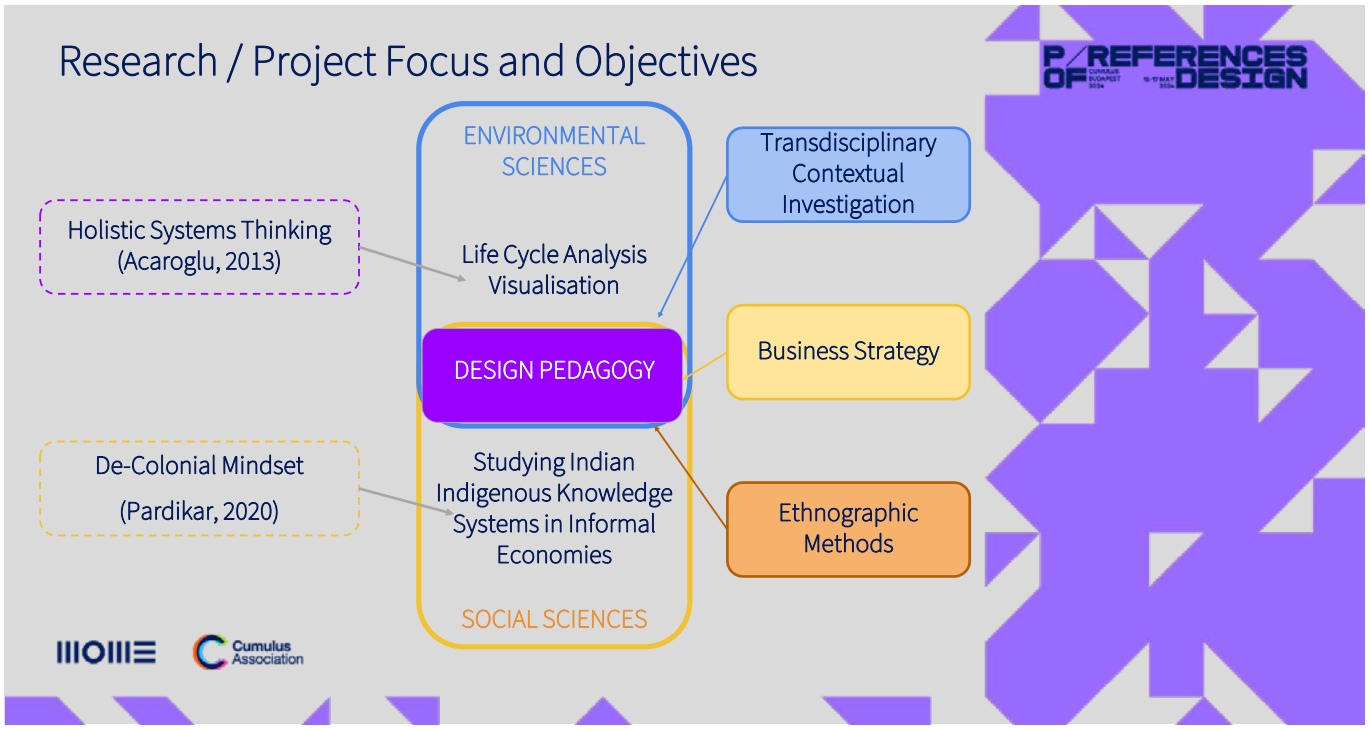
ABSTRACT | With exponentially growing global concerns about climate change, the responsibility of mitigating climate change is an emergent focus area in design studies. Thus, there is a growing critique of hyper-specialization and disciplinary education in design (Bremner & Rodgers, 2013). Acaroglu (2013) highlights the dangers of this silo-sized, disciplinary design thinking without understanding holistic systems, which can lead to a huge environmental impact. Additionally, while countries in the Global South are most impacted environmentally and socially by climate change, they are underrepresented in mainstream literature (Pardikar, 2020). Research on the nascent wisdom and extensive knowledge within informal economies of countries like India are also under-represented (Ohnsorge & Yu, 2022). This paper proposes a pedagogy that departs from these norms and advocates a radical reframing of design pedagogy by integrating systems thinking transdisciplinary, and social consciousness for sustainable social innovations. In line with the track "Converging Bodies of Knowledge," it positions design education as a bridge between Life-Cycle Assessments (LCA) from environmental sciences and the study of social networks and community well-being, situated in social sciences and sociology. It answers the following important questions:

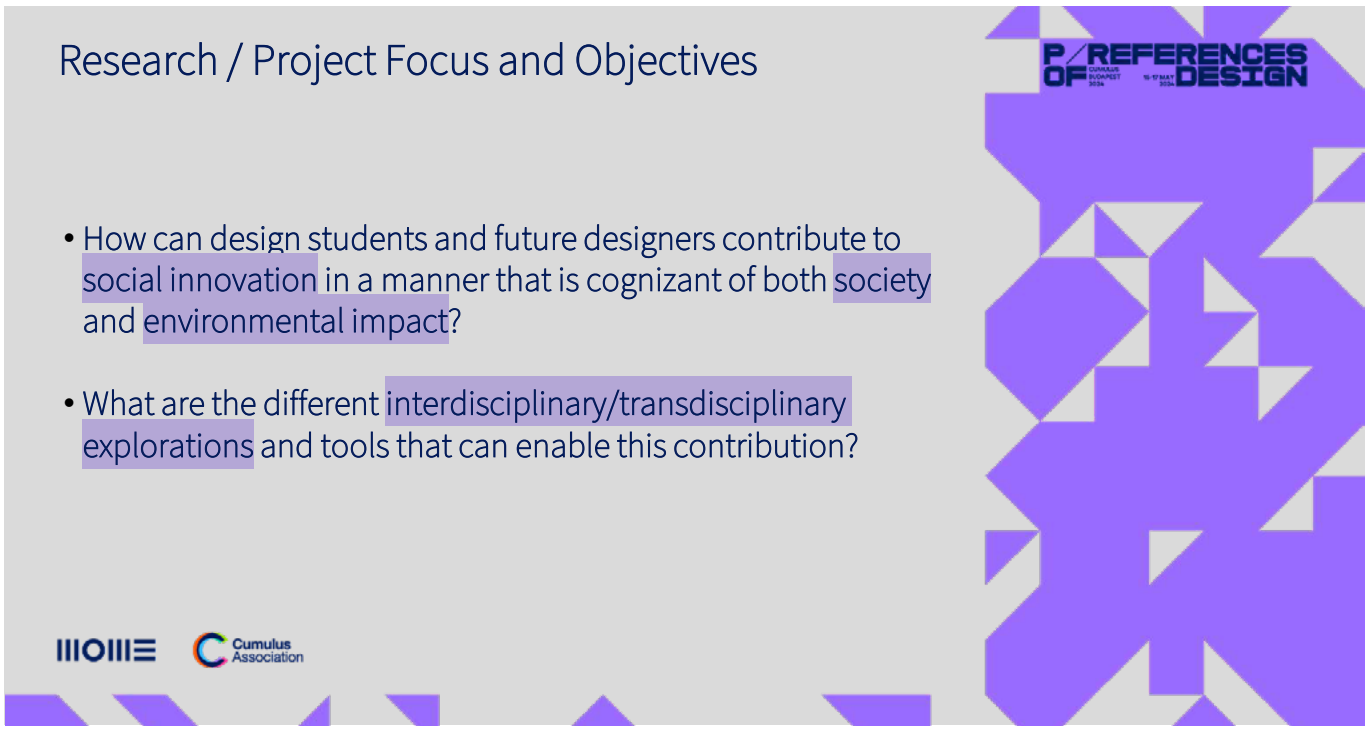
1. How can design students and future designers contribute to social innovation in a manner that is cognizant of both society and environmental impact?
2. What are the different interdisciplinary explorations and tools that can enable this contribution?

The pedagogy presented here is a composite framework comprising methods from two studios facilitated by the authors, namely "Managing Waste" and "Making That Matters" at Srishti Manipal Institute of Art, Design & Technology, MAHE, Bengaluru. It employs a four-pronged strategy to achieve its objective.

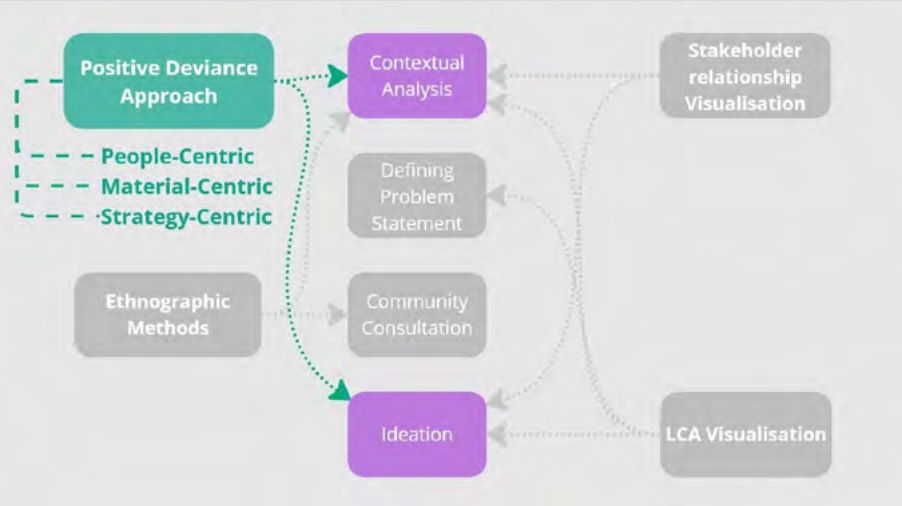
1. LCA Visualisation - Tools for visualizing LCA research papers as diagrams that can be used to easily identify opportunities for design contribution and intervention. This also promotes interdisciplinary collaboration and understanding.
2. Stakeholder relationship visualization - Existing models of stakeholder diagrams do not sufficiently visualize stakeholder networks, power relationships, and stakeholder-to-process relationships. An extensively detailed methodology to cover these gaps is introduced.
3. Interviews and ethnographic methods - Methods such as photo elicitation and interviews are encouraged to understand relationships and social networks. The importance of social networks, especially in informal economies for which they serve as an important driving force, is primarily recognized in sociological studies (Lomnitz & Sheinbaum, 2004). This perspective is brought into the design studio.
4. Positive-Deviance Approach or Ideation Through Observation - As appreciative inquiry (Cooperrider & Whitney, 2005), students are encouraged to identify positive outliers and build or scale them up (Baxter & Lawton, 2022). These positive deviances are categorized into three groups - people-centric, material-centric, and strategy-centric.

The paper presents student work from the two studios to demonstrate the strengths of this pedagogy. This resultant pedagogy can be applied in interdisciplinary design research studios at different levels of education. Additionally, one of the studios rooted in real-world issues and the physical context of Bengaluru, India, offers two more directions for this research, namely the decolonization of social innovation studies in the Global South and the possibilities for applications of this pedagogy by system designers in their practice. The paper also provides tools for applications of this pedagogy.


Research / Project Focus and Objectives
P/REFERENCES OF DESIGN
ENVIRONMENTAL SCIENCES
Holistic Systems Thinking (Acaroglu, 2013)
Life Cycle Analysis Visualisation
Transdisciplinary Contextual Investigation
DESIGN PEDAGOGY
Business Strategy
De-Colonial Mindset (Pardikar, 2020)
Studying Indian Indigenous Knowledge Systems in Informal Economies
Ethnographic Methods
SOCIAL SCIENCES
Cumulus Association


Research / Project Focus and Objectives
P/REFERENCES OF DESIGN
• How can design students and future designers contribute to social innovation in a manner that is cognizant of both society and environmental impact?
• What are the different interdisciplinary/transdisciplinary explorations and tools that can enable this contribution?
Cumulus Association

Pedagogical Framework



Positive Deviance Approach

- The positive deviance approach is a method that focuses on finding and amplifying beneficial behaviors and practices with the goal of producing positive outcomes for the community as a whole.
- This cyclical process that was utilized in the studio at critical stages of the design process - research, ideation and validation.

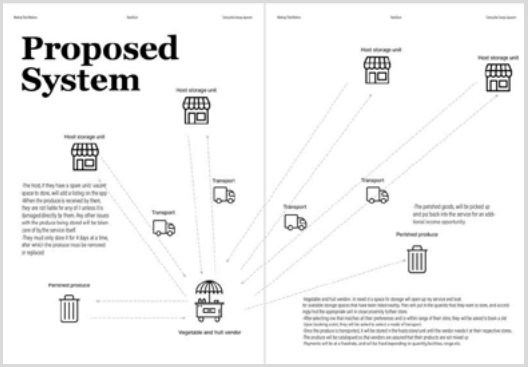


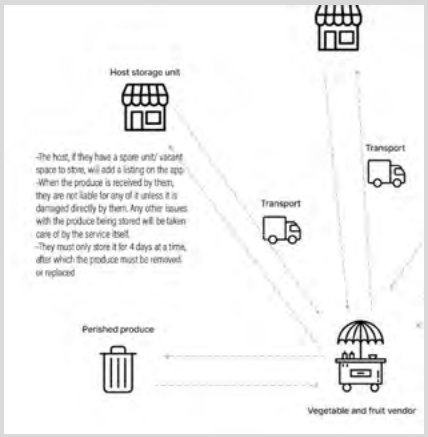
Positive Deviance Approach



Student Work - by Samyukta Jayaram, Srishti Institute of Art, Design & Technology

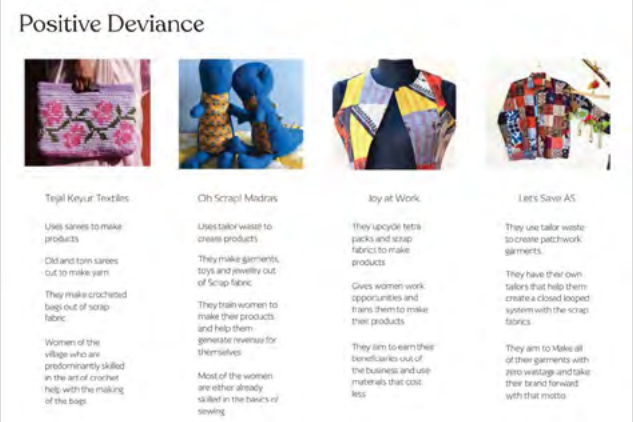
Positive Deviance Approach: Solutioning

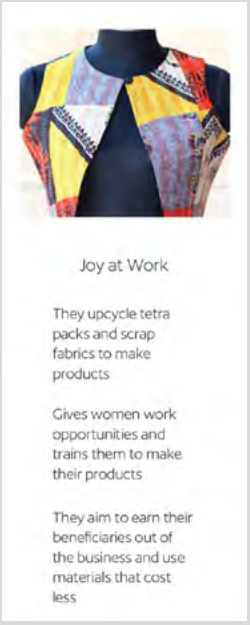




Student Work by Samyukta Jayaram, Srishti Institute of Art, Design & Technology

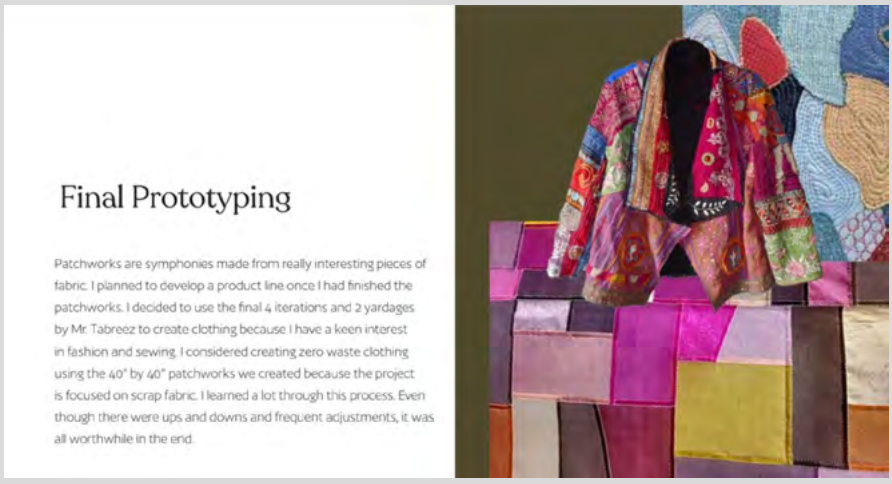
Positive Deviance Approach





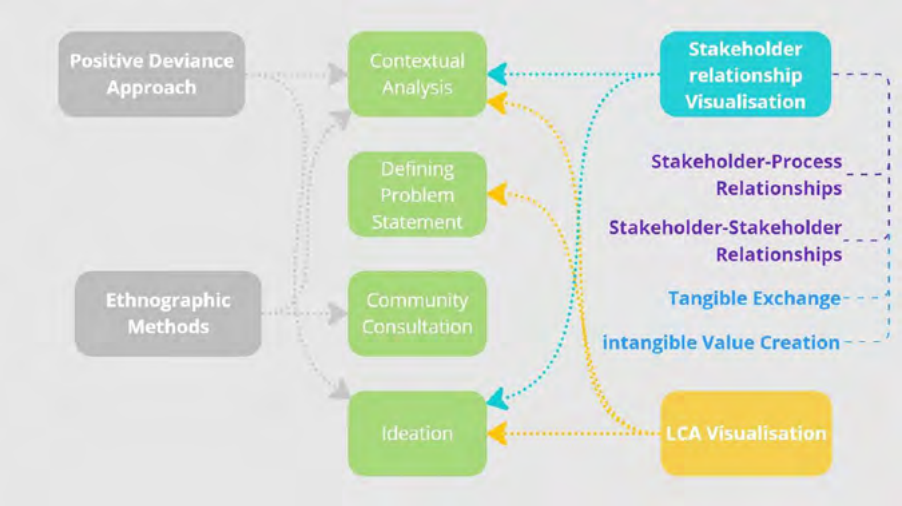
Student Work by ALVITA ANUSKA FERNANDES, Srishti Institute of Art, Design & Technology

Positive Deviance Approach: Solutioning



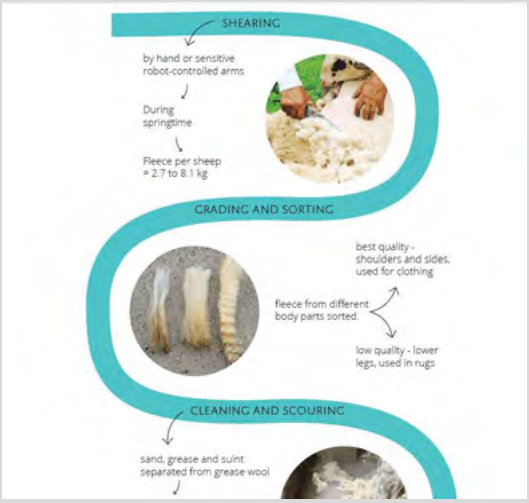
Student Work by ALVITA ANUSKA FERNANDES, Srishti Institute of Art, Design & Technology

Pedagogical Framework



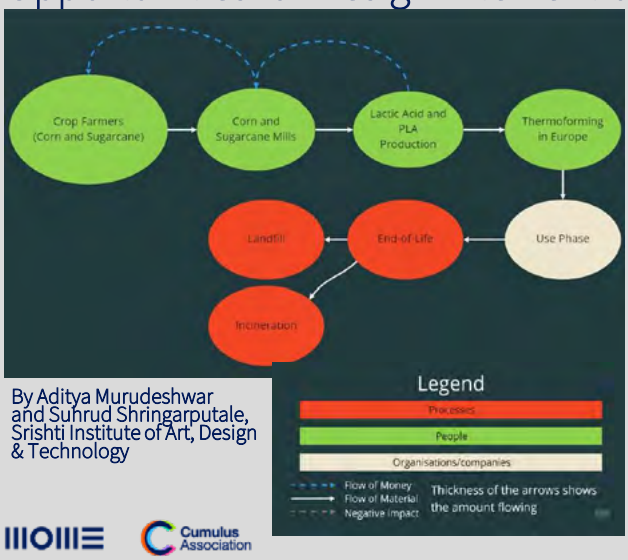
LCA Visualisation as a Tool to Identify Opportunities for Design Intervention

Tools for visualizing LCA research papers as diagrams that can be used to easily identify opportunities for design intervention. This also promotes interdisciplinary collaboration and understanding.

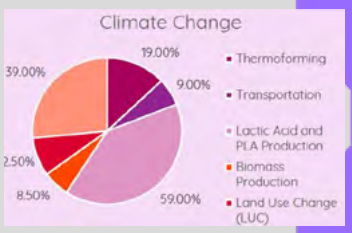


By Kasturi Pathak, Srishti Institute of Art, Design & Technology

LCA Visualisation as a Tool to Identify Opportunities for Design Intervention



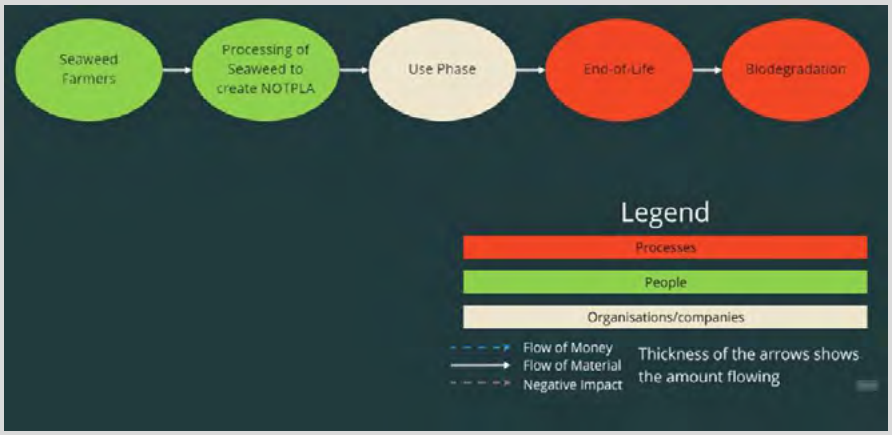
By Aditya Murudeshwar and Suhrud Shringarputale, Srishti Institute of Art, Design & Technology





Aditya Murudeshwar and Suhrud Shringarputale's LCA understanding clearly depict the harmful effects of various parts of the product's lifecycle (such as thermoforming, disposal etc.) on the environment through visualisation of "impact categories" such as climate change and Photochemical Ozone Formation.

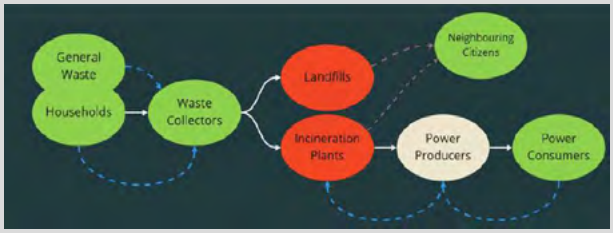
LCA Visualisation as a Tool to Identify Opportunities for Design Intervention

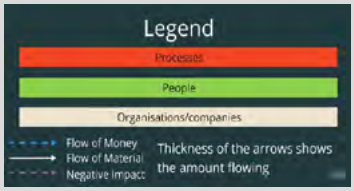


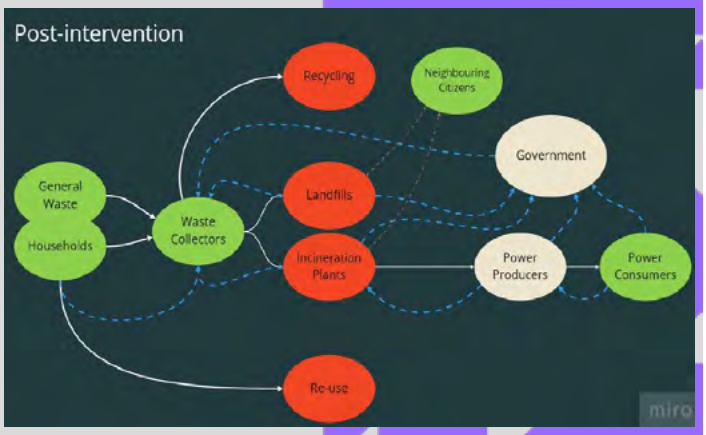
Student Work by Aditya Murudeshwar and Suhrud Shringarputale, Srishti Institute of Art, Design & Technology

Aditya Murudeshwar and Suhrud Shringarputale's then analysed the environmental impact of alternative material "NOTPLA" to demonstrate how it did away with harmful processes such as thermoforming and incorporated biodegradation as a end of life process.

LCA Visualisation as a Tool to Identify Opportunities for Design Intervention







Student Work by Aditya Murudeshwar and Suhrud Shringarputale, Srishti Institute of Art, Design & Technology featured above highlights how government taxation changed the whole system of waste disposal surrounding PLA cups

Evolution of Stakeholder Visualisation Techniques

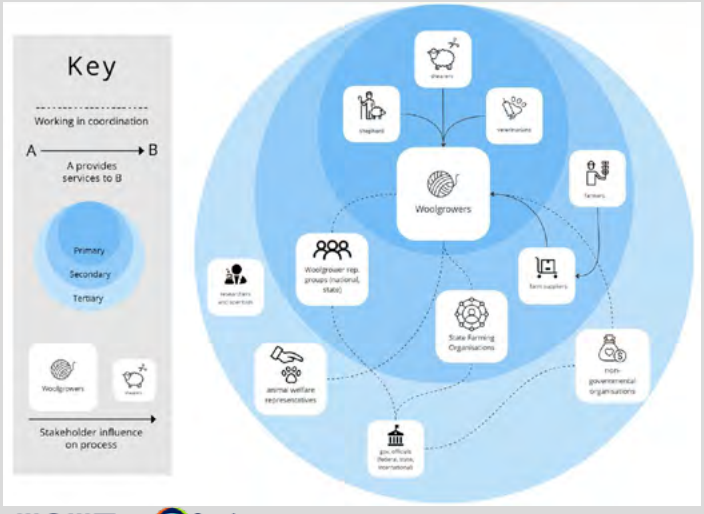
Existing models of stakeholder diagrams do not sufficiently visualize stakeholder networks, power relationships and stakeholder-to-process relationships. An extensively detailed methodology to cover these gaps is introduced.

	Primary/Secondary /Tertiary	Processes?	Relationship to Process	Stakeholder Impact on Process	Process Impact on Stakeholder
Stakeholder 1					
Stakeholder 2					
Stakeholder 3					
Stakeholder 4					

	Stakeholder 2	Stakeholder 3	Stakeholder 4	Stakeholder 5
Stakeholder 1				
Stakeholder 2	X			
Stakeholder 3	X	X		
Stakeholder 4	X	X	X	

Stakeholder mapping framework by Lakshmi Srinivasan

Evolution of Stakeholder Visualisation Techniques



The woolgrowers (sheep farmers) are the most influential stakeholders at the material sourcing stage of the life cycle. They interact with almost every other stakeholders in the process - employ some of them, hire some for their services and their activities are governed by some unions and organisations. They are the prime decision-makers in this process.

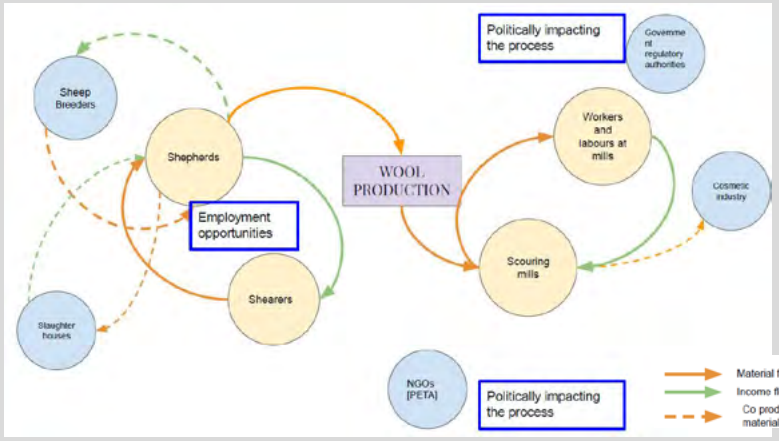
The labourers interacting directly with the sheep, like shearers and shepherds are stakeholders having a high interest in the process, because it is their primary source of livelihood. However, they have little influence on the process because they do not have the power to make decisions.

Trader unions and labor unions are functional in outlining the wages for labourers and safeguarding their rights. They have quite a critical role to play because primary workers are exposed to a number of disases, especially at the material sourcing stage.

Company directors and the government have a high influence in the process because they define the policies that the system runs along. However, they have lesser interest as compared to the primary labourers since their livelihood does not entirely depend on one industry.

By Kasturi Pathak, Srishti Manipal Institute of Art, Design &Technology

Evolution of Stakeholder Visualisation Techniques



Meghal Grover's work synthesises the tabulated data to identify the impact of stakeholders on other stakeholders and how product/income flows through the product life cycle.

By Meghal Grover, Srishti Manipal Institute of Art, Design & Technology

Future Directions

Expansion to Global South contexts:
Further investigation and adaptation of the pedagogical framework to address environmental and socioeconomic concerns specific to Global South countries, taking into account their distinct circumstances, informal economies, and various cultural landscapes.

Decolonization of Design Education:
Learn more about decolonization efforts in design education, particularly in the Global South, by focusing on indigenous knowledge, views, and practices for addressing sustainability and social innovation challenges.

Integration of Indigenous Wisdom:
Indigenous wisdom and traditional ecological knowledge are incorporated into the pedagogical framework, acknowledging the importance of local traditions in supporting sustainable solutions and community resilience.

Enhanced Community Engagement:
Improving community engagement tactics within the educational approach, encouraging closer collaboration with local stakeholders, grassroots groups, and marginalized populations to co-create solutions that address their particular needs.

Scaling and Dissemination:
Investigate strategies for expanding and disseminating the pedagogical framework beyond academic institutions, such as collaborations with government agencies, non-governmental organizations (NGOs), and industry stakeholders, to apply the approach in real-world contexts and amplify its impact on long-term social innovation.

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P/REFERENCES OF DESIGN

THINKING ‘TOOLS’; LOOKING AT OURSELVES.

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DOI: 10.63442/PZPS6059

KEYWORDS | DESIGN, COMPUTATIONAL ARCHAEOLOGY, BRAIN SCIENCES, TOOLS, DATA SETS

ABSTRACT | Conceptual Design practice case studies use design to bridge and rethink research tools in the fields of Brain Sciences and Computational Archaeology. Tools are central to the design discipline, they both allow for the realization of work, are expressions of design in themselves, and they tell the story of the people who made/use them. Tools are far from exclusive to Design. However, their fundamental standing in the discipline allows them to make a convenient and intimate point of entry into many scientific fields.

The showcased projects (Slide deck) are currently on show at the Hebrew University of Jerusalem's Brain Sciences art gallery and display the outcomes of the author's distinctive design interactions with the said gallery faculty as well as that of the Computational Archaeology lab at HUJI's Institute of Archaeology.

Both the fields of Archaeology and Brain Sciences create tools to study who we are/were. Increasingly, those tools are computational, processing data sets with outputs "translated" into visuals for easier human comprehension. An outsider's view of the scientific processes allows for spotting common ground, such as between methods used in these fields, e.g., convergence of individual instances into a more general digital model. Or, for instance, the realization that archaeologists creating digital tools for the study of prehistoric stone tools have inadvertently placed themselves into the hominin evolutionary lineage for having themselves created new tools. Tools, whether lithic or digital, are vehicles for studying the people who made them, understanding their interests, their technologies, their social organization/interactions, etc.

Dr. Gadi Herzlinger and Prof. Leore Grosman (Herzlinger, G. et al., 2018) developed software that analyses an assemblage of prehistoric hand axes (a popular "teardrop" shaped stone tool typology used by hominins for some 1.4 million years) found on an excavation, defining a typical average form, and identifying the extent of deviation from that average form. One series of design works subverts the computer program, using it as a creative tool and not for its anticipated analytics. For example, the use of a data set consisting of 10 hand-axes knapped by the designer and 10 Neanderthal hand-axes found in France. Based on his ancestry, the designer has 2-4% Neanderthal DNA, but through the creation of this new hand-axe form, the interspecies mix has been upped to 50/50. Or by questioning the assumption that a data set should include several (ideally many) artifacts to work properly instead of placing and flipping the same single artifact into the program twice, creating an overt self-symmetry assessment.

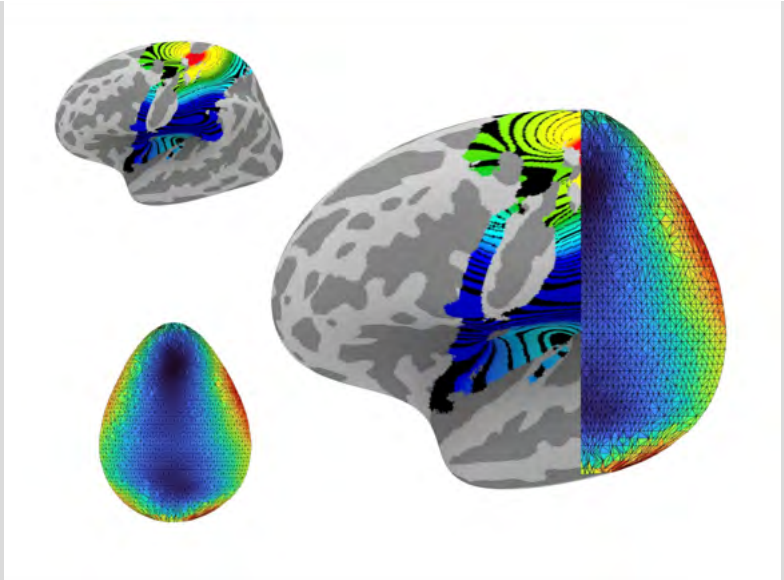
A parallel dialog with Prof. Yonatan Lowenstein's lab at the Faculty of Brian Sciences on fMRI-based research looking at selectivity in the brain cortex led to the design of shoes for the creation of brain analytics patterns as well as 3D printed brain infographics as a novel research dissemination tool. The design was used to bridge these two scientific fields by highlighting shared methods and interests, at the same time offering an alternative and subjective point of view through recontextualizing.



50% Neanderthal / 50% Human, Stratasys full-color 3D polyjet print, 2023

It is not by chance that many of the tools developed to study ourselves, whether through artifacts we created in the past or of our anatomical workings, rely on and output visual data. Both the fields of Archaeology and Brain Sciences make use of and develop such tools.

The detailed project herein focuses on these tools and what they signify to rethink them and leverage them for the creation of novel designs.



A 'mean output' visual comparison from computed data sets in the fields of Brain Science, and Archaeology

The project required identifying common research approaches shared by the fields of Brain Sciences and Computational Archaeology and later highlighting this through their property - developed digital research tools. Tools that require data sets, and hence propose the altering of results (i.e., *design*) based on control over the input data, in essence transforming analytical tools into creative tools.

Digital tools used included CAD and visualization software, Artifact GeoMorph Toolbox 3D, fsaverage, 3D scanning, 3D printing in PLA/Stratasys's polyjet/quartz sand, as well as bronze casing and flint knapping.



Creative process included physical-to-digital-to-physical workflows: sourcing flint, knapping stone tools, 3D scanning, CAD manipulation, 3D printing

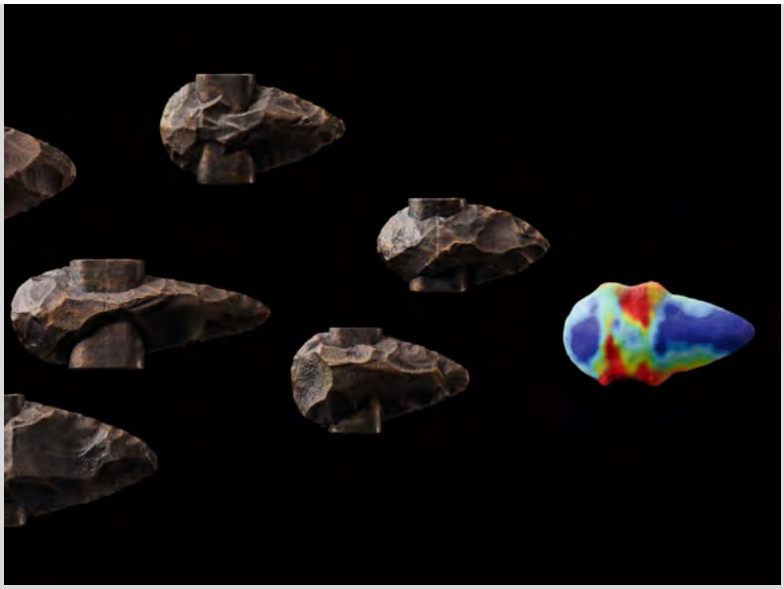
Dialogues were upkept with researchers in the discussed scientific fields, including visits to archaeological dig sites, material archives, digitized artifact repositories, sourcing raw flint from the desert, and academic conference workshops.

The creative process consciously constructed narratives or context beyond the objective geometry/neurological activity being observed by researchers. This included the creation of new objects that, for example, point to the evolutionary link between the researchers/designer and a prehistoric artifact maker. Or the extraction of actions taken as part of a controlled lab study utilizing fMRI and recreating them in life by means of streetwear.



The Whole Earth Hand-axe, Stratasys full-color 3D polyjet print, 2023.

The Whole Earth Hand-axe is a gesture to *unity* combining evolutionary backgrounds, our own, as well as those of parallel hominins, through a geographically dispersed common tool - the hand-axe. This work was created using property computational archaeology software to process a large group of Paleolithic hand axes originating from Africa, Europe, Central Asia, China, and the Levant.



Data Set, cast bronze, and Stratasys full-color 3D polyjet print, 2022

Six hand axes knapped from flint nodules were 3D scanned and then digitally manipulated, enabling them to be easily hafted to a shaft that could run through the artifacts as though they were forged metal axe heads. They were then cast in bronze – in accordance with the (pre)historic shift from the Stone Age to the Bronze Age. These new fictional artifacts were then fed as a data set to the AGMT3-D software, which produced a single multi-colored 'mean' artifact. A color scheme familiar from scientific and engineering analytic visualizations, the colormap here indicates deviation from the mean form, with red representing areas with the most form variability and dark blue representing areas where the artifacts were most similar.



Perpetual, 3D photopolymer and elastomer prints, 2D digital prints, synthetic hair, 2023

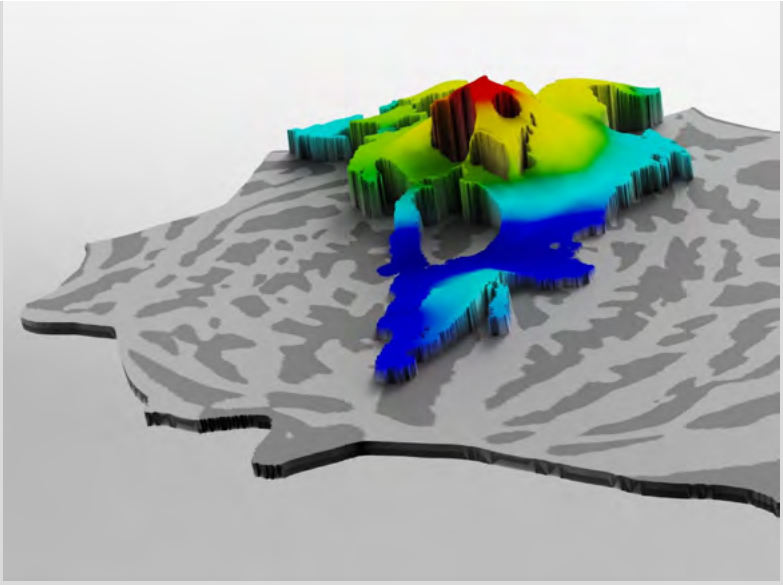
Brian selectivity levels correlating to the brushing of subject's limbs were displayed on an "inflated" brain model. The resulting analytics visualization was then "unwrapped" as a two-dimensional pattern. For the *Perpetual* shoes design, leg stimulation information was isolated from the overall data. The obtained two-dimensional color pattern was treated as though an animal hid and used to make the shoes upper, with the left hemisphere map applied to the correlated right shoe and vice versa.

The brushes incorporated in the shoe design pay homage to the way the scientific study was conducted and, at the same time, brush the wearer's legs when walking, thus stimulating the brain and producing color cortex maps, which can then be used in the creation of shoes…





Design works and scientific workflow illustrations incorporated in the exhibit *"Looking at Ourselves"* at the ELSC Martine De Souza-Dassault Brain Art Gallery, at the Hebrew University of Jerusalem

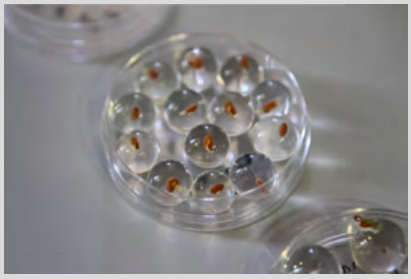


Mapping of the neural level of response in the brain to somatosensory stimulation, its *selectivity*, indicates the large-scale organization of hierarchies in the somatosensory domain. Degree of change is represented here by color as well as height.

An unanticipated outcome of the project was the development of a technique of showing brain activity data in a novel fashion; to date, the lab has used virtual 3D models with applied heatmaps (color correlated with degree of selectivity) to illustrate their findings.

Through 3D printing, researchers now have physical 3D brain activity models that can be handled and observed. Additionally, they regularly "flatten" the brain models to fully view the information on the folded brain surface. Taking those flat mappings and assigning a physical height value to the heatmap results in "mountains" materializing on the flat brain map, allowing for the intuitive reading of how rapidly the selectivity changes from one area to another simply by looking at the degree of incline.






MDes student projects in collaboration with HUJI's Physics, Chemistry, and Earth Sciences Department labs

The references and framing of this project rests, in part, on the backdrop of an academic collaboration I co-tutor with Maya Ben David held within the framework of an MDes course between design students and "hard science" labs at the Hebrew University of Jerusalem. The students are introduced to content – research topics in Physics, Chemistry, and Earth Sciences labs, and from there, embark on a hopefully collaborative 'response' through design. Projects at times propose applications, communicate science, speculate through alternative futures on implications, latch onto poetics identified in the lab environment, or otherwise give a subjective context to purposely objective research.

P/REFERENCES OF DESIGN

CODING IN ART AND DESIGN: FROM DEMOCRATIZATION TO MAINSTREAM.

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DOI: 10.63442/GPMR9128

KEYWORDS | VISUAL PROGRAMMING, ARDUINO, DISABILITY

ABSTRACT | In the „Stage of Impossibilities" project, I created a puppet moving mechanism for children with multiple disabilities. In this structure, the marionette is not manually controlled but can be moved by a robotic arm through tracking head movements. This technology has been used in a special needs school in Budapest as part of movement therapy and art classes.

A working prototype has been created in a few days using Arduino and visual programming languages. In my artistic research, I am exploring my role, primarily how a person with a background in arts education can take on a creative role in areas traditionally associated with engineering, particularly the creation of prototypes that require programming skills. The project led me to explore the origins of the tools I use, the ambition behind their creation, and their validity in today's world.

A key element of my research is the study of development environments that have been created to democratize programming and make it accessible to artists and designers. John Maeda's "Design by Numbers" project and its continuation with Processing and Arduino significantly contributed to making programming-based art an integral part of the cultural discourse, and many development environments - used in interactive and visual artworks - derive from them. These are certain types of development environments that I call the "build-your-own-tool" software. They approach the relationship between humans and machines from a different perspective. The „build-your-own-tool'" software allows artists to create complex digital works without having deep programming skills.

It was the pioneers of computer art who gave directions for making this software, while they couldn't rely on anything similar and had to write the algorithms themselves. The „build-your-own-tool" software gives the illusion that we create every part of the creative process ourselves, but at the same time, we are bound by the characteristics of the software itself. With these development environments, it is possible to make rapid progress, and they provide insight into the operation of the computer, but only a mediated and thus superficial knowledge.

The recognition of the boundaries recalls the Manifesto of Computer Art written by the Hungarian computer artist Tamás Waliczky in 1989, in which he stated, "Programmers develop software for us, the users, to use. Unless we know the capacities of the computer, we cannot sufficiently formulate our needs. Unless we sufficiently formulate our needs, we will receive nothing but traditional replies, programs that mimic the usual logic." How relevant is the manifesto in today's era when computers have become intricately more sophisticated? In my opinion, we have drifted from this statement just as much as computers have become more complex. In this context, even greater significance can be attributed to the Arduino and microcontrollers when creating programming-based art or design, as their complexity is comparable to that of early computers, and understanding them is much more approachable.

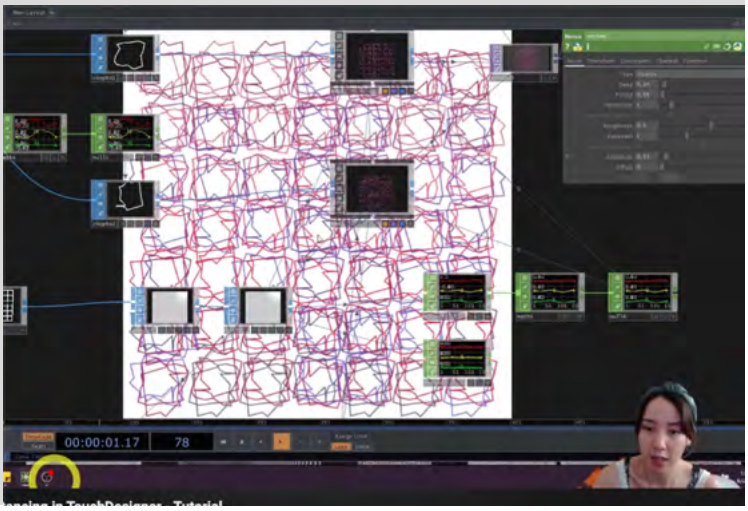
Focus of research

inspired by own project "Stage of Impossibilities”

DEVELOPMENT ENVIRONMENTS FOR DESIGNERS AND ARTISTS

- "Build your own tool"
- Origins and Historical Context
- Ambitions behind their creations
- Promises
- Limitations
- Creator’s way of use
- Future, sustainability

Research methodology:
practice-based
interviews with artists and designers



The Stage of Impossibilities

ARTISTIC RESEARCH

puppet moving mechanism for children with disabilities

development in Csillagház Elementary School in Budapest

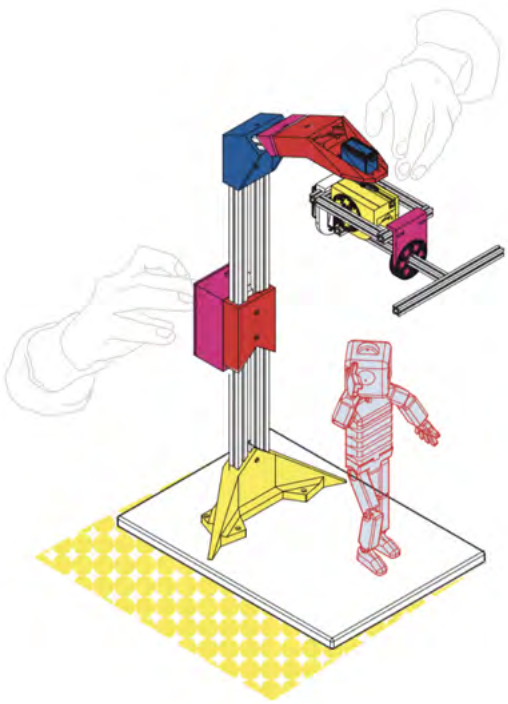
technical details

interdisciplinary network

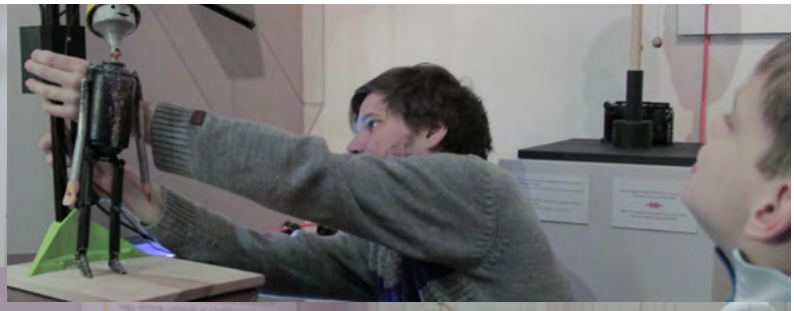
examining own role in the project

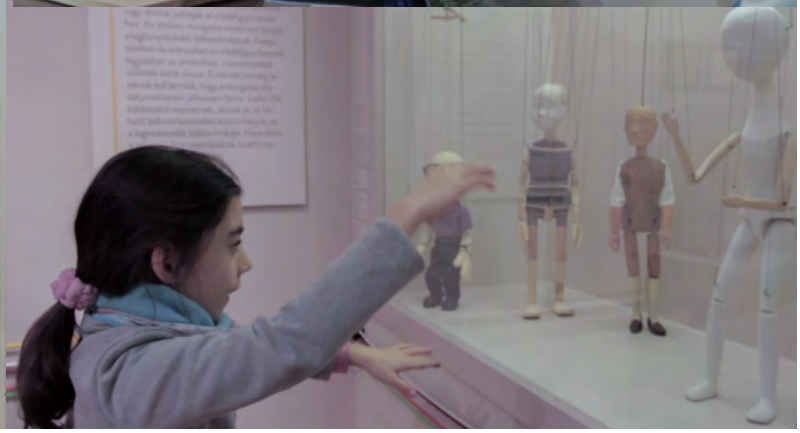












Democratisation of programming in art and design

Text-based IDE
DESIGN BY NUMBERS
- **John Maeda, 1999**

PROCESSING
- **Ben Fry and Casey Reas, 2001**

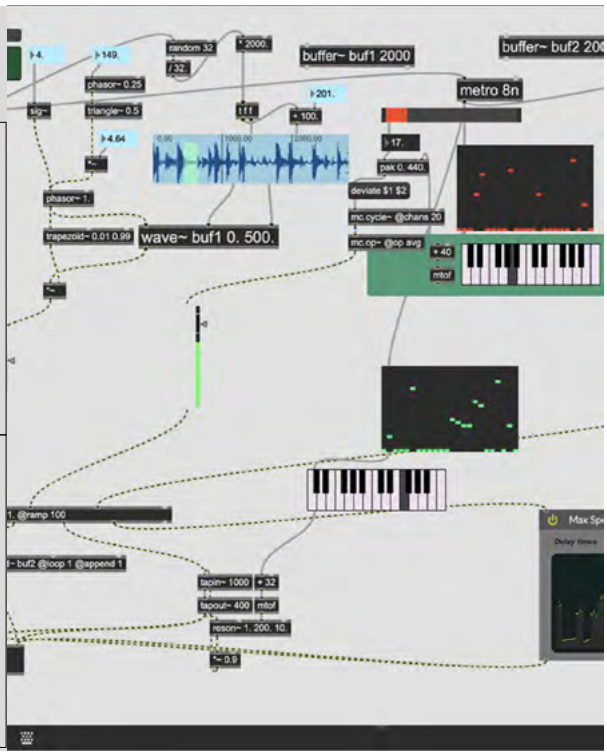
WIRING
- **Hernando Barragán, 2003**

ARDUINO
- **M. Banzi, D. Cuartielles, T. Igoe, G. Martino, and D. Mellis, 2005**

Visual programming language
AUDIO FOCUSED
MAX/**MSP (1985), PURE DATA (1996)**
- **Miller Puckette**

VISUAL FOCUSED
VVVV
- **Mezo, 1998**

Touch Designer
- **Derivative, 2000**



Historical Context - Aspirations in Art and Code

- **MILLER PUCKETTE**
- **JOHN MAEDA**
- **TAMÁS WALICZKY**

The Manifesto of Computer Art, 1989

Let's establish a much better relationship with programmers. Because they become our co-authors even when we buy programs ready-made, and our work will bear their mark as well.

Programmers develop software for us, the users, to use. Unless we know the capacities of the computer, we cannot sufficiently formulate our needs. Unless we sufficiently formulate our needs, we will receive nothing but traditional replies, programs that mimic the usual logic.



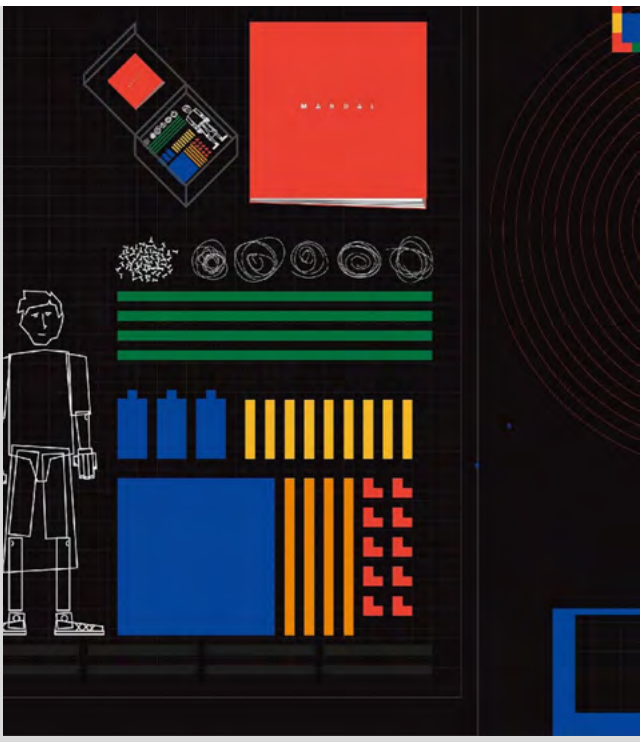
Limitations

- footprint
- prototyping versus product
- good for all, master of nothing
- cross-platform problems
- visual abstraction of written code
- licencing
- promise of easiness



Conclusion

- From democratisation to mainstream
- New directions: market segment of software
- Straightforward solutions - less ‘build your own tool”
- Insight into the operation of the computer
- Effective tools in education and fast prototyping
- Software is leaving its mark on creations
- Preservation difficulties



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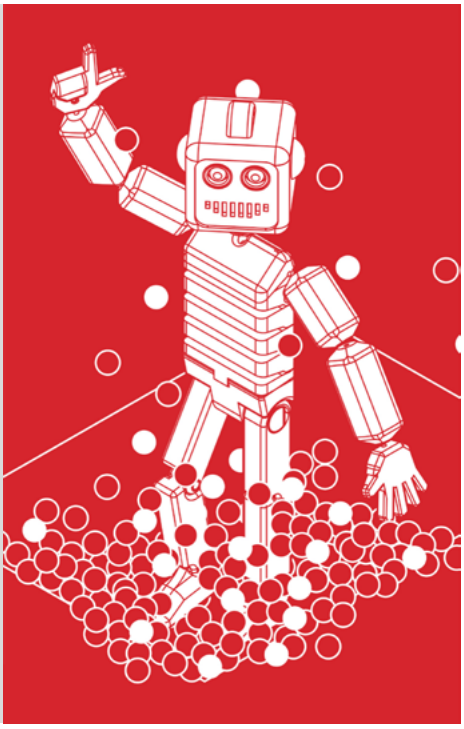
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https://www.arduino.cc/



P/REFERENCES OF DESIGN

IS THIS PRINT TALKING TO ME? MATERIAL AGENCY IN DESIGN.

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DOI: 10.63442/REMH6225

KEYWORDS | MATERIAL AGENCY, SENSORY DESIGN, EXPERIENCE DESIGN, PERCEPTION, INTERACTION

ABSTRACT | The workshop “Is this print talking to me?” is a relational practice in which we shift the perspective to the object. Human participants will be chosen by one of the participating objects, and the research team will observe the level of agency of the objects. On the other hand, participants will reflect on and define the qualities of the relationship they have established with their objects based on a questionnaire that will be provided.

1. Theme and Objectives

The theoretical model that governs the workshop is framed within Lambros Malafouris' Material Engagement theory (2013). It rethinks the agency of objects as a shared feature, within the framework of the new materialism movement (Harman, 2010). Subjects and objects are understood as part of the socio-material assemblage of design (Bill et al., 2015, p.10). Design is defined as the process of characterizing an artifact, encompassing its essence through to the elicited sensations, experiences, values, and imaginary signs it activates in the user (Calvera, 2007).

During the workshop, we will observe how prints activate sensory processes (Bedolla, 2005), how they have their own agency, and how they address participants in the personal, social, and practical spheres (Walker, 2015). Participants will also share the lived experience with the print, and we will use the collected data to validate the main hypothesis of the research, according to which end objects have an agency capable of addressing users in the most personal sphere.

Both the theoretical model and the questionnaire (research instrument) have been improved and validated with feedback obtained in previous editions of the workshop. With the edition we are presenting, our goal is to compare the experience of material agency across the cultural contexts of Barcelona-Lisbon-Hungary.

2. Schedule

Workshop schedule will last 90 minutes, with the following agenda:

1. Introduction (10 min):
   - Introduce the topic and the research context;
   - Sign permissions for collecting data (only research purposes).

2. Objectives (5 min):
   - Outline the specific objectives of the workshop and encourage active participation.

3. Time for Person-Object Interaction (15 min):
   - Choose an object and interact with it;
   - Objects can be shared, but responses are individual.

4. Questionnaire Response (20 min):
   - Written activity for participants to reflect on what they feel // data gathering for research.

5. Sharing Session (25 min):
   - Group discussion to share responses and reflections from the questionnaire;
   - Debate and exchange of ideas among participants.

6. Time for Person-Object Interaction (10 min):
   - A second connection to consolidate knowledge.

7. Conclusion (5 min):
   - Summarize key points and highlights of the workshop;
   - Stay connected

3.Questionnaire

The questionnaire is structured in four phases:

1. Level of agency (Malafouris, 2013; Harman, 2010, Bill et al., 2015)
   - Origin

2. Material experience (Desmet, 2012; Dezcallar, 2012; Morales, 2015; Bedolla, 2020)
   - Sensory
   - Emotional
   - Meaningful

3. Interaction (Rognoli, 2018; Lefteri, 2005; Maldonado, 1993)
   - Physical
   - Emotional
   - Mixed

4. Spheres of meaning (Walker, 2012)
   - Personal
   - Social
   - Practical

4. Audience

The targeted audience is people from art, architecture, design and/or research areas.

It is recommended that participants attend our paper presentation in order to familiarize themselves with the concepts that we will work with before the workshop begins.

Expected number of participants: Between 15 and 20 persons.

5. Equipment needed

20 chairs, 2-3 tables for object exhibition and to fulfill questionnaires, computer and projector, 20 pens, 20 printed copies of the questionnaire.

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Lluc Massaguer is a designer, holds a Ph.D. in Education from the Autonomous University of Barcelona (UAB), and is professor at the Studies of Information and Communication Sciences at the Universitat Oberta de Catalunya. She is member of the research group Mediaccions.

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P/REFERENCES OF DESIGN

STICKS AND LADDERS - PHYSICAL AND THEORETICAL APPROACHES TO THE INTEGRATION OF PARTICIPATORY DESIGN INTO SCHOOL CURRICULA.

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KEYWORDS | PARTICIPATORY DESIGN, LEARNING SPACES, LEARNING ENVIRONMENT EDUCATION, SPATIAL LEARNING, OUTDOOR LEARNING

ABSTRACT | To look at spatial perception and creation as learning processes and the connection between learning spaces and pedagogical methodologies. The workshop is rooted in two physical exercises from the introduction phase of Basalt School, an educational program to create outdoor learning spaces in elementary schools through participatory design. CAN Architects' Basalt School program has provided Hungarian schools with 22 outdoor classrooms in 2021-2023 and, in 2024, is planned to grow with 100 more, already on an international level too. Building as a learning process provides an ideal environment for experience-based education due to its seemingly elementary yet multi-sensory and multi-layered activities, which raise the curiosity and awareness of participants effortlessly. Due to the 1:1 scale conscious transformation of the environment, teamwork becomes natural, and the spatial vocabulary is introduced through the perception and use of the natural and built environment. The use of real-scale tools to create real-scale spaces is a key element in the process, based on the Inner 3D (CSEH 2015) spatial learning method and also following spatial education methods from the Bauhaus Vorkurs and its Total Theatre (WILCOX 1998) as well as the experimental architecture courses of Juhani Pallasmaa (WALL 2013).



Figure 1. The Ladder - Building trust through cooperation in 1:1 scale spatial exercises.

At the start of participatory design processes, the workshop's building and reflection tools are used as an introduction to spatial consciousness, possibilities and responsibilities towards the natural and built environment, representation roles in the process, and target levels on the ladders of citizen participation (ARNSTEIN 1969) and children participation (HART 1992).

These tools - the sticks and ladders - are not just spatial elements to create with but also representations of the possibilities/abilities and difficulties/disabilities of participating groups and individuals. Their presence creates burdens and opportunities to be handled. Inclusion comes through the investigation of the shared tasks, the reflective role assignment of the members of the group, and the building process itself.



Figure 2. Sticks – Spatial teamwork about the possibilities and responsibilities towards our natural and built environment.

The evaluation starts with the objective and measurable attributes, looking at the data of the result objects. The process assessment follows with a self-reflective evaluation of the learning curve and the possible applications of these build-and-learn spatial learning methods.

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András Cseh is a graduate in architecture from the Budapest University of Technology and Economics. In 2008, he started working at CZITA Architects and in teaching architectural design at Széchenyi István University. Pre Architecture - Learning Through Space, his doctoral research at Moholy-Nagy University of Art and Design investigated the connections between spatial perception and creation as learning processes. In 2017, he co-founded CAN Architects, an architectural studio with a strong focus on learning spaces and built environment education. Based on their multidisciplinary research with pedagogic and psychological experts, the studio developed spatial learning innovations such as the Alcoved Classroom and the Turning Classroom. Currently, he is lecturing on learning spaces, school architecture, and spatial awareness in education for students of pedagogy at the University of Pannonia and students of psychology at Eötvös Loránd University. He promotes outdoor learning and 21st-century learning design at the Basalt School, his office's education program.

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Acknowledgements: Basalt School is the spatial education initiative by CAN Architects. Therefore, the whole team of the architecture firm deserves praise and recognition, especially our founding partners: József Élő, Dávid Németh, and Ádám Tátrai.

P/REFERENCES OF DESIGN

DESIGNING REFLECTIVE FRAMEWORKS FOR ENHANCING COLLABORATIONS BETWEEN NGOS AND ACADEMIA.

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ABSTRACT | While the essence of social design varies between cultures and local contexts, two of its key features are working with and for local communities and partnering with stakeholders other than the industry. While many design researchers, practitioners, and educators work with NGOs, be they local and small-scale or structured global entities, working with NGOs is hard to define. Indeed, reflecting on the key writings of classic social design (Papanek, 1971 and Margolin, 2002, to name just two), we find key attributes that are debated at length, but the importance of working with NGOs in this sphere of design practice is far from ideal. Tromp and Vial (2022) offer several components revolving around adding to a broad and rather flexible ethical common good. First, care-driven activities for the well-being of underprivileged people. This component accentuates an active role in starting with empathy and care while aiming at communities that truly need the additional knowledge of design professionals. Second, responsiveness-driven activities for good governance. This approach is especially important during collaborations with civil servants, NGOs, and nonprofits in better addressing the needs of their beneficiaries. Third, political progress-driven activities for empowered citizens.

Social justice, design ethics, participatory strategies, and politics-in-action are especially important when conducting joint projects with NGOs and local communities. NGO as a key partner differs immensely from other typical stakeholders. Due to its ideological nature, as well as its reliance on volunteers and pro-bono contribution, as well as its complex relation to industry and commercial venues, this all imbues working with an NGO with a unique layer.

The workshop is aimed towards design researchers and educators working with NGOs in higher educational contexts. During the workshop, participants in a group setting familiarise themselves with two collaborative scenarios: 1) a student project with an established long-term partnership with a community center, and 2) a design research project with a new collaboration with a local NGO. After choosing one scenario, participants dive into planning the community engagement by thinking through a framework that is currently under development by the authors: the level of participation, the necessary context analysis, trust-building exercises, care-driven activities, emerging conflicting themes, as well as collaborative strategies and suggestions. The creation of the framework is also supported by a probe kit that encourages participants to create a three-dimensional model of participation for discussing responsiveness.

This creative planning exercise helps design researchers and educators carefully consider all elements prior to setting up a collaboration with an NGO. The proposed framework as a workshop could be organized among team members within relevant HEIs, design students, or with local NGOs. The reflective questions developed by the authors during the Change Agents, an EU-funded project, can enhance future partnerships by creating fairer collaborative processes.

20 participants (3-4 on each team)

Timeline (90 minutes):

- 5 min - introduction and icebreaker
- 10 min - presentation of the context and frameworks
- 60 min - facilitated group work (5 groups)
- 15 min - shareback and conclusion

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Dr. Bori Fehér, an associate researcher at MOME Innovation Center, leads the Social Design Hub, guiding practice-based research projects for over a decade. Her focus lies in social, eco, and humanitarian design, particularly addressing the climate crisis and its impact on social resilience, particularly in rural areas. She co-founded and co-chairs the Social Design Network and is currently leading the Erasmus+ Cooperation Partnership Change Agents project. Bori has been a visiting researcher at the Maryland Institute College of Art Center for Social Design since 2014. She earned her degrees in architecture and design management from MOME, where she also obtained her doctorate summa cum laude. With prior experience in architecture in Budapest and New York, USA, she now teaches R&D&I courses and supervises at the MOME Doctoral School.

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REDEFINING DATA BOUNDARIES



P/REFERENCES OF DESIGN

CUMULUS BUDAPEST 2024



P/REFERENCES OF DESIGN

REDEFINING DATA BOUNDARIES THROUGH DESIGN.

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In the evolving landscape of technology and design, traditional notions of data are being challenged and reimagined. Data are no longer confined to quantitative measurements but have been actively shaping creative processes, design outcomes and human-non-human interactions. The track Redefining Data Boundaries explored the transformative potential of data which involved recognizing data's agency and its capacity to influence outcomes autonomously. This transition requires a re-examination of our understanding of the roles of technology and humans in the design process. There is an increasing recognition of the emergent agency of digital technologies, rather than perceiving them solely as instruments controlled by humans. This viewpoint considers technology and people as collaborators in a symbiotic relationship, wherein both possess agency that converges in practice.

One aspect of this transformation is the integration of aesthetic computing in design. Using computational methods to simulate human aesthetic decision-making allows designers to enhance creativity and efficiency. Systems that generate visual content based on specific inputs, such as mood boards, demonstrate how data can bridge the gap between quantitative metrics and qualitative experiences. These systems extend designers' creative possibilities by automating tedious tasks, prompting inspiration and extending the scope of ideation. Close to that, in some cases also the materiality data can acquire present a unique balance between numbers and live experiences. When data are embedded into the physical world, this raises the need for ethical

considerations in data representation that span beyond the digital. Thus, in those cases, data are transformed into a tangible experience that challenges the definition of data. Moreover, physicalizing data may facilitate profound relationships between individuals and the information conveyed through reflection. Physical data underscores the capacity of data to foster empathy, contest prevailing perceptions, and enhance informed and compassionate decision-making processes.

In addition, the redefinition of data boundaries necessitates an extensive examination of the interaction between machines and human agency. Understanding that technology can operate independently and affect events requires the development of new frameworks for assessing and designing these interactions. By evaluating the agentic capabilities of technology, designers may foresee future impacts, align human and non-human agency, and develop more equitable and ethical systems. This approach transcends conventional human-centric or techno-centric approaches, promoting a more integrated vision that recognizes the reciprocal nature of humans and technology.

The redefinition of data boundaries highlights the emergent, contextual, and distributed characteristics of agency. Agency is perceived not as a binary characteristic but as a spectrum of dependent phenomena that vary across circumstances. This understanding encourages designers to evaluate the different levels of autonomy and impact that technologies exhibit, and how these attributes might be used or regulated within design methodologies.

Moreover, the increase of data's significance in design and interaction underlines the ethical implications of technology use. As data integration increases and technology acquires greater autonomy, providing transparency, accountability, and responsibility is essential. Designers are required to build systems that are both functional and visually appealing while also contemplating the ethical and societal implications of their work. By adopting innovative frameworks of agency, incorporating aesthetic computing, and promoting empathetic interactions with data, we can create new methodologies that enhance human experiences and tackle intricate difficulties. This redefinition promotes an extensive perspective that values the interaction among humans, technology, and data, hence fostering more considerate, innovative, and ethical actions in the digital era.

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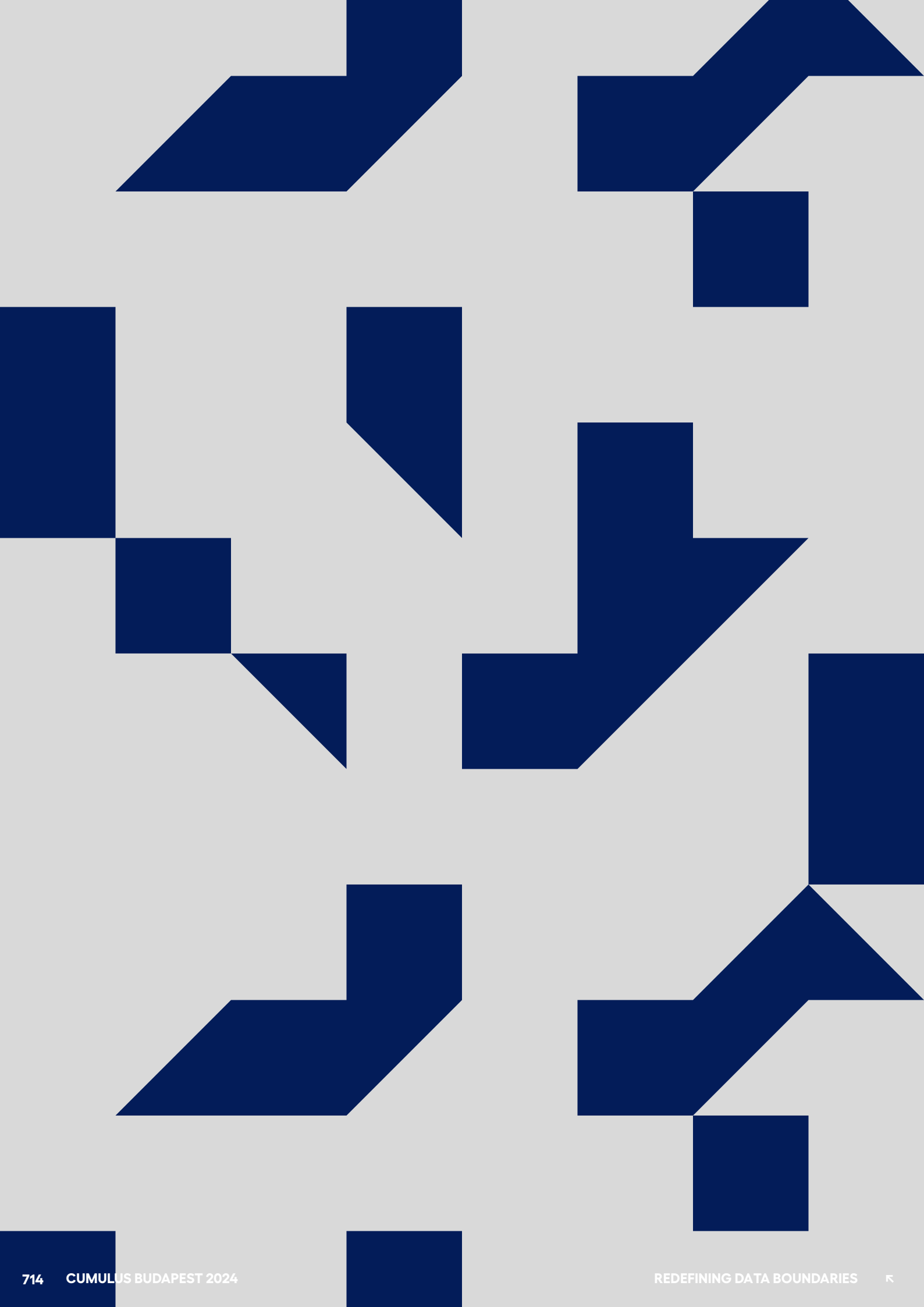
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AESMOOD: AN INTELLIGENT SYSTEM FOR GENERATING MOOD BOARDS WITH AESTHETIC COMPUTING.

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KEYWORDS | MOOD BOARD, IMAGE GENERATION, AESTHETIC COMPUTING, DEEP LEARNING

ABSTRACT | In the design process, manually constructing mood boards is a difficult, multi-step task requiring significant time and effort to gather and select images. To improve the efficiency of mood board creation, we introduce AesMood, an intelligent mood board generation system based on image generation and aesthetic computing. AesMood utilises the Stable Diffusion 2 image generation algorithm, which enhances the diffusion model by introducing a cross-attention layer into the model architecture and substantially improves visual fidelity. To mitigate the issue of inconsistent aesthetic quality among generated images, AesMood integrates the Style-specific Art Assessment Network (SAAN). SAAN efficiently extracts both style-specific and generic aesthetic features to evaluate and ensure the high aesthetic quality of the images for mood boards. In the preliminary phase of designing the system, interviews were conducted, which yielded three design requirements: meet user needs, editability, and simplicity of use. Three important functionalities are encoded in the AesMood system, including intelligent mood board generation, aesthetic scoring, and mood board editing. We invited 20 designers to employ our system, and its performance was assessed across four dimensions—usefulness, ease of use, learnability, and satisfaction—using the Likert scale in conjunction with semi-structured interviews. The results demonstrate high satisfaction levels, with participants noting the system's ability to broaden inspiration, stimulate creativity and imagination among designers, and enhance the efficiency of the ideation capture phase.

1. Introduction

Mood boards are an important tool for designers in the design process and are a source of inspiration. The construction of mood boards is a complex, multi-step task requiring designers to spend a lot of time and effort gathering and selecting images. Additionally, this process is confronted with the challenge of accessibility to high-quality image resources. Consequently, designing an automated system capable of generating high-quality mood boards is important for optimising the design workflow. Such a system could reduce designers' cognitive load and time demands by adjusting the resource acquisition phase and ensuring a consistent supply of premium visual materials.

In an era where data is not merely a collection of numbers but a rich canvas of human experience, aesthetic computing is redefining the boundaries of data interpretation and representation. Aesthetic computing enables designers and artists to experiment with different identities and forms of expression, exploring how data can shape and reshape design expression and self-perception. Aesthetic computing refers to the application of computational methods by computers to simulate human aesthetic decision-making (Xu, et al, 2022), and it represents a quantitative study of the aesthetic attributes of artistic forms such as images. Aesthetics assessment, as one of the primary research directions in aesthetic computing, principally involves extracting aesthetic perceptual features to assess the aesthetic quality of visual inputs. Prior research has applied aesthetic computing to the domain of photography recommendation (Wu, 2022). However, studies focusing on utilising aesthetic computing for mood board construction assistance are currently absent. Integrating aesthetic computing into an intelligent mood board generation system is anticipated to alleviate the issue of inconsistent aesthetic quality among generated images. The most employed datasets for aesthetics assessment include AVA (Murray, et al, 2012), AADB (Kong, et al, 2016), and CUHK-PQ (Tang, et al, 2013). Given that mood boards are a crucial referential component in the design process for designers and are often characterised by their aesthetic and abstract nature, we have incorporated the Style-specific Art Assessment Network (SAAN) (Yi, et al, 2023), trained on Boldbrush Art Image Dataset (BAID), into our intelligent mood board generation system as an auxiliary tool for designers. The SAAN algorithm effectively extracts specific styles and general aesthetic features to evaluate and ensure the high aesthetic quality of mood board images.

This paper proposes ***AesMood***, an intelligent mood board generation system based on image generation and aesthetic computing. The primary objective of AesMood is to enhance the efficiency of mood board creation by automatically generating images corresponding to specific keywords input by designers and conducting an aesthetics assessment of these images. The image generation algorithm used by AesMood is stable diffusion 2 (Rombach, et al, 2022), which improves visual fidelity significantly by incorporating cross-attention layers into the model structure. Through a series of user studies, we have evaluated AesMood's performance in assisting designers, overall user satisfaction with the system, and the effectiveness of its various functions. The contributions of this work are as follows:

- The mood board intelligent generation system, named AesMood, has been developed, which generates images corresponding to specific keywords input by designers to construct mood boards. The intelligently generated mood boards feature a fixed layout and are endowed with editable capabilities.

- We have creatively integrated an aesthetics assessment algorithm into the AesMood system, referencing public aesthetics during the mood board construction process and assisting designers in their decision-making.

- Experimental results indicate that AesMood performs well in assisting designers with mood board generation, enhancing design efficiency, providing a broader source of inspiration, and stimulating designers' creativity and imagination.

2. Related Work

2.1 Mood Board

The mood board is a collection of visual images arranged to express the emotional response to a design brief (Garner, et al, 2001). Lucero (2012), through empirical research, identified five main functions that mood boards can serve in the early stages of the design process: framing, aligning, paradoxing, abstracting, and directing. Current research on mood boards primarily focuses on innovation in the form of mood boards. Koch et al. (2020) investigated the innovative use of digital mood boards to enrich designers' creative process by attaching semantic labels to images. Their study introduced SemanticCollage, a digital tool that employs advanced semantic labelling algorithms to assist designers in transforming vague visual concepts into searchable terms, thereby enhancing the understanding and communication of design ideas without disrupting their creative thinking. Zabotto et al. (2019) explored how to use Kansei engineering to connect users and designers, employing automated mood boards to convey emotions and aid clients in analysing ideas for product development. Their paper examined the potential of a Kansei engineering system based on rough set probability statistics, which could link customers' affective words with sustainably collected images online. They proposed a new Kansei engineering process comprising five cycles that capture user opinions at all stages of the design process. Ivanov et al. (2022) introduced the MoodCubes system, a system for rapidly creating and manipulating multimedia content to address the challenges of gathering and combining inspirational materials in the early stages of the creative process. MoodCubes supports designers by deconstructing objects (such as extracting colour palettes), suggesting new materials (such as 3D models, images, and lighting effects), and providing filters to alter the aesthetic of a scene. These studies have expanded creative research on constructing mood boards by incorporating new elements such as text and 3D models, yet they still utilise existing collected materials. Wan et al. (2023) proposed a digital mood board, GANCollage, driven by StyleGAN and supported by a pretrained anime image classifier, which aids designers in organising and understanding these generated ideas in the form of “sticky notes” on the mood board canvas, with a primary application in character design. Our research, however, attempts to explore the automatic generation of mood boards using the stable diffusion 2 image generation algorithm by generating a diverse range of mood board images to support designers in various design fields (e.g., product design and vehicle design).

2.2 Image Generation

Image generation algorithms are an artificial intelligence technology that typically relies on sophisticated mathematical models to produce images that appear authentic by emulating the characteristics of real-world imagery. These algorithms have utility across various applications, including artistic creation, game development, film special effects, and aiding designers in conceptualising new product designs. Currently, the mainstream algorithms for image generation include GANs (Generative Adversarial Networks) (Goodfellow, et al, 2020), VAEs (Variational Auto-encoders) (Kingma, et al, 2019), and diffusion models (Ho, et al, 2020). Due to their superior image quality, diffusion models have gradually replaced GANs and have become the most popular image generation models. Among the research based on diffusion models, Avrahami et al. (2022) proposed an innovative method for the local editing of natural images using natural language descriptions and region of interest (ROI) masks. This method combines a pretrained language-image model (CLIP) with a Denoising Diffusion Probabilistic Model (DDPM) to guide the editing process toward the textual prompts provided by the user, ensuring seamless integration of the edited area with the rest of the image. Kim et al. (2022) introduced DiffusionCLIP, a powerful method for text-guided image manipulation using diffusion models, addressing the limitations of GAN inversion methods in diverse real-world image applications. Their work highlighted the full inversion capability of diffusion models, enabling zero-shot image manipulation across unseen domains and diverse content. They introduced a novel noise composition method to facilitate direct multi-attribute manipulation. Additionally, Gu et al. (2022) proposed the vector quantised diffusion (VQ-Diffusion) model for text-to-image generation, which combines vector quantised variational autoencoder (VQ-VAE) with the recently developed conditional

variant of DDPM. Their approach aims to overcome unidirectional bias and error accumulation in existing methods, demonstrating significant improvements in text-to-image generation tasks. The VQ-Diffusion model handles more complex scenes and significantly enhances the quality of the synthesised images. Our research employs the stable diffusion 2 algorithm, which enhances the diffusion model by incorporating cross-attention layers into the model structure, thereby significantly improving visual fidelity.

2.3 Aesthetics Assessment

Research on aesthetics assessment currently focuses on two main areas: Image Aesthetics Assessment (IAA) and Personalized Image Aesthetics Assessment (PIAA). In Image Aesthetics Assessment, Ke et al. (2023) proposed a novel method to learn image aesthetics from user comments, employing vision-language pre-training to develop multimodal aesthetic representations. He et al. (2022) conducted a comprehensive study on image aesthetics assessment, introducing the TAD66K dataset containing 66K images across 47 themes. They also developed a Theme and Aesthetics Network (TANet), a model that adapts to the image assessment rules of different themes, achieving state-of-the-art results on several datasets. Furthermore, He et al. (2023) proposed An Enhancer for Aesthetics-Oriented Transformers (EAT) to improve the performance of transformers in IAA tasks. EAT utilises a deformable, sparse, and data-dependent attention mechanism, refining attention through offsets to balance foreground and background, thus outperforming previous methods on various datasets.
In the domain of Personalized Image Aesthetics Assessment, Li et al. (2022) addressed the challenges of PIAA by proposing a meta-learning-based algorithm—Transductive Aesthetic Preference Propagation (TAPP-PIAA), which avoids the need for fine-tuning personal data, thereby reducing training costs and preventing underfitting/overfitting. Yang et al. (2022) tackled the challenges of PIAA by introducing a new personalised image aesthetic database—Personalized image Aesthetics database with Rich Attributes (PARA). They presented a conditional PIAA model that uses thematic information as a prior condition, surpassing existing methods and offering insights into the complex interplay of image aesthetics and personal characteristics that generate personalised aesthetic preferences. Considering mood boards' aesthetic and abstract attributes, our research has incorporated the Aesthetics Assessment Algorithm SAAN, trained on the Boldbrush Art Image Dataset (BAID) with 60,337 art images, into our intelligent mood board generation system. This provides designers with a quantified reference to public aesthetics.

3. Design of a Mood board Generation System

3.1 Pre-study Interview

To comprehensively understand the significance of mood boards to designers, their challenges in creating mood boards, and their needs for an automated mood board generation system, we interviewed seven designers (aged 26-30, with professional experience ranging from six months to six years). The positions of the participants were as follows: interior designer (3), game designer (1), spatial designer (1), fashion designer (1), and CMF designer (1). As the participants were in various cities, the interviews were conducted online and audio-recorded for subsequent analysis. We designed a survey questionnaire comprising eleven questions that covered basic information, the importance of mood boards, experiences and challenges with using mood boards, and the needs related to an automated mood board generation system. The synthesised feedback from the interviews is summarised as follows:

Importance of Mood Boards. All designers concurred on the paramount importance of mood boards in the design process, describing them as perpetually essential. One designer stated, *"You cannot leap from an idea in your head directly to a sketch or a model. There is a chasm in between."* Designers regard mood boards as a source of inspiration, an intuitive guide, and a visual summary. Regarding communicating with clients, a spatial designer mentioned, *"Mood boards can better help users grasp the general feel of a proposal before any concrete design is in place."*

Difficulty in Finding Images. All designers identified the most significant challenge in constructing mood boards as difficulty in sourcing images. They often spend considerable time searching online for images that meet their requirements but fail to find suitable ones. "*No matter how you search, you cannot find what you want,*" one designer illustrated, "*For instance, if you have a creative idea that might not exist in the market currently, you actually cannot find corresponding images. I think finding images is a significant challenge, especially when making creative-type mood boards.*" Another fashion designer said, "*The images found may not match the needed tone, requiring modifications to the images, such as removing certain elements, which is time-consuming.*"

Automated Generation of Mood Boards. All designers strongly desired a system that could automatically generate mood boards, saving time seeking out and editing images. One designer stated, *"If it could automatically generate mood boards based on the textual information we have researched, that would significantly reduce our workload."* Regarding the functionality of the automated mood board generation system, one designer believed, *"The simpler the system, the better, focusing on the core function of generating mood boards."* Most designers hoped that the layout of the final mood board could be flexible enough, with added editing capabilities. One designer had specific requirements for the precision of generated images, hoping for a more accurate match of suitable images to the input keywords.

3.2 AesMood System Design

Informed by interview feedback, we developed AesMood, an intelligent mood board generation system designed to create mood boards that align with designers' needs. This system encompasses three primary functions: automatic mood board generation, aesthetic scoring, and mood board editing. The entire system was developed using Python. The operational workflow and system framework of the AesMood system are shown in Figure 1.

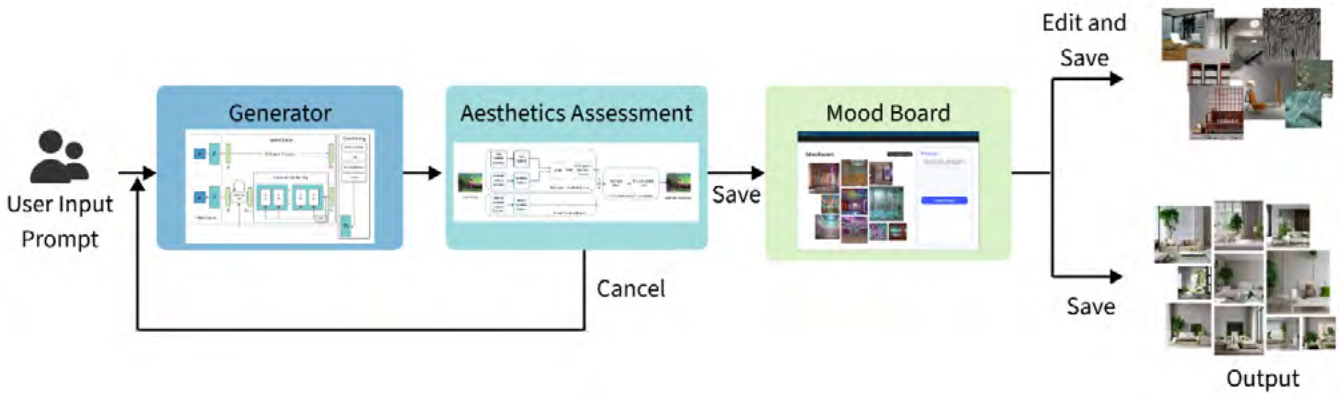


Figure 1. Operational workflow and system framework of AesMood.

Based on the interview feedback, we developed the AesMood to address three core requirements of designers, as shown in Table 1. Beyond following these requirements, to address the issue of inconsistent image quality commonly associated with current image generation algorithms, we incorporated an aesthetic scoring feature into the AesMood system. This feature is intended to assist designers in building mood boards by providing aesthetic evaluations.

Table 1. Design Requirements for Constructing an Intelligent Mood Board Generation System.

	Design Requirements
1)	Develop a system capable of automatically generating mood boards that more accurately align with the requirements of designers, thus conserving the time they spend searching for images.
2)	Create an intelligent mood board generation system with image editing capabilities, enabling designers to utilise this system to complete the construction of mood boards directly.
3)	Design an intelligent mood board generation system with a simple interface and precise interactions, facilitating ease of learning and use for designers.

Figure 2 presents the main interface of the AesMood system. The left side is a blank space as the Mood Board display area, where designers can modify the size and position of selected images after saving them. On the right is the prompt input area, where designers can enter keywords related to the images they wish to generate into the text box, separating each term with a comma. Upon entering the desired keywords, click the “Generate Image” button to initiate the image generation process. As depicted in Figure 2, we entered a set of keywords “future interior design, renaissance painting installation, digital visual, cyberspace” as an example of usage.

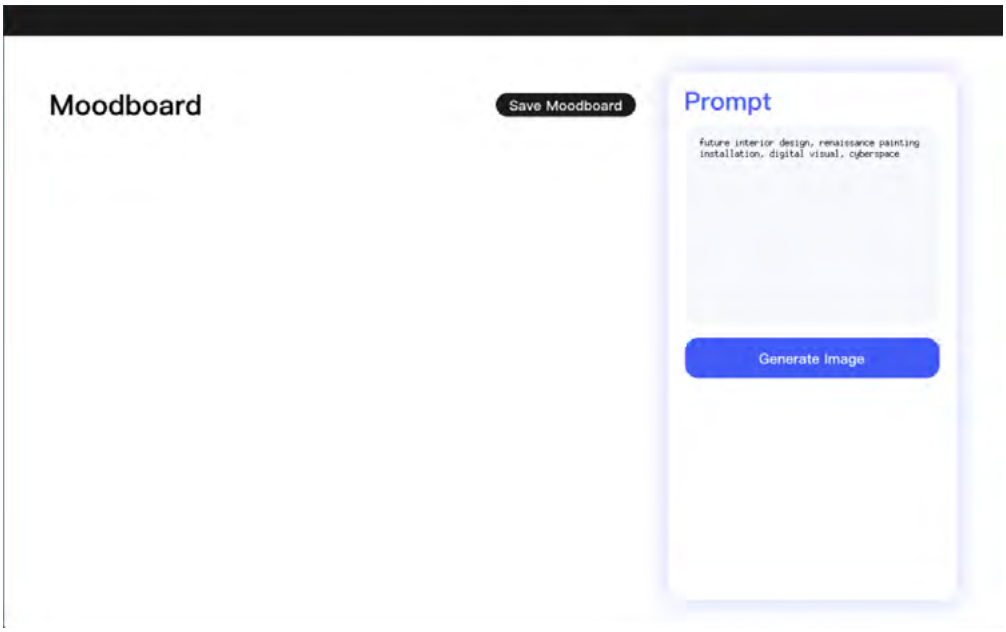


Figure 2. The main interface of the AesMood system.

The interface for image generation using the prompt is depicted in Figure 3. The current image's prompt is displayed at the top of the interface, with the generated image showcased in the centre. Concurrent with the image generation, an aesthetics assessment algorithm calculates an aesthetic score for each image displayed below the image. This aesthetic score offers a quantified evaluation of public aesthetic appeal, serving as a reference for designers when deciding whether to incorporate an image into the mood board. If the designer opts to include the image in the mood board, they select the “Save” button; if not, they choose the “Cancel” button.

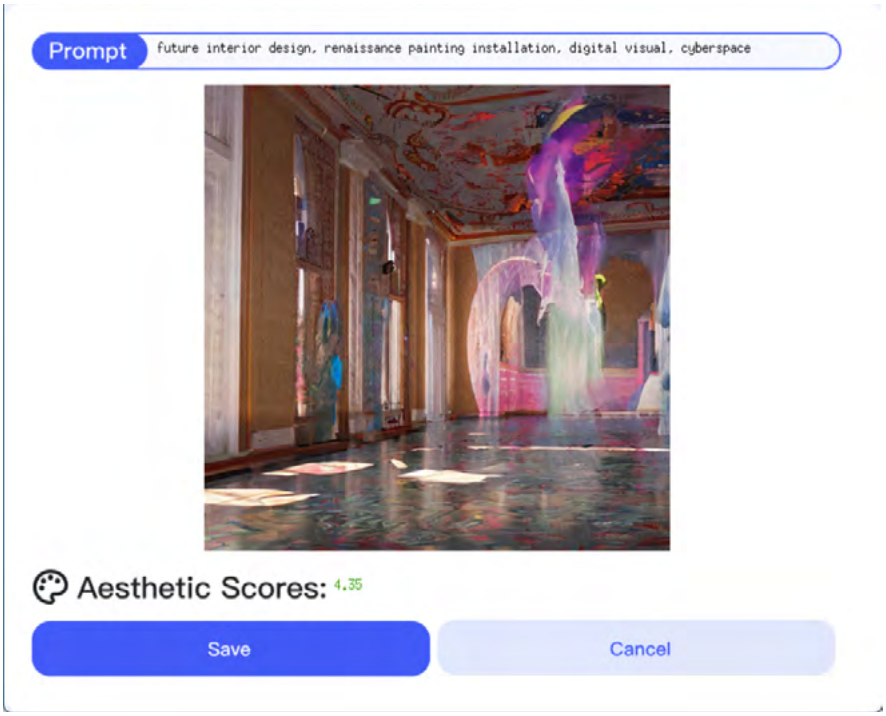


Figure 3. Image generation interface.

As seen in Figure 4, after saving an image, it is directly displayed on the mood board and arranged in a preset sequence with a fixed layout, with a maximum of ten images for the designer's reference in layout planning. If the designers are satisfied with the fixed layout, they can choose to save the mood board directly. If the designers feel adjustments are necessary, the AesMood system also supports editing functionality. The specific operations are as follows: images can be moved using a drag-and-drop action with the mouse's left button, and the size of the images can be adjusted by placing the cursor over the image, holding down the control key, and scrolling the mouse wheel. The designer can flexibly adjust the position and size of the images on the mood board while adding images that meet their requirements until the final composition is determined. The designer can select the “Save Moodboard” button to save the mood board. Additionally, the images generated during the construction of the mood board are saved on the computer, allowing the designer to edit them further using other specialised design software if needed.

3.3 Algorithm of AesMood

The image generation algorithm AesMood uses is Stable Diffusion 2, as illustrated in Figure 5. It enhances the diffusion model by incorporating cross-attention layers into the model structure, thereby significantly improving visual fidelity. The differential model learns data distribution by denoising standard distribution variables, effectively reverse-engineering a fixed-length Markov chain. In image synthesis, these models are trained through a series of denoising autoencoders to predict the denoised version of the input. The algorithm's perceptual compression model allows access to a lower-dimensional latent space that is more suitable for likelihood-based generative models. This algorithm uses image-specific inductive biases and 2D convolutional layers to construct a UNet, focusing on the perceptually most relevant parts. Additionally, by incorporating a cross-attention mechanism, the algorithm transforms the differential model into a more flexible conditional image generator capable of handling inputs across various modalities, preprocessing these inputs through domain-specific encoders.

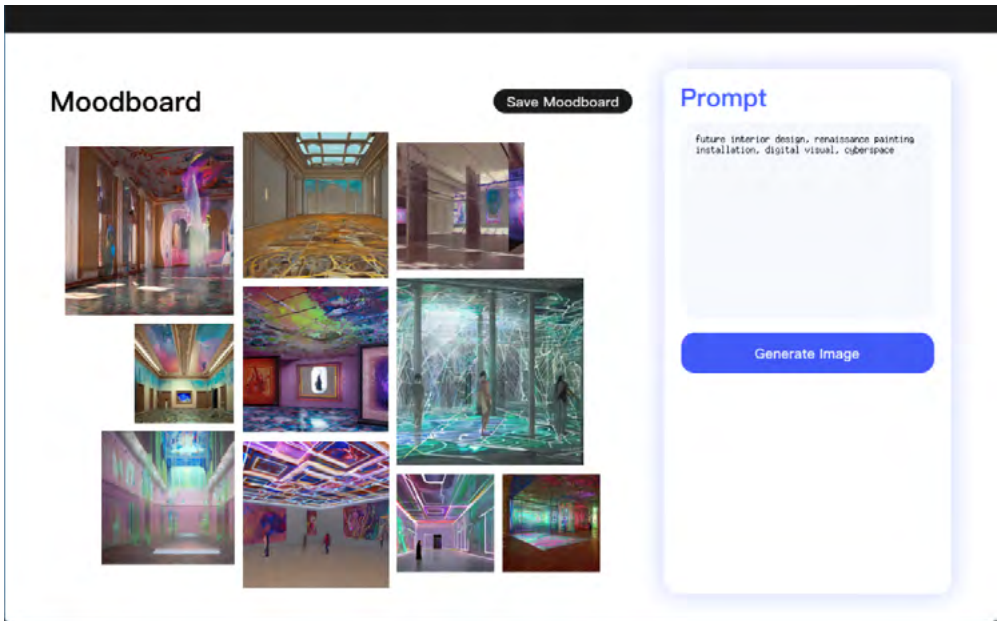


Figure 4. Fixed layout of the mood board generated by AesMood.

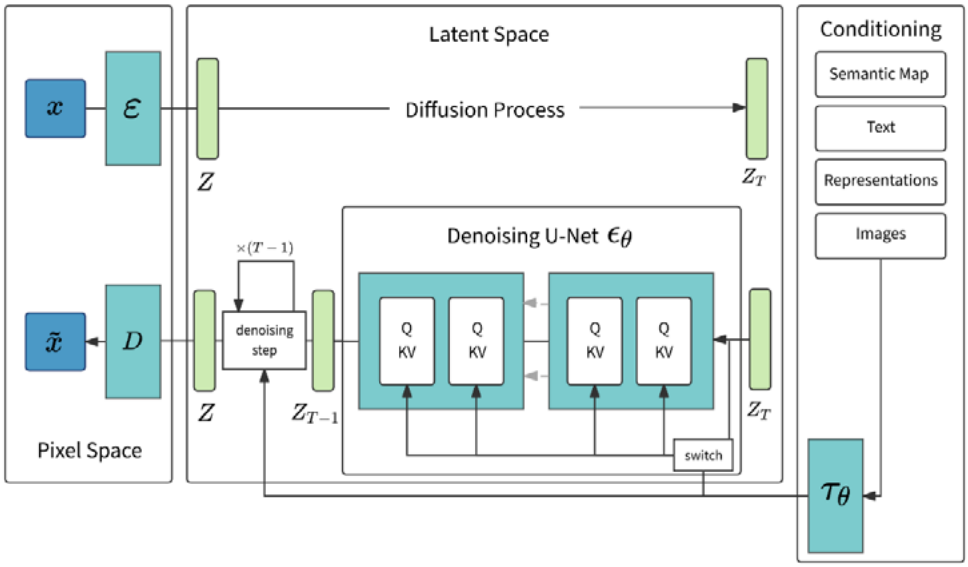


Figure 5. Network structure of the image generation algorithm.

AesMood also introduces an aesthetics assessment algorithm, the Style-specific Art Assessment Network (SAAN), trained on the Boldbrush Artistic Image Dataset (BAID), which comprises 60,337 artistic images. As shown in Figure 6, the SAAN algorithm contains three modules: (1) Style-specific Aesthetic Branch (SAB): This extracts aesthetic features related to artistic style, using a pre-trained VGG-19 to extract style features and a pre-trained ResNet-50 to extract aesthetically relevant features. The AdaIN layer integrates style features into aesthetic features while preserving the spatial structure of style features. (2) Generic Aesthetic Branch (GAB): This branch extracts general aesthetic features based on self-supervised learning, such as the integrity of prominent parts and frame layout. It uses ResNet-50 as the backbone network and applies self-supervised learning methods for pretraining. (3) Spatial-information Fusion Module: This module uses non-local blocks to fuse spatial information and incorporates the composition of artworks into the assessment. It merges the features extracted by SAB and GAB and then uses non-local blocks to fuse spatial information.

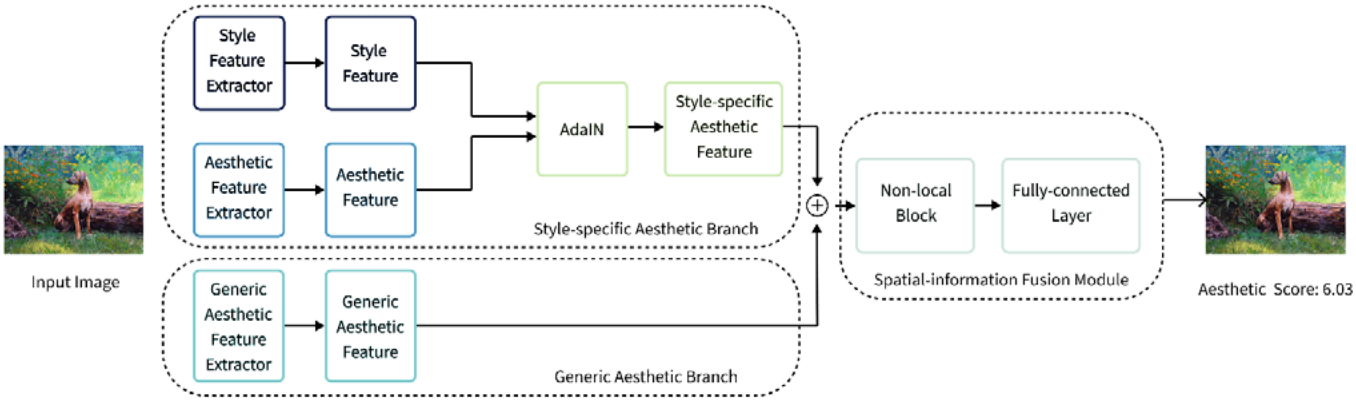


Figure 6. Network structure of the aesthetics assessment algorithm.

4. Evaluation

4.1 Experimental Setup

To evaluate the performance of the AesMood system in assisting designers and to assess overall user satisfaction and the effectiveness of each system function, we conducted a series of user studies. We recruited 20 participants (age 22-30, M=25, SD=5.94) as the human subjects in this study. All of them were designers (average of 6 years of design experience), specialising in product design, landscape design, interior design, etc. The experiment involved asking designers to conceive designs based on the fixed theme of "smart home" and to create mood boards using the AesMood system. The experiment included three main parts: (1) pre-experiment, (2) creation of mood boards, and (3) post-test.

1. Pre-experiment: Designers initially familiarised themselves with the AesMood system by trying out its main functions and operating procedures. After several adjustments, they preliminary determined the prompts to be used in creating mood boards to minimise the impact of prompt adjustments during the subsequent experimental process.

2. Creation of mood boards: In the formal experimental phase, we set up four control experiments to verify the effectiveness of the functions in the AesMood system and their impact on designers during the mood board creation process. We asked designers to create mood boards using four different versions of the system, each with varying functionalities: AesMood, which includes the full functionalities of image generation, aesthetic scoring, and image editing capabilities (dragging and resizing); AesMood-edit, which provides for only image generation and aesthetic scoring; AesMood-score, which includes only image generation and image editing; and AesMood-edit-score, which provides for only image generation. Designers used these four systems in a random order to create complete mood boards to prevent the order of the experiments from affecting the results.

3. Post-test: We designed a user questionnaire based on a 7-point Likert scale across four dimensions—usefulness, ease of use, learnability, and satisfaction (Lund, 2001)—and asked designers to rate their agreement after each experimental group (1: strongly disagree, 7: strongly agree). Designers were also asked to score the final mood boards they created (on a 10-point scale). Finally, we conducted a semi-structured interview to gain more specific feedback from designers about the AesMood system.

4.2 Results

The normality of the Likert scale data was assessed using the Shapiro-Wilk test, which yielded significant results ($p < 0.01$), indicating that the data did not follow a normal distribution. Consequently, we employed the Kruskal-Wallis non-parametric test to determine if there were significant differences between the various systems across the four dimensions of usefulness, ease of use, learnability, and satisfaction. Dunn's post hoc analysis was conducted to further discern specific differences between pairs of systems. The mood boards created by designers using the AesMood system are shown in Figure 7.



Figure 7. The mood boards created by designers using AesMood.

1. Usefulness

As shown in Figure 8, significant variances were detected through the Kruskal-Wallis test in the areas of usefulness ($H=14.89$, $p<0.01$), efficiency ($H=9.00$, $p<0.05$), and requirement satisfaction ($H=23.70$, $p<0.001$). Pairwise comparisons revealed that AesMood significantly outperformed the other three systems in terms of usefulness, with p-values less than 0.01 when compared to AesMood-edit, less than 0.05 when compared to AesMood-score, and less than 0.001 when compared to AesMood-edit-score. This indicates that the functionalities for aesthetic scoring and mood board editing substantially impact the enhancement of system usefulness.

Regarding the fulfilment of needs, AesMood was significantly superior to both AesMood-edit and AesMood-edit-score ($p<0.001$), and AesMood-score also significantly outstripped AesMood-edit and AesMood-edit-score ($p<0.01$), indicating that the capability to edit mood boards is of paramount importance to designers

from the perspective of meeting their needs. Concerning the enhancement of mood board creation efficiency, the evaluation (M=5.60, SD=0.50) indicates that designers generally perceive the AesMood system as having improved the efficiency of mood board creation. Furthermore, from the assessment results concerning the acquisition of design inspiration (M=5.85, SD=0.59), it can be inferred that the image generation capabilities of the AesMood system have aided designers in obtaining more design inspiration.

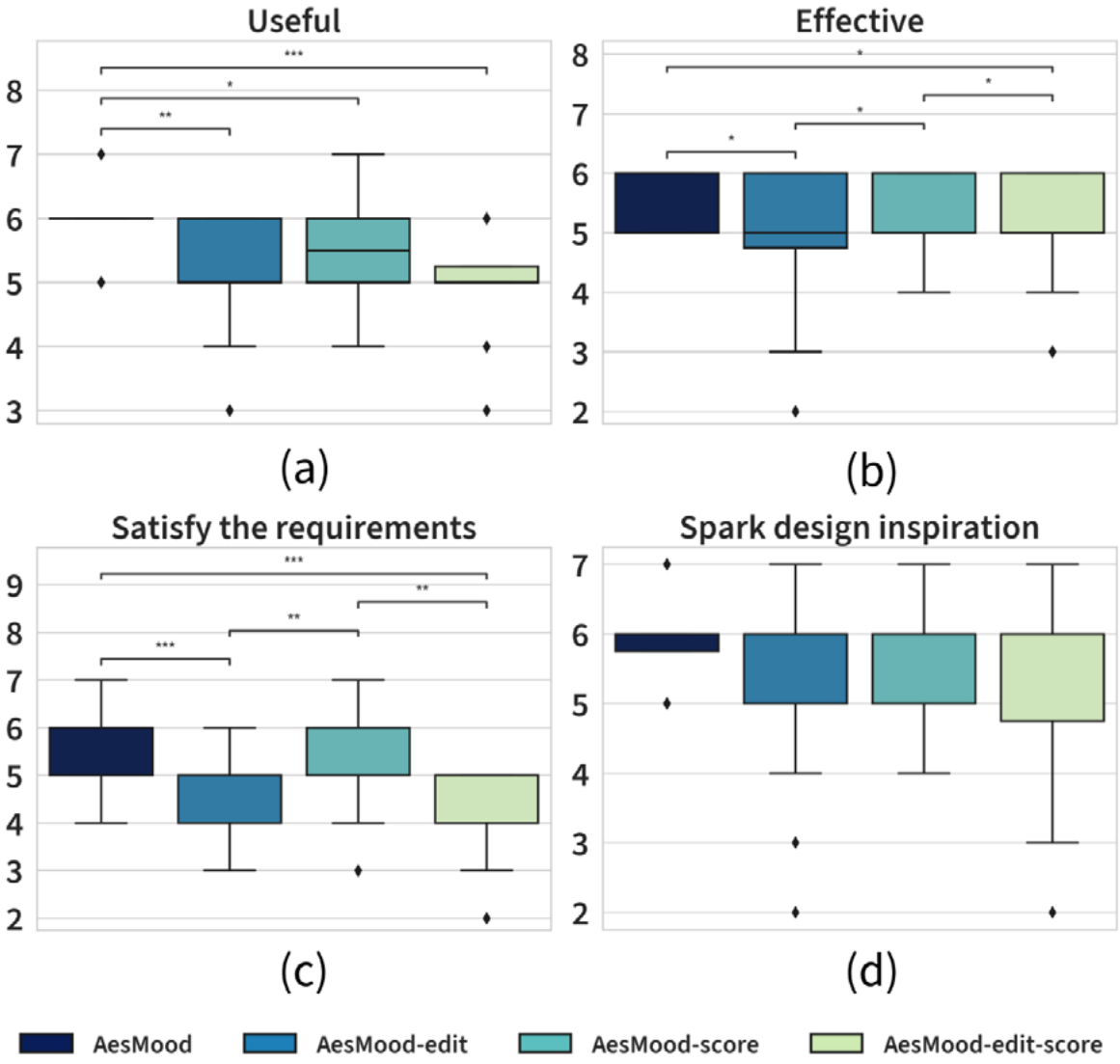


Figure 8. The evaluation results for system usefulness (*: 0.01 < p < 0.05, **: 0.001 < p < 0.01, and ***: p < 0.001). (a) the system's usefulness in facilitating the creation of mood boards; (b) the improvement in efficiency for creating mood boards compared to usual practices; (c) the system's fulfilment of needs concerning the creation of mood boards; and (d) the system's role in augmenting design inspiration.

2. Ease of use

As depicted in Figure 9, there is a statistically significant variance in user-friendliness among different systems (H=8.09, p<0.05), with pairwise comparisons revealing that systems without an editing feature are rated lower in user-friendliness. The AesMood system scores favourably in ease of use (M=6.20, SD=0.62), indicating that it is relatively easy to use, and it also receives a positive rating for user-friendliness (M=6.05, SD=0.83).

3. Learnability

Figure 10 indicates no significant difference in learnability among the various systems. The AesMood system demonstrates commendable learnability in the overall assessment (M=6.40, SD=0.60), and designers can achieve proficiency in utilising the AesMood system with relative swiftness (M=6.55, SD=0.61).

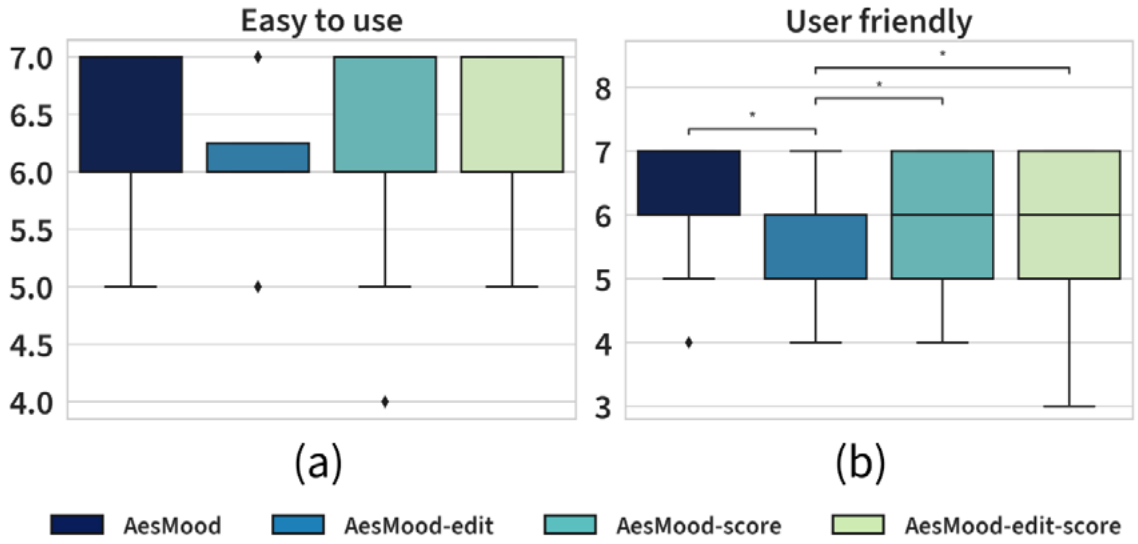


Figure 9: The evaluation results for system ease of use (*: 0.01 < p < 0.05, **: 0.001 < p < 0.01, and ***: p < 0.001). (a) This system is very simple to use. (b) This system is user-friendly.

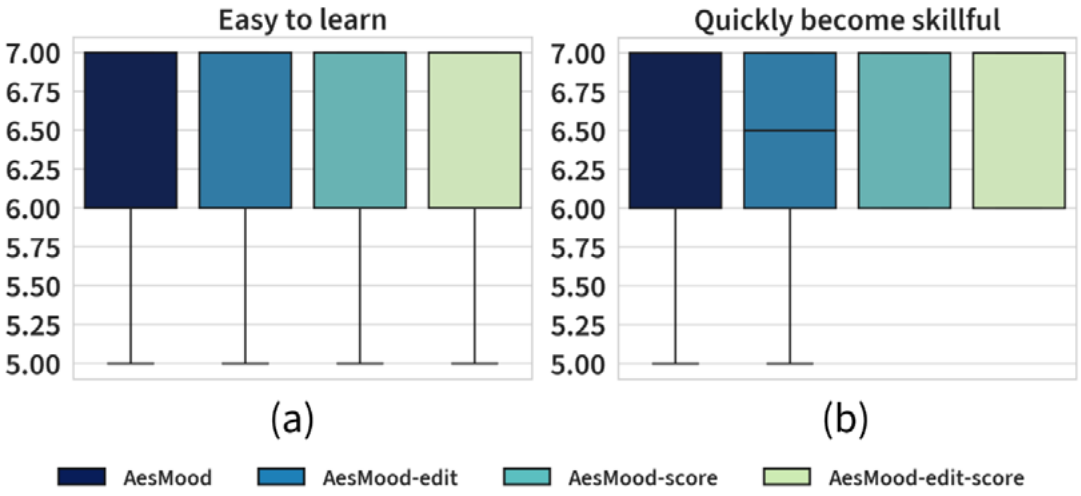


Figure 10. The evaluation results for system learnability. (a) It is easy to learn how to use this system. (b) I was able to become proficient in operating this system quickly.

4. Satisfaction

Figure 11 reveals that there are significant differences in the system satisfaction assessment, specifically in the domains of user enjoyment (H=13.20, P<0.01), overall system satisfaction (H=8.92, P<0.05), willingness to recommend the system to other designer friends (H=10.16, P<0.05), and satisfaction with the mood board (H=12.04, P<0.01). Through pairwise comparisons, it was found that AesMood significantly outperformed both AesMood-edit and AesMood-edit-score in terms of user enjoyment (P<0.05), and AesMood-score was significantly superior to AesMood-edit and AesMood-edit-score (P<0.01), indicating that the addition of mood board editing features can enhance designers' pleasure when using the AesMood system. Regarding the willingness to recommend the system to other designer friends, AesMood was

significantly preferred over AesMood-edit (P<0.05) and AesMood-edit-score (P<0.01), suggesting that designers are more inclined to recommend a system with a more diverse and comprehensive set of features to their peers.

The overall satisfaction with the AesMood system was evaluated from two perspectives: satisfaction with the system and the generated Mood board. The results showed that systems with editing capabilities, AesMood and AesMood-score, were evaluated significantly higher than those without editing features in both system and Mood board satisfaction assessments. Analysing the AesMood evaluation scores, it is noted that AesMood received high ratings in terms of system satisfaction (M=5.65, SD=0.67) and Mood board satisfaction (M=5.30, SD=0.66), indicating that, overall, designers have a favourable satisfaction rating for the AesMood system.

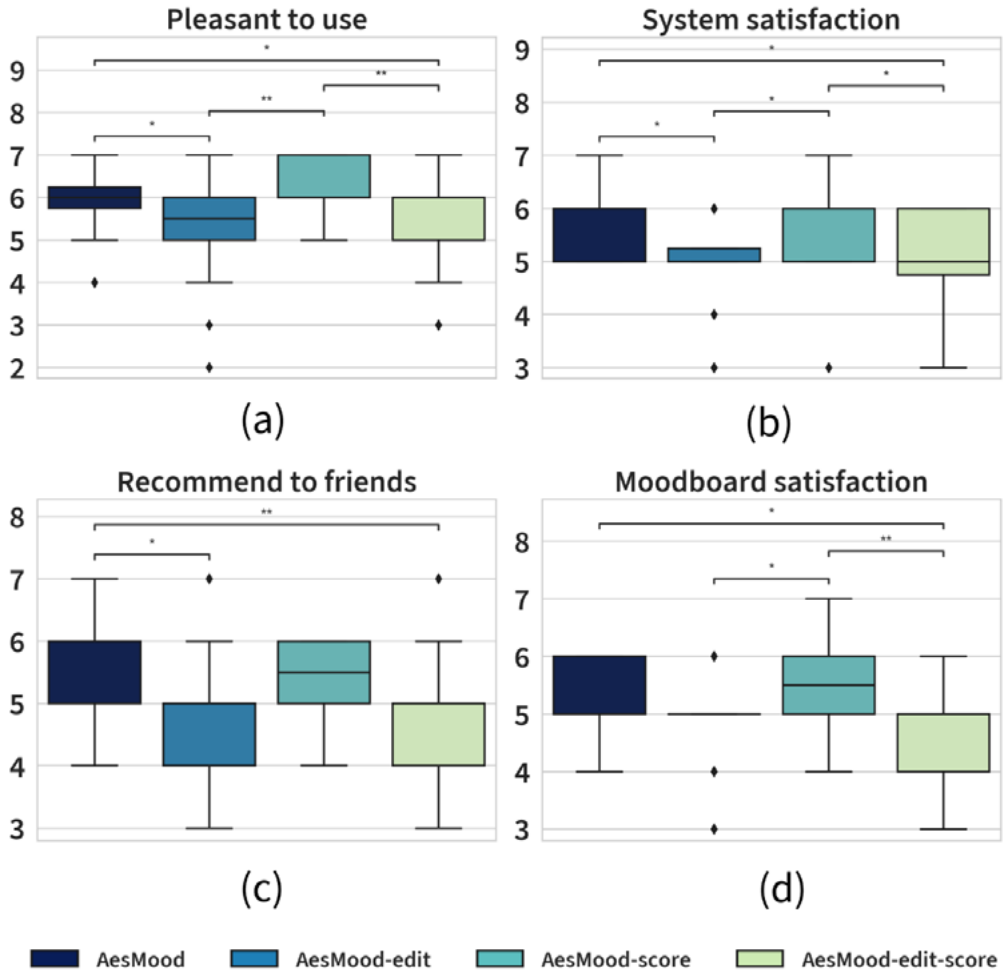


Figure 11. The evaluation results for system satisfaction (*: 0.01 < p < 0.05, **: 0.001 < p < 0.01, and ***: p < 0.001). (a) Utilising this system is a pleasant experience for me. (b) I am satisfied with this system. (c) I am willing to recommend this system to other designer friends. (d) I am content with the Mood board generated by using this system.

We also collected designers' scores for the final mood boards, as shown in Figure 12, which indicated significant differences between systems (H=20.48, P<0.001). Pairwise comparisons revealed that the mood board scores for AesMood were significantly higher than those for AesMood-edit and AesMood-edit-score (P<0.001), and AesMood-score was also considerably higher than AesMood-edit and AesMood-edit-score (P<0.01). This suggests that the mood board editing feature is critical to the designers' evaluation of the final generated mood boards. The AesMood mood board generation system, which has editing capabilities, better responds to the needs of designers and helps them create more satisfactory mood boards. Additionally, the size of the P-values and a comparative analysis of the scores for AesMood (M=7.70, SD=1.03) and AesMood-score (M=7.40, SD=1.00) suggest that the aesthetic scoring can enhance the mood board scores to a certain extent.

Furthermore, we used the Mann-Whitney test to analyse whether the use of other AI image generation tools affected satisfaction and found no significant differences in satisfaction with the system (U=710.50, P>0.05), satisfaction with the mood board (U=742.50, P>0.05), and mood board scores (U=801.00, P>0.05). This indicates that designers who have used other AI image generation tools are also delighted with our designed AesMood system.

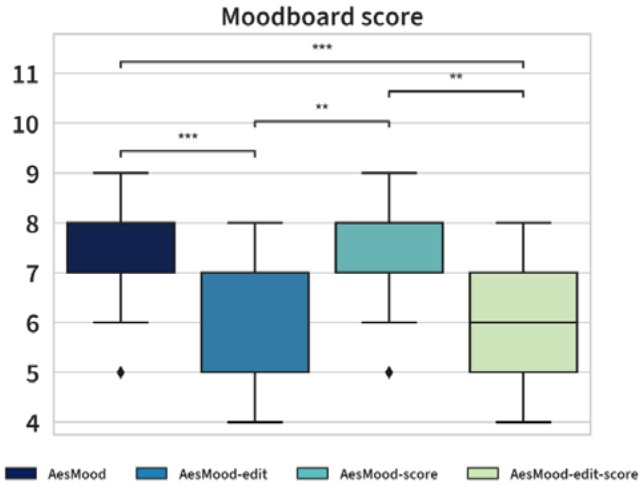


Figure 12. Mood board score (Ten-point scale) (*: 0.01 < p < 0.05, **: 0.001 < p < 0.01, and ***: p < 0.001).

In the semi-structured interviews, we posed some open-ended questions to understand designers' more specific opinions about the AesMood system. Regarding which system they liked the most, 80% of the participants chose AesMood. At the same time, 75% of the participants least liked the AesMood-edit-score system, indicating that most designers prefer a mood board generation system with more diverse functionalities. We have also compiled some representative responses in Table 2. Most designers considered the aesthetic scoring feature to be of certain assistance in creating mood boards. They believe that "*Aesthetic scoring plays a role in assisting decision-making.*" "*With a high aesthetic score, I feel more confident about the mood board I create.*" Some designers noted no significant impression when first using a system with aesthetic scoring. However, the difference became quite pronounced compared to systems lacking this feature, leading them to favour mood board creation systems with aesthetic scoring. The designers expressed satisfaction with the functionality and interface of AesMood, noting that "*The innovation in generating mood boards is stronger and more aligned with my needs.*" and "*The user interface is simple, and I am quite satisfied overall.*" One designer highlighted that "*The generated images exhibit proficient style integration.*" demonstrating one of the prominent advantages of applying an image generation algorithm to mood board creation. Additionally, the randomness of the image generation algorithm provides designers with a broader source of inspiration, as one designer mentioned, "*The randomness in the generated images is quite interesting and helps to inspire creativity.*"

Designers have offered several suggestions to address the shortcomings of AesMood. Regarding aesthetic scoring, they propose that "*Aesthetic scoring based on the client's preferences is more referential.*" This means that in the design process, by allowing the aesthetics assessment algorithm to learn the client's aesthetic preferences in advance, the system's aesthetic scoring suggestions would align more closely with the client's tastes, thereby better fulfilling the client's needs. Regarding system functionality improvements, designers have indicated a desire for "*some help available when entering prompts.*" During our experiments, we observed that designers with more experience could easily conceive the keywords for their prompts, quickly obtaining the desired mood board images. In contrast, other designers required more time to consider or search for relevant keywords using search engines. Therefore, incorporating prompt suggestions into AesMood would significantly enhance user-friendliness.

Table 2. Examples of User Responses from Semi-Structured Interviews.

Cluster	Notes
Aesthetic Scoring	"Aesthetic scoring plays a role in assisting decision-making." "With a high aesthetic score, I feel more confident about the mood board I create."
System Functionality	"The innovation in generating mood boards is stronger and more aligned with my needs." "Once I have the images for the mood board, I can layout directly, which is very convenient." "The generated images exhibit proficient style integration."
System Interface	"The user interface is simple, and I am quite satisfied overall."
Inspiration Stimulation	"The randomness in the generated images is quite interesting and helps to inspire creativity."
Improvements in Aesthetic Scoring	"Aesthetic scoring based on the client's preferences is more referential."
Improvements in System Functionality	"I hope there could be some help available when entering prompts."

5. Discussion

We designed the AesMood intelligent mood board generation system based on user needs derived from preliminary interviews. This system enhances the efficiency of mood board creation by automatically generating images corresponding to specific keywords input by designers. Integrating an aesthetics assessment algorithm into the AesMood system allows designers to reference public aesthetics during the mood board construction process. Feedback from designers indicates that AesMood increases the efficiency of mood board creation, a development that saves time and introduces new dynamic elements into the creative process. Overall, our proposed AesMood system can allow designers to reference public aesthetics, increase creative efficiency, and provide a broader range of inspiration. Additionally, the AesMood system excels at integrating styles, which can stimulate designers' imagination and creativity.

From both quantitative analysis and qualitative feedback, we observe that designers perceive aesthetic scoring as a supportive tool for decision-making, which can enhance their confidence while creating mood boards. Furthermore, including the aesthetic scoring feature can, to some extent, elevate the designers' final appraisal of their mood boards. However, aesthetic scoring also presents an issue of insufficient interpretability. As Wu (2020) has indicated, the issue of insufficient interpretability accompanies aesthetic scoring, which more closely resembles a black box that directly maps inputs to aesthetic scores. In practical application, designers may be more concerned with understanding how aesthetic scores are calculated and how to obtain higher aesthetic scores. Future work could consider incorporating suggestions on enhancing aesthetic scores and guiding designers to input more appropriate prompts to improve the aesthetic quality of the generated images.

Our experiments show that AI-based image generation algorithms possess an element of randomness. This randomness can aid designers by expanding their creative boundaries and offering a broader source of inspiration. However, it can also lead to issues of excessive divergence. Such divergence may prevent designers from constructing mood boards within a more defined scope. The algorithms perform notably well in aesthetic-related directions but exhibit certain limitations in displaying design products and specific product functions. Future work could contemplate fine-tuning the image generation algorithms on datasets related to design products and specific product functions to compensate for the current deficiencies.

Designers' unfamiliarity with prompt writing can affect their use of the AesMood system, necessitating additional tools to help designers better translate their requirements into suitable and accurate prompts.

In this context, the SemanticCollage digital tool (Koch, et al, 2020) serves as a pertinent example, employing advanced semantic tagging algorithms to aid designers in converting vague visual concepts into searchable terms. Future work could integrate prompt suggestions into the AesMood system to facilitate more precise prompt descriptions by designers, ensuring that the generated images align more closely with their needs.

In exploring the development of automated design assistance tools, it is essential to reflect deeply on their ethical implications for design practice. The design process is not merely an output of functionality but also an integral part of a designer's personal expression and experience, characterised by exploratory, intuitive, and emotional investment. Although automated design tools can significantly enhance efficiency, they may also deprive designers of intuitive responses and emotional experiences during the creative process, potentially leading to a reduced depth of understanding of design materials and elements. Zhang et al. have determined in their research that using artificial intelligence in the design process can induce an illusion of success in human designers, contributing to their complacency. The study states, "*Once human designers follow AI suggestions, they give up the opportunity to explore the design space by themselves.*" (Zhang, et al, 2021, p.20) Therefore, in the development of automated design assistance tools, consideration should be given to how to preserve the designer's creative involvement while increasing efficiency. Future work could enhance interactivity by learning the personal aesthetics of designers and catering to their individualised customisation needs.

Our work also has limitations: The aesthetics assessment algorithm we selected is somewhat limited, as it was trained on a limited artistic image dataset and may provide lower scores for complex design products and other types of images. Furthermore, due to constraints in model size and computational resources, we chose the Stable Diffusion 2 algorithm for image generation. However, if computational resources permit, selecting algorithms like Stable Diffusion XL could generate images of higher quality and clarity.

In future work, the AesMood system is anticipated to incorporate many innovative features, such as multimodal creation capabilities. Beyond images, it aims to automatically generate text, 3D models, sound, video, and other components constituting novel mood board forms (Ivanov, et al, 2022). Additionally, we plan to introduce real-time collaboration tools for use by multiple designers simultaneously, which is expected to enhance their workflow and creative expression. It is also worth considering training the aesthetics assessment algorithm on different aesthetic evaluation datasets to see if this leads to higher satisfaction with the aesthetic scoring feature among designers. Future research could further explore how to refine the algorithms to accommodate a broader range of design contexts and personal preferences. Additionally, considering AI algorithms cannot understand overly abstract design descriptions, future work could focus on developing a design corpus and optimising image generation algorithms to meet specific design needs more accurately.

6. Conclusion

In this paper, we design, construct, and evaluate AesMood, an intelligent mood board generation system based on image generation and aesthetic computing. Utilising the Stable Diffusion 2 image generation algorithm and the SAAN aesthetics assessment algorithm, AesMood automatically generates images corresponding to specific prompts by designers and references public aesthetics to assist designers in constructing mood boards and facilitating their judgment. User studies indicate that AesMood performs commendably in aiding designers with creating mood boards, enhancing design efficiency, broadening the scope of inspiration, and stimulating the designers' creativity and imagination. We aspire for our work to contribute to AI-assisted design, and future work will aim to refine the system further to accommodate the increasingly diverse needs of designers.

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P/REFERENCES OF DESIGN

FROM BIG DATA TO LOCAL DATA: AN EXPLORATION OF ALTERNATIVE APPROACHES TO DATA IN DESIGN.

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ABSTRACT | We live in datafied societies where data is collected and used to shape even the most intimate spheres. The last decade has seen the emergence of new and critical data practices as well as approaches to the study of data that have had little applications and impact on design so far. With increasing demands on designers to work with and use data in their practice, more reflection is needed to frame the relationship between design and data, and to expand the boundaries of how design should and could understand and use data. The paper begins by exploring the key changes from within design as a result of increased engagement with data (and specifically big data). Drawing on reflections from two practical design research cases, the paper then offers an invitation to rethink the boundaries of data and explore alternative approaches that focus on everyday data cultures. As a more nuanced understanding and use of data develops (including within design), a more nuanced knowledge of alternative data practices and critical ways of framing and exploring data is required. By tracing the new boundaries of emerging alternative data practices, this paper aims to make a contribution in this direction.

1. Introduction

Data are everywhere. Through digitalization and the proliferation of devices that can capture, measure, collect, store and compare data about most of our social (digital) actions and interactions, we have come to produce an incredible amount of data that we now need to understand and make use of. Increasingly, data is being collected by governments, companies and by us (e.g. by self-tracking) through a variety of tools and during most of our social interactions, whether we know it or not. When we buy tickets for a concert with our credit card, when we watch a film on one of the many movie platforms, when we go to the doctor, or simply when we switch on or off the lights in our smart homes or walk through the train station in a smart city, different actors are collecting, storing and trading our data at different times.

Scholars have dubbed this phenomenon *datafication,* as we increasingly live in *datafied* societies (Hintz et al., 2018). What this label attempts to capture – I believe – are at least four fundamental shifts that have occurred in our relationship with data, namely: i) that data is now collected continuously through and during most of our social interactions; ii) that data is increasingly used to make sense of our societies, including by shaping what is knowable and valuable; iii) that for most of us, collecting data is a largely *passive* activity, done *to* people who are represented and treated differently as a result of data collection; and iv) that data is collected and used interchangeably in different parts of the world and according to a universalizing approach, as context does not matter.

This paper aims to build an argument for design to become more attentive, take a stance and define its roles in relation to data, seeing itself not only as a practice that uses data to improve services and products, but increasingly as a practice that is critically engaged throughout the data lifecycle (including the planning, storing and reuse of data). Drawing on two practical cases, the paper presents alternative data practices as an invitation to rethink the boundaries of data in design, including dealing with the politics of datafication, and to reflect critically about new forms of inequality and injustice that can result from data-driven decision-making and profiling. The case studies present two different pieces of research, one in the field of mental health (Pierri, 2020) and one in the field of smart cities (Pierri and Wiltshire, 2021). As the presentation of the findings and methods of both research projects is the focus of the papers just referenced, this paper will mainly draw on the findings to share reflections and extrapolate some general concepts about data that might be useful for design.

As design is increasingly asked to engage, learn and produce things and meanings through data, more nuanced knowledge from within the discipline of alternative data practices and critical ways of framing and exploring data is needed. By tracing the new boundaries of emerging alternative data practices, this paper aims to make a contribution in this direction.

2. Who Is Talking About Data and Why?

The last decade has seen the emergence of new and critical approaches to the study of data at the intersections of anthropology of technology, critical and internet studies, science and technology studies, and increasingly in design and HCI, which seek to complexify and counter alternative views of data to those that are more dominant.

In an attempt to make sense of the increasing amount of data we face today, scholars (Kitchin, 2014) have started to differentiate between so-called '*captured data'*, which is intentionally collected to produce specific datasets and knowledge, and '*exhaust data',* which is the type of data that is unintentionally produced in large quantities by electronic devices and digital systems, and which is mostly a *by-product* of other activities. This typology of data, sometimes also known as *'big data'*, is considered to be the most promising for advancing science and supporting business objectives.

Since the emergence of big data, scholars have warned of a quasi-religious process and new forms of *faith* in data, referred to as *dataism* (van Dijck, 2014) or *data fundamentalism* (Crawford, 2013). Both terms point to a pervasive and unwavering belief in data as the primary and only source of knowledge: if we have the right data, there is nothing we cannot do, know or decide. Early questioners of this mantra of *'big data'* as the solution to all problems have also emerged (Boyd & Crawford, 2011), who questioned the objectivity and accuracy of this type of data. Thanks to these critical stances, big data has been framed as not neutral and as deeply political instead (Coté et al., 2016), and therefore a site of struggle over meaning, power, interpretation, inclusion and exclusion in the production and use of data.

What most of these narratives have in common is a set of assumptions about data: What is it? Why is it useful and valuable? What is its power? As the field of critical data studies has developed, it has been pointed out that "[a] potentially serious problem with some of these forms of critique is that they risk echoing, mirroring or amplifying – rather than debunking – the dominant myths about the power of technology" (Burgess et al., 2022, p. 12). Indeed, some of these critical approaches lack engagement with the lived experience of those affected by new data practices and risk becoming as abstract and universalist as the theories and practices they seek to critique. As an alternative to these framings, "everyday data cultures" approaches (Burgess et al., 2022) have been put forward, reminding us that people are not only and always *passive* subjects of data (or data objects). These approaches underpin the research presented in this paper.

'Everyday data cultures' is an emerging framework for studying the impact of data and digitalization, paying attention to the datafication of everyday life, the ways in which people develop intimate relationships with and through data and digital tools, as well as the mechanisms they develop to cope with, resist and better control the digital technologies used in their lives. These research methodologies – so-called "from below" (Miller et al., 2021) – focus on how ordinary people live with technology (and data) and develop their own creative and ingenious ways of using the data to address issues they face (e.g. from ageing to health care or maintaining social relationships). Through an everyday lens, people's experiences in the use of technology (for instance, in everyday routines in the home) become central as sites for demystifying technological determinism, that sees technology as being introduced and used in the same way everywhere.

3. Design and Data: What Are the Boundaries?

Design research and practice are increasingly paying attention to the ways in which they can capture and understand data, particularly in the cases where design deals with digital platforms and services as well as machine learning. In the following pages, the paper attempts to provide a brief overview of the main literature on the topic. In the last 10 years the number of articles on the topic has been gradually increasing, also due to the influence of conferences and special tracks dedicated to this issue. Overall, from the literature analyzed it emerges that design seems to follow the path that other disciplines have also taken, showing an increasingly critical view on the topic of data.

Unsurprisingly, many studies in design still fall into the mainstream field of *'big data'*, which focuses primarily on the role of data in innovation and in corporate settings (Urbinati et al., 2019), highlighting the challenges and opportunities that big data offers to companies, and mostly focusing on the tools and methods that are needed in order to create and fully capture the value of *'big data'*.[1] Other studies (Mortati et al., 2023) question the value of (big) data used in design projects and explore how big data can be combined with the qualitative 'thick data' that design also produces, or for creative purposes (Quiñones-Gómez, 2021).

[1] Mortati et al. (2023) provide a good review of the literature on data and innovation, where data is used at different stages of innovation to generate new knowledge to support business processes and develop products and services.

A useful definition for capturing how designers work with data and how data is used differently to support their practice, distinguishes three types of value associated with data in design (Speed and Oberlander, 2016): i) raw measurements; ii) commercial and social; and iii) moral and ethical (which mostly relate to the management of personal data). Looking at changes in computing and communication technologies, Chris Speed and Jon Oberlander have provided a robust reflection of the key developments in design as data moves from being a source to design '*from'* to something more complex and fluid that designers need to design '*with',* if not to a state where design is produced '*by*' data (2016). In the first mode of design '*from',* data is collected and used in more classical ways, for instance to allow design to improve its services and products and enhance innovation. Designing '*with'* data includes the possibility of designing with the live streams of data generated through digital interactions and captured live. In this case, data operates as a *flow* rather than an object, which raises new challenges for design to use it and requires new knowledge and tools. Design *by* data illustrates the case where design happens autonomously, as systems design other systems. At the time of writing their article (2016), the latter mode was generating a lot of interest as well as anxiety about the "[…] emerging prospect that data itself, supported by an algorithm, will become a designer" (p. 9).

While the last scenario has not materialized (at least not yet), we could say that there is still a risk that design will lose its roles if designers (especially those working on digital platforms and services) do not expand their boundaries for how they look at and consider data in their work. While many approaches, especially in corporate design practice, still reproduce an understanding of data (and specifically *big* data) as "the new oil" (Porciuncula & de La Chapelle, 2021) that needs to be accumulated and used to gain business and scientific advantages, interesting research is emerging within the design field, that aims to expand the boundaries of data and of what design could do for shaping the data infrastructures.

These attempts include for instance new reflections around the role of designers in the process of *data transformation* (Prendiville et al., 2017), as a key moment where design can contribute practically to make data available, accessible and comprehensible to communities and the general public. Other studies have put forward innovative models for rethinking data visualization (as another key area for design), either to put people's senses and experience of data at the center (Hogan, 2018) or to expand new data imaginaries (Benabdallah et al., 2023) through participatory engagement with different actors and as a way to increase people's data literacy. Tools and methods have also been identified for designers to make the most of *open data* that is accessible in new and generative ways for research (Kun et al., 2018).

Within HCI studies, nuanced ways of reflecting and using data have also been proposed, where data is clearly no longer a simple input or output of design activities, but is more fully understood as an *object* of design (Feinberg, 2017). Melanie Feinberg draws on Redström's concept of "design after design" to frame digital processes as those in which the product of one design activity becomes the material for subsequent design activities. In doing so, she foregrounds new roles for digital designers in dealing with data, including the design of data infrastructures, collection and aggregation. From within HCI we can therefore observe alternative narratives emerging where the nature and essence of data are questioned, and data is no longer a simple means to an end, but a material that can be shaped by design to create a diverse range of experiences (Lee-Smith et al., 2023).

This brief overview of the modes of interaction between design and data illustrates a growing and moving field, where we are shifting away from acritical practices fueled by big data enthusiasm (still mostly happening in corporate design), towards building the right tools and methods to sharpen design understanding and use of data, as well as questioning the role and essence of data overall.

In the next section of this paper, two alternative approaches to the understanding of data will be discussed, drawing on reflections from two projects. These aim to put forward practical ways in which the boundaries of data could be extended within design, namely by extending *data as plural* as well as by introducing questions of *justice* in relation to data.

4. Alternative Framing of Data

The previous sessions aimed to present the context in which alternative framing of data in design could (and should) happen, as well as to highlight the reasons why this is an important issue for design to address. Summarizing, the paper presented the following arguments: i) that data is becoming a complex and central new object for design in *datafied* societies; ii) that critical data studies are increasingly complemented by new and interesting approaches that pay attention to everyday data practices; iii) that current reflections within design on its mode of use and relationship with data are still taking place within narrow boundaries; and iv) that design could benefit from expanding its boundaries and understanding of data through alternative data practices.

These alternative approaches draw on principles of "data feminism" (D'Ignazio & Klein, 2023), which pay particular attention to the political and power dynamics in the collection, use and reuse of data, and (most importantly) question whether and how the *'datasets'* compare with the lived experience of those who are the object of the data collection. Following these accounts, when attempting to design a digital service or product, designers should critically explore what data is available, what the data means from the everyday point of view of the lived experience of those represented by the data, its politics and meaning as well as paying attention to the data that is *not* there. This last point was perfectly illustrated during the COVID-19 pandemic, where data were used to define the problem, design solutions and prioritize groups or areas for care interventions. In these number-based policies and narratives, certain groups – whose data was *not* collected – were deliberately made to disappear by design. Scholars who paid attention to what was not in the data during the pandemic were able to identify what they called instances of "data poverty" (Milan & Treré, 2020), which constitutes a new form of invisibility that perpetuates and creates new forms of inequality. Interestingly, these scholars also mapped the ways in which these so-called *'marginalised communities'* still succeeded in creating forms of solidarity from below to mitigate the negative effects of their (data) invisibility.

Through these accounts, data is not simply something that is *done to* people, as we can see how people become *subjects* of their data, or how data itself becomes the terrain for new struggles and the object of new forms of action that aim to produce new narratives (not captured by data), through alternative ways of documenting and making visible.

This next session draws on two design research projects I was involved in that aimed to explore data not as a neutral or objective thing, but as something produced through social relations and in context. Both projects had a clear stance on valuing and eliciting the *'lived experience'* of data in order to focus on the concerns and priorities of those most affected, their views, fears or wishes for how data could be used differently by design.

4.1 Data as Plural

Data is usually used as a singular noun (we say that data *is*, or that data *does,* etc.). The idea of data as singular has profound consequences in shaping the unspoken ways in which we understand data. Data as singular evokes the idea that data is one thing, that it has no differences, and no relationships. Data used as singular reinforces universalizing conceptions of data (Chan, 2014; Douglas-Jones et al., 2021) that seem to imply that data is the same everywhere and has the same meaning that cannot be questioned or contextualized.

In the first case study presented in this paper (Pierri and Calderón Lüning, 2023 and Pierri and Wiltshire, 2021), participatory design research aimed to engage citizens in four European cities to reflect and learn more about digital technologies and data collection at the city level. The whole project was based on the premise of understanding data (and the digital technologies used to collect it) as *contextual*. General data on the impact of digitalization in smart cities or local data from the four participating cities were already

collected and available through national and local statistical portals. However, by adopting a more contextual understanding of data, the project did not start by simply using the data that already existed, even if it was presented as objective and reliable data. Instead, the team was interested in capturing the local understanding of data, the data that was not being collected, as well as how different people in different parts of the city were affected by and used the data differently. Therefore, at the beginning of the project, the team brought together local residents and digital rights experts to map the local context and provide insights into the local priorities around data and digital technologies. The local maps of data and digital knowledge that were collectively created in each city immediately revealed a more diverse data landscape. Each city then took a bespoke approach to designing engagement around the data, and several workshops were held with citizens, all of which were tailored and varied in terms of topics and focus. All workshops and events were conducted in the local language and facilitated by local researchers and professional facilitators.

This approach assumed data (from now on in the plural) and allowed them to emerge as deeply local objects. Which data were collected during the project and to which data citizens paid attention to, depended on the different local sensitivities and approaches to data and digitalization more broadly. This mode of engaging with data draws on recent studies in anthropology and design (Douglas-Jones et al., 2021; Loukissas, 2019) that frame data as cultural and locally embedded objects and practices. In these accounts, data *settings* (rather than data*sets*) are most relevant for describing data that make sense and produce knowledge in context. The *'settings'* of the first case study were the different maps and priorities that were identified locally, that spoke the local language (problematizing the use of English as the most common language in mainstream and universalized narratives of *'smart cities'*), and that framed data as being used and understood differently in each of the cities. These contextualized and different approaches gave cultural flavor to our *data conversations,* as the tone and content changed, sometimes significantly, in different cities. We learned through contextual research that data are no agnostic to places (Loukissas, 2019) and additionally we learned how data can have histories as well. In fact, even before digitalization data have for long time been collected and used and may evoke different emotions and attitudes in different places based on their histories. As one of the cities involved in the project was part of a former communist country, questions about local sensitivities to data collection and use based on past history could not be ignored. In this way, data start to be framed beyond the universal data of machine-readable information, but through the cultural, historical and lived experiences of those who produce and make sense of data locally through their practices.

4.2 Data and Justice

Linnet Taylor (2017) is the scholar who originally introduced the concept of data justice, understood as the ambition to achieve "fairness in the way people are made visible, represented and treated as a result of their production of digital data […]" (p. 1). Particularly when used in public services (as well as for political purposes), data effectively become the way in which citizens are grouped according to identity traits or behaviors and are made visible, represented and treated differently as a result of their digital profiles.

As data tracking and automated decision-making through data are currently being designed into most of our public services, with the aim of increasing efficiency and evidence-based decisions, issues of social justice come to the fore for all those designing these platforms. This is particularly true in what Virginia Eubanks calls "low rights environments" (2018, p. 12), which are the social and health service sectors:

> "Those designing AI systems in general, as well as those focused on the welfare state are overwhelmingly white, male, well-off, and from the Global North. No matter how committed they might be to certain values, the assumptions and choices made in shaping the digital welfare state will reflect certain perspectives and life experiences." (Alston 2019, p.4)

The second example this paper is putting forward is based on research into community mental health in the UK (Pierri, 2020), where digitalization of public services was introduced on a massive scale (and to the

enthusiasm of many) in the early 2000 (HM Government 2012). Community mental health includes health care services (not just medical ones) that are designed to be delivered closer to the people who need them, and that involve local communities in various ways, with the aims of both: building joint collaborations to provide a caring local environment for those in need, as well helping to raise awareness of mental health issues and thereby reduce stigma for those affected by poor mental health.

In practice, the digitalization of mental health services in the UK meant that services were de-materialized as health and social care assessments were increasingly carried out online using purpose-built platforms. According to the government narrative, these digital platforms were designed to be *'neutral'* as they operated in a data-driven mode, collecting and using all available data to make the best decisions in each individual case. The aims were to drive cost savings and provide the best support based on the data available. The data points in these cases were generated by triangulating a wide range of data: including people's biographies, their work experiences, previous episodes and encounters with the National Health Service (NHS), and *potentially* other available datasets about the neighborhood in which people lived, the schools they attended and the behavior and interactions of the extended network of friends and family members. This is a *potential* list (albeit a very realistic one) because at the time of their introduction – and in some cases this is still true today – it was neither transparent, nor even understood as problematic, what data these platforms were fed and how the algorithm processed them to learn and adapt (Alston 2019).

Data in this project were revealed as a terrain of power struggles over visibility and justice: what data were being collected and *not* collected, what knowledge the data were supposed to hold about people's fluctuating mental health and how the data were being used was not clear to anyone involved in the process. Using what we now refer to as *design justice* (Costanza-Chock, 2020), the project engaged advocacy and campaigning mental health organizations to call for more participation of those involved and affected (especially those potentially harmed) in deciding what data should be collected and how the practice of data collection should be designed in advance to create more transparent, alternative and inclusive data infrastructures. If faced with similar design briefs, designers asked to design digital platforms for public services might even consider the option of not designing with the available data, as this can be opaque and biased.

5. Pushing the Boundaries: What Are the Implications for Design?

In the preceding pages, this paper has explored the current ways in which design practice engages with data, both as an input to the design process and as an output or object of design. Drawing on practical cases, the paper has developed alternative understandings of data (as plural and as a terrain of struggles for justice). The aims are to trace new boundaries for what data are and what design can do with/for/by data and to make a further contribution towards new approaches to design and data.

The main argument of the paper is for design – especially when used to design digital services or platforms, or increasingly in machine-learning – to take a stance and define its roles not just as a practice that uses data to improve services and products, but increasingly as a practice and mode of research that is critically engaged throughout the data lifecycles. This would include, for instance, rethinking the roles of design in the *planning*, *collection*, *storage* and *use* phases as well as in thinking creatively about opportunities for *data re*use (which, for example, should be fostered and facilitated by design and for the public good).

As Feinberg writes:

> "[…] the development of data infrastructure is not commonly considered as a design activity, perhaps because such decisions often seem banal and obvious, or because they seem more associated with subject-matter expertise and scientific methods than with a design perspective. The use of temperature to understand weather, and the means in which temperature is

> measured, seem a matter for meteorologists to specify, not for designers to interrogate or imagine differently." (2017, p.2954)

Echoing Feinberg, this paper asks designers to question whether and why this should actually be the case and suggests that re-imagining data infrastructure and data practices across the whole lifecycle is precisely a role for designers. As Crawford reminds us: "Data and datasets are not objective; they are creations of human design" (2013). And therefore attention from design to how these data infrastructures are currently made, or could be made differently, would be a fruitful question for design to address.

The main objective of this paper has been to raise the need for design to expand its boundaries and understanding of data. It has attempted to do this by drawing on recent critical literature on data and on two practical projects where design has been confronted with the complexities of dealing with data. While both projects foreground critical questions and ways of dealing with data, and perhaps even imagine cases where designers choose not to work with the available data, more work and cases are needed to expand the methods we have available to deal with data critically, as well as thinking of ways to bring these questions and alternative data practice straight into the design education for the future designers. Interesting examples that have been developed on the methodology level, include "data journeys" (Bates & Goodal, 2016) as qualitative ways of experiencing the geographical and temporal scale of data and capturing the 'life of data' from its initial phases to modes of reuse in different contexts; or "data walks" (Murray et al., 2015), which are creative ways of analyzing data and their meaning with different actors, including those affected by the shared data. Expanding tools and methods to engage with data differently, including in design education (de Götzen et al., 2018), is the next terrain for design to explore further. For while more design researchers are becoming aware of the complexities of engaging with data, I believe the discipline still suffers from what has been defined as a form of conceptual dissonance "[…] where one knows conceptually that data is interpretively fluid and yet acts as if it were, might be, or should be objective and universal […]" (Feinberg 2017, p. 2).

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P/REFERENCES OF DESIGN

THE AESTHETICS OF LISTENING: MATERIAL-DISCURSIVE EXPLORATION OF VERBATIM TESTIMONY AND AUGMENTED REALITY.

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KEYWORDS | AUGMENTED REALITY, VERBATIM TESTIMONY, TRAUMA-INFORMED, HCI, CARE IDENTITY, POSTHUMANIST

ABSTRACT | This paper introduces a novel approach combining augmented reality (AR) and verbatim testimony to create sensory engagements with data as interactive digital artefacts. The project aims to supplement existing research by communicating how aspects of care feel from the perspective of young people with experience in the UK care system. Through a posthumanist lens, we explore trauma-sensitive considerations and material-discursive aspects of meaning-making. The project emerged from a collaboration with The Verbatim Formula, a participatory arts initiative. During playful workshops, care-experienced young people and theatre practitioners co-created AR artefacts using verbatim theatre and generative design techniques. These artefacts, comprising verbatim testimonies and physical expressions of lived experiences, were presented to policymakers at the Department for Education in London. Leveraging feminist scholarship, the study engages with new materialist concepts to analyse human-technology data interactions during the live performance. The paper foregrounds aesthetic and ethical considerations, examining the material-discursive dimensions of audience co-performativity with the AR artefacts. The insights contribute to dialogues on redefining data boundaries and conceptions of value in generative design research. The AR artefacts are spotlighted as active agents in creating and disseminating knowledge, offering a new trajectory for understanding and engaging with data and values. This approach positions listening and co-performativity as a mode of care and a sensory practice of knowing, challenging conventional perceptions of data and technology towards humanising policy and care services.

1. Introduction and Overview

“I think this form of listening is a very embodied mode of attentiveness.” Maggie Inchley of The Verbatim Formula (TVF) expresses how it feels to perform a verbatim recording.

This paper presents a novel approach to data visceralisation (Koterwas, 2023; Lee et al., 2020), blending verbatim testimony with augmented reality (AR). We discuss insights into the process and material practice of co-developing and presenting trauma-sensitive augmented reality (AR) artefacts to communicate an understanding of how navigating care services feels from the perspective of young people with lived experience. Care experience refers to individuals in or with a history of being in the care system. The traditional approach to policymaking for care services leans heavily on quantitative data for decision-making, which can lead to a disconnect between the lived experiences of people with care experience and those formulating policies.

This research, in collaboration with The Verbatim Formula (TVF), a participatory arts initiative, aims to enrich the knowledge base, supplementing statistics by highlighting novel trauma-informed and responsive approaches to communicate the lived experiences of individuals interacting with care services. It seeks to humanise policy and care services by providing textured and plural insights. It celebrates creative expression and encourages co-performative ways for policymakers to listen and engage somatically with the narratives of care-experienced individuals.

The paper draws on theoretical notions of more-than-human and emergent agency as conceptualised by feminist scholar Karen Barad (2007). We explore Barad's new materialist concepts by interpreting human-technology data interactions, particularly during a live verbatim performance made to policymakers at the Department for Education (DfE) in London. The paper foregrounds aesthetic and ethical considerations, analysing the material-discursive dimensions of audience co-performativity with the AR artefacts. We discuss how these entangled interactions can produce new forms of engagement and understanding with data, extending beyond human-centred narratives to include the agential capacities of digital artefacts and environments in shaping experiences. The insights are discussed in relation to the implications for affective data representation in transdisciplinary applications of generative design research.

The AR artefacts were co-created during trauma-informed workshops with young people who are care experienced and TVF theatre researchers and practitioners. These sessions enacted playful, performative inquiry, blurring disciplinary lines between human-computer interaction (HCI) and applied theatre to elicit novel, somatic experiences with participants and lens-based technologies. The resulting AR artefacts embody sensory information as data, comprising verbatim testimonies and physical expressions of lived experiences. These artefacts emerge from the entangled co-creative journey, where the interfaces between human and more-than-human assemblages shape the unfolding narrative. This situated and performative meaning-making process illustrates the co-constituted agential relations between data and personal value systems, resonating with Barad's (2007) ethico-onto-epistemo-logical principles that highlight the inseparability of emergent values, ways of being, and knowing.

The analysis spotlights the AR artefacts as active agents in creating and disseminating knowledge. They act as interfaces for audience interaction, inviting spatial, somatic, visual, and auditory engagement with the materialised data. This performative interface between human and non-human elements as a form of data visceralisation is exemplified in the interpretation of interaction with the AR prototype by Nadhim Zahawi, then Secretary of State for Education.

The conclusion summarises the research contributions to redefining data boundaries and conceptions of value by illustrating the role of material-discursive practices in data interaction and audience engagement. It underscores the potential of AR and verbatim testimony in creating interactive, emotionally engaging experiences, challenging conventional perceptions of data and technology. The paper concludes with a trajectory for future work that continues to develop an understanding of the generative dynamics for

engaging with data and values, where listening and co-performativity become a mode of care for the other and a sensory practice of knowing.

2. Care Experience

Care experience is a term used to describe a person currently in care or with a looked-after background. In the UK, the most common settings for care delivery are Foster, Kinship, and At Home. Foster care involves placing a child or young person with a foster family, Kinship care refers to care by relatives or friends, and At Home care involves providing support services to families in their own homes. The vast majority of people enter the care system due to a need for care and protection. However, media narratives and prevalence data presented as statistics on care identity can have dehumanising effects while perpetuating a stigmatising and fatalistic deficit discourse, which becomes embedded in the public's psyche (FrameWorks Institute, 2020). We argue that quantitative data on its own represents an incomplete picture of care identity, signifying probabilistic but not deterministic outcomes, which lack nuances of human experience or a causal understanding of how to make improvements to care systems.

The findings of the Scottish Independent Care Review (2020), which included qualitative research, unveiled critical insights into the care system, notably the need to minimise care placements, the importance of listening to care-experienced individuals, and the often dehumanising feel of the care system. These findings resonate with our research and, while perhaps not unexpected, underscore the urgency for approaches to understanding and reforming care systems and practices with and for those who access, design and deliver them.

In response, this project endeavours to embody and enact a process of attentive listening for building bridges between care experienced individuals and policy makers. Our research involves co-creating safe and brave spaces (Arao & Clemens, 2013) for creative expression, exploration and dialogue. From these experiences, the paper foregrounds epistemological and methodological contributions for new trauma-sensitive approaches to creative co-performative data presentation and interaction. The objective is to engage policymakers with an immersive, trauma-informed experience that conveys the emotional texture and experiential realities of those navigating the care system. By doing so, we hope to facilitate a deeper, more empathetic understanding of the lived experiences of those the care system is intended to serve towards policies that are informed by these insights and shaped by the compassion and understanding they engender.

3. Theoretical Background

This section outlines the theoretical framework guiding this study, which integrates transdisciplinary concepts to address our objectives within trauma-sensitive generative design research. The framework is structured into two main subsections: firstly, principles of empathy and trauma-informed design, which lay the ethical foundation for understanding and applying design practices that are sensitive to young people with care experience. Secondly, agential realism is explored, emphasising the relational dynamics in the co-creative processes of knowledge production. This theoretical bricolage scaffolds our approach to engaging complex ethical challenges of participation, representation, agency, and uncertainty. It also highlights more-than-human assemblages and co-performative nature of digital materiality for creative expression, underpinning our generative approach and methods for engaging with and through data.

3.1 Empathy and Trauma-Informed Design Research

By critically appraising the framing of empathy within design methods, this section aims to develop a more holistic conceptualisation of subjective lived experience in design research. As noted by (Brown, 2010), mainstream design thinking frequently positions empathy as a mechanism for designers to 'put themselves

in the users' shoes' with the intention of gaining a deeper insight into user needs and experiences. This perspective risks not adequately acknowledging power relationships and oversimplifying the complex dynamic nature of identity and empathetic engagement in posthumanist and transdisciplinary applications of design research with stigmatised communities.

Drawing upon our prior experience in community-based speculative design and participatory photography workshops with young people who have experience with care systems, we frame our understanding of empathy through Edith Stein's (2012) phenomenological framework. Stein emphasises empathy as a deeply embodied understanding, bridging the gap between observing and experiencing emotions. Her concept of empathy, where one is 'alongside the other but never one with them,' offers a more nuanced and respectful approach than the notion of putting ourselves in the other's shoes. It suggests that while experiential engagement can lead to a better understanding of another's experiences, complete identification with the other is neither possible nor desirable, as it risks erasing the individuality and subjectivity of the other person and may not be ethically cognisant of power relations (Stein, 2012). This distinction invites a mindful and ethical approach to empathise with participants, recognising the limits of our understanding alongside the importance of respecting participants' autonomy and individual lived experiences.

Given the tendency of individuals with care experience to have imposed framings, a key starting point for our generative workshops drew on queer theory for the co-creation of safe and brave spaces for dialogues and creative expression (Arao & Clemens, 2013). Fundamental to this endeavour is an emphasis on trauma-informed practice, recognising the self-efficacy of individuals in shaping their own narratives and representations throughout the data generation, analysis, interpretation, and representation processes.

Building on the framing of empathy in design research, this section provides an overview of the research's application of trauma-informed and responsive practice grounded in a UK policy context. The principles covered include a nuanced understanding of our fundamental ethical duty of care, including preventing re-traumatisation in the research activities and nurturing emancipatory and reparative practices. This discussion aims to bridge the theoretical insights on empathy with practical approaches in trauma-informed and responsive care.

Gabor Maté (2022) defines trauma as a psychologically distressing event outside the usual human experience, often involving intense fear, terror, and helplessness, with complex trauma persisting over time and being difficult to escape from. In the context of policy, trauma is frequently communicated through the related principle of Adverse Childhood Experiences (ACE), which tend to be higher for care-experienced individuals (Appleton & Stanley, 2010). Simkiss's (2019) research highlights that the transition into care itself, despite being a protective measure, can also be a traumatic experience, exacerbating the sense of insecurity and loss, making it more challenging for these children to form stable, trusting relationships, develop a sense of self-efficacy, and feel safe and loved.

Trauma-informed practice recognises the widespread impact of trauma and seeks to create environments that promote safety, trust, and self-efficacy for individuals who have experienced trauma (Fallot & Harris, 2009). Drawing on guidance from NHS (2017), we emphasised safety, trustworthiness, choice, collaboration, active involvement, and building opportunities for individuals to benefit from their participation. We focused on understanding factors such as play that shape environments conducive to co-creating safe and brave spaces, facilitating active participant engagement and mitigating activities that could inadvertently cause re-traumatisation. The project's emancipatory and reparative potential was demonstrated during the participant-led performative event at the Department of Education, which emotionally engaged attending policymakers and politicians.

3.2 Agential Realism

Traditionally, Human-Computer Interaction (HCI) has foregrounded human experience and agency, positioning technologies as auxiliary instruments in the process of knowledge production. However, this perspective may limit our understanding of agency in a more expansive sense. Drawing on the feminist scholarship of Karen Barad, we challenge the prevailing assumption that human intentionality or reflexivity are prerequisites for agency. Instead, we argue that lens-based technologies actively contribute to the unfolding of phenomena in their unique ways, manifesting their agential capacity within the dynamics of a more-than-human assemblage of actors. From this perspective, lens-based technologies such as augmented reality can influence how events are framed, perceived, and interpreted, co-shaping the practices of meaning-making they are involved in.

Agential realism is a philosophical concept proposed by Karen Barad (2003) that emphasises the emergent performative nature of mattering. This perspective highlights the entanglement of human and non-human actors in the ongoing production of knowledge and meaning. Agential realism challenges the notion of fixed boundaries between subjects and objects and recognises that meaning-making is a dynamic and relational process. Barad foregrounds the notion that agency does not pre-exist but rather emerges through the dynamic 'intra-actions' between different entities, including technologies and environments. Table 1 summarises the pivotal agential realist concepts important to our research.

Table 1. Fundamental agential realist principles.

Agential Realist Principles	Description
Intra-action	Unlike interaction, which presupposes the existence of separate, independent entities that come into contact, intra-action posits that entities do not pre-exist their relations; rather, they continuously materialise through their ongoing relational engagements reshaped within the ecologies of intra-actions (Barad, 2007).
Diffractive Methodology	This study's analysis and discussion on the experience of digital artefacts employ Barad's (2007) diffractive methodology. This diffractive perspective diverges from traditional evaluative methodologies such as triangulation by not seeking fixed data points for analysis. Instead, it acknowledges the mutable and entangled nature of the research constellation, recognising the interconnectedness of all elements—participants, researchers, environment, activities, and lens-based technologies. This approach highlights the role of multiple perspectives and the active participation of research apparatuses in the shaping of unfolding phenomena. It examines patterns of difference, interference, and entanglement that arise when entities intra-act, inviting the exploration of agential relationships and uncertainty.
Ethico-onto-epistemo-ology	Combines ethics, ontology, and epistemology to explore the interconnectedness of values, existence, reality, knowledge, and belief.

Developed on agential realist foundations, this study emphasises the co-constitution of tacit and latent knowledge that are central concerns of generative design research (Sanders & Stappers, 2012) emerging from agential relationships among research stakeholders, care-experienced communities, lens-based technologies and environments. The emergent nature and focus on care identity in this research necessitate a flexible and adaptive theoretical approach, which accommodates generative insights throughout the creative and participatory design process of interpretive understanding.

Incorporating principles of agential realism into applied theatre and design research offers fertile ground for innovative explorations. This perspective can open new avenues for understanding and designing interactive experiences responsive to the complex entanglements between humans, technologies, and

environments. Additionally, by recognising the co-constitutive nature of knowledge production, researchers can develop more inclusive and collaborative approaches that value the contributions of all actors involved in the research process.

The subsequent methodology section of the paper furthers this explanation and justification for these philosophical and theoretical principles with a focus on generative design research practice. It delineates how the posthumanist perspective, along with principles of empathy and trauma-informed design research, was operationalised in the study. The section also discusses the practical application of verbatim and image theatre techniques in the co-creation and presentation of the augmented reality (AR) artefacts.

4. Methodology

> "Play delights in uncertainty."
> Alex Dunedin

4.1 Generative Design Research

Our application of generative design research revolves around a playful and collaborative approach to navigating uncertainty. Generative techniques can be articulated in multiple dimensions of our creative research practice. Firstly, we work with and for communities through active and attentive listening, collectively generating topics for exploration rather than hypothesis testing. Secondly, we generate knowledge on tacit and latent aspects of social and technical phenomena by playfully and reflexively attending to what people make, improvise, and dream.

Drawing on Sanders and Stappers (2012), our generative process aims to co-develop insights that can be difficult to surface through other research approaches. By technique, we refer to the material-discursive activity - in this case, playful practice-led applications of ubiquitous technologies animated with participatory and emancipatory mindsets. These generative principles align well with the techniques of eliciting, encoding and performing verbatim testimony as practised by The Verbatim Formula.

4.2 The Verbatim Formula

The Verbatim Formula (TVF) is a participatory arts initiative based in London. TVF employs verbatim theatre techniques, using words identical to the original source, to attend to the voices of care-experienced young people. 'Verbatim' signifies a commitment to honouring fidelity in representing participants' testimonies through word-for-word performative delivery with care professionals and policymakers (Baker & Inchley, 2020). TVF emphasised reparative facets of verbatim techniques and performance, underpinned by activist and justice-orientated principles from applied theatre towards change and community cohesion.

The verbatim formula process, from the acquisition of testimonies to the headphone theatre performance, is characterised by its simplicity and accessibility, facilitated by low-fi technologies like iPods. In workshops, participants are considered co-researchers; they actively shape discussions about topics that matter to them, sharing their thoughts and experiences, which are recorded as verbatim testimonies. Subsequently, these recordings are transformed into headphone theatre performances, where audiences experience the testimonies directly, creating an intimate and impactful connection with the narratives.

This participatory method is a compelling approach to information design. It represents an affective form of data physicalisation through performance, preserving the essence of human connection through eye contact between the performer and the audience. From an ethical perspective, it respects the integrity of the co-researchers' testimonies while inviting audiences to engage with the lived experiences conveyed in the recordings in novel and immersive ways. Table 2 summarises ethical considerations aligned with trauma-informed design principles alongside our application of verbatim techniques with digital media.

Table 2. Ethical and trauma-informed design principles alongside verbatim techniques.

Ethical Consideration	Our Application of Verbatim Techniques
Duty of care, confidentiality, and privacy	Participants are not asked to repeat their story multiple times, reducing the risk of re-traumatisation or desensitisation.
Trauma-sensitive relational design	Verbatim techniques are integrated into a trauma-sensitive relational design approach, positioning participants at the centre rather than engaging in pseudo-consultation.
Active participation	Co-researchers have control over their own stories and representation throughout data collection, analysis, and communication.
Self-efficacy	Hearing their words voiced back to them can be a powerful means for young people to realise that their opinions and the things that matter to them are being heard, valued, and acted upon, supporting a sense of self-efficacy.
Attentive care	Verbatim techniques nurture a mode of attentive care through active, embodied listening for co-researchers and audiences.
Emotional engagement	Verbatim performances create emotionally affective engagement with audiences through the embodiment of what is being shared, inviting them to listen with their hearts.

4.3 Verbatim Audio with Augmented Reality Artefacts

Early in the collaboration, TVF expressed an interest in the narrative and audience engagement capabilities of immersive technologies such as augmented reality (AR), especially the notion of a 'digital trace'. We came to understand their position from an applied theatre perspective, in that the digital artefacts created would resonate with the audience after the live performance, involving a two-step rhetorical process:

- Firstly, evoking emotional echoes reminiscent of the live event — much like how certain songs, flavours, or scents can transport one back to a past emotional and sensory moment;
- Secondly, it is a means of reminding audiences of their promises to honour what they heard and experienced.

In addition to TVFs' expectations of digital technologies, we were keen to investigate how live audiences' experiences of digital artefacts might not only evoke but also provoke emotional responses on their own merit. This conceptualisation of the digital artefacts as material-discursive vessels of data positions them as a fundamental component of the live experience rather than an instantiation of a verbatim performance. This idea resonates with the enquiries posthumanist stance and Christopher Frayling's perspective of 'design as research', where he suggests that knowledge is embodied in design artefacts, which are not just an instantiation of an idea, it is the idea (Frayling, 1993).

5. Trauma-Informed Workshops

As an antecedent to the discussion section, accounts of workshop activities are communicated through critical 'reflection in action' (Schön, 1983). The augmented reality (AR) artefacts were co-created during trauma-informed workshops with the young people who are care experienced and The Verbatim Formula (TVF). These sessions enacted playful, performative research, blurring disciplinary lines between human-computer interaction (HCI) and applied theatre to elicit novel, somatic experiences with participants and lens-based technologies.

After engaging in applied theatre games as a playful way to establish a sense of safe and brave space, the care experienced co-researchers discussed what they would say if they could speak to the people in charge of the care system. They recorded verbatim audio testimonies on aspects of their lived experience, such as not being able to hug their social worker and the uncertainty of care placement moves. Key relational moments from these scenarios were then expressed in Image Theatre activities as tableaux for deeper analysis and discussion. A tableau is a theatrical technique where participants pose to create a freeze-frame with their bodies (Jackson & Boal, 2005). This creative participatory practice facilitated an embodied means of reflexivity among the participants, enabling the appreciation of multiple subjective perspectives on the same social phenomena.

Collaboratively 'making' rather than the researcher 'taking' images, various tableaux were recorded by co-researchers using a volumetric camera, resulting in 3D digital ethnographic artefacts for continued dialogue, meaning-making and reflexive practice. Figure 1 represents an image developed between the workshops in response to the testimony about not being able to hug a social worker. To preserve the confidentiality of the care experienced co-researchers in the border dissemination of media, the two figures are 'corporate parents' from Edinburgh Napier University, who willingly participated in an image theatre activity. In the UK, a corporate parent is the name given to an organisation or person who has special responsibilities to care experienced children and young people. In this improvised tableau, one participant embodied a foster carer, while the other represented a young person with care experience. Their enacted hug, depicted in the render, emerged intuitively in response to the emotional theme and timbre of the verbatim testimony.

These artefacts form spatiotemporal representations of the image theatre activity. The aesthetic decision to present the artefacts as point clouds and wireframes is congruent with the tableau workshop experience and research objectives. It preserves the fidelity of the original data while creating a layer of abstraction for addressing ethical challenges of representation and confidentiality.



Figure 1. 3D Scan of hug image statue.

To enrich the co-performative meaning-making process, we embraced the notion of prototypes as media for human interaction, presenting the co-researchers with digital prototypes of the artefacts in augmented reality (AR). The experience facilitated a reflexive process of coding and feedback. This approach underscored the importance of intersubjectivity and ongoing dialogue in the dynamic, iterative experience of creating meaning.

On one level, the prototype represents a digital echo of the initial image theatre experience, encapsulating data as a trauma-informed means of presentational knowing. At another level, the prototype is an invitation to engage with the sculptural piece actively and generatively. This material-discursive perspective aims to extend the actively participative process of the artefact's initial creation by opening up spaces for ongoing dialogue by exploring the affectual collaborative meaning-making potential of AR data artefacts with the co-researchers and audiences.

The sensory information codified in the AR artefacts from the workshops comprises data as verbatim testimony and physical expression of lived experience. The AR artefacts are framed as a potential interface for ongoing meaning-making, illustrating co-constituted agential relations between data and personal value systems. This positioning resonates with Barad's (2007) ethico-onto-epistemo-logical principles, highlighting the inseparability of emergent values, ways of being, and knowing.

6. Performance at the Department for Education

> “What’s your available agency to make a change?”
>
> Sylvan Baker TVF

The account of the audience engagement with the verbatim AR artefact was part of an event titled ‘My Story, My Words’ that took place at the Department for Education (DfE) in London. Pseudo-names are used to protect the confidentiality of the care experienced co-researchers. The room where the performance took place had four rows of seating and a capacity for around 50 people; most seats were occupied, with some people standing at the back. Audience members included the Head of Wandsworth Social Services, the Minister of State for Children, Nadhim Zahawi, and senior civil servants from the DfE. Our showcase of the AR artefacts was preceded by other performative activities delivered by the co-researchers.

When it was our turn, we continued the ethos of a prototype as a means of crafting interactions and dialogue with the audience and initiated a ‘show and ask’ communication to solicit comments and elicit feedback. A co-researcher, whom we will pseudonymously call Nathan, described to the attendees how our digital prototype draws from the testimonies of co-researchers who felt objectified by the care system, feeling reduced to mere files or numbers. Addressing this, our prototype featured the AR verbatim statue that functions via a barcode system. When scanned, it projects a 3D image, encapsulating the message: "I'm more than my barcode, I'm more than a statistic." Yet, discerning this message requires a distinct 'lens' or viewpoint (See Figure 2 by Paula Siqueira).



Figure 2. AR Artefact Demo.

Preceding to a live demonstration using an iPad, Nathan invited participants from the audience to experience our digital piece first-hand. He conveyed that the heartfelt testimony "A hug can change a lot" inspired the 3D imagery. As the participant explored the AR representation – two figures intertwined in an embrace – Nathan narrated the development journey, explaining the design choices and encouraging them to explore the 3D sculptural nature of the visual (See Figure 3 by Paula Siqueira). Upon activating the integrated verbatim audio testimony projected to the audience via a Bluetooth speaker, Nathan emphasised our intention: leveraging technology to communicate narratives of how the care system feels from the perspective of those with lived experience through and beyond live performances. The audience's response was positive, and the outcomes aligned with TVF's vision of a digital trace.



Figure 3. AR Artefact Demo 2.

Going beyond visualisation, it hints towards a form of data visceralisation (Koterwas, 2023; Lee et al., 2020), conveying multi-sensory information emotionally. In line with the utilisation of verbatim techniques, trauma sensitivity is elegantly integrated by creating distance between personal stories, the performer of these and the audience.

During the Minister of State for Children, Nadhim Zahawi's closing remarks, he contemplated the need for a more humane system, expressing his personal agency for change,

> "How can I get the whole system to hear you, to listen to the uncomfortable truth? We have to listen to you if we want to make the system respond and be better. I will take that away and think about how we can scale this up."

Following these reflections, he engaged with our AR prototype. Nathan assisted him in launching the application on the iPad. Zahawi then intuitively navigated around the 3D model in AR of the hugging figures, which remained anchored to the Zapcode on the lightbox (See figure 4).

From an agential realist perspective, by observing Zahawi engaging with the AR prototype, we became an integral part of the unfolding phenomena. He expressly shifted his stance to observe the model from different angles, gaining various perspectives on the figures embraced in a hug, evoking Stein's (2012) definition of empathy 'alongside the other'. Beyond passive observation, his active participation could be seen as a material-discursive mode of being, knowing and valuing. A meaning-making process involving engaging visual, auditory and somatic senses as a form of embodied cognition with digital data. In this dynamic, the actualisation of agencies within the constellation of phenomena is expressed through the interplay of several elements. These include the environment of the Department for Education (DfE), the AR 3D figures, the iPad, Zahawi and our role as observers. This entangled and contingent relationship underscores an emergent material-discursive view of reality, where both the observer and the observed co-constitute the reality being experienced.

During Zahawi's engagement with the AR prototype, the interplay between the digital and the physical realms became a focus of our attention. It was as if his movements weren't just physical adjustments; they symbolised a conceptual journey of understanding. He paused his spatial exploration to listen to the verbatim audio recording, focusing on the message that 'a hug can change a lot'. His interaction with the piece echoed a core objective and challenge of qualitative research—understanding complex social phenomena by empathetically identifying with others and attempting to grasp their subjective experiences. The extent to which this generative engagement stimulates cognitive empathy, as enabled through active participation in the narrative and connection with the stories being told, were themes we became curious to explore in future projects.



Figure 4. AR Zapcode on the lightbox. Follow the web link to see a video of the AR prototype in the DfE: https://youtube.com/shorts/JoNtBrJGkGg.

Zahawi was enthusiastic about his experience with the prototype and its potential for supporting his commitment to the co-researchers in exploring how to create a care system that values listening over bureaucratic protocols. He left us a card with his details requesting a version of the prototype and lightbox for his office. This was a positive affirmation of the concept and an opportunity to continue dialogues by sending him future AR testimonies as they develop.

Reflecting to what extent the digital prototype addressed TVF's interest in the narrative and audience engagement capabilities of immersive technologies, we returned to their notion of a 'digital trace'. The idea is that digital media can be positioned to evoke emotional echoes reminiscent of the live event, reminding audiences of promises they made to honour what they had heard and experienced. The interaction with Zahawi demonstrated the potential of the digital prototype to open new avenues for story presentation, ensuring that the co-researchers' narratives could continue to resonate and exert influence at both live and asynchronous events in and beyond the traditional practical and temporal limits of a live performance.

7. Discussions on Digital Artefacts as Data: Values, Being and Knowing

This section expands on the key insights gained from exploring the intersection of augmented reality (AR) technology and verbatim techniques, especially during the live Department for Education (DfE) event. Barad's (2007) diffractive methodology proved useful in analysing and interpreting how the means of investigating emergent values and phenomena interact and influence each other, communicated as critical 'reflection on and for action' (Schön, 1983).

Framing verbatim testimonies and AR artefacts as data based on ethico-onto-epistemo-logical principles that recognise the inseparable nature of emergent values from ways of being and knowing lays the groundwork for discussions on the intersections of values, data, and generative design methodologies. This discussion on digital artefacts as data and interfaces of emergent knowledge includes aesthetic and ethical discussions on the degrees to which they honour the fidelity and immediacy of lived experience and their potential for generative interaction with audiences. The focus is to illuminate the material-discursive interplay between the co-researchers' narratives, environments, audiences, and digital media materiality in contributing to understanding trauma-sensitive meaning-making and reparative practices with care experienced communities and policymakers.

Earlier descriptions characterised the digital artefacts from the co-creative workshops as active conveyors of meaning and knowledge. In exploring generative factors relating to the dialogical and socio-technically constructed values embedded within the AR prototypes, we characterise them as epistemic artefacts (Rheinberger, 1997). This perspective is extended through an agential realist worldview, recognising the intertwined nature of human and technological elements in the knowledge production process. In the context of generative design research, the AR epistemic artefact is explored in relation to co-performative extensions to our sensory perceptions. This includes material-discursive factors of how and what we come to know, who is represented and by whom. We discuss these ideas by reflecting on the AR epistemic artefact experience at the DfE performance and potential future iterations.

The positioning of the AR prototype as an epistemic artefact recognises its participative potential for codifying data that is a trauma-sensitive representation of the original image theatre activity and an ongoing co-performative experience in itself. This framing opens a perspective for exploring the blurring of spatiotemporal and conceptual boundaries between digital and physical realities towards novel and emergent material-discursive treatments of data. For instance, by actively involving the audience and the surrounding environment, the digital experience has a generative potential. While the verbatim audio remains consistent with each playback, the values and meaning derived are emergent, contingent on the audience's viewing perspective, interpretation, lived experience and ambient environment. In its 'not-yetness' (Ross & Collier, 2016), the material-discursive essence of the experience cultivates a dimension of uncertainty, one that is required to actualise agential relationships within the distinctive amalgamation of elements during each unique encounter.

The sensory information codified in the digital epistemic artefacts comprises data as verbatim testimony and physical expression of lived experience. The audience intra-acts with the artefacts through spatial, temporal, somatic, visual, and auditory means. This performative interface between human and technological entities could be seen in the conceptual journey of understanding described earlier in Zahawi's engagement with the AR prototype. In this configuration, AR offers novel, creative opportunities for representing subjective lived experiences distinct from other extended reality (XR) technologies.

Unlike virtual reality, which immerses you in a fully digital environment, AR allows for the layering of digital content onto the physical world. This layering creates a hybrid space that invites the audience to seek new perspectives alongside the image statue renders, connecting digital experiences, environments, and audiences. This blending of the physical and digital in AR enables a modality where the digital artefacts become part of the audience's immediate environment, positioning the environment and audience as characters in the unfolding narrative.

The experience of the AR prototype mimics aspects of a theatrical fourth wall break, a potentially self-revelatory experience where the lines between the audiences' physical and conceptual worlds become blurred with the digital scene. By blurring these boundaries, the audiences' intra-action implies a degree of agency to influence both the digital and physical world. The juxtaposition and interplay within the entanglement of the digital and the physical provide opportunities to study how constructing perceptually novel ways of experiencing narrative data can alter the audiences' attitudes and awareness of their own agency. The experience is intended to leave audiences with the implicit question: What is their available agency for making changes? Morrison and Kranicz's (2022) related research with extended reality (XR) technologies incorporates verbatim testimonies with the Microsoft HoloLens to explore the roles of interactive elements within mixed reality experiences.

This analysis of the epistemic artefacts as material-discursive experiences contributes to the discussion on the generative and interconnected nature of agential relations between values, design approaches, and data codified in digital artefacts. A similar conceptualisation of value alignment can be found in Barad's (2007) view of the intertwined nature of knowledge and materiality between humans and non-humans, grounded in their ethico-onto-epistemo-logical principles. This worldview underscores the reciprocal nature of the research endeavour, where lived experience, data, and values are inextricably intertwined. Such connections illustrate the entangled and reciprocal nature of material-discursive experiences, where the integration of digital media can reshape the ways we perceive and understand the world, influencing how we interact and respond to our environment and others.

The verbatim testimonies maintain the co-researchers' confidentiality while facilitating the audience's embodied listening, creating a trauma-sensitive interface between the audience and co-researchers' lived experiences. This aligns with Stein's (2012) phenomenological framework, which emphasises empathy as a deeply embodied understanding, bridging the gap between observing and experiencing emotions alongside the other. The application of applied theatre techniques with the iterative cycles of design prototypes provided introspective moments of reflexivity, enriching ethical strategies for qualitative rigour in the process and practice of digital experiences developed with and for communities as contributions to generative design research.

8. Conclusion

This research has explored the potential of augmented reality (AR) incorporating verbatim testimony in communicating and disseminating trauma-sensitive qualitative research to audiences while respecting the fidelity and emotional integrity of the original data and its source. Positioning the AR prototype as an epistemic artefact has opened new avenues for exploring interfaces between the digital and physical, introducing new pathways for appreciating the entanglement of the observer and the observed and creating opportunities for reconfiguring the audience's emotional and participatory engagement. The AR prototype's capability to involve audiences suggests a generative dimension to digital experiences. The dynamic nature of these epistemic artefacts, where values and meanings emerge contingent on individual perspectives and situated contexts, offers opportunities for developing perceptual insights into the potential affective and political possibilities of the technologies.

Positioning the epistemic artefacts as data prompts critical reflections about their impact on the ethics and politics of representation and potential value in policymaking. By disrupting conventional value structures, this experiential data unfolds a divergent counter-narrative. Beyond relying on impersonal statistics or pseudo consultations, the verbatim artefact approach signifies an opportunity for a potential relational and reparative representation of societal reality from the perspective of individuals with lived experience of the care system. Within the ethical boundaries of the research and the DfE event's political context, this enriched perspective supplements existing data and knowledge towards the potential to impact real-world conditions.

By grounding the findings in Stein's phenomenological framework and Barad's agential realism, this discussion illuminates the potential of AR and verbatim techniques in creating emotionally engaging, trauma-sensitive experiences. The insights contribute to dialogues on redefining data boundaries and conceptions of value in generative design research. The AR artefacts are spotlighted as active agents in creating and disseminating knowledge, offering a new trajectory for understanding and engaging with data. This approach positions listening and co-performativity as a mode of care and a sensory practice of knowing, challenging conventional perceptions of data and technology towards humanising policy and care services.

8.1 Future Work

> “Be ruthless with systems and kind with people.”
>
> Chanel Contos

Future research will focus on advancing the co-creation of digital epistemic artefacts, focusing on generative and speculative data imaginaries for education, advocacy, and a call to action by engaging audiences in the emotional dimensions of lived experiences. We aim to contribute further insights into the embodied co-performativity of somatic data, examining the potential of affective, collaborative approaches to meaning-making. While detailed discussions on applied findings are beyond the primary focus of this study, future applied research could strengthen the bridge between research understanding, theory development, methodological pluralism, and broader practical applications.

We will continue to explore the possibilities of immersive and affective experiences that engage audiences on a visceral level, investigating how design elements can be leveraged to provoke emotional responses and create a more embodied understanding of the experiences being represented. We are exploring how emergent extended reality (XR) technologies continue to blur the boundaries between the digital, physical, and conceptual realms, where the audience's intra-action implies a degree of agency to influence both the digital and physical worlds. The juxtaposition and interplay of forces within the entanglement of the digital and the physical provide opportunities to study how constructing perceptually novel ways of experiencing narrative data of lived experience can alter the audiences’ attitudes towards their available agency for change.

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P/REFERENCES OF DESIGN

DATA-DRIVEN DESIGN FOR THE DESIGN HERITAGE.

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ABSTRACT | The integration of digital technologies in museums has instigated a transformative shift in various facets of museum practices, reshaping acquisition, preservation, communication, and exhibition processes. This evolution has given rise to a hybrid physical-digital nature within heritage institutions, where analog, surrogate, and digital dimensions coexist while retaining their distinct identities.

Within this dynamic context, digital data has emerged as a pivotal design material, fundamentally altering the operational landscape of museums. The field of "digital cultural heritage design" provides tools and processes to develop solutions that bridge preserved heritage with practices enhancing visitor experiences both on-site and online. This exploration of digital technologies and diverse media has led to three main types of intervention: datafication, representation, and narration.

Identifying design heritages as a field that due to its peculiarities can benefit manifold from these practices that open up new perspectives on the enhancement and understanding of collections, the paper investigates data-driven design approaches for design museums geared toward promoting innovative forms of heritage fruition and knowledge sharing.

The research identifies the designer's role, outlining objectives, target beneficiaries, competencies required, and associated deliverables for data-driven design approaches in museums. Envisioning a "process interface museum," the research suggests that data serves as a resource for study, research, exhibitions, and a foundation for a shared production of design history. It anticipates a future where museums seamlessly integrate physical and digital elements, leveraging data to enrich visitor experiences and contribute to the collaborative construction of cultural and design history.

1. The Museum's Digital Transformation

Museums encourage and stimulate the spread of knowledge by contributing to the preservation of a society's memory and the construction of its history through methods, processes and practices which characterise the social, cultural, and technological context in which it was conceived. Their Collections, presented in both temporary and permanent exhibitions through a specific didactic apparatus resulting from historians' and curators' in-depth studies, elaboration and interpretation, have been until recently the main instrument for the diffusion of cultural heritage. (Parry, Ortiz-Williams & Sawyer, 2007)

The introduction of digitalisation indeed marked a major departure from the consolidated practices of acquisition, conservation, filing, research, communication and exhibition of said heritage (ICOM, 2022) triggering an overall process of change that still today produces and requires epistemological, cultural and social reflections on the functions of the museum institution as well as on the hybrid physical-digital nature that increasingly characterises heritage. (Parry, 2007) Not only that, the refinement of renewed digital collection management systems demonstrates the intensification of opportunities for museums to interrogate, interconnect and share data. It basically amounts to two different forms of data, first made official in 2003 (UNESCO, 2003), namely *digital surrogates*, visual reproductions of analog artefacts created through standardised methods and techniques (Marras et al., 2020), and *digitally born*, artefacts existing merely in the digital format.[1]

The inclusion of digital surrogates and digitally born heritage by museums – e.g. by London's V&A, Washington's Smithsonian Institution and New York's MoMA – has made possible the broadening of the collections' boundaries with digital materials including digital texts; organisational and personal records of activity; transactions; correspondence; datasets collected to record or analyse scientific, geospatial, spatial, sociological, demographic, educational, health, environmental and other phenomena; learning objects; software tools such as databases; models; simulations and software applications; digitally-generated artworks and documentary photographs; scans, still and moving images; audio recordings; graphics; web sites; blog posts; social media pages in a wide and growing range of formats.

This increase in museum heritage has been accompanied by the expansion of digital-driven modes of fruition and specific personal devices and technological apparatuses (Lewi et al., 2019), enabling museums to offer plural narratives, conveyed by physical and digital devices, and to disseminate knowledge to a broader public that, when involved, relates directly to the artefacts. Digital data can in fact take on two functions: on the one hand, they convey the content of the narrative associated with the physical artefacts; on the other, they constitute the information carrier integrated with the artefacts and represent both the useful tool for conveying communication and part of the potentially communicable content.

Regardless from the will and possibilities of the various museums, this introduction to the digital dimension, in view of obvious benefits, has fuelled a broad debate on the planning and adoption of strategies to face this historic transformation, which has, with the *OpenGlam* movement (https://openglam.org) come to prefigure ethical open access to cultural heritage.

On the one hand, through an agenda promoted by dedicated international organisations, among which the International Council of Museums (ICOM, https://icom.museum/en), the International Committee for Audiovisual, New Technologies and Social Media (AVICOM – ICOM, https://avicom.mini.icom.museum/), and, in Italy, the *Commissione tematica Tecnologie digitali per i beni culturali* (https://www.icom-italia.org/commissione-tecnologie-digitali-beni-culturali-icom-italia/).[2]

[1] The former corresponds to the operations of digitalisation of historical documents, while the latter to the production of digital material.

[2] A body that, while taking care of AVICOM's work on a national level, develops initiatives for the activation of a dialogue between experts and institutions in the field of digital technologies for the conservation, documentation and communication of cultural heritage. Retrieved 2 August, 2024, from hjcjttps://avicom.mini.icom.museum/.

On the other hand, through activities by organisations/networks – among which the Museum Computer Network (MCN, https://mcn.edu/), the Museums Computer Group (MCG, https://museumscomputergroup.org.uk/), and the Network of European Museum Organisations (https://www.ne-mo.org/).

In the different occasions promoted in these contexts, since 2017 the discussion between professionals and institutions has covered multiple aspects: from the introduction of new forms of communication, fruition and participation, to the connection and relationship between institutions, from the accessibility of heritages and technologies to the development of an evaluation model for European museums, with a specific focus on the measurement of social impact (MOI - Museum of impact https://www.museumsofimpact.eu/en/museums-of-impact). Last but not least, the question of the relationship between the material essence of the artefact and the immateriality of the digital surrogate (Drucker, 2013). Indeed, the process of abstraction that characterises the acquisition of artefacts transforms the relationship between user and heritage, which, being more accessible and shared, nevertheless loses its qualitative-sensorial material dimension with the consequent reduction of values, at least from the point of view of perception. (Cameron, 2021, p. 105)

2. Data and Dataset in the Museum, from the Functional Role to the Social One

In a nutshell, the historiography of museum computing identifies in the 1960s in the United States the first initiatives of automated cataloguing of collections (Parry, 2007) that, by replacing paper instruments and the curators' memory with the primordial electronic documents provided the first systems of data search and retrieval (Sartori, 2016, p. 3). The continuation of catalogue automation processes goes in the following decade through the introduction of "new standards, a control of terminology and a systematisation of data entry" (Parry, 2007, p. 51), associated with the development of relational database management systems based on interconnected data tables (Sartori, 2016, p. 4). This production of information, at first only functional for the optimisation of the cataloguing and management of museum collections, becomes in the next phase one of the main goals and tasks of the museum, reconfiguring it as a repository and transmitter of information within society (Parry, 2010). George MacDonald and Stephen Alsford explain the influence of this transition in 1991:

> "Indeed, we must define "information" broadly. It may be intellectual, aesthetic, sensory, spiritual or emotional in nature or, more likely, an experience involving some combination of these elements. Culture is learned as a set of "messages", each of which includes various types of information. Culture is expressed not only through objects, but also through processes, ideas, feelings, personalities and so on." (MacDonald and Alsford, 1991, p. 308)

This idea of the museum as an "information utility", in which artefacts, didactic apparatus, audiovisual materials, databases, staff experiences, oral histories, re-enactments and live performances are understood as complementary, layered and overlapping communicative resources (MacDonald & Alsford, 1991), comes into being at the beginning of the Millennium with the spread of the World Wide Web, which allows for an enormous expansion of the relationships between multimedia, hypertexts, hypermedia and the Internet itself (Cameron, 2007). The discussion started even before the advent of the Internet era and the Graphic User Interface, and it focuses on shared/searchable databases; re-using research and data; visualising geographical and architectural contexts for museum objects; enhancing learning environments by adding multimedia capabilities; creating immersive galleries and virtual tours; and solving usability issues through interface design. (Farrelly, 2016, p. 172)

Underlying this transformation is the shift in the role of information technology from being a mere support for the internal management of collections to becoming an instrument of communication to the outside world, making information– and thus the collections themselves – accessible not only to the museum community but to the wider public. The structure of the museum is therefore assimilated to an indexed

collection of information, designed for archiving and retrieval, and identified through a reading of the objects systematised according to predefined and shared rules in a multi-layered information system and with the goal of clarity promoted by the desire to be informative.

Is the museum therefore a database? This provocative proposal by Mike Pepi (2014; 2019) picks up on Manovich's observation that “the database is the symbolic form of the post-industrial era” (1999, p. 2) and alludes to Parry's studies for which not only has the database become “the metonym of the museum” but, on the contrary, “the database itself [...] is endowed with the qualities traditionally associated with the museum”. (Parry, 2007, p. 51)

On the other hand, the overlapping of the term “museum” with “library”, "collection” or "archive” has now made the boundaries of these institutions increasingly blurred and sometimes ambiguous (Lupano, 2013), both in the structure they bring to mind and in the roles connected to it, all the more so when, moving out of the almost exclusively public dimension, they represent entire collections of materials that could be acquired by almost any Internet user in the more or less recent past (Schnapp, 2008).

Beyond definitional and terminological disputes that are beyond the scope of this paper, it is however clear that in just a few decades, as mentioned so far, the digital dimension has profoundly altered the structure and nature of the museum, highlighting both the possibility of considering different forms of expression and the connective properties of data as foundations on which to base museum practices and the need for interdisciplinary approaches and skills to govern the “new museum”. (Manoff, 2004; Clement, Hagenmaier & Knies, 2013)

3. The Case of the Design Museum

Between two traditional museological models, synthetically referring to the isolation of the art object or to the exhibition of the functionality of the technical object, the design museum constitutes a category of exhibition and research structures, sometimes elusive due to the history of the institutions that deal with it, the different types of artefacts it contains, or because the same artefacts are often kept in museums dedicated to something else. (Dalla Mura, 2010)

Even in this museum “category”, the debate, besides highlighting specificities and critical issues, has raised the question of its expansion through digital interactivity. (Farrelly & Weddell, 2016) In 2016 the scholar Liz Farrelly thus predicted: “An examination of some moments in the pairing of museums and ‘hypertextual connectivity’ reveals the digital online museum as a site for the production of meaning and points towards innovations that might push the ubiquitous website beyond the current paradigm” (2016, p. 171), and since then design museums have also experimented with digital modalities to avoid the risks of dispersion of materials, facilitate new perspectives of study and “animate” their collections.

As far as collections are concerned, the digital transition has had at least two significant effects.
Firstly, it has highlighted the importance of new types of heritages previously overlooked as media artefacts, pieces that can offer, among other things, a representation of new fields and professions in the field of design, and of modes of interaction between person and object. It is no coincidence that in 2012 Paola Antonelli, Senior Curator of the Department of Architecture and Design at MoMA, by acquiring 14 videogames stated that she “kicked off a new era for the collection”. (MoMA, 2012)

Exhibitions such as *Decode: Digital Design Sensations* in 2009 at the V&A in London, co-curated by Louise Shannon, curator of Contemporary Programmes, and Shane Walter, director of the digital media agency Onedotzero, or *Talk to Me: Design and the Communication between People and Objects* in 2011 also at the MoMA, where Antonelli, with Kate Carmody, Curatorial Assistant of the Department of Architecture and Design, “tested” the combination of the physical exhibition of pieces and its web version containing official and online materials, have indeed contributed to generate the current collections. For example, the online catalogue of the V&A currently shows a total of 302 pieces, of which 32 are in the “Design, Architecture and

Digital Collection" (https://www.vam.ac.uk/collections) under the heading "software", while MoMA and the Cooper Hewitt Smithsonian Design Museum include 88 and 60 artefacts respectively, dating from 1966 onwards and distributed among digital fonts, digital posters, smartphones, videogames, interactive visualisation and much more (https://www.moma.org/collection/; https://collection.cooperhewitt.org/search).

The second aspect concerns the possibilities offered by the combination of heritage digitisation and data interoperability, which, by allowing the analysis of masses of materials belonging to different conservators, from institutional to individual users, can, on the one hand, contribute to the reconstruction of processes by connecting the contents of different collections – i.e. by exploiting the potential of using Linked Open Data (LOD) technology in creating relationships inside and outside the archive (Listo, 2019) – and on the other hand extend and renew narratives. These enormous digital datasets open up new perspectives on the understanding and valorisation of design collections by prompting one to reason about quantitative parameters and metrics such as occurrences of formal patterns that can reveal stylistic trends and cultural influences, or chronological links that show the evolution of artefacts over time, or even semantic relationships between different elements of collections that allow conceptual and thematic connections to be identified.

It should also be considered that what closely links this category of museums to the opportunities offered by the digital transformation is one of its distinctive features with respect to other museum categories and an expression of one of the contemporary interpretations of design, namely the possibility of making its process dimension evident (Bulegato & Scotti, 2024): "The design museum – design being the whole process between project and product – cannot be a place where only the finished product can be observed, because this is 'only' the result and the point of arrival of a long journey. In order to be aware of this path, one must have knowledge of all the actors and all the actions necessary, and indispensable, for its completion". (Cecchi & Pirola, 2022, p. 336)

This historiographical and museological approach (Huppatz, 2020) has characterised the realisation of two recent structures, questioning, among other things, those historiographical readings and curatorial practices of acquisition, cataloguing and display that have by now been canonised and consolidated. The renovation of the Design Museum in London in 2016 in which the permanent collection, *Designers, makers and users*, explores the history of design through extensive materials documenting and explaining the interconnections between the three subjects: creator, producer and consumer. (Newson, Suggett & Sudjic, 2017)[3] Similarly, in 2021, the ADI Design Museum in Milan, the newest of the Italian design museums, exhibited its permanent collection, *Il cucchiaio e la città* (The spoon and the city), dedicated to the Compasso d'oro[4] awards using heterogeneous documents – sketches, drawings, models, prototypes, products, communication artefacts, photographs, documents, publicity and so on – generated by the various parties involved in the project-production-sales-consumption-disposal process – client, designer, model-maker, printer, entrepreneur, factory technician, graphic designer, copywriter, distributor, consumer and so on – with which the design process can be summarised.[5]

4. The Museum as an Interface

The elaboration by Petrina Foti, Professor in Museum Studies at the Rochester Institute of Technology, helps precisely to frame the role of data in the museum context. Reasoning about possible display modes for computer history collections, Foti (2022) questions the characteristics of data. In the proposed matrix (fig. 1), the data, an informational unit, is expressed in six different forms (bits, evidence, lens, tool, object,

[3] The digital catalogue is more or less non-existent and the printed one only partially includes the many exposed pieces.

[4] *In progress*, as the prize is still active.

[5] There still isn't an archive in which the exhibited materials are accessible, while a printed catalogue is currently in the works.

story subject) which correspond to contexts of use (discipline, objective analysis, contextualisation, historical preservation, professional practice, interpretation) represented within the museum by different outputs and practices of research and knowledge restitution. The datum as bit expresses the minimum unity of the scientific discipline being exhibited; the datum as evidence constitutes evidence and traces in a process of objective analysis; the datum as lens is a functional device for contextualisation; the datum as object is an artefact to be preserved; the datum as tool is the subject of multiple professional practices; and the datum as story subject is the protagonist of an interpretation. (Foti, 2022, p. 26)

Data is INFORMATION	*Due to DEFINITION*	*This is expressed in a variety of way, such as Bits; Evidence; a Lens; an Object; a Tool; a Story Subject.*
Data is seen as ...	*Due to ...*	*Is this expressed in the museum's research interests and outputs? If so, where and how?*
... bits	*Discipline*	
... evidence	*Objective Analysis*	
... a lens	*Contextualization*	
... an object	*Historical Preservation*	
... a tool	*Professional Practice*	
... a story subject	*Interpretation*	

Table 1: The Synthesis Matrix

Figure 1. Petrina Foti, The Synthesis Matrix, 2022.

A further effect of the digital transition is the consideration of new skills and approaches for the orientation and management of a new living and adaptive museum. There is no uniquely defined digital heritage professional or scholar. The figures who come together in the renewed context are technologists, computer scientists, archivists, academics, historians, designers, curators who are called upon to be part of an interdisciplinary dialogue the effects of which also reverberate on each of their relevant communities. (Parry, 2010, p. 3) In the context of this dialogue, particular importance is assumed by professionals such as interaction designers, visual designers, exhibition designers and science communicators, as they are active in contexts that require cross-sectoral skills that facilitate the integration of tools and the mediation of contents. (Vane & Davis, 2020)

The design of the museum thus approaches that of an interface capable of integrating physical and digital dimensions “that delimits a cultural space within which a specific set of relationships can occur” (Hookway, 2014); an interface that conditions the production and circulation of information and meanings based on its spatial arrangement, connectivity, depth, responsiveness and reconfigurability. The museum understood as an interface for knowledge recalls the research hypotheses put forward by Kathleen Pirrie Adams (2018), Professor of New Media at Ryerson University, who clearly propose the connections between the physical and digital dimensions, the “enriched space” that, as theorised by Elisa Bonacini (2020, p. 55), is the paradigm on which the museum reframes its characters.

In particular, Adams' conceptual framework of the museum system is defined through a vocabulary that draws on the language of computer science and interface design where the terms “asset”, “platform” and “affordances” accompany and extend museum practices metonymically. Adams identifies “collection” with the term “asset”, with which she highlights the coexistence of a variety of quantitative and qualitative data: objects, texts, images, media and records of intangible culture. (Adams, 2018, p. 296)

The artefact, brought from a material dimension towards a more informational one (Adams, 2018, p. 294) and placed in a system of dynamic and plural connections, contributes to the production of an “exhibition” that defined as a “platform” brings associations with shared space, multimodality and multimedia to mind. Interpretation – historically a monopoly of the museum and its curators – is in turn renamed "affordance", recalling a term imported from the field of user experience design that frees it from subjectivism by bringing out objective and relational aspects.

5. “Digital Cultural Heritage Design” for Design

Starting from Foti's theoretical framework and Adams' metonymies, considering physical and digital data, whether surrogate or digital born, as plastic and adaptive resources, this paper investigates design-driven practices for design museums, aimed at promoting original forms of heritage fruition and knowledge sharing.

Even in the case of this category of museums, design practices for museums are based on the in-depth study of content that encourages dialogue with curators and cultural heritage professionals, and on the consideration of technologies, tools and languages with which to enhance the specificities of the heritage while taking into account issues related to infrastructure and economies available at the time of setting up and in later periods, when use and management make maintenance necessary.

Design for the enhancement of the museum heritage uses the potential of digital to highlight, superimpose and integrate the visitor’s experience also through the use of quantitative and qualitative data in its different expressions (Foti, 2022), according to different media. As claimed by Mason and Vavoula (2021), this is “digital cultural heritage design”, an

> “Activity system where a disciplinarily diverse team of staff and partners engages in the (co)creation of knowledge about how to design in ways that are specific to and appropriate for the museum and its audiences; in terms of the network of actions and actors that constitute the practice; in terms of the design methods and representations that catalyse the design activity system; and in terms of the design knowledge assets that grow out of and feed back into the system.” (pp. 406- 407)

Digital cultural heritage design is therefore the project serving digital cultural heritage, which in this research is applied to design museums. It is concerned with relating the specific preserved heritage to practices that enhance the visitor's experience of knowledge on site and online by exploring digital technologies and different media.

Applying the prefigurative vocation of design to the field of museum studies and orienting research toward the production, interpretation and fruition of cultural datasets, the authors identifies three main types of intervention: datafication, representation, narration.

For the sake of clarity and coherence, it was decided to formalise the framework of interest of each intervention according to predefined parameters. For each typology we choose to indicate the objective pursued, beneficiaries to whom the action is addressed, design solution, services and competences required of the designer, tangible or intangible deliverable to which forms of expression of the data and context of use with reference to the matrix elaborated by Foti (2022) are associated. In support of the proposed framework, exemplary cases of design museums that give concrete expression to its potential will follow.

Table 1. Data framework.

	Datification	Representation	Narration
Data expressive form	bit / object	evidence / lens / tool	story subject
Context of use	discipline, historical preservation	objective analysis, contextualization, professional practice	interpretation
Objective	to promote the queryability of the collection; move beyond the punctual research key; use of metadata as a means of aggregation, grouping, filtering and retrieval.	to organize the complexity of information by promoting its understanding; to share the complexity of an issue; to create public engagement; to highlight relationships; to reveal aggregations.	to offer adaptive content, personalized narratives, and systems that can combine and transmit knowledge and expertise, making explicit the narratives inherent in an artifact; to elicit emotion and involvement; to transfer individual and collective memories between generations; and to foster connections between institutions and heritage, individuals and communities.
Solutions	search and retrieval system; data-driven hub	reading and orientation system, lens for clustering content	interpretation system
Competences	product and service design strategy; user research; UX, UI, brand design, front back-end development, impact monitoring	analyzing, cleaning and formatting data; UI; UX	UX; UI; user research; content management; engagement strategy
Deliverables	websites, content archives, digital platforms, online exhibitions	static and dynamic data visualizations	integrated physical-digital systems and applications; digital platforms
Beneficiaries	researchers, students, online visitors, curators	researchers, students, on site e online visitors, non-specialistic public	researchers, students, on site e online visitors, non-specialistic public

5.1 Datification

With datafication interventions, the designer proposes the development of research/retrieval systems that are configured as data-driven hubs for research exploration and planning and are aimed at facilitating the queryability and usability of the collection.

The museum as interface emphasises the multifaceted identity of the artefact as a complex of information/attributes. The transformation of artefacts into data is not a mere transposition of the physical object/document into digital, nor is it its reproduction on another medium; it is a translation process that by standardising the heterogeneity of formats, through the production of metadata, facilitates the possibility of connection, interconnection making relationships between different artefacts, collections and digital environments, possible.

This lays the foundations for overcoming the punctual access to information traditionally guaranteed by the “search field” – which Mitchell Whitelaw (2015) defines as a “stingy interface” – in favour of a fruition in which the “generous interface” allows the user to have a contextualised view of the content searched in the archive-museum through aggregations and filtering.

Among the metadata associated with resources, tags “identify and classify” artefacts with non-specialist language. This opportunity bridges the “semantic gap” between cultural heritage professionals and the

public using less specialised terminology, laying the groundwork for reinventing ways and practices of using collections that stimulate different public use and understanding. (Whitelaw, 2015)

Interface and metadata constitute devices that can organize and manage complex cultural datasets by facilitating access to the data for an extended audience. If the focus shifts from access to analysis, the adoption of AI and in particular machine learning models, can function as a multiplier of data processing capacity, for example to perform recon on massive cultural datasets that with generous interfaces produce research on aggregated connected domains. Indeed, algorithms for mining, shaping, and representing large datasets play a key role in several stages of the so-called "data processing pipeline," for example, in operations involving digitization, transcription, pattern recognition, simulation and inferences, preservation, and curation. (Kaplan, 2015, p. 3)

Good examples are the Triennale di Milano Online Archive (https://archivi.triennale.org/archive/archivi) and the V&A Archive of Art and Design (https://www.vam.ac.uk/info/archive-of-art-and-design). Particularly interesting is also the online platform of the Cooper Hewitt Smithsonian Design Museum archive, which houses the collections of the different departments. The file of each artefact shows: tag (these tags connect diverse objects from across the collection: they represent themes that extend over time and across the different museum departments), timeline (year of production, year in which it was reproduced photographically, year of acquisition, exhibitions in which it was exhibited), metadata (type, producer, materials, production process, donors – connected to its collection), number of images available, the place where it is exhibited, other related artefacts selected by the curators from those present in the archive, size, colour palette. The use of the IIIF framework6 (Rodighiero et al., 2023) extends the queryable holdings to all objects held by the Smithsonian institutions.

[6] The International Image Interoperability Framework (IIIF), is an interoperable protocol for publishing high quality images on the web and sharing them. It was created for sharing images between digital libraries, is open source and has several levels of APIs (authentication, annotation, search, presentation) to be able to build and implement different services.

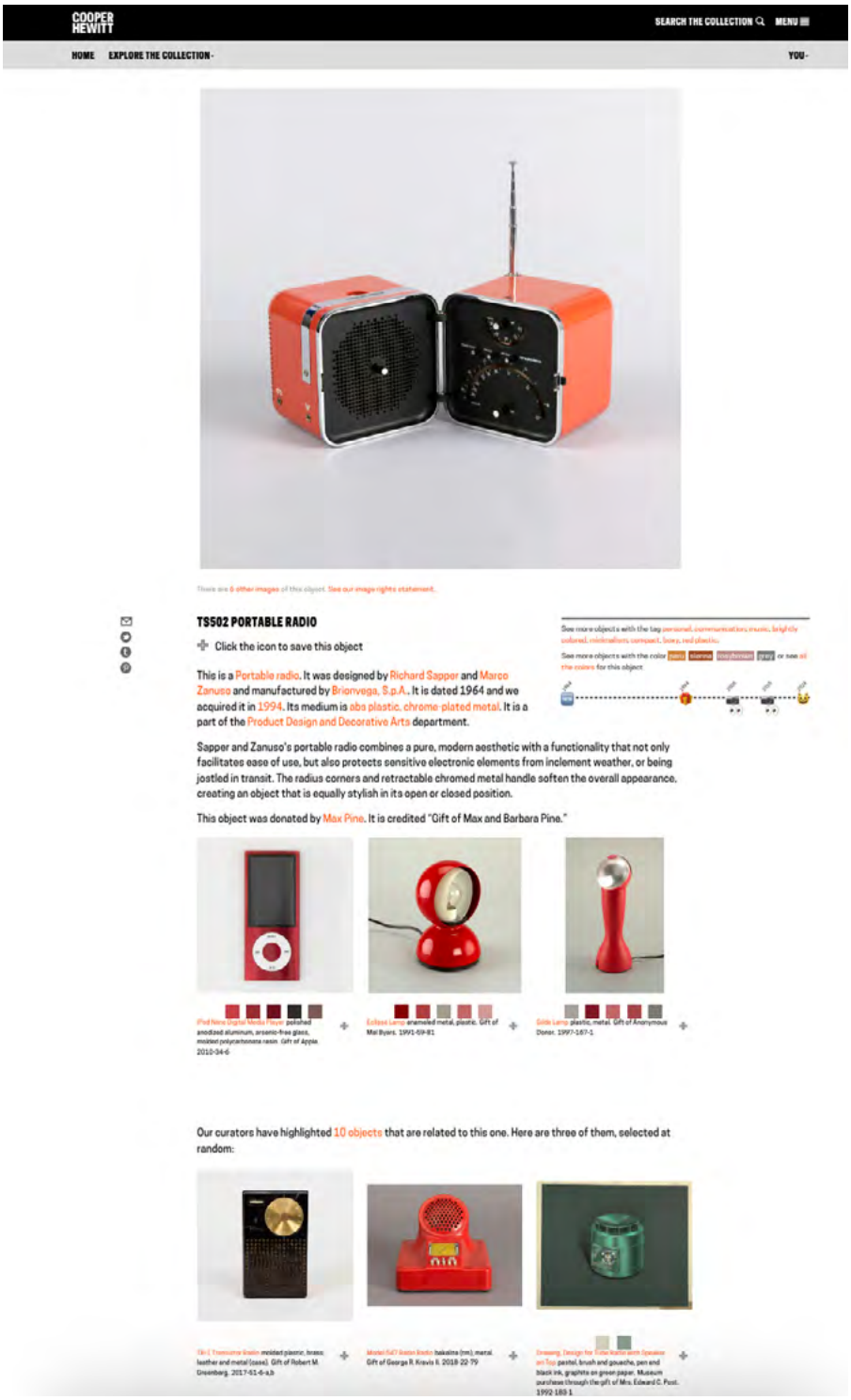


Figure 2. TS502 ts502 Portable Radio; Designed by Richard Sapper (German, 1932 - 2015), Marco Zanuso (Italian, 1916 – 2001); Manufactured by Brionvega, S.p.A. (Italy); Italy; abs plastic, chrome-plated metal; H x W x D (open): 13 x 33 x 16.5 cm (5 1/8 x 13 x 6 1/2 in.) H x W x D (closed): 13 x 22.5 x 13 cm (5 1/8 x 8 7/8 x 5 1/8 in.); Gift of Max and Barbara Pine; 1994-59-3. Retrieved 2 August, 2024, from https://collection.cooperhewitt.org/objects/18648915/.

5.2 Representation

With representational interventions, the designer, through practices of analysing, cleaning and formatting of extended datasets, proposes the development of orientation systems for the in-depth study, visualisation, sharing and dissemination of complex content in museum contexts.

Visualisation, a crucial intermediary between the digital archive and its big data, functions both within galleries and beyond their physical location as networked access (Kenderdine, 2021). The extent and heterogeneity of the preserved and digitised materials require the structuring of static and dynamic reading systems; interfaces to aggregate, filter and group the stored data that allow both “distant” and “close reading”. (Drucker, 2017; Kaplan, 2015; Kenderdine, 2010; Moretti, 2005)

Visualisations foster multi-level readings by highlighting relationships and revealing associations that, through interaction, can extend the experience from the screen to the physical setting (Windhager et al., 2019) opening up the museological heritage to exploration both within and beyond the institutional walls. This type of intervention sees designers and digital humanists working on the qualitative dimension of the data often in a parallel way, the former focused mainly on the design of physical and digital interfaces for expanded access to information – approach that finds in the use of AI driven tools the possibility of expanding, refining and updating research outcomes over time by reiterating the data query against the acquisitions made –, the latter rather more on analysis through visualisations as research tools and methodology.

The activity is aimed at diverse and broad audiences, involving experts as well as non-specialists. Three main approaches have been identified by Sarah Kenderdine (2021), professor of Digital Museology at the École polytechnique fédérale de Lausanne: collections visualisation, embodied visualisation and spatial and temporal visualisation.

An example of the most widespread practice, collection visualisation, is the work of Olivia Vane, researcher and data-visualisation designer (https://www.oliviavane.co.uk/cooper-hewitt-tags) who, wanting to narrate the breadth of the Cooper Hewitt Smithsonian Design Museum's collection, worked on the tagging system of artefacts by identifying in morphology and colour search attributes that multiplied by the numbers of artefacts in the collection highlight hidden narratives, surprising even museum staff. “Organising the data into timelines makes it possible to trace how a concept or idea has been visually expressed across time. Bringing objects from very different places together in these visualisations encourages serendipity and unexpected juxtapositions” (Vane & Davis, 2020, p. 29). In this case, the dynamic representation of specially designed digital data exploits and enhances the basic powers of human perception and supports the understanding of large-scale information (Card, 1999). In this way, user interaction highlights patterns and trends that are difficult to detect with point-in-time research.

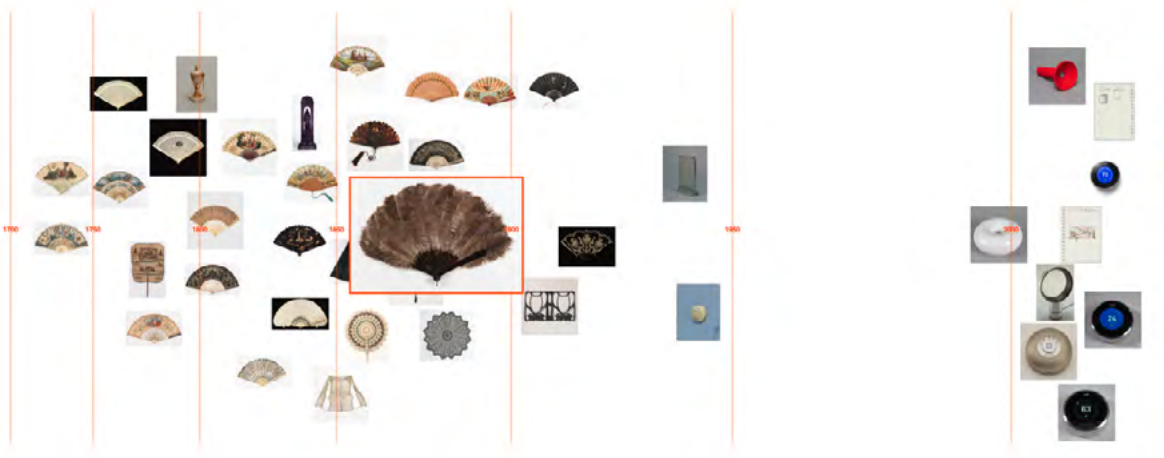


Figure 3. Personal environmental control timeline: a dry juxtaposition of these decorated fans against modern Nest thermostats. Olivia Vane, https://www.oliviavane.co.uk/cooper-hewitt-tags.

The *Surprise Machines* project (https://mlml.io/p/choreographic-interface/), developed in 2022 by metaLAB Harvard FU Berlin (https://mlml.io/) for the Harvard Art Museum is an example of embodied visualisation. Part of the temporary exhibition *Curatorial A(i)gents, Surprise Machines* is a data visualisation designed using AI algorithms that maps more than 200,000 digital images and shows them in an interactive installation enriched by "a choreographic interface" (Rodighiero et al., 2022) which allows visitors to understand the vastness of the collection by interacting through a camera that captures body gestures.



Figure 4. Surprising Machines, Harvard Art Museum, 2022 . Retrieved 2 August, 2024, from https://mlml.io/p/curatorial-aigents/.

Inscribed in the "spatial and temporal visualisation" typology, *The Room of Change* (https://accurat.it/work/broken-nature) is the environmental installation designed by the studio Accurat on the occasion of *Broken Nature: Design Takes on Human Survival* at the XXII Milan Triennale curated by Paola Antonelli. The room is empty and the walls are covered with a wallpaper that incorporates visual patterns derived from the processing of extensive datasets on global issues such as world population density, energy consumption and variation in average temperatures. These patterns represent environmental changes in the past, present and future. The wall is a device for conveying content through interaction with a mobile application that offers keys to interpreting the visual codes used. Following Giorgia Lupi's approach of "giving human life to data" (Lupi, 2014, p. 62), this project combines research and data design. The aim is to go beyond traditional data visualisation codes, incorporating cognitive studies on perception to make the project accessible to a wider audience, including non-specialists.

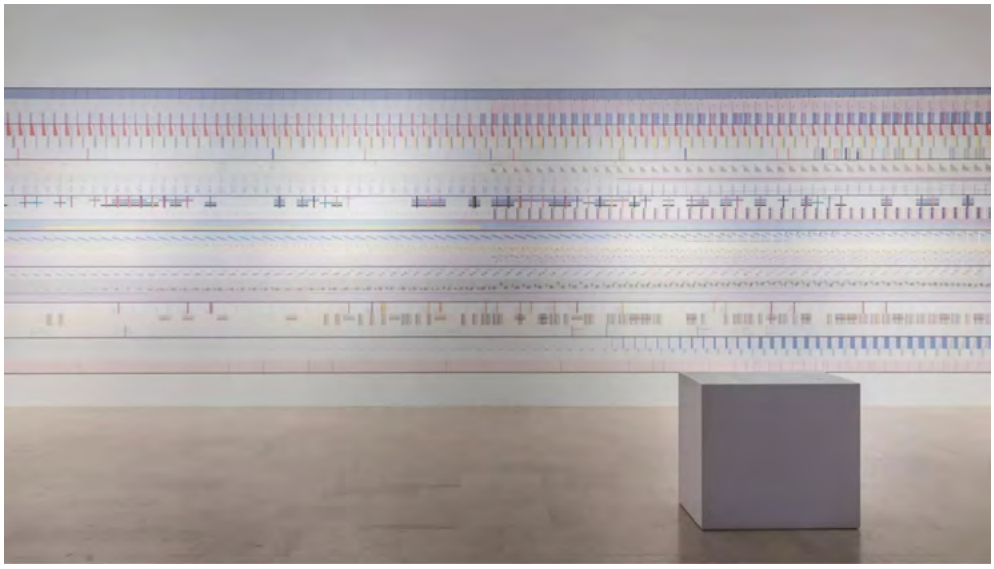


Figure 5. The Room of Change, Accurat, 2019. Retrieved 2 August, from https://accurat.it/work/broken-nature.

5.3 Narration

With storytelling interventions, the designer designs systems of multilevel interpretations aimed at combining and transmitting knowledge and expertise in order to: make the stories inherent in an artefact explicit; arouse emotion and engagement; transfer individual and collective memories between generations; and foster connections between institutions and heritage, individuals and communities (Bonacini, 2020). These systems include user customisation of content, the ability to offer adaptive content or customised narratives, and systems that can combine physical narratives with digital narratives (Poulopoulos & Wallace, 2022).

Variable, situated and dynamic interfaces are an expression of the expanded museum, a "living" organism with high complexity due to the variability of content aspects (Atzori et al., 2023, p. 38). Artefacts communicate themselves through their material properties but they also carry "other" and intangible stories concerning their contextualisation.

The contents that augment the artefact, whether created by museum professionals or ordinary people, or generated by AI give plasticity to the artefacts as they can be recalled on demand according to specific reading frames. These interventions also exploit the potential of hypertextuality and hypermediality as for the same content the narrative can take on different formats: text, audiovisual, images, links to collections or other.

The development of "augmented narration" systems requires the presence of a network infrastructure and connection systems for geo-localising information. Digital information is in fact made accessible through photographable two-dimensional codes (Qr Codes) or through various proximity devices (RfiD tags, NFC, Beacons), or directly through GPS positioning (Bonacini, 2021).

The aforementioned exhibition *Talk to Me: Design and the Communication between People and Objects*, curated by Paola Antonelli and Kate Carmody (MoMa, New York, 2011) integrates information on the contextualisation of the artefacts on display through the use of Qr-codes. The installation proposes a "connective and amplified narrative" (Trocchianesi, 2015, p. 101) in which the flow of information unites and connects internal and external visitors and exhibits. Each piece in the exhibition has a QRcode – this is the first time this device has been used in an exhibition context – that allows visitors to access in-depth information on the designer, project specifications, as well as tweets (according to a real-time data retrieval dynamic) posted by other visitors connected to the same piece. Products, installations and constituent systems of the contemporary communicative sphere are on display: interfaces, interactive multimedia systems, robots,

mobile devices, monitors, screens, and the use of the QRcode allows further links to other works linked by thematic affinity. In this case, the construction of the narrative in the exhibition stems from the object itself, a harbinger of new codes, which integrates them and injects them into the relationships between objects, visitors and the exhibition design that arise during the course of the event.

Although not directly related to a museum institution, but nevertheless interesting as an example of renewing relationships with artefacts, *Teaching with Things*, an experimental research project (2013) developed at Harvard's metaLab under the guidance of Jeffrey Schnapp (2018) and aimed at restoring three-dimensional objects in a multimedia catalogue, integrated augmented storytelling through the three-dimensional representation of the object. In this case, the three-dimensional modelling of the object becomes not only a digital surrogate informational node, but also an access point to a library of additional information capable of proposing relations with other documents and user comments. The digital surrogate, represented within a navigable system of spatial coordinates and queryable with regard to its physical information such as size and weight, is associated with acoustic properties, component attributes and other significant usage details. Information is conveyed through audio, video and photos. As the first experimental version of an "artefactual interface", the project proposes the transformation of an analogue object into an augmented version of it, where the integration of its attributes with those dictated by the users' annotations contribute to the "description of an object record, understood as an interpretative process that results in a multimedia composite". (Schnapp, 2018, p. 430)

Finally, the narrative of *Analogous city*, a multimedia installation proposed by researcher Dario Rodighiero (2021), clarifies the sources through the use of augmented reality. The work is an Archizoom initiative protracted in collaboration with Bonnefanten in Maastricht, EPFL in Lausanne, and GAMeC in Bergamo.[7] Placed within an exhibition context, Aldo Rossi's (1976) map of the *Città Analoga* takes the form of a collage that brings together drawings, images and extracts from artworks. Through a mobile application for tablets and smartphones, it is possible to frame parts of the work, which are recognised and give access to the respective augmented versions.

The augmented reality system graphically depicts touch points that, once selected, refer to bibliographic and iconographic references.

6. Conclusions

The study and analysis of datasets in a qualitative-quantitative key by the field of design supports processes of re-elaboration and signification of the heritage of design from the specificities of artefacts. This process, which is already in use in digital archives that go beyond the punctual search key through the use of metadata, favours the possibility of making the processual dimension of design evident as it makes the set of information supporting it explicit and more easily accessible.

As we have documented, existing data retrieval systems – for example those used at the Cooper Hewitt Smithsonian Design Museum – offer infrastructures and technologies capable of supporting the development of selection practices on which exhibitions can be based, capable of restoring the information content regarding the history of an artefact: the client's request, the conception, the choice of materials, the production technologies, the marketing strategies, communication and use, up to its obsolescence. The most recent design museums show some signs of openness towards this new approach but, although they interpret the logic of data (classifications, aggregations, filters, relations), they end up limiting themselves to the exhibition of analogue and digital artefacts and communication apparatuses, with limited bridges between the two.

[7] In addition to these museums, the Map of the Analogous City has been exhibited at the Triennale of Milan and MAXXI in Rome.

Even the most virtuous experiences and in line with the idea of a "museum as interface of the process" for design, the proposed "augmented narratives" related to artefacts – also by means of digital – remain in fact confined to the physical space of the museum for the duration of the exhibition for which they were conceived. The transience that characterises such "narratives" on the one hand limits their wider and shared access and on the other hand does not provide for their preservation.

Despite the resources available and the knowledge of the advantages that the digital dimension of data offers (hypertextuality, hypermediality, interaction with the digital object and with the information resources connected to it) what is still missing is the project of dialogue and connection between the exhibition dimension, often still limited to the finished product, and the digital dimension on which historical and curatorial studies could be expanded, favouring new reconstructions and interpretations based on an extended network.

The network of the new design museums based on the idea of a "museum as interface of the process" prefigures itself as a giant global and shared archive, implementable and queryable by each institution and by any user, where data constitute the project material at the service of study and research but also of temporary and permanent, physical and digital exhibitions. The data, an authoritative resource for the construction of memory and knowledge, thus becomes on the one hand the foundation for a shared production of the history of the project based on sources and documents, and on the other hand a support for the process of expansion of participatory and shared culture.

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Author's Note: The contribution is the result of a common reflection of the three authors. Nevertheless, "1. The museum's digital transformation" was written by Alessandra Bosco. "2. Data and dataset in the museum, from the functional role to the social one" was written by Lucilla Calogero. "3. The case of the design museum" was written by Fiorella Bulegato. "4. The museum as an interface", "5. "Digital cultural heritage design" for design" and subchapters "5.1. Datafication", "5.2 Representation", "5.3 Narration" were written jointly by Alessandra Bosco and Lucilla Calogero. The Conclusions were jointly written by the three authors.

P/REFERENCES OF DESIGN

MATERIALISING DATA: GETTING TO GRIPS WITH SLIPPERY CONCEPTS.

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ABSTRACT | Data is ubiquitous in the 21st century, we voraciously create and consume it, and it can be the driver of innovation and the lens through which we view the world. But data is a slippery, shapeshifting material that can take a myriad of forms which makes it challenging to engage with in a critical manner. This paper explores how design can address the challenge of revealing complex and sometimes hidden relationships with data from the perspective of six individual pieces that have been created as part of two exhibitions. The first project entitled There Be Dragons commissioned five pieces from artists/designers that challenged them to represent data in a way that was meaningful to their lived experience of being a creative practitioner. The five responses sought to untangle personal relationships with data through the application of techniques such as interaction, storytelling, and wayfinding. The Picture Your Poisons piece was created by two of the authors and related to the previous work as it gave form to highly personalised data about cancer treatments through the medium of glass. The paper will reflect on the body of work from the perspectives of the authors as both active agents in shaping the first project and as creators of the second piece. The combination afforded insight into the production of creative work for public exhibition together with the requirements that exhibition places on this process. The subsequent interpretation has identified three emergent themes: performance and participation; rethinking value and representation – making data physical and explicit.

1. Introduction

In 2017 the Economist published an article claiming that, “The world’s most valuable resource is no longer oil, but data” (The Economist, 2017). In the years since then, a great deal has been written about the role that data is playing in shaping the world. In this paper, we look at this often daunting and intractable global topic on a smaller scale, through the lens of the lived experience of the creative practitioner. In this paper, we present reflections on two examples of creative projects that dealt with this topic, and the process of producing them. The first was an exhibition presenting five works; *There be Dragons: Navigating the uncharted data territories of creative practice*. The second is a work titled *Picture Your Poisons*, an artistic project that aims to make scientific and medical data more accessible and impactful to the public. This work was exhibited as part of a larger exhibition. The paper considers themes emerging from these creative works, and we reflect on the development and curation of creative exhibitions as a research method.

2. The Exhibition Contexts

2.1 The Backdrop of Creative Informatics

Creative Informatics was an ambitious research and development programme based in Edinburgh, aiming to bring the city’s world-class creative industries and technology sector together, providing funding and development opportunities that enabled creative individuals and organisations to explore how data can be used to drive ground-breaking new products, businesses and experiences. Creative Informatics nurtured local talent through five key funding programmes and regular events that supported Edinburgh’s creative industries to do inspiring things with data. One of these funding programmes had the aim of bringing academics and industry together in order to break new ground and establish how technology could benefit the creative industries in the future. It was under this initiative that the *There be Dragons* work was produced. The other project discussed was a collaboration between two of the researchers working on the Creative Informatics programme.

Whether implicit or explicit, data plays a role in the work of creative practitioners and artists. From a commercial perspective, even the smallest creative enterprise can benefit from knowing more about their customers, stakeholders and audiences and about wider trends that could influence their future planning. Data comes in many forms, whether it is generated from within the creative practice itself or alternatively whether it comes from an external source. For example, data is collected about creative practices and individuals for use by other agencies, such as to inform government policy and to develop strategies to support creative practice at a wider level. In considering the value produced by data, Speed & Oberlander (2016) assert that creative practitioners can design from, with and by data. For example, design *from* data might use measurable data that can be processed to make it useful; *with* data could involve making use of live data streams or feedback to create interactive designs; and *by* data involves a situation where data itself, supported by an algorithm, will become a designer. Bound up in such an entanglement of the uses of data and the value it may or may not generate, is the question of how data impacts on the lived experience, and the identity, of being a creative practitioner. The mechanism of exhibition was chosen as a catalyst for exploring these issues, foregrounding the experience of being a working practitioner.

2.2 Exhibition as Research Method

As researchers, we had three main aims with the development of these exhibition works. Firstly we wanted to investigate how creative and artistic practitioners understand and articulate the role that data – a complex and multi-faceted concept – plays in their working lives. Secondly, we were interested in design methods and approaches around co-creation, curation and collaborative exhibition design. Thirdly, the projects acted as public engagement activities, aimed at both the general public, and also a particular set of stakeholders. In this latter case, the works acted as stimulation and provocation to inform further

research investigations into the role of data-driven technologies and the challenges of accessing and using data for creative industry participants of all scales, especially small businesses, freelancers and individual practitioners. In this paper we mainly focus on reflections on the first two of these aims.

There be Dragons: Navigating the uncharted data territories of creative practice was funded directly by the Creative Informatics project. It focused on the form and nature of data and specifically addressed the question of how data might best represent the lived experience of creative practitioners. A brief was set by the authors, and five creative practices were selected after a review process to develop their submitted concepts to be part of the final exhibition. The brief was intentionally open and encouraged respondents to

imagine future possibilities for data as well as considering how it exists today. To support this approach practitioners took part in a series of workshops, run by the authors over the six-month development period. To further coordinate the development of the individual pieces and to ensure the overall coherence of the exhibition, a curator from New Media Scotland, an agency fostering artist and audience engagement with all forms of new media practice, was appointed. The curator provided an important point of contact for the practitioners and – critically – was independent of the authors.

The second event was the centenary exhibition of Visual Arts Scotland at the Royal Scottish Academy in Edinburgh. As part of the larger exhibition, the work entitled *Picture Your Poisons* was created by two of the authors and sought to make visible the normally hidden data associated with a medical procedure.

All six pieces created an opportunity to both engage with and reflect on the nature of data through the creation of physical artefacts and the process of making (Huron et al, 2023). In the first instance, the authors were engaged throughout the production process and worked with the individual creatives as they developed their ideas from initial concepts to a final exhibition piece. In the second instance, it was two of the authors who produced the work for the exhibition. These roles provided a unique insight into the role and representation of data during the production process and how audiences responded to the final exhibition pieces.

3. There Be Dragons: Navigating the Uncharted Data Territories of Creative Practice

The motivation of the *There Be Dragons* project was to critically reflect on the types of data that practitioners considered to best represent their experiences of producing creative output. These individuals and groups were attempting to wrangle the disruption of the digital shift, with its increased pressure to continuously acquire new technical skills, and to build upon existing proficiencies for creative production, collaboration, innovation and dissemination (Helgason et al, 2023).

Up to this point much of the data used to describe what is referred to as the creative industries has been at a systemic level. For example, in the Spring budget of 2023, the UK Chancellor declared that the creative industries were a growth industry. This served as recognition that the sector had generated over £100 billion in revenue, representing over 10% of the UK economy and providing 2.29 million creative industry jobs. But behind these statistics lie real people, producing creative output in times of undoubted challenge. The aim of the *There Be Dragons* project was to explore how creative practitioners saw themselves and what data they considered to best reflect their own lived experience. The approach complemented the human-centred approach of the Coast to Coast project (Smyth & Delaney, 2023), also undertaken as part of Creative Informatics which conducted a visual and textual study of creative practice that focused on individual practitioners in Scotland and Northern Ireland.

The work reported in this paper contributes to the overarching goal of giving a voice to practitioners in terms of how they identify as creatives while acknowledging that it is a very personal and contextual endeavour that is set against a backdrop of the seemingly continuous shifting sands of economic and social change.

The *There Be Dragons* project started from the premise that data can empower creative businesses to do more and to do it better. Data can be used *for* creative practice, *with* creative practice, and to tell us *about* creative practice. However, coping with data is not a simple or straightforward activity. It has to be collected, analysed, visualised, understood and communicated (Sanches et al 2022). There are ethical and privacy issues to consider. The project aimed to investigate and untangle some of these messy issues in order to build a more representative picture of the role that data plays in the life of the creative practitioner. A key objective was that the project should speak to and for the creative community, so it was critical to harness the creative and artistic skills of the community itself in a collaborative design and exploration process.

As a source of inspiration, the artists were encouraged to consider future scenarios or "imaginaries" as a method to speculate about data. This technique gave permission to decouple from many of the practical issues associated with data and to give a freedom to their imagination as they explored the relationship between data and creative practice. It was hoped that this approach could reveal insights for further discourse and create outputs that would engage a wider public audience in an accessible way. The result was that each of the artists' responses provided an insight to their complex and sometimes very personal relationships with data and how it was seen to reflect their practice.

3.1 The Exhibition Pieces

The five works that comprised the *There Be Dragons* exhibition are described in the following section.

When Do You Give Yourself Away? by Theodore Koterwas

The motivation of this work was to examine aspects of daily experience that often go unnoticed, with a particular focus on data as it relates to the body. The installation took the form of a large screen that displayed coloured patterns and shapes that responded to the pulse and galvanic skin response of people who placed their hands on two pads of medical gel that were attached to the screen (Figure 1).



Figure 1. When Do You Give Yourself Away?

By physically engaging with the work, the artist wanted to explore the idea of "giving away" data and how the normally hidden physiological data could be reimagined as a public performance. The experience was further enhanced through floor-based speakers that literally shook the ground beneath the feet of participants.

The overall effect was that intimate personal data coming from the body was being magnified and displayed in full view. The piece sought to explore how personal data might be externalised and, if personally identifiable, what this might mean for data that is more intimate and internal.

Doing Data by Elke Finkenauer

This response took the form of experimental sculptures that used strategies inspired by data analysis to create physical forms that explored parallels between the worlds of making and data (Figure 2). In essence, the work was a metaphor for data gaps and ways to handle what slips between the cracks of data analysis.



Figure 2. Doing Data sculptures.

Inspired by the idea of data that gets left out or ignored, the practitioner created a database of materials from her studio. One of the categories was “material scraps,” from which items were selected to create a series of configurable sculptures. The processes and materials were documented in infographic sheets as part of the exhibit (Figure 3). At the core of the work was an exploration of tension between data-driven systems and structures, and things that don’t fit.

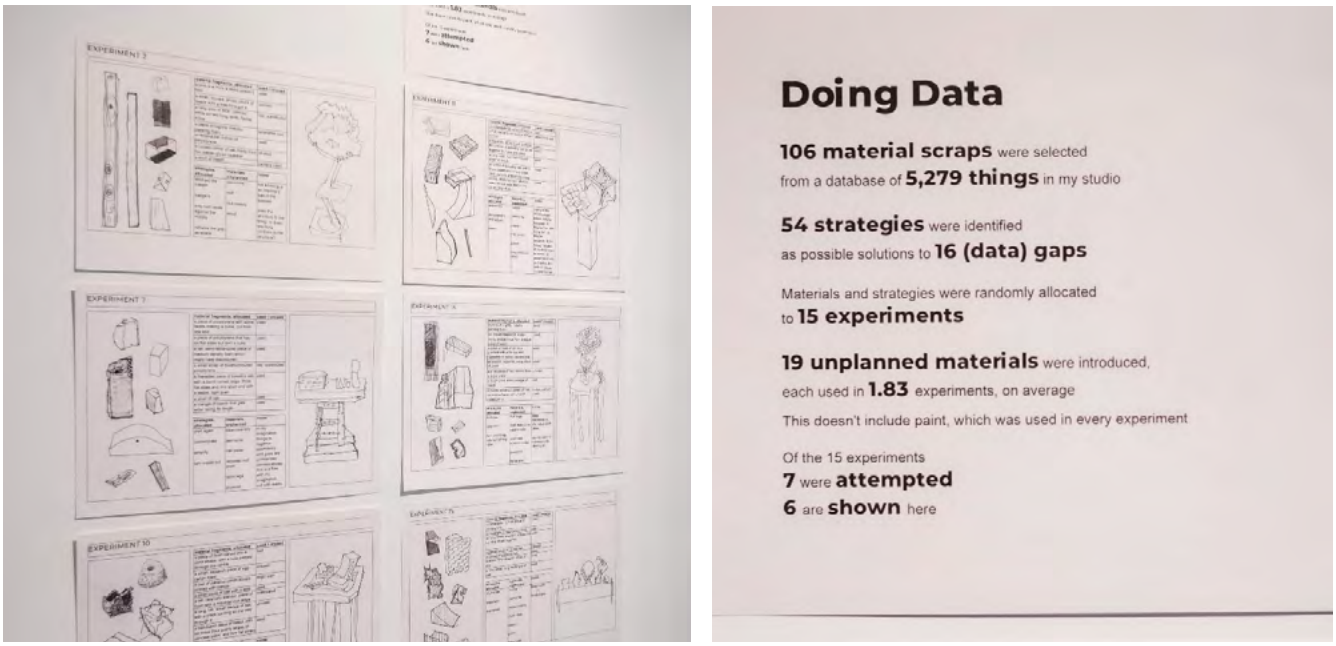


Figure 3. Doing Data Infographic sheet.

Privacy Wizards or Data Thieves? by More Fun With Games, in partnership with Ray Interactive, Cameron Hall and Two Rats Press

Through the use of an interactive walking adventure, this piece explored the idea of personal data and how much participants were willing to reveal of themselves to discover new information. Based on the premise of a “shadow self” that was created by a person's online presence, the setup of the game assigned participants to a character class, either Privacy Wizards – people with relatively data-secure habits – Everyday Rangers in the middle, or Data Thieves – people using services that might detect a lot of their data.

The set-up process engaged participants in a playful dialogue that encouraged them to provide personal information in order to take part in the walking game. This formed the basis of a later conversation about the unknown nature of data that is revealed during the typical sign-up process to a mobile app.



Figure 4. The walking game; Unveiled Edinburgh, part of Privacy Wizards or Data Thieves?

The walking game was called Unveiled Edinburgh (Figure 4) and required the players to engage with the local area, and discovering something, or see something familiar in a new way. Through participation, the piece sought to highlight how people use data to "feed" their digital shadow self, and through the provision of alternatives, the work encouraged discussion of data, privacy and manipulation, together with face-to-face social connection.

Enough is Enough by Amy Dunnachie, Lorna Brown, Lynne Hocking – on behalf of Applied Arts Scotland

This piece was a collaborative, participatory installation laid out on a tabletop grid of tasks and accompanying tactile tokens that were used to indicate specific activities and tasks that reflected the daily work of creative practitioners. The tasks were categories of creative work and revealed the broad range of possibilities associated with creative production. For example, research new materials, share skills, go for a walk, read for fun, do the tax return, meet clients or research exhibition venues (Figure 5).

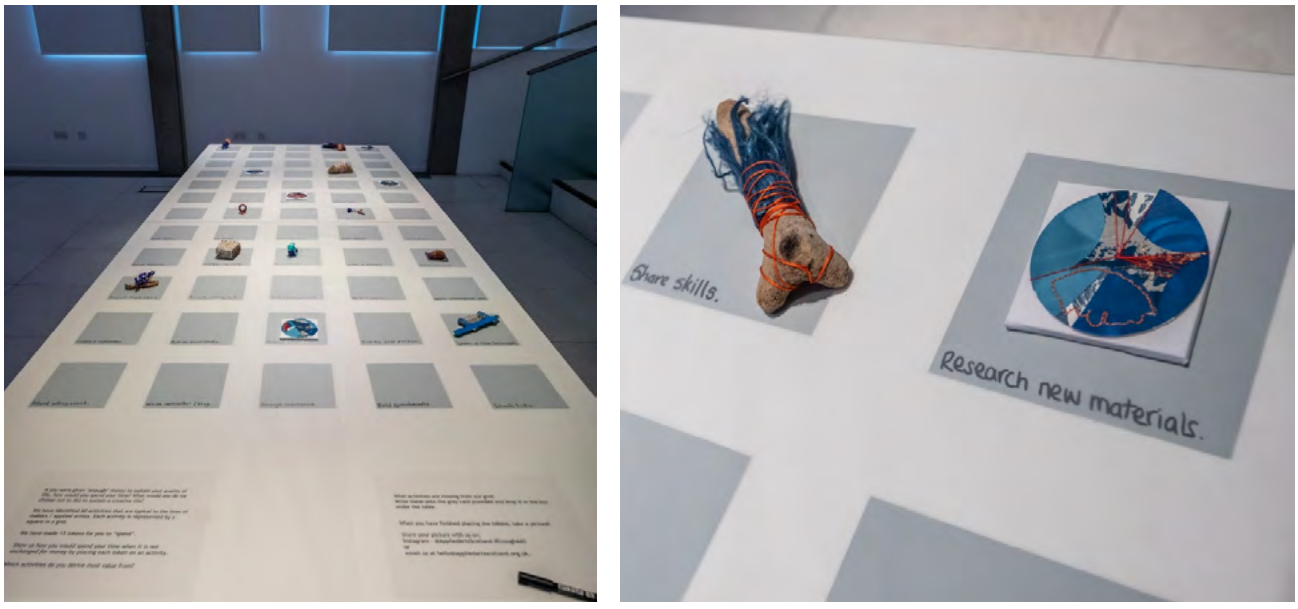


Figure 5. Enough is Enough.

Visitors could place the tokens on the grid of tasks, signalling their affinities and priorities, and creating a shifting picture of contemporary creative practice. The act of selecting categories also acted as an opening of discussion about creative work and livelihoods.

As well as giving a current snapshot of making practice, the installation invited people to think about how creative practice might be different. For example, if you didn't have to think about financial values or income streams, how would your creative choices change? What would be made? How would the values change?

People could add their own tasks and ideas to the grid, so it was also a way to gather data on other people's value systems around being a creative practitioner or running a creative business."

Cloud by Melanie Frances

The piece (Figure 6) was more abstract and consisted of a series of data fragments that revealed multiple narrative threads centering on the operation of a fictitious data cloud. The format acted as both a provocation and a metaphor for how data can mean different things to different people and can be read in different ways by different people. The work sought to find ways of exploring that diversity of viewpoint and the plural nature of data.



Figure 6. Cloud.

4. Picture Your Poisons by Inge Panneels and Caitlin McDonald

This work is distinguished from the previous exhibition pieces in that it was created by two of the authors blending their unique artistic backgrounds as a glassmaker and a mixed-media memoirist to represent unique, highly personalised data about one of the author/artist's cancer treatments. Their prior collaborations on *There Be Dragons* and its sister research project about data used in creative industries policymaking, *Detecting Dark Matter Data,* informed the artists' intentions to use historical medical data in the creation of *Picture Your Poisons,* as well as the subjective, experiential lens that naturally infuses all self-portraiture. The artwork was selected for display as part of a retrospective exhibition organised by Visual Arts Scotland, as well as displayed among works bridging the artificial divides between the arts and sciences in the Edinburgh Science Festival, the UK's largest science festival (Figure 7).

Picture Your Poisons presents an intimate portrait of a cancer treatment journey as experienced by one of the artists. Nearly 1 in 2 people born in the UK in 1961 will be diagnosed with some form of cancer during their lifetime (Cancer Research UK, n.d. a), including one in seven women with breast cancer (Cancer Research UK, n.d. b). The glass casts featured in *Picture Your Poisons* ground viewers in the real-world material origins of systemic anti-cancer treatments through the specific lens of one patient's course of treatment. Each of the six glass casts and one wax mould constituting the artwork represents the substance from which a type of cancer treatment was originally derived in nature, including mouse-derived immune

proteins, yew tree bark, soil bacteria discovered in Tuscany, the elements carbon and platinum, and radioactive energy. These treatments are usually discussed in a clinical context with reference to their bodily effects on the patient, leaving out the rich history of their discovery and development. By materialising each treatment, the casts allow viewers to explore data which is more usually presented in an abstract, clinical context through a striking visual medium that elicits an emotional as well as a cognitive response (Figure 7). The artwork encourages the viewer to explore aspects of the patient experience relating to bodily autonomy, selfhood, and dis/empowerment in medical contexts by confronting them with the disembodied partial body casts of the affected breast.

The difference between medicine and poison is largely one of dosage (Grandjean, 2016). Substances which in one context are deadly (and indeed, used as weapons, such as the mustard gas from which the chemotherapy cyclophosphamide is derived) are also life-saving. *Picture Your Poisons* explores this relationship using glass, a substance of many dualities: brittle yet strong, transparent or opaque, malleable yet firm. Glass is forged in a transformative process of great stresses on the raw materials, and similarly, cancer survivors endure treatments which radically transform their bodies in order to survive.



Figure 7. Picture Your Poisons (Photo by Caitlin McDonald).

5. Discussion and Reflection

5.1 The Question of Data

Data is ubiquitous in the 21st century, we voraciously create and consume it, it can be the driver of innovation and it can replicate the world through digital twinning (Ganguly & Venkatasubramanian, 2022). Data has become a lens through which we view and seek to understand reality. But data is a slippery, shapeshifting material that can take a myriad of forms which makes it challenging to engage with in a critical manner. It hides in plain sight but remains resistant to classification. The reality is that data is never neutral, it is always gathered by stakeholders, for a given purpose using specific tools. This illusion

regarding the neutrality of data has been referred to as the "commodity fiction" of data by Gitelman et al (2013). This idea has been further developed by Sanches et al (2022) who report on the growing body of design research that shows that data is neither immaterial, nor finished but is instead co-produced by many entangled factors including people, context and the sensors, analysis and display techniques employed. It was against this backdrop that the work reported here sought to shed light different forms of data and how that data might best reflect the eclectic nature of creative practice.

6. Emergent Themes

The *There Be Dragons* project offered the authors a particular insight into the production of creative work for public exhibition. The authors set the brief and selected the creative practitioners and while not producing the work themselves, the authors were at the centre of the process and were undoubtedly active agents in shaping the project. The introduction of a curator contributed to the overall coherence of the exhibition and alleviated some of the tensions over adherence to the brief that emerged during the various workshops. An independent writer was also employed in the second half of the production phase to interview each of the creatives in order to better understand their experience of being part of the project. The resulting publication was available during the exhibition (Horne et al, 2023).

While it is acknowledged that this does not constitute an exhaustive or indeed controlled environment, the insights gained from the *There Be Dragons* exhibition, in particular the representation of hidden data, went some way to informing the approach of the authors who created the *Picture Your Poisons* work.

Based on the authors' interpretation, three main themes emerged from the work:

6.1 Theme: Performance and Participation

All of the work described previously was designed to be experienced in a public gallery or exhibition setting. As a way of attracting people, some of the pieces employed an explicitly performative style in terms of how they either represented data or encouraged people to interact with the data, or as a means to reveal hidden data and provoke further discussion.

For example, *When Do You Give Yourself Away?* used abstract colours and sound to represent physiological data that was harvested through physical gel pads which people touched. The abstract nature of the representation actively encouraged exploration through movement as people tried to apply meaning to the data. The performative nature of the work was a natural draw to visitors at the exhibition.

A different perspective on performance was provided by the *Enough is Enough* work. This piece was explicitly designed to be performative where individuals moved counters on a tabletop grid to prioritise the daily work of creative practitioners. The act of making these choices visible acted as a catalyst for discussion and encouraged participation.

Finally, the work entitled *Privacy Wizards or Data Thieves?* adopted a deliberately performative style by incorporating an interactive walking adventure to highlight issues around data privacy. Through the use of a facilitator/guide participants in the adventure were encouraged to discuss how much data about themselves they were willing to provide in order to discover something new by participating in the walk.

6.2 Theme: Rethinking Value

Data is about choices; making selections about what data is gathered and for what purpose, how, where and when it is gathered and by whom. The work of Sanches et al (2022) emphasises these complex entanglements around the gathering of data and builds on the growing body of design research that shows that data is neither immaterial, nor finished but is instead co-produced by many entangled factors

including people, context, and the particular sensors, analysis and display techniques employed. Each of these factors contributes to the value placed on data. This view of data draws from the concept of diffraction as presented by Barad (2007) which prioritises what is referred to as the "entanglement of the apparatus of production".

The work entitled *Doing Data* explicitly interrogated the notion of value attributed to data by focusing on gaps in data, the forgotten or hard to reach data that becomes somehow devalued because of its inaccessibility. By explicitly documenting what was referred to as material scraps, the piece presented five configurable sculptures representing data that would have otherwise been lost. By reasserting the value of these materials, the work sought to demonstrate how the production of data is both a complex and multi-stakeholder endeavour.

6.3 Theme: Representation – making data physical and explicit

The ubiquitous nature of data makes it challenging to pin down and engage with in a critical manner. The approach taken in this paper has been to employ exhibition as a research method from which to explore methods of representing data and in particular how design can address the challenge of revealing the complex and sometimes hidden relationships with data through the making of physical artefacts.

For example, the piece entitled *When do you give yourself away*? translated normally hidden physiological data into abstract colours and sounds that created a performative experience in the exhibition setting. The *Enough is Enough* work encouraged the audience to engage in conversations as they prioritised a series of activities that reflected the daily work of creative practitioners, through locating tokens on a tabletop grid.

Cloud explored the multifaceted nature of data through the use of interconnected narrative fragments that revealed how different people might respond to the ever present nature of data in an imagined future. By exploring that diversity of viewpoint and the plural nature of data the work interrogated how data can mean different things to different people.

The most explicit representation of data that is normally hidden was illustrated in the *Picture Your Poisons* work which used the medium of glass to represent and make visible the treatment of breast cancer. The visualisation of a series of anti-cancer treatments through a series of glass casts and their concomitant labels which mimicked the safety data sheet enclosed in drug packaging, attempted to reveal data that more normally resides in a clinical context and thereby provoke both an emotional and cognitive response in the viewer.

7. Conclusion

This paper presents a description and discussion of two related exhibition projects, together comprising of six individual creative artworks, that addressed the relationship between data and creative practice. The authors' roles in this process were varied; as instigators, curators, researchers, and as creative artists. From this range of perspectives the paper presents our interpretation of the themes that emerged from the exhibited works. It also argues that exhibition production can be a valid and fruitful design research method for interrogating intangible concepts that impact on lived experience. In this case, the act of creative making, and the demands of public exhibition, supported deep reflection on the meaning of data and how it relates to life as a creative practitioner.

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P/REFERENCES OF DESIGN

BEYOND AUTOMATION: AI'S ROLE IN REDEFINING DESIGN PARADIGMS.

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ABSTRACT | AI's ability to process vast data sets, predict trends, and develop innovative solutions makes it experienced and perceived beyond a simple tool, fostering changes in the design domain in both the theoretical framework and practical applications. This paper aims to explore the significant transformation within the design discipline, increasingly influenced by the integration of Artificial Intelligence (AI) in creative processes.

The contribution critically examines the theoretical and methodological challenges brought by AI, particularly regarding generative content creation. Through the analysis of various aspects of AI integration in design – from how AI algorithms are influencing aesthetic choices to their role in automating and enhancing creative processes – the paper discusses the evolving role of the designer in an AI-integrated environment, contemplating the balance between human creativity and machine intelligence.

This contribution aims to discuss AI as a transformative force that is redefining design processes, encouraging designers to embrace new creative challenges and opportunities in the AI era. Through this exploration, the paper aims to contribute to the broader discourse on the evolving relationship between technology and creative industries, particularly focusing on the dynamic interplay between AI and design.

1. Introduction

Digital technologies permeate every layer of society, mediating interactions between subjects and objects, thereby accelerating a profound transformation of the world, which necessitates a new ontological and epistemological framework across various disciplines (Dufva & Dufva, 2019; Kraus et al., 2021). Enabling technologies, brought by digital transformation (DX), are embedded in creative and business processes, intervening in producing value across numerous human activities, with design, production, and consumption processes directly implicated. The necessity for design to recognise the interdependence between humans and their surrounding environment, encompassing natural, artificial, and digital entities becomes crucial in the era of digital transformation (Escobar, 2018; Forlano, 2017; Irwin, 2015). Design must address the challenge of harmonising technology with the global ecosystem, acknowledging that this transformation is deeply rooted in physical, ecological, and social contexts. It is increasingly important to consider the ethical and environmental impacts of activities, as well as technological innovations.
As early as the first decade of the new millennium, Sellen, Rogers, Harper, and Rodden (2009) reflected on emerging paradigms in human interaction with technology, reshaping the boundaries between computers, individuals, and artifacts. The advent of intelligent networks has amplified this dynamic, with non-human entities assuming an increasingly active role in decision-making processes, establishing a symbiotic relationship where humans and software operate collaboratively.

Artificial Intelligence (AI) stands out as one of the most powerful and discussed technological innovations in our era, particularly regarding its potential impact on creative processes (Lubart, 2005; Daniele & Song, 2019; Fujita, 2018; Mazzone & Elgammal, 2019), and the ensuing ethical implications. AI is increasingly permeating design professions due to its proficiency in executing repetitive or challenging tasks for humans, such as analysing and extracting big data, forecasting outcomes, and even generating new content (Anantrasirichai & Bull, 2022).

Recently, innovative tools have utilised Generative Adversarial Networks (GANs) to generate new, previously unseen data that learn from and *creatively* use existing data to generate new outputs, significantly influencing the creative stages. These tools are not merely facilitative; they are transformative, offering the potential to reshape methodologies and processes within design and manufacturing, pushing pivotal questions concerning AI's capacity to shape creativity, creation processes, product development, and the audience's engagement with creative activity (Daniele & Song, 2019; Miller, 2020). Despite the undeniable impact of these powerful technologies on numerous human activities, there are also many misconceptions about AI that are perpetuated through the choice of wording, imagery, or analogy (Kurenkov, 2019).

AI is deeply rooted in the data revolution (Tedeschi & Lombardi, 2018) and anchored to mathematical-logical structures that underpin its ability to process, analyse, and interpret vast volumes of data efficiently. Mathematics provides the foundational structures for AI algorithms, while machine learning and neural networks utilise advanced calculations to 'learn' and improve. Concurrently, logic plays a crucial role in AI decision-making, allowing it to evaluate information, recognise patterns, and make choices based on well-defined criteria (Esling & Devis, 2020). Hence, introducing AI in the design domain can expand creative opportunities while introducing new ethical and methodological challenges (Verganti et al., 2020; Weisz et al., 2023), rewriting the relationship between design and mathematics, and between design and computational geometry.

This scenario transcends mere process automation, fostering multidimensional collaboration to explore previously inaccessible domains. It leads to behavioral models no longer confined to human-computer interaction but evolving into human-computer integration (Farooq & Grudin, 2016), a trajectory that envisions a partnership between humans and computers in the context of AI, meriting holistic consideration. In such a context, Artificial Intelligence (AI) emerges as a powerful catalyst for transformation, profoundly influencing socio-cultural, political, and economic dynamics in the contemporary evolution of design. The design field is facing the need to re-examine its foundations in terms of roles, functions, and approaches, and to weave new disciplinary relationships (Ozmen Garibay et

al, 2023). AI's ability to process vast data sets, predict trends, and develop innovative solutions fosters changes in the design domain in both the theoretical framework and practical applications. Particularly, the advancement in image and morphology generation through generative algorithms enables the creation of high-quality, realistic content in very condensed time frames, thus broadening the scope of creative possibilities while presenting significant ethical and methodological challenges.

This paper aims to critically examine the theoretical and methodological challenges brought by AI, particularly regarding generative content creation. It navigates through various aspects of AI integration in design, from how AI algorithms are influencing aesthetic choices to their role in automating and enhancing creative processes. It discusses the evolving role of the designer in an AI-integrated environment, contemplating the balance between human creativity and machine intelligence. Additionally, the paper investigates the ethical and practical implications of AI in design, addressing how AI-driven design approaches are reshaping expectations and redefining standards. Through this exploration, the paper aims to contribute to the broader discourse on the evolving relationship between technology and creative industries, particularly focusing on the dynamic interplay between AI and design.

2. Designing with AI

As the design discipline dynamically co-evolves with technological and societal shifts, experimentation with AI algorithms catalyses a substantial paradigmatic shift (Kuhn, 1962), offering unprecedented capabilities in exploring novel design possibilities (Daniele & Song, 2019; Fujita, 2018). AI is not a single entity, but rather a set of techniques and ideas (Kurenkov, 2019). It embodies a diverse spectrum of technologies and methodologies that can facilitate the creation of efficient solutions (Abd Aziz et al., 2021) and potentially enhance the design process, improving both the quality and functionality of design outputs (Thompson et al., 2016; Xiong et al., 2019).

New tools enabled by AI can invest both the input (design-management-control methods), as well as the output (product performances and meanings) of design processes, potentially revolutionising the way designers approach their work, offering the ability to verify and simulate various design scenarios. This advancement allows designers to predict outcomes and assess the feasibility of their ideas with greater accuracy than ever before. This not only streamlines the design process but also opens up new avenues for creative exploration, changing the way design innovates and delivers value (Magistretti et al. 2019). As AI progressively permeates daily activities, designers are prompted to explore the challenges of working with AI 'as a new design material' (Holmquist, 2018; Dove et al., 2017; Yildirim et al., 2022), considering AI not only as a tool or technology but as an integrated component of the creative process, a perspective that brings with it specific anomalies and opportunities. For instance, AI-driven tools can simulate the environmental impacts of in-progress designs, a capability that aligns with the growing need for sustainable design practices. They can also model user interactions, thereby enhancing user experience design, and evaluate the long-term sustainability of a design, ensuring that products are both environmentally and economically viable in their lifecycle.

AI has reached a significant level of maturity, both as a scientific discipline and as a technology. In recent years, a growing number of studies have focused on examining the challenges, benefits, and potential impacts of AI in achieving the Sustainable Development Goals (Goralski & Tan, 2020; Truby, 2020; Vinuesa et al., 2020). In this regard, the environmental impact of training AI models, particularly large-scale ones, has become a prominent concern (Nishant et al., 2020). The process of developing advanced AI systems, which involves extensive computational power and data processing, results in significant carbon emissions (Wu et al., 2022). This environmental cost raises critical questions about the sustainability of current AI practices (van Wynsberghe, 2021), especially as the demand for more sophisticated and larger models grows.

The integration of AI into design processes has the potential to radically transform the discipline, bringing significant changes across three main key areas:

1. Streamlined Prototyping and Simulation: The advent of AI is redefining design processes, allowing for ultra-rapid prototyping, real-time testing, and fast refinement of design concepts. AI's ability to quickly analyse and simulate various scenarios can enable designers to explore different kinds of proposals and iterate designs in real-time, significantly accelerating the design development process and enhancing its adaptability to changing requirements and user feedback.
2. Enhanced Customisation and Predictive Capabilities: AI's proficiency in dissecting and interpreting user data leads to unprecedented levels of personalisation, allowing designs to be precisely tailored to individual user profiles. Furthermore, AI's predictive abilities equip designers to not only address current trends but also anticipate future developments, thereby future-proofing design outputs.
3. Collaborative Dynamics in Human-AI Interaction: The relationship between human designers and AI systems is evolving into a synergistic partnership. AI's computational strength in processing and analysing large data sets offers insights and perspectives that can - to some extent - augment human creativity. This collaboration has the chance to expand the realm of creative possibilities, enhances problem-solving, and facilitates informed decision-making, merging human intuition with AI's analytical strength.

Despite this shift burgeons unprecedented creative opportunities, it concurrently unveils fundamental challenges (Verganti et al., 2020; Weisz et al., 2023) concerning potential impact on creative and cultural products, which are not simply consumer goods but they act as genuine devices of symbolic and cultural mediation (Branzi, 2007; Kubler, 2008). With AI in creative processes, these products are now being shaped by or within any potential AI's bias and perspectives.

Indeed, the literature widely acknowledges that digital technologies like AI have agency, this means that they transform, translate, distort, and modify the meaning of elements they are supposed to carry (Latour, 2007). In addition, ethical data management, bias mitigation (Harrison et al., 2019; Ntoutsi et al., 2020; Siau & Wang, 2020) and decision-making transparency, as well as designers' role as involuntary and often unwitting 'trainers' of 'learning machines' will probably have a profound impact on the future of design practice. This evolution in design, where the underlying rules and algorithms take precedence over the creation of artifacts, signifies a profound departure from the conventional paradigm of computer-aided design to a realm of digitally mediated design. The implications of this transition are multifaceted and far-reaching. Designers are now required to engage with the complex and often opaque algorithms that drive AI-based tools. This necessitates a deeper understanding of AI technologies, not just as instruments of efficiency or creativity but as active agents that can shape the outcome of the design process in significant ways. This recalls an expansion in the skill sets required for design professionals, with a comprehensive understanding of AI, data analytics, and programming. These skills are essential for effective interaction with AI systems and for leveraging AI-driven insights in the design process. This new dynamic challenges designers to maintain a balance between their creative intuition and the data-driven insights provided by AI. It requires a nuanced understanding of how AI processes and interprets data, and an awareness of how these interpretations can influence design outcomes.

Furthermore, this transition brings to the forefront the broader ethical and cultural implications of design work that need further investigation. In the realm of this contribution, it is important to highlight that systems are fed with data that may carry inherent biases, designers with AI should be (and know how to be) vigilant about the potential for these biases to be reflected in their designs. This raises ethical questions about representation, inclusivity, and the societal impact of design.

In summary, the shift to a digitally mediated design process redefines the essence of design practice. It requires designers to be interpreters and custodians of the complex interplay between human creativity and machine intelligence. This paradigm shift presents an opportunity for designers to explore new creative frontiers, while also imposing a responsibility to ensure that their work remains ethical, culturally sensitive, and socially responsible in an increasingly AI-driven world.

3. Changes and Challenges

The shift from traditional and human-centric design processes to digitally mediated and algorithmically-driven practices demands a critical exploration into the role, value, and nature of human thought, creativity, and ethical considerations within the AI-augmented design landscape. Following this streamline, recent studies in the creative research field, highlight the profound impact of AI on creativity, transforming its five core elements: actor, process, outcome, domain, and space (Wingström et al., 2023). With AI's integration, actors now include both humans and machines; processes are influenced by algorithms; outcomes merge human and AI contributions; domains extend into digital realms; and creative spaces blend the physical with the virtual. In essence, AI is becoming a partner, an extension, a material, and a medium, reshaping the very essence of creative practices (Särmäkari & Vänskä, 2022).

In the 'traditional' design process, creativity dynamically emerges, often marked by 'creative leaps' that transition ideas from conception to realisation (Dorst & Cross, 2001). Designers explore possibilities through iterative sketching, prototyping, and refinement, navigating various solution pathways and overcoming creativity obstacles (Boden, 2004; Cross, 2006; McKelvey & Munslow, 2011; Hopkins, 2021). Moreover, scholars acknowledge that 'traditional' design approaches are deeply rooted in human intuition and experience (Cross, 2004; Lawson & Dorst, 2013; Särmäkari, 2021; Bruce et al., 2002), and the ability to envision beyond the tangible and the explicit through tacit and technical knowledge. Despite its advanced capabilities, AI still lacks essential elements of creativity, such as intention, motivation, self-assessment, and the capacity to interpret outcomes or discern innovation (Davis, 2013; Aoki, 2021; Mitchell et al., 2019). This brings forth the intricate debate surrounding consciousness and whether AI can genuinely manifest it. However, it is essential to note that AI does not necessarily need to be 'intelligent' to contribute to the creative process. Design can still uncover novel and intriguing possibilities through collaboration with AI. This perspective aligns with posthumanist theories, where the creative product is a joint endeavour, co-constructed through the symbiotic interaction between design and AI (Ihde, 1990; Latour, 2013; Rose, 2017).

Hence, while it is not possible to decelerate technological advancement, comprehending it becomes crucial to navigating it in orientation. It is significant, thereby, harnessing the potential of AI to enhance, rather than undermine, the cultural and creative processes intrinsic to design practices. This means recognising the growing influence of the tech-computational domain, advocating collaboration over replacement, studying processes and establishing frameworks that steer technology integration in an informed, ethical manner and are aware of its broader impacts, especially in domains intersecting with cultural and social identity, such as design (Symbola Foundation, 2023).

Those challenges underscore the significance of multidisciplinary collaboration in tackling a multifaceted issue that instigates ontological and epistemological reorientations. The burgeoning weight characterised by the technological-computational realm also envelops the sphere of problem-solving, increasingly entrusted to AI, data, and computational capacity. Consequently, it becomes crucial to embrace the transformation through disciplinary collaboration between the mathematical-computational and design fields to address various emerging questions in this new scenario, which pushes the question: 'What kind of thinking is left to humans in innovation?' (Verganti et al., 2020, p. 224).

3.1 Human-Centricity vs. Algorithmic Design

The integration of AI into design practices marks a significant transition from human-centricity to algorithmic design, a change that presents a wide array of ethical and social challenges. This shift is not merely about adopting new technologies but fundamentally rethinking the design process itself. Design approaches, which have predominantly centred around human intuition, experience, and creativity, are now evolving to incorporate algorithmically-driven methodologies that leverage AI's computational power.

This pivotal shift necessitates a deep dive into several critical areas. First and foremost among these is the ethical management of data. As AI systems rely heavily on data for learning and decision-making, the integrity and fairness of this data become paramount. This recalls the works of Harrison et al. (2019),

Ntoutsi et al. (2020), and Siau & Wang (2020), who pointed out the importance of bias mitigation in AI systems. The risk of AI inheriting and amplifying existing biases present in the data is a significant issue, which, if unaddressed, can lead to skewed and unfair outcomes.

Additionally, the transparency of decision-making in AI-driven design is a crucial concern. As design processes become more reliant on algorithms, understanding the rationale behind AI-generated decisions is essential. This transparency is not only important for the designers to retain control over the design process but also for end-users and stakeholders who need to trust and understand the products created through these methods. As AI takes on more responsibilities in the design process, there is a risk of underestimating the unique qualities that human designers bring to the table like empathy, contextual understanding, and creative intuition that are, as of yet, beyond the reach of AI.

In essence, the integration of AI into design practices is not just about harnessing a new set of tools; it is about striking a balance between the efficiency and capabilities of AI and the irreplaceable value of human insight and creativity. This balance is crucial in maintaining the integrity, ethicality, and quality of design in an age increasingly influenced by algorithmic methodologies.

3.2 Integrating AI in Design Cultures

While the role of AI is prominent in the industrialisation phases of design production processes, its application in the ideational and creative phases remains less explored. This expansion of AI's application requires a careful examination of its potential to contribute to every stage of the design process, acknowledging that AI can offer more than just efficiency and automation and recognising that every stage of the design process is potentially computable.

One of the critical areas in this exploration is understanding the impact of AI on authorship in design. As AI systems can generate design elements autonomously, questions arise about the originality and ownership of such creations. This challenge necessitates a redefinition of authorship in the context of AI-generated content, where the role of the designer may shift from being the sole creator to a curator or editor of AI-generated options. Copyright issues also emerge as AI becomes more involved in creative processes. The legal framework surrounding AI-generated content is still evolving, and there's a need for clarity on how copyright laws apply to designs partially or wholly created by AI (Pasa, 2023). This area requires ongoing dialogue among legal experts, designers, and technologists to establish clear guidelines and standards. Furthermore, the agency of AI in design, where AI systems make decisions or suggest design alternatives, poses a challenge. This situation calls for a balance between leveraging AI's computational power and maintaining the designer's creative control and judgment. It involves understanding and setting the appropriate boundaries for AI's role in the design process, ensuring that AI acts as an enhancer of human creativity rather than a replacement.

Integrating AI into design cultures is not just about adopting a new set of tools; it's about navigating a complex landscape of ethical, legal, and creative challenges. It requires designers to adapt and develop new ways of working, where AI is a collaborator that brings computational power to the creative process, but human creativity, judgement, and ethical considerations remain at the forefront.

3.3 Avoiding the AI Black Box

Addressing the issue of the AI Black Box is critical in the context of design practices. The term 'AI Black Box' refers to situations where the decision-making process of AI systems is opaque (Castelvecchi, 2016; von Eschenbach, 2021), leading to a lack of transparency and understanding about how AI algorithms arrive at certain conclusions or design solutions. This opacity can be problematic, particularly in fields like design, where the rationale behind each decision can significantly impact the final product.

To navigate and mitigate the challenges posed by the AI Black Box, it's essential to prioritise the development and use of AI systems that are transparent and interpretable. This means designing AI

algorithms in a way that their decision-making processes can be easily understood and explained, not just by AI specialists but also by designers and stakeholders involved in the design process. Transparency in AI facilitates a more collaborative and trustful relationship between human designers and AI systems, ensuring that AI is a tool that enhances, rather than obscures, the creative process. One approach to avoiding the AI Black Box in design is to implement explainable AI (XAI). XAI refers to techniques and methods that make the outputs of AI systems more understandable to humans. This involves creating AI systems that can provide understandable reasons for their decisions or suggestions, allowing designers to make informed choices about whether to follow these suggestions or take a different path. Moreover, as anticipated, avoiding the AI Black Box also involves educating designers about the basics of AI and machine learning. By understanding how AI systems learn, process data, and make decisions, designers can better anticipate and interpret the outputs of these systems. This knowledge is crucial for effectively integrating AI into the design process in a way that is both productive and responsible.

Furthermore, there is a need for continuous monitoring and evaluation of AI systems to ensure that they function as intended and do not inadvertently introduce biases or errors into the design process. Regular audits and updates can help in identifying and correcting any issues that arise, maintaining the integrity and reliability of AI-assisted design processes.

4. Conclusions

The integration of Artificial Intelligence (AI) into the design discipline marks a significant paradigm shift, bringing forth complex challenges and new opportunities. As we delve deeper into this era of digital transformation, the relationship between human creativity and algorithmic processes becomes increasingly intertwined, necessitating continuous study and adaptation.

The evolving dynamics of human-AI interaction in design highlight a transformative shift from traditional, human-centric methodologies to more algorithmically driven practices. This transition is not just about harnessing a new set of tools; it represents a fundamental rethinking of the design process itself. It demands a critical exploration into the ethical management of data, bias mitigation, and decision-making transparency. These aspects are crucial in maintaining the integrity and authenticity of design outputs in an increasingly AI-dominated landscape. It is evident that the technical possibilities offered by computational technologies have consequences beyond the technical area. They intervene in thoughts, approaches, and generation of ideas determining new ways of defining things and their relations. Hence, AI intervenes substantially in the methods and tools to 'make' artifacts, i.e. on the entire design process, raising critical questions about the ways design designs (Giaccardi & Redstrom, 2020).

Moreover, the necessity to continue studying this integration is crucial. As AI technologies evolve, so too must our understanding and methodologies. The field of design must embrace this change, fostering an environment where AI is not seen as a replacement for human creativity but as a collaborator that enhances and expands creative possibilities. This requires a balance, ensuring that AI's computational power is harmonised with human intuition and creativity.

Educational and professional frameworks within the design discipline must evolve to accommodate these changes. This includes integrating AI literacy into design curricula and professional development programs, ensuring that upcoming generations of designers are equipped to navigate this new landscape. Additionally, interdisciplinary collaboration becomes vital, bringing together expertise from fields such as computer science, cognitive psychology, and ethics to address the multifaceted nature of AI in design. Furthermore, the ethical and cultural implications of AI integration in design need continuous scrutiny. As AI systems increasingly influence the creative process, it becomes essential to ensure that these technologies are used responsibly, respecting cultural diversity and social values.

Hence, the journey of integrating AI into design is ongoing and dynamic. It presents a world of possibilities, redefining the essence of creativity and innovation in the design field. However, it also poses significant challenges that must be thoughtfully addressed. In fact, despite the suggestive more-than-human

experiences provided by AI, we are still experimenting with it, often producing risky, concerning, and undesired results (Taddeo & Floridi, 2018). The future of design in the AI era is not just about technological advancement; it's about shaping a future where technology enhances human creativity in ethical, responsible, and culturally sensitive ways.

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P/REFERENCES OF DESIGN

POST-CADASTRAL DETERMINISM: UNRAVELLING URBAN CARTOGRAPHIES, VALUATION, BEHAVIOUR AND DECISION-MAKING IN REALTIME.

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ABSTRACT | The contemporary urban landscape delineates a departure from traditional descriptors and historic anchors, propelled by a confluence of pervasive distributed digital systems. The entanglement of the spatial internet, Web3, APIs, digital twins, real-time data, and analogous platform technologies is pivotal, enmeshing, and orchestrating interactions within urban domains. The influence of network technologies ripples across multifaceted dimensions, shaping navigation, mobility, and service provisioning.

Recursive feedback mechanisms and algorithms such as ratings, reviews, suggestions, and recommendations collectively catalyse the attention economy and choice architectures through categorising individual preferences. It is an emergent landscape where the technological infrastructures permeate, not just as tools, but as mediums intertwining with the fabric of societal existence, cultural expression, and urban architecture.

The 'Post-Cadastral' condition establishes and explores a domain of urban and architectural invention – a city's imminent escape from cadastral space, embracing virtual realms and digital ubiquity. It is concerned with the hyper-reality of virtual space as mooring of invisible cultural, economic, and societal forces. The domain of research operates at limits of material and spatial practice, integrating the physical, the virtual and holographic; and engaging with real-time, urban data analytics, simulation, gamification, techno-cultural discourse and narrative, AI, and generative techniques.

The research explores the convergence of augmented urban infrastructures and services, delineating the interwoven threads of value generation (value capture), behavioural shifts, and performance metrics. It unpacks the emergent paradigm where cities, unleashed from historical cartographic constraints, traverse fluid territories shaped by the synergistic forces of digital evaluations and algorithmic orchestration. In this epochal shift, urban spaces transmute into arenas where cadastral limitations yield to an amorphous terrain of digital augmentation and evolving spatial imaginaries.

This paper scrutinizes the intricate interplay of web-centric reviews, ratings, comments, and AI-driven algorithms that organise a departure from conventional urban spatiality – a city abstracted by search terms and contained in the comments sections and sorted by popularity. Delving into this labyrinth, it dissects the convergence of diverse valuation systems, nuanced behavioural patterns, and algorithmically mediated decision-making processes, illuminating the evolving dynamics within contemporary urban environments.

Through projects, bespoke workflows, and methodologies, its objective resides in rendering discernible precise pathways wherein technological transitions become etched within the urban continuum, consequently integrated within the realms of architectural practice.

1. Introduction

The contemporary urban condition and by extension the future proposition for cities is underpinned by elaborate frameworks. Urban landscapes manifest across the boundaries of its instruments and mechanisms. The thresholds between the physical and digital experiences dissolve and architectural sequences intertwine. There is a reverberation brought about by the permeation and inundation of the systems of the city with data and information. This resonance manifests as a chaotic haze, information swirling through the cityscape. Here, the city transcends its mere physicality to embody a dynamic amalgamation of technological, socio-cultural, and political forces, where the amalgamation of data smudges merges seamlessly with the everyday artifacts of human existence.

Embedded within this realm is the essence of the city, extending beyond its tangible structures to encompass the digital fabric interlaced with comment sections, drop-down menus, and the nuanced expressions of approval or aversion evident in reviews, subscriptions, likes, and dislikes. Within this digitized landscape, the urban environment is meticulously organized according to metrics of "relevance" or "popularity," wherein virtual registers methodically decode our behaviours, anticipate our inclinations, and prompt our actions.

The orchestration of daily life, whether within public thoroughfares or private domains, is governed by these virtual entities, guiding individuals through endless feed interfaces, spinning pull-wheels, and incessant scrolling. Algorithms wield significant influence, systematically categorizing the city's amenities and services through recursive processes. However, amid this relentless structuring, the efficacy of the city is not solely defined by its ability to prioritize but also by its capacity to overlook, all under the guise of an architecture of promotional content.

The physical manifestation of the city extends beyond the confines of handheld devices; its infrastructures and amenities intricately interconnect within platform applications and social media platforms, directing behaviour towards predetermined patterns. Within this milieu, the city's potential to facilitate human interaction is scrutinized, as desires are perpetually stimulated, and every manifestation of excess is fervently pursued.

Within this urban ecosystem, the city's devices propagate memes, and its desires seamlessly intertwine with those of its inhabitants, blurring the boundaries between the city's aspirations and individual yearnings.

2. Devices, Instruments, Mechanisms

The subsequent discourse endeavours to dissect and contemplate, both theoretically and concurrently, the interaction between market mechanisms and the instrumental domain of urban architecture, envisaging a tangible practice that is stimulated, calibrated, and sustained by the operations and endeavours of the market.

The city grid serves as a fundamental descriptor of architectural experimentation and consensus. Although the grid was not expressly devised by the market, its patronage ensures that the architectural discourse is influenced by its medium. Market forces and urban architecture exhibit a symbiotic relationship through their logics, patterns, and approximations. Architecture not only occupies property but also serves as an instrument of the property itself, representing a spectrum of specificity encompassing the tools, techniques, and mechanisms employed in realizing objective realities. Urban structures function as relentless agents that delineate and conceptualize the contingent nexus between production and consumption, imparting material, and spatial syntax to formlessness. Architectural devices serve as a language and capability for abstraction to facilitate comprehension.

This confluence between regulation and governance epitomizes architecture as the vessel for socio-political ideals. In the convergence of the market and architecture, abstraction emerges as both a utility and a domain of value. Instruments and mechanisms facilitate the integration of policy and market dynamics within a flexible framework. Architecture embodies the tangible manifestations of both the real and the abstract. The grid, famously described by Rem Koolhaas as the device "that renders the history of architecture and all prior urban lessons irrelevant," (Koolhaas, 1994) not only instigates a novel system of formal values but also provides a rigorous platform and discipline for speculation, both architectural and economic.

Robert Hoddle's Melbourne grid, characterized by minimal allocation of open space, aligns with the maximizing and totalizing influence of market dynamics. Market forces within cities are intertwined with a marketplace of technological instruments, concurrently technical and social in nature. In its current iteration, technology assumes the role of a social institution, with platform technologies and peer-to-peer economies reshaping traditional hierarchical relationships between governing bodies and citizens, disrupting social and civic enterprises.

Architecture's capacity to influence the organization of social activities is inherently connected to its precision in encompassing, accentuating, and imparting precise vocabulary to the organization of economic and market activities. With the advent of distributed technologies, this capacity becomes diffused across a landscape of cumulative individualization, characterized by choice architectures. The current market, shaped by various assemblages and obscurities, emphasizes the contrast between individual and collective elements. Within this construct of connections and activities, the continuum or flow is punctuated by the density and intensity of activities. Devices and apparatuses encapsulate human dispositions, with user data emerging as a commodity in the experience economy, serving as a transactional conduit between the market and the architectural fabric of the city, represented through virtual avatars and physical proxies.

The expansive realm of various technological ecosystems reshapes the dynamics and subtleties of agency, underscoring the asymmetric impact of human dispositions in compelling market actions. The French term "agencement," as expounded by Callon and McFall, underscores the inseparability of agencies and arrangements, encompassing everything from tools and equipment to statements and instructions. (McFall, 2009)

The role of architecture extends beyond mere categorization, rationalization, operationalization, or optimization; rather, it encompasses a fusion of these roles while aspiring to transcend them optimistically. Beneath the surface of marketing strategies lies a deeper inquiry into the potential of architectural mechanisms. Can these mechanisms not only realize inherent potentials but also provoke unforeseen patterns and behaviours beyond their intended purposes? How might architecture push the boundaries of innovation by leveraging keen observations and the nuanced workings of its mechanisms? These questions invite a deeper exploration into the transformative drive of architectural design and its impact on shaping environments and experiences.

3. Cadastral

A cadastre conventionally systematizes the spatial management of land parcels intertwined with supplementary narratives articulating the intricacies of these interests. It extends to include the custodianship or supervision, and often, the appraisal of the parcel and its accompanying enhancements. The establishment of the system sets in motion a sequence of diverse objectives. These objectives encompass fiscal ambitions, including property valuation and taxation. Legal aspirations are also integral, aiming to streamline conveyancing procedures. Furthermore, the system aims to facilitate effective land governance and utilization, especially within planning and administrative frameworks. Additionally, it seeks to nurture sustainable development and environmental stewardship. (International Federation of Surveyors, 2019) A cadastre constitutes a parcel-centric, contemporaneous arrangement of land data, encompassing an exhaustive ledger of vested interests in land, including entitlements, encumbrances, and responsibilities.

At the core of a cadastre is the foundational element of the cadastral plan. Each genesis of a new land parcel necessitates the creation of a fresh cadastral plan, rendering each iteration a snapshot frozen in time. These plans, immutable in their depiction, encapsulate the contours and conditions of the cadastre at the moment of survey. (Intergovernmental Committee on Surveying and Mapping, 2020)

4. Atemporality

The urban landscape is a perpetually shifting entity, a dynamic proscenium where the perception and legibility is recast consecutively. Its essence is not fixed; instead, it undergoes constant constitution and reconstitution. Every moment sees the city's fabric being stretched and moulded by the movement, clashes, logistics, and the myriad operations of its users, stakeholders, and infrastructural networks.

Further accelerating the patterns of perpetual transformation is the subjective concept of 'extreme present'—an abstract, hyperbolized rendition of the 'now'. This extreme present is a juncture where the collective consciousness grapples with an inundation of rapid changes spanning societal structures, data velocity, architectural assemblages, environmental narratives, and the very fabric of reality itself. It exists in the interstices between a past continuously accessed and repurposed, a 'now' disseminated and archived across digital platforms, and futures already set in motion.

Here, time behaves nonlinearly, defying conventional linear trajectories. The extreme present accelerates the possibilities inherent in any given moment, mutating the present into an intense yet elusive state. It defies direct (static) temporal correlations. This particular dynamic of the organization, reaction and expectation of the city, sits in stark contrast to the established frameworks of urban planning and indeed statutory planning or the instruments of the cadastre and surveys.

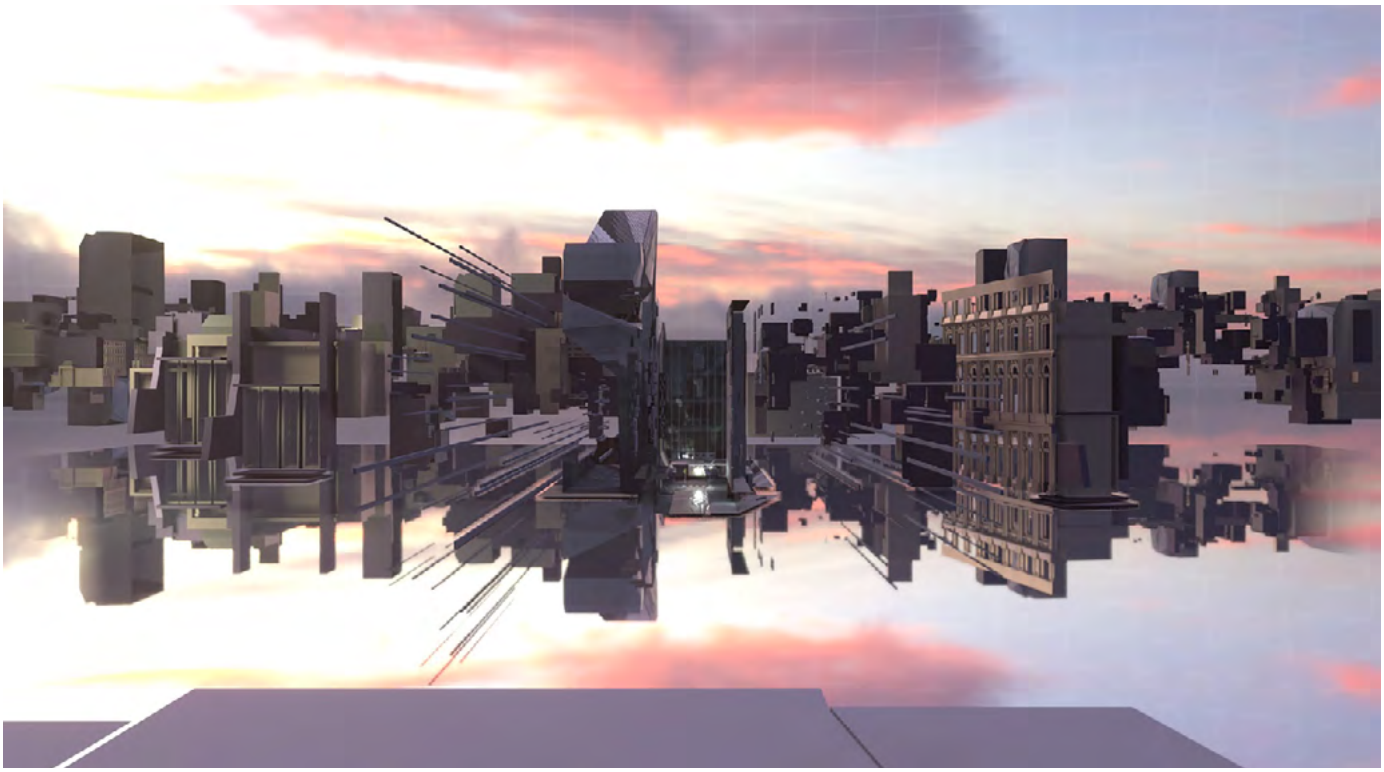


Figure 1. Shapeshifting, transiting between the physical and the virtual, and escaping cadastral space. Image: Kevin Gao with Ian Nazareth and David Schwarzman.

5. Post-Cadastral

The ‘Post-Cadastral’ paradigm speculates about the unfolding of a disruptive dynamic sequence, where cities emancipate themselves from the traditional cartographic and cadastral boundaries. It explores the conceptual terrain of a virtual city, enabled by platform technologies, real time data and digital ubiquity. Of specific interest is the exploration and conceptualisation of the intricacies of these hyper-realities, where the intangible yet potent forces of culture, economy, and society converge within the boundless expanse of virtual space.

Positioned at the edge of material and spatial exploration, the research aims to seamlessly intertwine the tangible with the intangible, bridging the physical, virtual, and holographic dimensions of urban existence. Immersed within this multidimensional framework, the research traverses the fringes of real-time urban data analytics, navigating through the intricate landscapes of simulation, gamification, techno-cultural discourse, artificial intelligence, and generative techniques.

The body of work also engages with a critical examination of the nodes between augmented urban infrastructures and services—a confluence wherein the processes of value generation and capture, behavioural shifts, and performance metrics converge and intertwine. (Nazareth, 2023) Through meticulous dissection, it presents a burgeoning paradigm where cities, unshackled from the confines of historical cartography, embark upon fluid trajectories sculpted by the symbiotic interplay of digital assessments and algorithmic arrangement and orchestration.

In this metamorphosis, urban landscapes cease to be mere static entities confined by cadastral boundaries; instead, they evolve into dynamic arenas pulsating with digital augmentation and evolving spatial imaginaries. As cadastral limitations dissolve, a new paradigm of urban possibility emerges—an amorphous landscape where the boundaries between the physical and the virtual blur, giving rise to a realm of potential and innovation across multi-disciplinary interests and concerns.

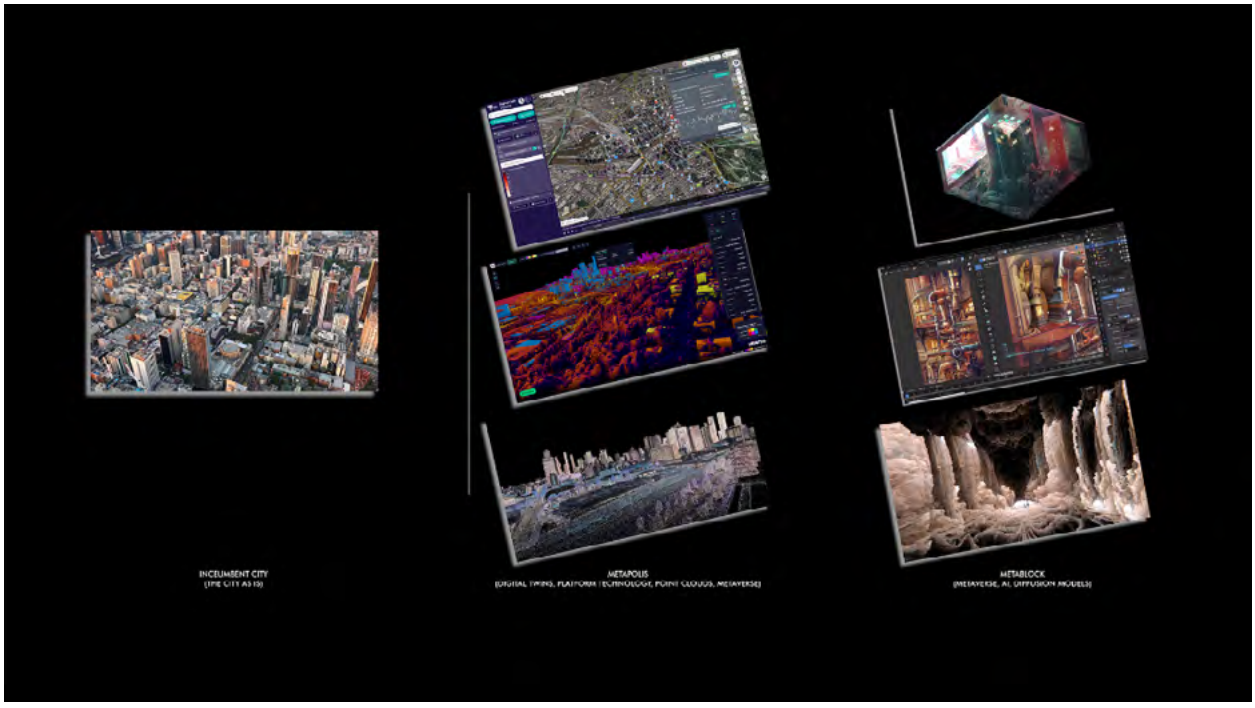


Figure 2. Conceptual platform – (i) the incumbent city (the city as is), (ii) the Metapolis – that connects smart city platform technology, digital twins, real-time analytics, APIs and (iii) the Metablock that builds on the data models of the Metapolis to reconstitute a city block in the open metaverse, spatialized through AI diffusion model and search terms. Image: Ian Nazareth. (The diagram also includes images from HEAVY.AI, NVIDIA Omniverse and City of Melbourne LIDAR Point Cloud Data.)

6. Clayton – Between the Algorithmic Yoke

The subsequent projects are located in Clayton, a suburb 18km southeast of Melbourne CBD, in Australia. Clayton, for purposes of the project is a laboratory for speculations and counterfactual propositions of its urbanism, through harvesting its meta data and locational information. Presently, Clayton is defined as much by the density of exchange as by the relationships between the post-industrial fabric and the suburban intensification projects. It sits within a field of intersections and entanglements - a growth corridor, a major train station, a university and medical precinct, a proposed national innovation and employment cluster – high technology, high science and the suburban rail loop. Here, the nodal will be further intensified by the distributed. (Monash NEIC, 2017) The speculation advances an agenda that the city is not just a multiple of buildings – the city and its metadata determine the valency of a location which is crystallised into a building, or rather, the potential for what a building might be is determined by the city and its virtual presence. It suggests a new extractivisim, appropriation, and contingency and an operative techo-financial space.

In this post-cadastral metropolis, the boundaries between reality and virtuality have long since eroded. The sectoring between government and enterprise has worn thin. As cities yield assets and control, public and private sectors emerge as a techno-political entity of neoliberal machinations. The city is presented as seamless experiences, a holographic luminance, with real-time data streams and strategic capital works projects condensed in geographical and meta space. Here, predictive algorithms dictate the rhythm of the city's life.

The aesthetic, ethical, inter-disciplinary, and philosophical quandaries are not mutually exclusive. The architecture and urban process is one of screened initiative and ingenuity, a rogue subroutine, adapting to the shifting landscapes of behaviour, process and data, actioning and shaping exploits and vulnerabilities.

The urban experience of unfolded encrypted code signals an urban optimisation, of algorithms that parsed the ebb and flow of citizens to maximize efficiency, economic growth, and the seamless propagation of capital. Optimisation is nothing but conformity, meeting the expectations of algorithmic desires and a shallow computation on large datasets.

The city is not homogenous, and the conceptualization of this project seeks to maintain and resist consistency. Between the algorithmic yoke, a city emerges, where the impeding clash of ideologies and generative principles of architecture are dispersed in the data-soaked streets, buildings and infrastructures —the precipice between algorithmic control and the chaotic potential of human experience and rebellion.

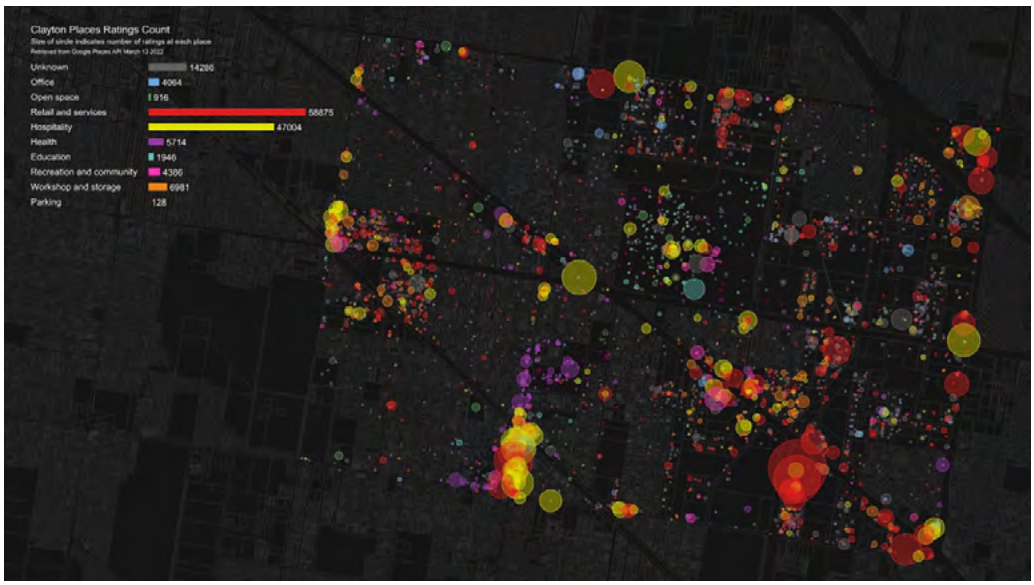


Figure 3. Geolocating user rating counts in Clayton, Melbourne, 2022. Image: Kathryn Larkin and Ian Nazareth.

7. Pattern, Like, User…

The project employs Application Programming Interfaces (APIs), with a specific focus on the Google Places API—a service facilitating the retrieval of information about various locales through HTTP requests. (Nazareth, Schwarzman, 2021) Within this API framework, places are delineated as establishments, geographic coordinates, or important points of interest. Notably, this repository includes user-generated reviews and star ratings, serving as pivotal metrics within a decentralized framework wherein user, customer, and subscriber perspectives converge. These metrics, arguably, represent an open fount of both emotional response and service valuation.

The analysis discerns a correlation between the interpretation, extrapolation, and subsequent manifestation of peaks and troughs within broader processes and mechanisms, particularly within the contexts of real-time data, informational dynamics, and urban development paradigms. Within this framework, the presence of 'noise' within datasets may engender intermittent peaks and troughs, which, over time, assume discernible patterns and forms influencing infrastructural responses, speculative activities, valuations, and urban behavioral patterns. This observation underscores two salient prospects:

1. the potential to access nuanced individual preferences amidst collective dynamics, which exhibit temporal fluctuations; and
2. the propensity for short-term biases and variances within datasets to potentially inform longer-term transformations.

Through the process of data scraping, a diverse array of categorical information is geolocated and spatially represented. The project endeavors to explore potential avenues and mechanisms for integrating this data into the built environment. Assessment, valuation, and categorization of establishments are intricately linked to property and spatial considerations. Hierarchical structures are scrutinized against parameters such as scale, temporal significance, and permanence. API-derived data is meticulously parsed and classified based on aggregated reviews and ratings. Multipliers are employed to amplify the impacts of factors such as popularity, supply, and demand. Consequently, tenancies may expand, contract, or exhibit resistance to change, with instances where the decline of certain establishments surpasses the ascent of others, leading to the emergence of voids within the urban fabric, catalysing a phenomenon of an entrenched hyper-tenancy.

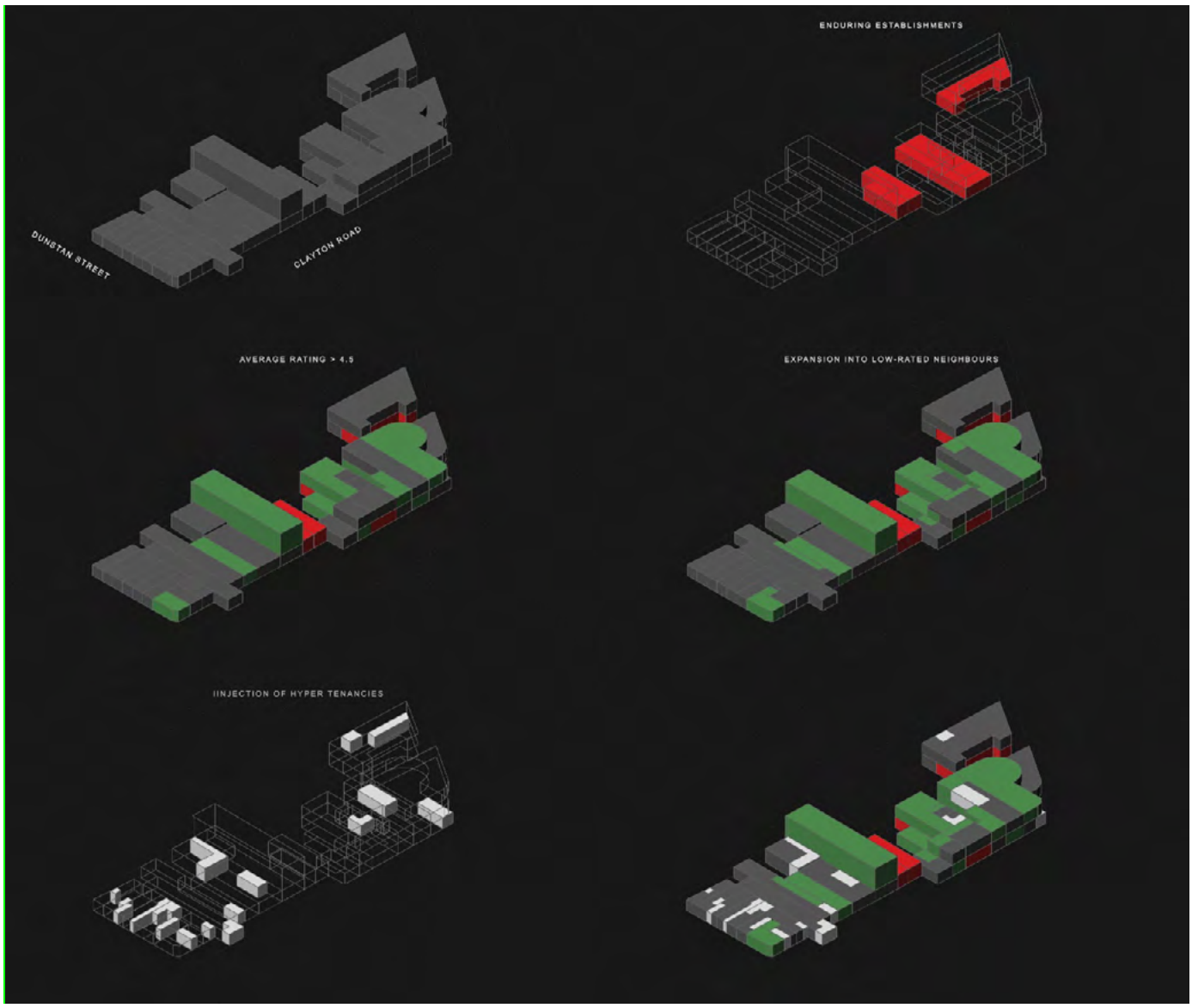


Figure 4. Hyper Tenancies in Clayton, Melbourne, 2022. Image: Kathryn Larkin and Ian Nazareth.

8. Hyper-Tenancies

Individuals play a pivotal role in furnishing platform technology systems with data through various means such as likes, ratings, and reactions. The cumulative effect of these contributions suggests a democratized reservoir of collective detail, information and therefore intelligence. Personal attributes act as a lens through which urban landscapes manifest themselves. Traditional urban hubs, exemplified by the High Street (Main Street), yield precedence to algorithmically curated search results, shaping our personalized encounters with the city.

The concept of hyper-tenancy serves as a deliberate understatement, a distinctive feature within the urban landscape characterized by its service-oriented nature, symbolic resonance, and adaptive deployment. It emerges as a consequence of disruptive forces engendering novel functionalities, mirroring the interplay between digital hype and tangible service capacities. It epitomizes the localization of unbounded expression.

Inflation predicated on popularity represents one facet of this dynamic milieu. It delineates the interactions between consumers, industries, infrastructures, and their urban representations, constituting a public interface. Retail establishments perpetually vie for prominence within the civic realm, paralleled by their

virtual counterparts competing in the digital sphere. The convergence of physical and virtual realms culminates in a distinct urban fabric, intricately interwoven within this realm. Here, the measurement of floor space serves as an indicator of assets and significance, symbolizing value derived through financial, technological, and commercial mechanisms. The inexorable progression towards inevitability is propelled by factors of convenience, initially conceived as an idealistic aspiration but subsequently co-opted by influential power dynamics.

9. The Bi-Lo Hi-Fi



Figure 5. Bi-Lo exterior and car park. Image: Tony Hu and Ian Nazareth.

This project aims to establish a critical and projective design practice. It seeks to engage with urban histories and data, examining the ways in which the city functions through speculative processes. Furthermore, it aims to reposition urban amenity while establishing a paradigm for machines and machine intelligences to inhabit and traverse the urban environment. The project explores various aspects including neuromorphic cartography, urban augmentation, synthetic navigation, and retro-fictive narratives.

Neuromorphic Cartography: Combines principles of neuroscience and cartography to create maps. It uses computational models mimicking neural networks to interpret spatial data, aiming for adaptable mapping systems.

Urban Augmentation: Enhances urban environments through technology like digital infrastructure, IoT devices, extended reality infrastructure and smart systems. The goal is to improve aspects like transportation, sustainability, safety, and efficiency, creating smarter, more connected cities.

Synthetic Navigation: Uses artificial or synthesized data for navigation, including simulated maps, virtual environments, or augmented reality overlays. It's often paired with GPS and computer vision to enhance navigation accuracy, especially in complex areas.

Retro-fictive Narratives: Fictional stories reimagining historical events or past eras from a contemporary

perspective. They blend nostalgia, speculative fiction, and historical revisionism to explore "what if" scenarios or alternate timelines, providing insights into history and memory.

The Bi-Lo Hi-Fi project represents a nuanced exploration and speculative reconstruction of the transition from the Bi-Lo supermarket chain to Coles, epitomized by the emergence of dual Coles supermarkets situated at opposing ends of a desolate car park in Clayton, Melbourne. Within this juxtaposition is a complex narrative of coexistence and spatial advantage. Rebranded as 'Meta-Coles' or 'The Bi-Lo Hi-Fi,' this locale serves as a juncture where relics of the past intersect with contemporary amenities, blurring the boundaries between obsolescence and utility.

Embedded within the network of urban memory and speculative data flows, the 'Bi-Lo Hi-Fi' surfaces as an anomaly, weaving a description through echoes of a counterfactual history. Within the simulation, the urban landscape unfolds as a decipherable cryptogram, with physical artifacts, digital point clouds, real-time data, and Non-Uniform Rational B-Splines Modeling (NURBS) surfaces gradually decoded by human cognition intertwined with the computational insights of machines and AI systems. These overlays unravel the multidimensional codes and augmentations inscribed within the urban fabric.

Through a choreography of esoteric interventions, these structures transcend their commercial origins, evolving into urban relics that straddle the realms of the tangible and intangible. These entities serve as conduits bridging physical reality with the elusive realm of the virtual. They engage in reconceptualizing architectural form, adapting it to accommodate essential services, organizational systems, and non-fungible tokens (NFTs). In doing so, they infuse these elements with fresh subjectivities and value propositions, transforming their significance within the architectural landscape.

The project delves into alternative cartographies, psychogeographies, and narratives of conceptualization, visualization, and immersion within a virtualized urban environment. It envisions a landscape where humans, non-humans, and sophisticated AI systems collaboratively navigate and reinterpret urban spaces. Amidst the flux of corporate dynamics, rebranding endeavours, and market fluctuations within the (extra)urban realm, the project operates within a liminal space, oscillating between corporeal reality and the ethereal expanses of the virtual.

This liminality offers opportunities for novel configurations of amenities, as well as the development of spatial grammar and lexicon comprehensible to both organic and synthetic intelligences within the urban architectural tapestry.

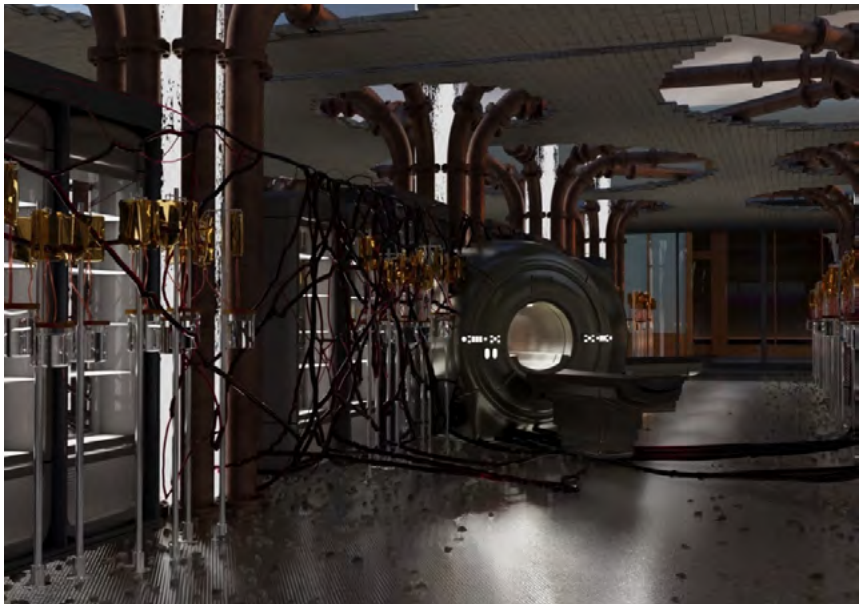


Figure 6. Bi-Lo interior. In its state of obsolescence, it provides a description to accommodate temporal amenity. Image: Tony Hu and Ian Nazareth.

10. Conclusion

In the layered intersections of technological acceleration, economic dynamics, political manoeuvring, and contextual fluctuations, the urban architectural process develops at a pace that seems almost agonizingly slow. Decisions made in the initial stages of long-term strategic urban projects often dictate the fate of major works spanning decades, rendering them obsolete before they even materialize. In this milieu, architecture struggles to capture the zeitgeist, appearing redundant, contemplative, and retrospective.

Meanwhile, the physical infrastructure of cities finds itself increasingly entangled within the realms of technology, as the innocuous internet-of-things, semantic executing web, and Industry 4.0 appropriate urban assets. This fusion accelerates the interaction between static and non-static elements, driving global shifts in topology and characteristics.

We now find ourselves in the midst of gamification, or a gamified urban experience, where gaming mechanics are seamlessly integrated into the fabric of the built environment to encourage participation, offering incentives, risks, and rewards. The city becomes a catalyst for virtual interaction, shaping and reflecting human impulses in a stochastic, non-deterministic manner.

The post-cadastral state engages in a nuanced negotiation between liberating and constraining the physical infrastructure of the urban environment, catalyzing temporal dynamics and potentials towards acceleration and exponential growth (Kurzweil, 2001). Within this theoretical framework, the perception of choice becomes entwined with structures of preference, fostering a cumulative effect through innovative combinations.

This proposition operates within the realm of speculation, persistently navigating the boundaries delineating rationality and speculative thought. It adeptly manoeuvres through esoteric realms, embraces idiosyncrasies, and penetrates pervasive constructs, addressing the turbulent techno-political climate and the stark contrast between claims of reality and simulation. Employing unconventional methodologies, it disrupts the delicate balance within urban and architectural discourses, grappling with an alternative urban narrative.

The conceptually flexible domain of the Post-Cadastral condition provides a means to abstractly represent the city, to reveal its full potential by reordering data and facts into landscapes of relevance. This city of the future harnesses spatio-temporal models to create functional representations that extend far beyond the limitations of current urbanity, sensing and adapting to its environment on a scale previously unimaginable. It becomes not just a settlement pattern, but a technology itself—an infinite canvas of spatial and temporal possibilities.

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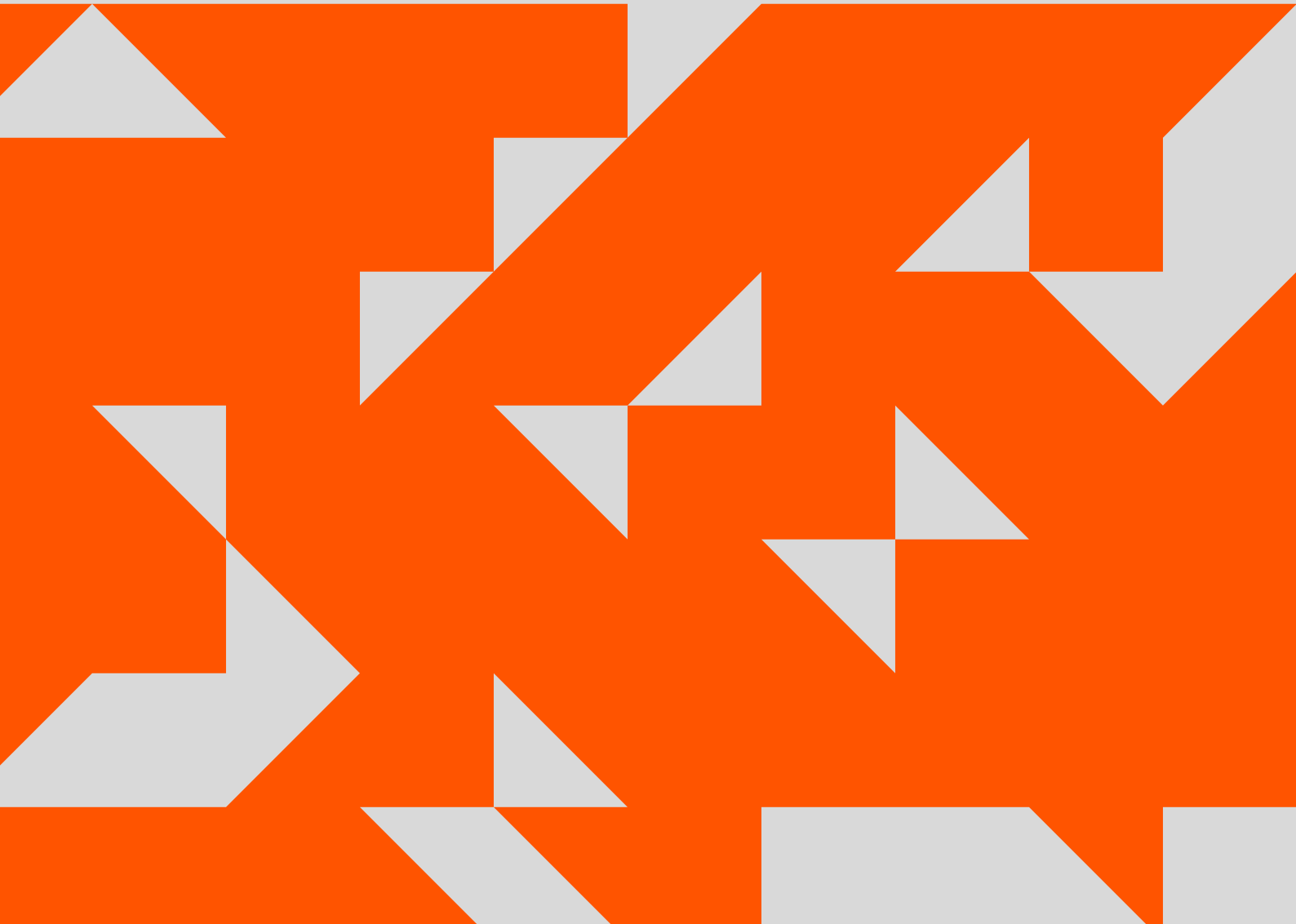
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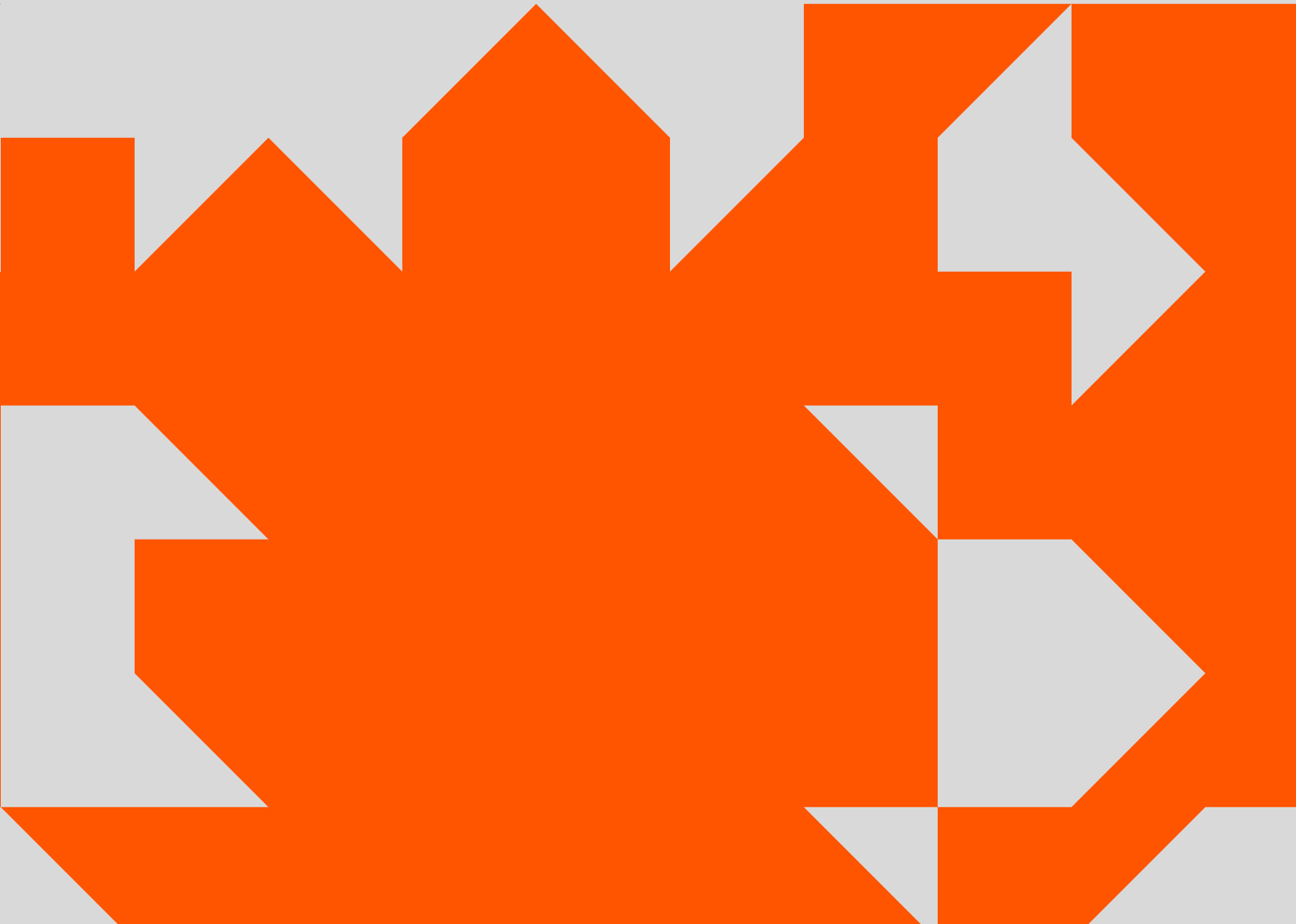
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BRIDGING DESIGN AND ECONOMICS



P/REFERENCES OF DESIGN

CUMULUS BUDAPEST 2024



BRIDGING DESIGN AND ECONOMICS.

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As new and systemic complexities continue to challenge our societal structures, the role of design in shaping and influencing spaces of governance, business, and innovation is becoming increasingly vital. Global challenges demand innovative approaches, and design, with its capacity to navigate and reframe these complexities, holds the potential to play a transformative role. This track explored the narratives of governmental policy design and the emergence of alternative economic frameworks. As governments struggle with new economic realities and businesses seek to innovate within shifting markets, design offers a unique toolkit for addressing these challenges.

The track was also a reflection on the evolving boundaries of today's creative industry, encompassing everything from corporate design initiatives to entrepreneurial ventures.

Our authors clearly stated that strategic, design-driven decision-making must play a more central role in shaping our collective future. For this to occur, it is essential to develop new, frameworks for evaluating design's impact. How can designers effectively influence business and policy decisions? Can we measure the tangible and intangible impacts of design? What methods and approaches are effective, and which fall short? Given the inherent agency in design, this discourse aims to address the evolving position of design in contemporary contexts, emphasizing its critical role in shaping the future of governance, business, and innovation. These topics are crucial, as they highlight design's growing responsibility in shaping the systems and structures that define our world.

While the track prescribed an approach focused on the systemic and strategic dimension of design, authors could choose the purpose to which such an approach is applied.

One area of focus was sustainability, which is an overarching issue that characterises much of the innovation efforts of the past decade across many disciplines.

Design is a profession responsible for defining desirable products (and services) and hence it is capable of promoting consumption, a reason why it has been criticised in the past from a sustainability perspective, but that is also why Design Research tackles mitigating negative impacts, as well as building design capabilities focused on environmental sustainability.

On the most immediate level, these capabilities can be focused on the threefold principles of "reduce reuse recycle", exploring the necessary design approaches to optimise material use, adequate production technologies, as well as consumer behaviour changes that lead to longer product lifespans or more sustainable purchase choices.

However, design can tackle sustainability also at the level of organisations, from interventions in existing companies to setting up new enterprises, up until shifting values in an entire market segment.
The four contributions in the "Designing for Sustainable Economies" session focused on integrating design principles with environmental sustainability in product design, circular economies, and premium markets.

Sustainable design practices can be challenging to implement in well-established enterprises with industrially relevant production and tight profit margins, and one of the contributions tackled these by analysing the practical challenges both based on a semi-systematic literature review and an interview campaign.

A fundamentally different approach was represented by an entrepreneurial project from the Amazon rainforest, experimenting with bioeconomy based on growing useful design objects on trees and, in particular, establishing a local community of artisans to manage production.
Another contribution argued that, conversely, shifting the high-end market might stimulate the diffusion of good sustainable design practices.

Finally, a critical reflection highlighted the potential oxymoron lying behind the term circular economy, proposing that there is a need for a regenerative economy, which requires not only a regenerative design approach, but also systemic policy changes in order to adapt to the Anthropocene.

Another group of contributions in the track, arranged in the "Local Design Strategies" session, have explored how design can act strategically to develop projects that are relevant to a specific geographic area.

The first one in this session focused on how to prepare the interdisciplinary students of a Master in Business Design for an entrepreneurial role, developing their skills at the "Entrepreneurship Through Design" workshop, which also allowed them to critically assess the effort distribution throughout the innovation process, confronting the double diamond model with its practice.

The other two contributions in this session reflected on the design strategies within a manufacturing company and a territorial system of manufacturers.

In enterprises, Chief Design Officers (CDO) have an increasing presence, but their position and roles are still not entirely well understood, therefore one of the presented papers has observed and analysed the CDO's activities in a company, highlighting its mediator role between various organisational units and disciplinary backgrounds.

On the other hand, the success of design products often depends on the effectiveness of an entire industrial district, rather than a single manufacturer's capabilities. The second contribution argues that beyond effective

supply chain management, for sustainable development it is essential to establish a “cultural value chain”, which considers local identity and community, thus leveraging and further enhancing cultural capital.

Finally, the session named “Perspectives of Innovation” examined design methodologies and cultural entrepreneurship, exploring new methods to foster innovation and deliver value. Design Thinking received some criticism recently, however, its influence remains and continues to impact how businesses operate. While its benefits are known, its role in promoting ambidexterity is less studied.

One paper presented case studies, identified key factors for successful Design Thinking implementation and its impact on organizational learning, particularly valuable for managers. Another contributor went beyond this methodology and explored how sensemaking and effectual thinking can enhance normative design thinking, presenting design as an imaginative, embodied practice that evolves through stakeholder collaboration, reflection, and learning.

The importance of a design-based approach, using design as a steering force in urban innovation processes was explored in another case study. Often overshadowed by administrative concerns, here, design’s value was demonstrated even in the procurement process.

To make sure, the track covered multiple dimensions of the market, it featured papers demonstrating design’s influence beyond corporations. A study explored crowdfunding’s potential at micro, meso, and macro levels, highlighting its role in innovation, and economic growth, especially for small- and medium-sized enterprises in light of recent regulatory changes.

Leaving the business world behind, one of our contributors presented a case for public services. In this scenario, the digital transformation of the public sector fostered collaboration and experimentation, making room for design practices such as design thinking and service design. The paper explored how the Design Research Lab (DRL) framework, rooted in the arts, and focused on public interest, can offer valuable insights for improving public sector innovation labs.

As track chairs, looking back at our track, we observed that case studies showcasing the relationship between design and the economy are highly important for Cumulus. This should be treated as a key topic, as design in the business world tries to assert itself within capitalism, in the face of numerous other dominant approaches.

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EMBEDDING SUSTAINABLE VALUES IN THE HIGH-END MARKET THROUGH PREMIUM DESIGN.

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ABSTRACT | The sustainability challenge is one of the most pressing issues facing our world today, encompassing various environmental, social, and economic concerns. Addressing sustainability complexities necessitates a profound and radical transformation of our development model. This transformation involves not only production processes but also patterns of consumption and access to goods and services (United Nations, 2023). Design has emerged as a powerful tool to address these sustainability challenges (Walker, 2006; Bhamra & Lofthouse, 2007). Pioneering this integration of design and environment in 1985, Victor Papanek introduced profound environmental considerations into the design realm (Papanek, 1985). Building upon Papanek's legacy, the evolution of design for sustainability unfolded gradually from the early 1990s to the contemporary era, marked by diverse approaches and frameworks across different scopes and scales of innovation. In 2016, Adams et al. revealed a transformative shift from a narrow technical and product-centric orientation to an emphasis on system-level changes, addressing sustainability as a challenge to be tackled at a socio-technical-ecological system level (Ceschin & Gaziuluoy, 2020).

Confronted with an imperative challenge that demands immediate attention, the high-end market landscape is progressively under pressure and intensifying in its competitiveness. How to create new values in line with contemporary consumers and bring meaningful changes through design with a premium push to attain a long-term sustainable impact has emerged as a crucial subject for leading companies and organizations (Hemmings, 2019). The premium design encapsulates superior material quality, functional efficacy, and aesthetic allure into the fabric of products and services, thereby augmenting their perceived value and desirability within the high-end domain. It requires a delicate balance between shared value and banalization, ensuring quality preservation in the availability of products and services to a broader audience without diluting their fundamental essence (Ingaramo, 2022). This approach can mitigate irrational economic and environmental impacts through resource optimization while enhancing product quality and service efficiency. It resonates with consumers who value quality and ethical, environmentally conscious lifestyles and promotes the market's transition towards sustainable practices.

This paper employs a combined methodology, comprising a literature review and case studies, to elucidate the intricate interaction of the premium design approach across multiple design for sustainability levels. It aims to investigate the potential perspectives of such an approach in embedding sustainable values in the high-end market, ranging from product to service and social system spheres. The authors wish to offer valuable insights that can be used as a reference by fellow researchers engaged in exploring sustainability-focused design across relevant domains.

1. Introduction

The sustainability challenge is one of the most pressing issues facing our world today, encompassing various environmental, social, and economic concerns. Despite the declaration of a "code red for humanity" (United Nations, 2021) in the climate emergency, the prevailing trajectory diverges from the critical objective of limiting global warming to 1.5 degrees, posing a risk of exceeding 3 degrees by 2100 (COP26, 2021). While some progress is evident, an urgent call for decisive action to curb global temperature increases to the vital 1.5-degree threshold persists. A paradigm shift is imperative, emphasizing the transition from mere commitments to immediate, tangible actions, aligning economies with the natural world for a sustainable future. Effectively addressing the complexities of sustainability demands a profound and radical transformation of our development model, impacting production processes, consumption patterns, and access to goods and services. "We cannot simply continue with more of the same and expect a different result" (United Nations, 2023, p. 4). As emphasized by O'Brien, achieving comprehensive climate action requires a multifaceted transformation. Beyond technical and behavioral adjustments, a compelling need exists to reconfigure political structures, reshape belief systems, evolve values, and reconsider worldviews and personal behaviors (2018).

Confronted with an imperative challenge that demands immediate attention and action, the high-end market landscape is progressively under pressure and intensifying in its competitiveness. Most major advertisers have committed to achieving net zero by 2050, if not sooner. This commitment is mirrored globally among many leading brands, who have undertaken the pledge to achieve net-zero targets by 2050 or even sooner. Notably, a significant shift in climate action is observable within the Fortune Global 500. Thirty percent of these influential companies have either successfully achieved or publicly committed to ambitious climate goals by 2030, signifying a substantial rise from the relatively meager 6 percent reported in 2016 (Lu, 2021). In today's dynamic business environment, brands are actively steering away from "greenwashing" while guiding their consumers in transforming sustainable intentions into concrete action through impactful, transparent, and positive messaging. Creating new values aligned with contemporary consumers and bringing meaningful changes to attain a long-term sustainable impact has become crucial for leading companies and organizations (Hemmings, 2019). Design, in the current landscape, has emerged as a potent tool in facilitating and driving such transformation (Walker, 2006; Bhamra & Lofthouse, 2007).

2. The Essence of Sustainable Design

Pioneering this integration of design and environment in 1985, Victor Papanek introduced profound environmental considerations into the design realm (Papanek, 1985). He critiqued the consumer-driven nature of design, challenging the prevailing consumerist culture and calling for a more mindful and responsible approach to creating products. In line with the title of his book "Design for the Real World," Papanek underscored designers' social and environmental responsibility, urging them to be agents of positive change, advocating for social and environmental justice through their work and emphasizing meeting the real needs of social communities. Building upon Papanek's legacy, the evolution of design for sustainability unfolded gradually from the early 1990s to the contemporary era, marked by diverse approaches and frameworks across different scopes and scales of innovation. A study by Adams et al. found that the literature surrounding sustainable innovation has traditionally centered on technical solutions and gradual adjustments. However, recent perspectives highlight a shift towards people-centered innovation, viewing sustainability as a socio-technical challenge. Early emphasis on technical responses has evolved into a more comprehensive and systemic understanding, extending to a broader socio-economic system. Leading entities in this field now embrace novel business models and services with technological solutions (Adams et al., 2016). Building upon such insights, Ceschin and Gaziuluoy have expanded the design for sustainability framework by introducing an advanced innovation level. This elevated perspective envisions an earth-centric approach that comprehensively integrates socio-technical-ecological systems. Emphasizing a holistic view directs attention towards ongoing transitions, reflecting a forward-thinking stance in pursuing sustainable design (Ceschin & Gaziuluoy, 2020). As we progress into the upcoming

decades and witness the establishment of new dynamic equilibriums, another question emerges: What will define the essence of sustainable design in these post-transition contexts. Sametinger suggests that such essence may lie in interdisciplinary knowledge, the ability to transcend boundaries, and intrinsic motivation for ethical design practices, moving towards a "post-sustainable" (Sametinger, 2019, p. 41) design perspective: "sustainability by default" (Ibid.), which signifies that the fundamental values and principles of sustainability are seamlessly integrated into the design, constituting an inherent aspect rather than an additive element in the design process.

Defaults, in this context, encompass pre-established options individuals encounter, either predetermined or automatically assigned. Faced with these default choices, individuals often accept them without actively exploring alternatives (Smith et al., 2013). In behavioral science and marketing, default settings are potent tools to influence human behavior and capture a broader market share (Thaler & Sunstein, 2008). Within the design domain, practitioners and researchers are responsible for adeptly incorporating and standardizing this influential tool. This involves integrating sustainable values and principles into the design process "without awareness," streamlining the decision-making process for consumers to choose sustainability and facilitating the adoption of sustainable lifestyles.

In the premium market and beyond, promoting sustainability as the default and superior choice for consumers is termed "eco-accidentalism" (Holmes, 2022). This concept involves inadvertently encouraging environmentally conscious decisions, making sustainable options the default and the best selections in various marketplaces. The emergence of the notion is rooted in many research findings revealing a pronounced disparity between consumers' professed intentions and their actual spending behavior (IBV, 2022). Despite over half of consumers expressing a willingness to pay a premium for environmentally responsible brands (Orrell et al., 2021), a significant gap exists between their stated preferences and purchasing actions. To mitigate such a gap and fulfill unmet consumer needs, strategic initiatives must be directed toward overcoming obstacles throughout the consumer journey. By augmenting the accessibility of sustainable options while upholding product quality standards and facilitating a smoother transition for consumers, companies would have the potential to harmonize and influence consumer preferences, and consequently address environmental concerns and align with consumer demands within the market. This explains why the strategy of "eco-accidentalism" comes to the forefront as a potentially practical solution (WARC, 2022).

3. Premium Design: An Eco-Accidental Approach

The design discipline has undergone extensive exploration, evolving from its initial focus on endowing tangible objects with value to encompassing services and, more contemporarily, entire lifestyles (Celaschi, 2000). Design, in essence, involves imbuing products with material, functional, and aesthetic qualities, fostering a connection between form, functionality, materials, and surfaces. Throughout its evolution, these design elements have transitioned from mere characteristics to potent tools for enhancing the perceived value of goods and overall user experience within the marketplace. This evolution has intricately linked design with notions of high quality and luxury, which extends beyond the economic realm, forming a systemic landscape of values that attract, influence, and fulfil human needs, giving rise to a widely recognized premium paradigm (Volli, 2012; Harman, 2018).

In the contemporary landscape, the accessibility of high-end products and services has undergone a profound shift, evolving into a spontaneous, attainable experience by dismantling entry barriers. This evolution extends the potential for luxury to the middle class and the newly wealthy, less tethered to economic status but more to customer satisfaction (Bain & Company, 2021). The democratization of high-end markets signals a fading social stratification, granting everyone access to luxurious and exclusive experiences (Kapferer & Bastien, 2012). The concept of "premium" seamlessly aligns with this transformative narrative. Rooted in the Latin word "praemium," denoting prize or reward, the term "premium" draws connections to attractiveness, ambition, and peer competition, where rewards are consequential to individual efforts and choices. Within the premium paradigm, the economic value represents only one aspect; the further importance lies in the acknowledgment

that extends from material to societal value transformations, which guides consumers to (un)consciously select and enrich a multi-dimensional user experience (Teil, cited in Kapferer and Bastien, 2012, p. 79).

In today's voracious and redundant consumerist society, values once deemed distant from high-end products are now recognized as distinctive imperatives. They play a pivotal role in enhancing and imbuing positivity into the overall consumer experience and utilizing products and services. Leading organizations and companies are currently emphasizing novel values to attract and retain a fresh wave of consumers. In this evolving context, premium design is ideal for elevating the consumer experience and integrating with this transformative reality. The premium design encapsulates superior material quality, functional efficacy, detail sophistication, and aesthetic allure, enriching products and services' perceived value and desirability in the high-end domain. It requires a delicate balance between shared value and banalization, ensuring that products and services maintain their quality even as they become accessible to a broader audience without compromising their fundamental essence (Ingaramo, 2022). Such an approach optimizes resources, mitigates irrational economic and environmental impacts, and encourages socio-technical innovation to enhance product quality and service efficiency. Nowadays, consumers anticipate and actively seek out this formula, which can resonate particularly well with those who value quality, ethical practices, and environmentally conscious lifestyles, fostering a market transition towards sustainability. The following sections present four case studies to explain this concept better.

3.1 Orange Fiber: An Innovative Citrus-Based Fabric

Orange Fiber is a Sicilian company founded in 2014. Since its inception, it has been driven by a mission to actively contribute to an environmentally friendly future for the textile industry. The story of this start-up of two young Sicilian women started with the idea of utilizing "pastazzo," the residue remaining after citrus juice production, which constitutes a substantial 60 percent of the fresh fruit's weight, to create a sustainable and vitamin-rich fabric. Their groundbreaking journey began in 2012 when, in collaboration with the Politecnico di Milano, they developed an innovative process capable of transforming over 700,000 tons of waste generated annually by Italy's citrus processing industry into high-quality fabric. Unlike current artificial cellulosic fibers, this solution significantly curtails the exploitation of land and water, along with the usage of environmentally harmful pesticides (Caruso, 2014). Commencing in Sicily, cellulose is extracted from citrus pulp, marking the initial step. Subsequently, the extracted cellulose embarks on a journey to Spain, where a strategic partner transforms it into yarn. The journey comes full circle as the processed yarn returns to Italy, specifically to a Como weaving mill. Here, it undergoes the final transformation into a luxurious and sustainable fabric tailored for the fashion-luxury sector (Blueislands, 2017).

Throughout the years, their transformative and sustainable initiatives have earned them numerous awards, demonstrating that innovative thinking, collaboration, and a dedication to sustainable practices can not only align with industry demands but also foster a positive global sustainable impact. Orange Fiber, patented in Italy in 2013, took a significant stride by registering its trademark the following year—a pivotal move in discerning products featuring their exclusive yarns and fabrics. With dedicated labels, end consumers can effortlessly identify garments and furnishings crafted from Orange Fiber's citrus fabrics, showing the brands committed to their innovative and sustainable materials (Ibid.).

In 2017, Salvatore Ferragamo launched a capsule collection in collaboration with Orange Fiber on the 47th Earth Day (Figure 1). Made in Italy, luxury fashion, premium design, and sustainable practice—all these elements are encompassed in this "Responsible Passion" project (Giannetto, 2017). The impeccable quality of Orange Fiber mirrors the luxurious appearance and tactile elegance of silk, the exquisite prints crafted by Italian designer Mario Trimarchi, and the distinctive style synonymous with the Salvatore Ferragamo Maison converge to create an exclusive collection reminiscent of a poetic ode to the Mediterranean lifestyle (Ferragamo, 2017). Orange Fiber's commitment to transforming waste products destined for disposal into sustainable and enchanting fabrics showcases a remarkable blend of innovation, environmental responsibility, and community engagement. The company's journey exemplifies how creative solutions and strategic partnerships can contribute to a more sustainable and circular future for the textile industry.



Figure 1. Ferragamo Orange Fiber Collection S/S 2017. Source: mariotrimarchi.design.

3.2 La Compagnie: An Exclusive All-Business-Class Airline

La Compagnie, a distinguished French boutique airline founded in 2013, is dedicated to revolutionizing business aviation. Operating as an exclusive all-business-class airline, it provides flights to New York from Paris, Nice, and Milan, aiming to redefine business class with a personalized travel experience at an affordable rate. In contrast to conventional aircraft with a seating capacity of 230 seats, La Compagnie's Airbus A321neo features a spacious 2-2 layout accommodating only 76 seats (Figure 2). This design prioritizes passenger comfort, offering fully reclining seats that transform into horizontal beds measuring 192cm in length, complemented by a luxurious, thick overlay. The Airbus A321neo distinguishes itself as an efficient, quieter, and environmentally sustainable aircraft, boasting a remarkable 30 percent reduction in fuel consumption compared to its predecessors, emitting a carbon footprint that is 20 to 30 percent lower than competitors flying similar routes (BARR, 2023). Additionally, La Compagnie's ticket prices are approximately 30 to 50 percent more economical than the business class offerings of other carriers, changeable tickets at no extra cost (Ibid.). In 2022, the airline achieved an average load factor of about 75 percent, reaching 80 percent during the summer peak. The seasonal route from Nice to New York excelled with an impressive 85 percent load factor (AirGuide, 2023). These robust load factors instill confidence in La Compagnie for future growth and the launch of new routes.

Regarding the demographics of travelers, the airline reports a well-balanced mix of American leisure and European business travelers. Designed for stress-free journeys, the entire travel experience encompasses expedited airport departures through time-saving fast tracks, creating a seamless transition to the onboard ambiance and in-flight atmosphere. Safety instructions are creatively delivered through an emotional yoga-style video, and each seat is furnished with an extra-large 15.6-inch screen display. The fast satellite unlimited wifi connection ensures uninterrupted streaming. The specialized “bistronomic” cuisine offers extensive special request meal options prioritizing passengers’ health. Every tiny detail contributes to creating a comfortable and smart journey, ensuring the “Relax Onboard” experience (La Compagnie, 2023, p. 15)

La Compagnie’s business model thrives on a flexible and premiumised structure, utilizing modern and efficient aircraft to capture business clientele and a substantial portion of the leisure market. Christian Vernet, CEO of La Compagnie, underscores their services’ uniqueness and special nature, coupled with fare

flexibility, catering to a diverse audience that extends beyond business to include leisure travelers. Their focus on the "creative class," encompassing individuals in startups, design, fashion, art, and the broader lifestyle realm, sets them apart. Vernet emphasizes the privileged perspective they have on this creative class. La Compagnie's offerings are complemented by an optimal timetable, maximizing arrival and departure times, which is especially beneficial for business travelers. In essence, the airline distinguishes itself from competitors by providing superior travel comfort and user-friendly experiences. Vernet characterizes La Compagnie as a "Smart Business," highlighting their competitiveness in terms of costs and agility, a significant advantage over rivals in the business class travel sector (Incorvati, 2023).



Figure 2. La Compagnie's Relax Onboard experience. Source: lacompagnie.com.

3.3 NEXT: A Future Smart Transportation System

Established in 2017, NEXT Future Transportation stands as a pioneering Italian startup on a mission to revolutionize the field of road transport (Figure 3). The seeds of its groundbreaking concept were sown in 2012 by Tommaso Gecchelin, the visionary designer and founder of NEXT. He envisioned a prototype of self-driving vehicles for public transportation, with the audacious goal of seamlessly blending the convenience and sustainability inherent in buses with the nimble flexibility characteristic of taxis. The journey from conceptualization to realization gained momentum in 2015 when Tommaso Gecchelin found a crucial ally in Silicon Valley, the company's co-founder Emmanuele Spera. Their collaboration catalyzed the ambitious vision into a tangible and transformative project (Perfetto, 2015). Together, they embarked on a mission to redefine the future of transportation, combining innovative design and cutting-edge technology to create a dynamic and sustainable solution for the evolving urban mobility needs.

NEXT has ingeniously engineered a modular bus equipped with electric modules that seamlessly connect and disconnect as needed. This cutting-edge design enables the bus to operate autonomously without a driver, ensuring total security and compliance with permissible areas. The hallmark of this innovation lies in the dynamic modularity, allowing these modules to seamlessly connect and detach on standard urban roads, creating an open corridor when joined. Passengers benefit from the freedom to stand and move effortlessly between modules. These modules follow a shared route before detaching based on passengers' selected destinations, facilitated through a dedicated app (Gecchelin, 2023). The dynamic modularity ensures omnipresence and adaptability, akin to a personal car. Each vehicle can comfortably accommodate up to 10 passengers (six seated, four standing), measuring two and a half meters. Crafted

with a blend of lightweight yet durable aluminum, featuring four steering wheels, and powered by electricity, these buses provide enhanced coverage in geographically dispersed areas, elevating the overall level of comfort (Mazzucco, 2020).

In forward-thinking cities like Dubai, the concept of modularity introduces a paradigm of on-the-move transshipment. This dynamic approach optimizes system capacity, resulting in a substantial reduction of over 60 percent in fuel consumption, operating costs, and traffic congestion. Simultaneously, it enhances capillarity and passenger comfort, emulating an advanced on-demand shared taxi system free of intermediate stops and waiting times (Maci, 2020). The versatility of NEXT extends beyond sophisticated urban settings to simpler and easily implementable scenarios, such as the "variable capacity bus" concept. In this scenario, the bus driver dynamically adjusts the number of docked modules for traditionally scheduled services based on real-time data from NEXT. Even without autonomous driving and multiple drivers, this adaptive supply-to-demand approach ensures significant energy and maintenance cost savings, surpassing 50 percent (Gecchelin, 2023).

NEXT envisions a paradigm shift in the field of transportation, elevating it beyond a mere utility to become a living embodiment of "life in motion." NEXT's adaptability and transformative potential extend beyond conventional transportation, permeating domains such as retail and on-the-move services, healthcare, security, cargo transport, and airport services (Ibid.). More than just a mode of transport, NEXT represents a comprehensive solution. Its premium design and forward-thinking approach position NEXT as a catalyst for reshaping how we perceive and experience the journey, transcending traditional boundaries, and ushering in a new era of vibrant and seamlessly integrated mobility solutions.



Figure 3. NEXT modular, sustainable transportation solution. Source: (up) topsimages.com (down) aisociety-unipd.it.

3.4 The Line: A Revolutionary Vertical City

Nestled within the visionary Neom project in Saudi Arabia, The Line emerges as a groundbreaking linear smart city, stretching 170 kilometers across captivating landscapes, from the majestic mountains of NEOM to the enchanting Red Sea (Figure 4). This revolutionary urban development, a pivotal part of the Saudi Vision 2030 initiative, is designed with a singular purpose – to redefine the very essence of cities and urban living. Unlike traditional cities, The Line boldly discards the conventional concepts of roads, cars, and emissions. It is a cognitive city, standing as a mirrored architectural masterpiece soaring 500 meters above sea level, yet ingeniously compact with a land-saving width of only 200 meters. Its innovative design ensures a harmonious coexistence with nature, dedicating 95 percent of the land to preservation while operating entirely on 100 percent renewable solar, wind, and hydrogen energy. Excavation work, initiated along the entire length of the project by October 2022, signifies the ambitious vision of creating a city prioritizing the health and well-being of its residents over traditional transportation and infrastructure

concerns. The Line's blueprint envisions a utopian population of 9 million, comprising 25 percent of Saudi Arabia's current populace. The Line's reduced infrastructure footprint, spanning a mere 34 square kilometers, promises unparalleled efficiencies in city functions. This forward-thinking city ensures residents' convenience with daily essentials accessible within a five-minute walk and a high-speed rail facilitating an end-to-end transit time of just 20 minutes.

The ideal climate throughout the year further enhances the residents' experience, allowing them to blend with the surrounding nature seamlessly. As a pivotal component of the larger $500 billion Neom project, The Line embodies the principles of sustainable urban development, stands as a testament to the transformative power of innovation, and underscores a bold vision for future cities (NEOM, 2022).

The Line introduces a revolutionary urban design paradigm, embodying the concept of zero-gravity urbanism, which means minimizing reliance on the natural ground plane by establishing multiple vertically organized ground planes at elevated heights (Barandy, 2022). Unlike conventional tall buildings, The Line's innovative approach abandons the classification idea of zones and lays various city functions vertically, integrating living, working, studying, and entertaining synergetically. Residents can effortlessly navigate in three dimensions—up, down, or across—to access all their daily needs within a convenient five-minute radius. This innovative morphology ensures equal access to public services and amenities for residents from all backgrounds, allowing them to choose living preferences either vertically or along its length based on personal preference (Ibid.).

This forward-thinking cityscape features an outer mirror facade that not only allows for captivating views and natural sunlight but also bestows a unique identity, seamlessly merging with nature despite its compact size. The Line's groundbreaking blueprint disrupts conventional urban design by fully digitizing the city's plans and embracing significant industrialization in construction processes. This entails pioneering advancements in construction technologies and manufacturing methods, signaling a departure from the norm. While facing criticism for deviating from traditional urban design and concerns regarding sustainability and feasibility, the realization of The Line holds the potential to revolutionize our way of life, echoing the words of Mohammed bin Salman, Crown Prince of Saudi Arabia and Chairman of the NEOM Board of Directors, who envisions, "The Line will tackle humanity's challenges in urban life today and will shine a light on alternative ways to live" (NEOM, 2022).

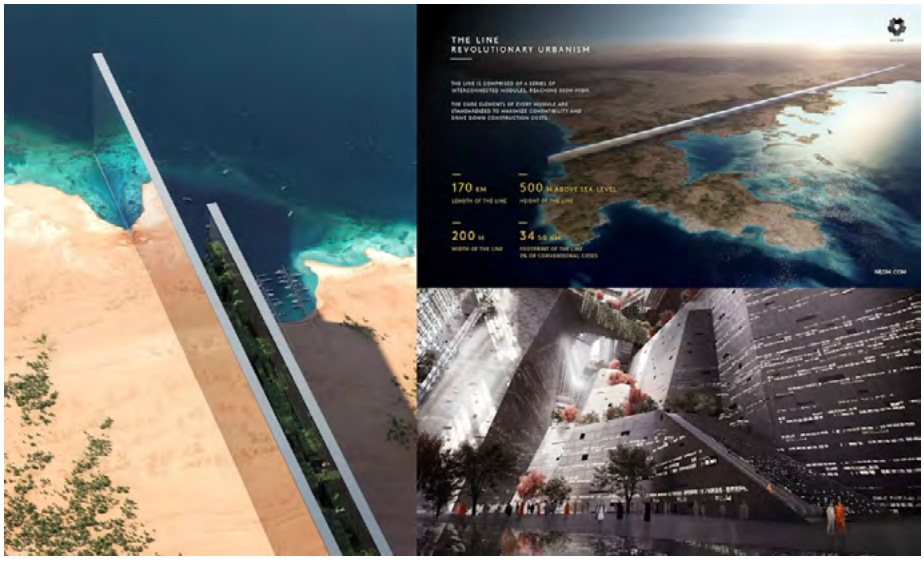


Figure 4. The Line: A vertical future city rises in the desert of Saudi Arabia. Source: cieloterradesign.com.

4. Discussion and Reflection

Premium design emerges as a potent tool for driving sustainable practices, leveraging the historical evolution of design elements from the refinement of tangible objects to the shaping of entire lifestyles. Beyond mere economic value, the democratization of high-end markets becomes a compelling narrative, echoing societal shifts and aligning with the dynamic values of discerning consumers. Analyzing the four case studies described above provides more precise insights into its potential to embed sustainable values within the high-end market.

Rooted in circular economy practices, where waste transforms into high-quality products, exemplified by Orange Fiber, the premium design approach helps transform an environmental challenge that navigates beyond material innovation into a luxurious and innovative solution, ensuring exclusivity and desirability. In the case of La Compagnie, adopting this approach not only harmonizes opulence with ecological mindfulness but also democratizes sustainable luxury, presenting distinctive and responsible value propositions to consumers who, consciously or not, embrace environmentally friendly alternatives. This overarching premium design philosophy extends to NEXT Future Transportation, where modularity and adaptability form its bedrock. The symbiosis of these values materializes in the form of modular buses, dynamically optimizing capacity and minimizing environmental impact—a synergy of optimal function and sustainability. This synthesis continues in The Line's vision for sustainable urban living, where digitization and industrialization redefine traditional cityscapes. Here, the emphasis on renewable energy, reduced infrastructure footprint, and equal access to services for all residents signifies a holistic commitment to a harmonious future. These case studies across diverse industries showcase that design for sustainability is not just an ethical choice but a strategic one that can drive innovation, create new value and market shares, reshape consumer experiences, and redefine the post-sustainable paradigm for living. As we navigate the present challenges, integrating sustainability into the default choices of the best design holds the potential to reshape our long-term collective narrative toward a more sustainable post-transition world.

Within the framework of this paper, a blended methodology, merging literature review and case studies, has been employed. Its purpose is to elucidate the interaction of premium design across various sustainable design levels, spanning from product to service and social system spheres. The investigation delves into the potential perspectives of this approach in embedding sustainable practices within the high-end market, introducing the innovative concept of "eco-accidentalism," which promotes sustainability as the default and optimal choice for consumers. The authors aspire to provide a valuable reference for fellow researchers navigating the design strategies centered around sustainability in both ongoing and post-transition contexts. Through this contribution, we seek to stimulate further inquiry and dialogue, fostering a collective advancement towards a more conscious future.

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IMPLEMENTING DESIGN THINKING FOR EXPLORATION AND EXPLOITATION: CREATING CONDITIONS FOR ADOPTION.

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KEYWORDS | DESIGN THINKING, ORGANISATIONAL CONDITION, EXPLOITATION AND EXPLORATION, AMBIDEXTERITY JUSTICE

ABSTRACT | This paper aims to investigate how organizations should create the conditions to facilitate Design Thinking implementation to balance their exploration and exploitation activities towards innovation. Literature has shown diverse contributions of Design Thinking to companies. However, very few have discussed one of its natures of being a mediator to nurture companies' capability to explore and exploit simultaneously and how Design Thinking implementation actions could foster this positive role. This paper has carried out a case study methodology to reflectively analyze three empirical cases in which authors have actively participated and has presented different approaches in three projects to reveal key factors that companies should take into consideration for creating the conditions for Design Thinking implementation. Implications for companies regarding the relationship with their organizational learning process have been discussed eventually. The research provides a deep understanding of how companies could facilitate Design Thinking implementation, highlighting which specific factors and conditions could enable its ambidexterity approach, especially for managers.

1. Introduction

The competitive condition of the market puts companies in the position of having to constantly find new ways and strategies to compete and succeed. According to March (1991), this condition of competitive advantage could be achieved by adopting a tradeoff between exploration and exploitation. Usually, companies are performing exploration when their activities are oriented to search, experimentation, and variation. On the other hand, companies concentrate on exploitation when there are choice, execution, and variance reduction (Lavie, Stettner & Tushman, 2010). Moreover, Levinthal and March (1993) added that the knowledge domain gives a fundamental difference between the two approaches: exploration focuses on new knowledge, while exploitation focuses on what is already known by the company. Over the years, companies often use exploitation more than exploration actions. This is because adopting exploitation brings more immediate results, and the returns of such strategies are more precise and more certain (Denrell & March 2001). However, the preference for exploitation actions alone may result in many companies needing to prepare for market changes (Fang, Lee & Schilling, 2010). In order to be truly innovative, companies need to adopt both: the real challenge is to understand how to balance the two approaches.

Balancing exploration and exploitation can be facilitated thanks to the adoption of Design Thinking (DT) inside companies. Indeed, Design Thinking has been classified as a catalyst for innovation and change by several scholars and practitioners (Brown, 2008; Forrester, 2018; Liedtka, 2015; Martin, 2009; Sheppard, Sarrazin, Kouyoumjian and Dore, 2018). Among the most established benefits are positive implications for organizational transformation and innovation (Brown, 2009), better decision-making (Liedtka, 2015), customer orientation (Kumar and Whitney, 2007) and competitive advantage (Martin, 2009). Design Thinking can act as an internal mediator giving companies the possibility to both explore and exploit (Deserti & Rizzo, 2014). The characteristic of ambidextrousness is indeed inherent to Design Thinking, given its nature of integrating deductive, inductive, and abductive thinking (Martin, 2009). This research aims to investigate how Design Thinking implementation has played a role in balancing exploitation and exploration inside companies. Moreover, it wants to underline what key factors companies need to consider creating the “conditions” to adopt and implement it effectively. The investigation is based on three empirical cases examined through three primary parameters: the design drivers, representing the strategic reasons behind the process of DT adoption, the implementation format adopted, and the organizations’ maturity in using design, looking at the grade of integration of DT. The investigation was made through participatory observation (made directly by authors) on three cases adopting DT. The authors had the opportunity to interact with the three companies for a period of 24 to 36 months.

The article is structured as follows: the subsequent section presents the adopted theoretical background, examining the evolution of exploration and exploitation processes and discussing their importance within organizations. Furthermore, Design Thinking and its importance in supporting exploration and exploitation processes are analyzed. Later, an overview of the research methodology and the adopted framework for selecting cases is presented. Then, empirical results are described and subsequently discussed, identifying five initial findings for companies when implementing DT to balance their exploration and exploitation activities. It ends with a discussion on how the proper conditions to guide companies in defining their own ways to balance exploration and exploitation activities should be set.

2. Theoretical Background

2.1 Exploration and Exploitation Towards Innovation

One of the most important objectives for companies is to sustain a competitive advantage inside their marketplace. Pavitt (2005) argued that innovation can be reached through a process of exploration and exploitation of opportunities to develop new products, processes, or services. The terms “exploration” and “exploitation” have taken on considerable centrality in organizations since their first appearance in March’s pioneering article (1991). They have become two fundamental aspects within organizational analyses of

technological innovation: organization design, organisational adaptation, organizational learning, competitive advantage and, indeed, organizational survival (Gupta, Smith & Shalley, 2006). Also, different literature started to discuss the notion of exploration-exploitation, such as organizational learning (e.g., Levinthal & March, 1993; March, 1991), organizational design (e.g. Tushman & O'Reilly, 1996), knowledge management (e.g. Brown & Duguid, 2001), adaptation (e.g. Brown & Eisenhardt, 1997), and Ambidextrous leadership (Rosing et al.,2011; Zacher & Rosing, 2015; Klonek et al., 2020). It is impossible to define a priori whether a given activity represents an opportunity for exploration or exploitation for all companies. These two concepts are often relative and have to be defined from the point of view of an individual organization. This is because specific knowledge, technology or markets may be new to one organization while already known to another.

All the literature agrees that resource-allocation constraints, organizational inertia, and desirable organizational outcomes condition the implementation of exploration and exploitation. A great debate has developed not only on the definitions of terms but also on the possibility of bringing these two processes forward in parallel within organizations. One of the main reasons for the difficulty of following them in parallel is that they require many resources. Companies don't have illimited sources, so they need to understand how they want to use them and where they need to be dedicated (Gupta, Smith & Shalley, 2006).

Anyway, since the beginning, there has been consistency in thinking that organizations need both exploitation and exploration to achieve persistent success (March 1991), so the real challenge is to understand how to balance these two processes. Some studies have suggested that "ambidexterity" (Benner & Tushman, 2003) is the answer, while others propose that "punctuated equilibrium" is the way to balance these aspects (Burgelman, 2002). Ambidexterity refers to the simultaneous pursuit of both exploration and exploitation by highly distributed and separated subunits or individuals, each of which specializes in one of these two activities. Punctuated equilibrium, on the other hand, applies to temporal rather than organizational distinction and implies that passing between cycles of exploration and exploitation is a wiser choice than pursuing both simultaneously.

2.2 Design Thinking in Organizations for Balancing Exploration and Exploitation

Design Thinking, as an innovation approach, is implemented to propose valuable ways to capitalize on organizations essential resources and generate experimentally cutting-edge solutions and changes. Design Thinking (DT) was born to codify how designers see and think (Liu, 1996). Nowadays, among the different sources, there is not a specific and precise way to define it, and its concept is broad (Cooper, Junginger & Lockwood, 2009). Many different debates take place around DT, about what exactly it means and what the differences are from other methods and processes such as creativity, innovation or systems thinking (Kimbell, 2009). The literature agrees it is an iterative and exploratory process (Braha and Reich, 2003) used to solve problems, guided by human-centeredness (Junginger, 2009; Liedtka, 2015; Dunne, 2018).

During the last two decades, DT has been critically analysed by scholars from design, business, and innovation management disciplines. It has been identified as a "powerful, effective, and broadly accessible" approach to innovation that can be integrated into all aspects of business and society" serving the purpose of "generating breakthrough ideas" (Brown, 2009). Recent literature, both from Design and Management scholars, consolidates how DT adoption brings positive implications for organizational transformation and innovation (Brown, 2009), better decision-making (Liedtka, 2015), customer orientation (Kumar and Whitney, 2007) and competitive advantage (Martin, 2009). An increasing number of organizations are aware of the potential to integrate and appropriate DT internally; contaminating the corporate culture with new practices can support how business approaches changes and innovation processes, such as balancing exploitation and exploration. The dual nature of the DT approach is strongly linked with the concepts of ambidexterity within businesses; DT adoption can play the role of the internal mediator, generating a fertile ground for companies to simultaneously explore - dealing with the uncertainty of the front-end innovation - but also exploit - dealing with the development of product and or services (Deserti & Rizzo, 2014). The ambidexterity in DT derives from the different thinking models that it embraces: one of the crucial characteristics of DT consists of combining deductive, inductive and abductive

reasoning (Martin, 2009); this is not only a pivotal aspect to bringing Design Attitude within organizations (Michlewski, 2015) but also a way to balance exploration and exploitation helping the established organization to reduce the typical “bias toward reliability” (Martin, 2009; Sutton, 2001). Ambidexterity may be created by dedicating a portion of the enterprise to DT. At the same time, the rest is based on exploitation or instilling a widespread mindset of DT that includes all of the company's components in the exploration activities. More specifically, it is worth illustrating the different aspects to consider when defining the various cases of DT adoption in organizations.

Most of the adoption cases of DT are recognized under the label of innovation activities or labs; however, the strategic reasons - the design drivers - behind the process of adoption are multiple, as effectively summarized by David Dunne in his last book “Design Thinking at Work: How Innovative Organizations are Embracing Design” (Dunne, 2018). For most, it is about facilitating a disruptive innovation path or improving better experiences for customers; an increasing number of other goals more oriented to internal cultural development for changing internal mindset or feeding internal teamwork across the organization silos, or also to retain and attract talent and valuable people; at last for some, adopting DT has the aim of activating a system change organizational and social (fundamental changes). Businesses might combine different reasons to implement DT, usually following a gradual process of integration of design into organizational life (Buchanan, 2015), starting from tactical issues arriving to vision and strategy passing by organizational problems of operation.

The other crucial factor to consider is the placement of the Design Thinking provider, internal or external (e.g., design consultancies). Different “placements” correspond to a variety of forms through which organizations adopt DT. The internal DT adoption forms vary from established innovation labs with designers - design units - recruiting designers in strategic positions or building the DT competence of existing employees through dedicated educational programs. The pure external DT adoption models include all the typical forms of design consultancy activities to support the adoption of DT in the organization: design sprint sessions, long-term projects, training programs, or other forms of design consultancy activities. The organizations choose the adoption model depending on their goals, culture, innovation strategies and sizes.

3. Methodology

DT adoption can guide companies in dealing with uncertainty in innovation - exploration and fostering the development of products and services - exploitation (Deserti & Rizzo, 2014). Therefore, this paper aims to understand how DT implementation has played this role and what key factors companies need to consider creating the “condition” to adopt and implement effectively. The case study method (Yin, 2009) has guided the research to analyze three cases in which authors have carried out DT implementation. In each case, the data has been collected through participant observation (Gatt and Ingold, 2013; Gunn et al., 2008) by the authors’ empirical research actions. The authors refer to this as not a detached form of observation but a close look at the engagement understood and responded to by the people involved in the research.

3.1 Case Selection

Three projects have been selected for empirical research actions, and authors have applied the following criteria of selection:

- Authors have participated directly in all three projects as an external expert team, who brought design thinking from outside and implemented it inside the companies;
- The methodological approach and methodology used in the projects is the same in all three cases;
- Organizations in all three projects are big companies which have a large internal structure and huge numbers of employees;

- In all three cases, design thinking activities have been conducted with the involvement of actors at the companies' strategic level;
- All three projects have been for a long period, between 24 - 36 months.

3.2 Framework for Case Analysis

The main indicators extracted from the literature that have guided the inquiry in the three cases are design drivers, the format or means of DT implementation, and the organization's maturity level of understanding and using Design.

Table 1. Case study framework (elaborated by authors).

Indicators	Contents
Design Drivers (why)	improving better experiences for customers or internal actors retain and attract talent and valuable people facilitating disruptive innovation path changing internal mindset (design culture) activating a system change
Format/Means (how & what)	design sprint training - dedicated educational programs create internal design unit/lab/hub recruiting designers in strategic positions long-term project collaboration
Design Maturity	design or design thinking is not considered an essential skill for companies' development design is used as aesthetic and functional skills for tangible outputs design thinking is acknowledged as strategic advantages

3.3 Innovation Stories in Three Cases

The design thinking activities conducted in each of the three cases will be presented and analyzed using the conceptual framework presented above. The following table has summarized the initial design drivers, the primary format of DT implementation actions, and the design maturity of each case to show the differences and similarities.

Table 2. Elements in the framework presented in each case (elaborated by authors).

	Initial design drive	Main formats	Design Maturity
Case One	Facilitating disruptive innovation path	a. Explorative projects b. Training activities	Design was used as aesthetic and functional skills for tangible outputs
Case Two	Changing internal mindset (design culture)	a. Explorative projects b. Training activities	Design thinking was acknowledged as strategic advantages, and operationally involved at the strategic level
Case Three	Improving better experiences for internal actors; Retain and attract talent	a. Practical projects b. Training activities	Design thinking was acknowledged as strategic advantages, but not yet involved at the strategic level

Case one: Implementing design thinking in a traditional Chinese furniture company.

The first project is an ongoing project between the authors and a Chinese furniture company that has been running its business for over 20 years. The initial collaboration aim was to find a new approach to facilitate innovation inside the company, not only at the product development level but the companies' strategic level. Thus, the drivers at the basis of this activity are facilitating a disruptive innovation path but also kicking off a process of internal cultural development.

The collaboration started with introducing an external Design Thinking team, composed mainly of authors, the company's CEO and managers of R&D to the whole company. The initial activities were explorative research projects and training courses for the company's managers and designers. The research projects in the first year were aimed mainly at collecting up-to-date resources and information on furniture and related sectors internationally and transforming them into thematic topics and directions for the company's internal R&D team (design teams included). On the other hand, the training course has been carried out twice. The first time, selected design managers and designers came to participate in training activities in the authors' institute (physically outside the company and their daily working routine and environment); the second time, the authors dedicated five days to the company and organized intensive training workshops with selected managers and designers (physically inside the company). All the activities have been strongly supported by top-down policy and guaranteed commitment from participants.

The second year's collaboration has been planned based on the first-year experience and has retained the two approaches: project-based and capability-building through training. Authors have worked on moving towards understanding the company's structure and logic, as well as exploring potential opportunities of intervention. The main collaborative actions were mixing and integrating two types of DT activities in order to have a coherent and effective result. The design methods and tools produced in the collaboration projects have also been taught to participants (employees) in the training so that they can apply them to practical challenges and problems. The main outputs of the second year's collaboration are strategic design guidelines for new product development, design research guides, and the launch of the joint design centre with the authors' institute inside the company. The idea of the third year's collaboration will then focus on supporting the building of a research centre abroad, which will strategically position as a bridge to link European resources and DT experts with the headquarters, as well as the recruitment of talents from abroad.

Case two: Design thinking training activities for a Japanese company in the telecommunication sector.

The second project was an activity implemented for four years between the authors and a Japanese company leader in the telecommunication sector. The initial collaboration was aimed to identify possible ways in which design can act as a boost for the implementation of innovation strategies across different levels of the company. The drivers at the basis of this activity are facilitating a process of internal cultural development but also retaining and attracting valuable people.

Firstly, during the first year, the authors were engaged to do explorative actions, supporting some level of the company in finding new possibilities for their company. New thematic topics and directions for the company's internal R&D team (design teams included) were identified. Then, during the other three years of collaboration, a series of training courses for the company's managers and designers were provided. All three years of courses were attended by design managers and designers selected by the Japanese company. For the second and the third year of the collaboration, attendants come to Italy, inside the authors' institute, to participate in training activities. The training activities were held for three weeks, each week, with five days of training per week. During the fourth year of collaboration, the training was held inside the headquarters of the Japanese companies, where the authors were invited to provide the training in-house. Here, the authors have provided training in five days using the format of workshops where selected managers and designers were also invited. All the activities have been strongly supported by top-down policy and guaranteed commitment from participants.

As mentioned above, the first year of activity, through research activities, was dedicated to mixing and integrating two types of DT activities. In particular, the focus was on both elaborating strategic design guidelines and creating design research guides. The objective of this first year of collaboration was to

understand how design can support different levels in finding new areas of development. During the other three years of collaborations, working through training formats, the activities focused on various aspects. One of the objectives was the training of international employees coming from different centres of the company operating in different parts of the world. Another objective was the development of a design culture through a general understanding of what design is and its evolution. Moreover, the training aimed to integrate design thinking methodologies and contents, developing first attempts through training workshops. Finally, the last objective concerned the development of a new process to use inside the company, integrating DT and scenario-building techniques. All training aimed to bring a design thinking approach into the company through training of essential stakeholders, experimenting with it since the courses where practical proposals were developed.

Case three: Design thinking implementation in a Corporate and Investment division of an Italian bank

The third case consists of a long-term design-based research project in collaboration with the Human Resources unit within a leading Italian bank. The trigger of this collaboration is to explore how DT adoption can improve the quality of the working life of employees. Thus, the drivers at the basis of this activity are: improving better experiences for internal actors, the need to retain and attract talented people, and also to kick off a process of internal cultural development. Thus, the HR management team invested in setting up a completely new operative team called People Experience, which literally has to design the "employees journeys". People Experience aims to design micro-experience that can reflect on macro-experience in order to promote organizational culture and make tangible the value offered by HR to the whole division. The strong commitment of HR and its awareness of the value of adopting DT facilitate the research collaboration. The authors perform an active role in all the different iterative steps of the project.

At first, the project focuses on understanding how to intervene through designing the employee experiences: mapping the state of the art of the employee lifecycle in this bank, understanding the context in which the DT project should land, and moreover, understanding the role of the DT implementation. This phase of the activities is named Scoping and permits the authors to redefine the shared direction of the project collaboratively with the company. Indeed, there a need to produce a permanent and long-lasting impact within the organization's routines; thus, the redefined focus consists of gradually fostering proactivity and an employee-focused vision (human centricity) within the HR unit first to finally promote and make the organizational culture tangible to the whole company. This passes by working on creative confidence (Kelly & Kelly, 2013) of employees, starting from enabling the People Experience team to develop qualitative human experience.

The means to initially address this challenge is a process of applied training dedicated to HR members of the company to feed the internal design culture through specific DT training activities. This phase of activities is called training and is divided into different phases, which gradually involve various actors in collaborative activities. Indeed, the ecosystem of actors involved is articulated in progressively bigger circles: the plan is structured in this way, aiming to effectively integrate the DT into the routines of the division, thus gradually impacting the internal client experience and the whole organizational culture. The approach that stands as a theoretical reference is to set up a process that activates a progress loop (Amabile & Kramer, 2011): make the employee touch the meaningful progress of each small step iteratively. This set of training activities takes place in multiple "Experience Design Lab" dedicated virtual places developed as a learning area for the employees involved in each step. After the first year of activities, mostly devoted to training, the project moves to a phase called Implementing. During this third cycle of activities, the DT implementation enlarges its scope to a wider audience. Indeed, the project finally arrived to propose exploratory solutions to define a new way of working life experiences after the COVID-19 pandemic.

4. Research Findings

The authors have reported on three projects to present how DT implementation has contributed to guiding companies in balancing exploitation and exploration. They have followed three different innovation paths and strategies; however, some common findings have been observed.

4.1 A "Reframed Brief" is Necessary to Guide DT Implementation Effectively

All three projects have started with requests from big companies to bring DT inside towards fostering innovation. All three companies have acknowledged the contributions and importance of DT, and all of them have considered DT to fit their development needs and desires they had in mind. However, none of them had a clear idea of the "proper ground" that DT could initially land inside the company as a "newcomer". The question is what DT could or should intervene and how DT could fit and effectively support the company's vision in the long term. In all three projects, the authors have spent a certain amount of time understanding who the companies are, their strengths and weaknesses, and their real challenges and problems.

In case one, after the initial collaboration request arrived, the authors physically conducted a visit and field trip to the company, which helped them gain a precious first-hand understanding of the company. This activity has modified and reset some parts of the collaboration plan (e.g., project topics) and expected results. In the second case, one part of the first-year collaboration was understanding how DT could intervene at different company levels to define new business opportunities. In the last case, the first phase was dedicated to defining the collaboration scope (e.g., project typology and potential areas) and checking the coherence between DT intervention and the company's needs. "Reframing" (Dorst, 2011; Cross, 2006; Kolko, 2010) has often been considered one of the main characteristics of Design Thinking. When conducting DT implementation, the reframing action not only plays a role in defining opportunities and solutions but, more importantly, enables the identification of real problems or challenges and sets the "proper" brief. Authors' practical experiences could tell that it is essential for companies who have an interest in implementing DT and external DT teams to take time to know each other, to share visions and opinions on approach and expectations, and to create a "situated" path for companies to benefit from DT before conducting concrete DT activities. This guarantees effective adoption of DT with a long-term vision and profound impact.

4.2 Design Training is an Effective Way to Implement DT, Contributing to Building Individual Capability Related to Exploitation and Exploration

Training activities have been carried out in different forms in the three projects, and it has been observed that big companies are willing to invest in talent capability building, especially the soft skills related to DT. The frequency should be well-planned. Stimulating internal culture development through DT training is a way to foster the condition to make DT approach adhere to the organizational context, as well as to align employees with this new approach from the mindset to operations. Furthermore, due to its feature and applications model, DT capability is only possible to learn and obtain with practical experience. Therefore, training activities provide a "ground" to try, do and learn. One difficulty or potential risk is that sometimes companies can struggle not clearly seeing the link between training outcomes and improvement on traditional/core business, especially when many of them started with an objective more related to exploration. Authors have dealt with this issue in all three cases through active communication among different actors at different levels, setting different parameters to evaluate the results and visualizing progress.

In the first project, training was a part of the initial collaboration ideas for organisations to gain DT skills, methods and tools. The training actions aimed to broaden employees' innovation views and equip them with a systemic approach. The training topics are highly related to the companies' core business and sector. Training activities are a significant part of DT implementation in the second case. The company has

chosen a new topic to work on, but the focus was on transferring the DT mindset, methods, and process to the participants. In the last case, training activities entered into play at the second phase and were oriented by project development needs thanks to the reframed brief. It has guided the company to link its initial exploration objective of implementing DT to generating results that could impact its core business.

4.3 Actors' Engagement at Different Levels and Positions Facilitates DT Implementation

It is important to engage stakeholders, from managers at the high level and at essential decision-making positions to individual employees at the basic operative level, in the DT implementation process towards transferring design intervention to design integration within the organization (Wrigley, Nusem & Straker, 2020). Rauth, Carlgren and Elmquist (2014 b) have stated the necessity of establishment legitimacy for gaining acceptance and support for DT implementation in organizations. Therefore, the engagement of

very top-level decision-makers, e.g., CEOs and directors of essential departments, could play as the endorsement to "welcome" DT. However, that is far more than enough. From project experiences, authors have understood that the challenge of effective implementation of DT is also about how employees perceive and practically benefit from it. Engaging them in real experience is necessary to make sense of why this approach and method will be helpful and should be integrated into their daily working activities.

In the first case, DT implementation has involved product designers, marketing researchers, design managers, the director of the R&D department, the marketing and communication department and companies CEO in different phases during the process. The engagement also enables these actors to understand among themselves: their different roles and perspectives towards a shared objective, as well as how the DT approach could support their work and tasks. In the second case, the design director, who acted as ambassador to introduce an external DT team (mainly composed of authors) within the company, selected employees with very diverse backgrounds (both cultural and professional) to participate in the DT training. In DT implementation activities, they shared perspectives and knowledge through collaborative learning. In the third case, DT is also welcomed from a top-down approach, guaranteed by the top managers. Nevertheless, the practices have enlarged from small groups to various departments and positions, which allowed diverse employees to take part in experimenting and interacting with situated DT methods and tools and providing their personal feedback as well as obtaining their personal learning results.

Therefore, involving actors and stakeholders of the company enables DT implementation to facilitate systemic change within organisations, both vertically and horizontally. These interventions are seeds for gradually cultivating a design culture inside in the near future.

4.4 Dedicated Physical and Digital Spaces for Practising DT

The notion of having physical spaces as an element for supporting the success of DT integration is documented in the literature (Leifer &Steinert, 2011; Dunne, 2018; Wrigley, Nusem & Straker, 2020). The dedicated spaces could isolate employees participating in DT activities from their daily working routine and tasks to feel safe to try, experiment and make mistakes, which are necessary to obtain the DT mindset and approach. These spaces also act as playgrounds or gyms for DT learners to do exercises and practices to train their DT minds and actions gradually. It is essential to specify that the dedicated spaces don't refer to the fixed physical ones. They correspond to the different DT implementation activities and formats. Due to COVID-19, many digital versions of dedicated spaces have acted actively in providing virtual spaces to substitute for conventional spaces.

In case one, in the beginning, DT actions have taken place outside the company, or the company has created specific rooms dedicated to particular DT activities. From the second year, a joint design center has been created to build an internal ground for cultivating DT initiatives, continuous DT practices, and a design culture. In the second case, most of the DT implementation actions in the second and third year have been conducted in a learning space inside educational institutes, where DT experts and all

participants (employees) frequently interacted and worked together for a certain period (around four weeks). In the third case, the “Experience Design Lab” - a temporary “digital” design lab with fixed scheduling- was created inside the company as a virtual learning area for involving employees in each step of the DT activities. However, the critical challenge is linking what is experienced in the “dedicated space” to a broader range of the organisation's audiences, actors, and stakeholders. This space should also deal with the request of being “open” and “connected” to other parts of the organizations. Companies should make use of the produced outputs, generated atmosphere, and reflections and effectively connect them to face other organisational challenges.

5. Discussion and Conclusions

The paper identifies a set of empirical directions to consider in setting the proper conditions to guide companies in defining their ways to balance exploration and exploitation activities through the support of DT adoption. These directions emerge from the analysis of the findings and their discussion in relationship with the extant literature and practitioners’ contributions.

As confirmed in the literature, DT adoption plays a mediating role between exploration and exploitation. DT is an “ambidextrous” approach by nature, generating a fertile ground for fostering companies’ ambidexterity. The empirical results obtained during the research projects present how the DT implementation can combine both “ambidexterity” with a “punctuated equilibrium” in an organization. Indeed, in various cases, DT's implementation makes the organization simultaneously deal with novel challenges by exploiting internal routines and resources. This happens, including multiple organization's units and individuals in the various moments of the exploration activities; the critical aspect involves various actors but in different and alternated experimental cycles of activities. This can be defined as an evolving path to gradual ambidexterity: business can be guided in gradually being ambidextrous thanks to DT's support that nurtures a specific type of (design) culture within the organization. As it happens in the process of DT adoption in organizations, a gradual integration process (Buchanan, 2015) can be the solution to permeate the organizational life effectively.

To make this process effective, it is fundamental to support the organization in being open and prepared to welcome changes to nurture resilience (Hamel & Välikangas, 2003) in the organization, thus proactively adjusting in front of an uncertain future. Indeed, DT implementation should start with a set of activities dedicated to facilitating a mutual understanding between the DT provider and the organization in question; as presented in the findings part, before conducting any activities, it is critical to comprehend the organizational context and cultural aspects deeply. This is why the first cycle of exploratory activity can often start in a dedicated space among the company components; this safe zone to experiment gradually can stimulate a more expansive area, merging its results with the more operative and routinary activities within corporations.

From a sustainable point of view, to balance innovation activities on exploitation and exploration, organizations should not only rely on external resources and support; it is crucial for them to gain the capability and gradually deal with it by themselves. By nurturing internal culture development, organizations acquire and internalize new knowledge that will make them more capable of autonomously facing changes. Even in this sense, DT implementation acts as a means to activate a matching process between exploration and exploitation.

Therefore, all the different DT activities inside organizations aim to nurture a knowledge transfer from external DT providers to internal receivers through capability building. In organizations where DT's values have not been well recognized and acknowledged, the knowledge transfer process should start with an introductory phase to relate DT to the pre-existent one in organizations (Aklin,2011; 2013) and to articulate the objectives, typology of actions and detailed plans. Actors (companies' employees) at different levels and positions should all be related or involved in the transfer process to be aligned.

The adoption of DT must be considered in a specific and situated context: it cannot be considered a model for organizational change that can be applied indifferently in any context or situation (Gero, 1998). Therefore, a critical reflection must be made on the conditions that characterize the context of the implementation of this kind of approach to innovation. Company factors such as the significant dimension, the vital need and tension of change, and the presence of knowledgeable top management ease and accelerate the contamination process with DT in the corporate context. DT must not be intended as the purpose of the innovation but instead, as a means through which innovative purposes are achieved. DT can act as an engine of change; DT adoption may play a critical role in activating static organization processes to exploit internal resources and actively explore uncertain paths.

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P/REFERENCES OF DESIGN

DESIGN RESEARCH LABS: A NEW PERSPECTIVE FOR PUBLIC SECTOR INNOVATION.

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KEYWORDS | INNOVATION LABS, DESIGN RESEARCH LABS, PUBLIC INNOVATION LABS, DESIGN FOR PUBLIC INNOVATION

ABSTRACT | The digital transformation of the public sector promotes collaboration and experimentation. Furthermore, it paves the way for design practices to enter new realms. Creative approaches, such as design thinking, service design, and system design, have surfaced, particularly within innovation laboratories. However, these organizational structures often face challenges related to achieving and executing changes, transferring knowledge, and gaining cultural acceptance. The structure of public sector innovation laboratories aligns with that of the private sector, where the phenomenon originated. Nevertheless, their primary missions differ: one focuses primarily on the common good, while the other prioritizes commercial interests. In contrast, the concept of Design Research Labs (DRL), rooted in the arts, shares a mission to serve the public interest, offering a different perspective on labs in the public sector. As authors, we explore what a DRL framework might offer to support public sector innovation labs. The paper serves a dual purpose: first, to develop a systematic understanding of the criteria for DRLs; second, to propose areas of tension and fields of action for what public innovation laboratories can learn from DRLs as a framework. By offering this new perspective, the article contributes to a better understanding of the characteristics of public labs, facilitating positive change.

1. The Rise of Public Innovation Laboratories

In the past decade, the landscape of innovation laboratories has flourished in various forms across different sectors (Bason, 2014; Mulgan, 2007). The rapid expansion in the public sector can be justified by the realization that traditional structures, practices, and approaches in politics and public administration may not adequately address contemporary challenges, including climate change, social justice, and shifting demographics (Ottenbacher & Dubé, 2018). This growth has also sparked a shift in the approach to strategy and implementation as well as an increased demand for cultivating creativity, collaboration, and prototyping (Graham & Milligan, 2019; Werneck et al., 2020; Wellstead et al., 2021; Pinder et al., 2017; Komatsu et al., 2021). Simultaneously, the term labification, as coined by Williamson (2015), underscores the temporary nature and the associated sense of a trend that brings high expectations and an element of the unknown.

This begs the question: do innovation labs hold more significance than merely being a passing trend?

1.1 Scattered Landscape of Forms, Missions, and Impact

The landscape above includes various forms named differently from policy labs, city labs, gov labs to social labs (Whicher 2021; Hinrichs-Krapels et al. 2020). Blazing an early trail was Denmark's MindLab, a cross-governmental innovation unit that involves both citizens and businesses, founded in 2002. It heralded a culture change in the Danish government, which labs around the world have attempted to replicate, but it was closed in 2018. While MindLab still serves as a great example, the BMZ digilab hardly operated for two years before the physical workspace space was converted into a modern meeting room. Reasons have been multiple, among them: first, a changing political party leading the ministry with different priorities. Second, the mission of the lab, to scale digital innovation, has not been easy to grasp for employees who were mostly new to digital transformation, and third, the team was built out of four institutions not equal in terms of resources, power structures, and mutual dependencies. These circumstances offer possible insights into success factors for public innovation labs. Another example is the Denkfabrik, an innovation laboratory founded in 2018 within a federal ministry in Germany, that transitioned to a department within the ministry in 2022. In addition, the CityLab is funded by the Berlin Senate Chancellery. It is designed as an open space and a point of contact for citizens and administrative employees interested in digitalization and combines elements of a digital workshop, coworking, exhibition, and event space to create a place where participation and innovation are conceptually combined. From a design perspective, the CityLab is clearly focusing on the first phase of ideation and prototyping; afterward, the city of Berlin should take over.

At first glance, those examples suggest the impression that setting up new organizational forms such as innovation labs is already perceived as a widely spread, and approved strategy to enhance change in the public sector. Nevertheless, forms, structures, missions, and expectations towards innovation labs are different and partly conflicting.

Most initiatives so far prioritize aspects such as new work methods, process design, digital tools, and workspaces, while elements like outcomes, key performance indicators, iterations, connections to innovation ecosystems, and competence models receive less attention. However, even though the number of innovation labs is increasing, a comprehensive theoretical foundation is still lacking. This scattered map might indicate the unknowns and one reason why labs often struggle to become a sustainable approach to contributing to changes.

1.2 Emerging Design Practices

The intersectoral expansion of design practices since the rise of design thinking has led to new roles for design as a discipline and new contexts for professional designers, particularly in the public sector and policy design (Villa Alvarez, 2022a & 2022b). Advancements in practical implementation suggest that the introduction and application of design practices often hinge on the expectations a methodological manual

provides to non-designers. Practical observations also reveal that its foundational principles, including problem orientation, user questioning or observation, and a prototyping approach (learning through trial and error), are novel for many workers in administration and often contrast with established performance characteristics such as predictability, the insistence on correctness, risk aversion, and the need to substantiate claims. Furthermore, the prescription of design (thinking) as a method comes along light-footed without emphasizing a systemic, holistic problem-solving approach. However, for newcomers, the toolboxes and method cards published during the emergence of design practices can create the impression that they can be applied without prior knowledge or adaptation to the specific context (Augsten, 2022).

Some design researchers proclaim that the application of design thinking as a method has split the role of professional designers from design practices and made it applicable to everyone through training. The final aspect has naturally faced criticism from professional designers who are concerned about its relevance and its place within the design community. Without ignoring these ongoing discourses about the transdisciplinary role of design (Hepburn, 2022; Peukert, 2021 & 2022), we as authors represent the position that the expansion and adoption of design thinking have been promoted by the toolisation approach of Stanford's design thinking version but have positively positioned design practices and professional designers in the context of innovation and facilitation (Augsten & Gekeler, 2017) as a predecessor for today's appearance in the public sector (see Schaminée, 2018).

1.3 The concept of labs in the design discipline

Scientific institutions, such as universities focused on art and design, often establish labs with names like Design Labs, or Design Research Labs (DLR). These labs have been recognized as agents of change and serve as spaces for experimentation and exploration in the context of organizational transformation. They attract individuals with foundational skills and experience in design practices and principles. Importantly, these labs existed long before the term labs gained popularity.

While these labs are hardly mentioned in design research discourses, they might offer new possibilities for the concept of public innovation labs. For instance, DRL holds promise in providing interdisciplinary knowledge transfer that supports impact-driven research, making it relevant for practitioners and multiple stakeholders. However, there is still a notable gap in design research when it comes to systematic investigations into the potential and criteria of DRLs.

In this paper, as authors, we aim to shed light on two key aspects. First, we seek to gain a better understanding of what a DRL entails, the role that design plays within these labs, and how it functions. Second, we aim to explore what lessons can be derived from DRLs for public innovation labs.

2. The Undefined Landscape of Design Research Labs

The number and significance of these labs have been on the rise, yet they have remained a relatively unexplored area in design research. The term and concept of DLRs first emerged in the UK during the 1960s, following the Design Method Movement (Alexander, 1977; Schön 1969; Jones 1970). However, it is in the early 2000s, particularly in the European context, especially in the Netherlands and Scandinavian countries, that DRLs have continued to evolve and gain prominence. The Helsinki Design Lab, closed in 2013, needs to be mentioned as a pioneer and still leading example. It accelerates the integration of design and government by establishing strategic design as a core discipline in supporting governmental decision-making and service delivery.

A current trend is the growing number of DRLs in German-speaking regions, with examples like Burg Labs at Burg Giebichenstein University of Art and Design Halle, Kind-Lab at the University of Applied Sciences Trier (among others), Hybrid Things Lab at the University of Applied Arts Augsburg, the Design Lab for Applied Research at Technical University Dresden (in collaboration with Fraunhofer-Institute). This growth is also mirrored on an international scale, with DRLs such as the DESIS Lab at the Parsons School of Design, MIT Media Lab at Massachusetts Institute of Technology in Cambridge, USA, Design Labs at Harvard University

Graduate School of Design, Diseno@QUT Design Lab at Queensland University of Technology in Brisbane, Australia in collaboration with universities from South America, or the Social Design Lab at Victoria University, School of Design Innovation in Wellington, NZ. The rise of labs can also be recognized in the global south. As one example among many, the Design Lab in Kigali, Rwanda, established in 2020 as CcHUB's Research and Development Unit, aims to bring design into the way public agencies and large corporations think about the implementation and use of technology to solve significant problems in society.

These labs share a focus on radical innovations to tackle complex social, political, ecological, and technological issues. They aim to generate new ideas that benefit the public, like DLRs and public sector innovation labs. With the growing urgency and complexity of these challenges, more DLRs in design schools and interdisciplinary settings, especially in the public sector, are likely to emerge in the future.

2.1 Theoretical Understanding and Characteristics

This evolution has been relatively unexamined in theoretical design discourse. While the potential and the role of design in interdisciplinary lab structures are increasingly recognized, there has been a lack of systematic research.

The first theoretical discussions can be traced back to Binder and Brandt (2008), who introduced the term in the context of design education. Their paper explores the concept of a design lab as a platform for conducting participatory design research, emphasizing the collaborative and interdisciplinary nature of design activities

within such a setting. It discusses the benefits of this approach for fostering creativity, innovation, and engagement among various stakeholders in design processes.

Since Binders' research in 2008, no further analysis, classification, or mapping of design labs has been published. Therefore, the purpose of this paper is to inquire about the role of design and design research labs, with the aim of developing a new perspective. This serves a dual purpose: it provides a framework for DLR to support the future impact of public innovation laboratories and sheds light on aspects overlooked in the field of design. Despite its potential to offer valuable insights not only for the public sector but also for design research itself, there is still a lack of updated and systematic investigation in this area. In the following paragraphs, we will propose four principles of the DLR framework before applying them to the public sector.

3. The DLR Framework for Public Innovation Laboratories

3.1 Theoretical Foundations of the Framework

The underlying definition of DLR in this paper is based on various sources: Binder and Brandt (2008), Binder (2007), Reynolds-Cuéllar (2020) or Boyer (2020). Binder and Brandt derived characteristics from a traditional lab as a metaphor, based on the practical example of the Malmö Design:Lab, defined in the paper as follows: "The Design:Lab is neither a particular set of methods and techniques nor a particular place or event; it is a platform for a collaborative inquiry that is based on design experiments" (2008, p. 121). We, as authors, use the term DRL in this paper as a comprehensive umbrella term that combines three fundamental characteristics: A DLR …

- is primarily affiliated with design schools and departments;
- explicitly applies design practices as a tool and method for inquiry; and
- is addressing emerging societal, technological, and ecological challenges.

3.2 Methodological Approach and Practical Use Cases

This definition laid the foundation for an investigation into existing DRLs associated with design schools. Our methodology involved a qualitative pattern analysis of four distinct design labs from various global

locations. This analysis was conducted by gathering information available online and visually mapping the data, which was a collaborative effort between both authors.

In the initial step of our methodology, we delved into the self-descriptions and profiles of the selected design labs to uncover shared traits and unique characteristics that define these entities. This allowed us to identify commonalities and distinctions among them.

Subsequently, the mapping process was enhanced through the utilization of guiding questions. They served as a framework for our analysis, enabling us to delve deeper into the structural aspects, functions, and purposes of each DRL. This comprehensive approach provided us with a holistic understanding of the design lab landscape, which we will further elucidate in the subsequent sections of this study:

Table 1. Guiding questions for mapping process.

What does the DRL?	Describing the aims, goals, and fields of actions of the DRL.	e.g.: aligning design practice with societal issues
Who is part of the DRL?	Describing the stakeholders involved directly and indirectly in the DRL.	e.g.: research partners, collaborators, and affected groups
Why is the DRL operating?	Describing the missions of the DRL.	e.g.: specific societal issues, and design research questions
How does the DRL operate?	Describing the structures, processes, and operating principles.	e.g.: theme-based organisational structure, research portfolio
Where does it operate?	Describing where the DRL is operating.	e.g.: local or international level, facilities of the lab

Through rigorous discussion and an iterative open coding process, we derived four fundamental principles from the dataset, which subsequently formed the basis of the framework (see figure 1). This framework represents a significant outcome of our research, serving as a conceptual structure for understanding and analysing DRLs and their impact.

It is important to note that this framework is not static; rather, it serves as a prototype that will be subjected to empirical testing and refinement, aligning with the dynamic and evolving nature of DRLs and design research.

Furthermore, to illustrate the practical utility of the framework, we present four case studies of DRLs that exemplify its application in real-world contexts. These case studies showcase how the framework can be employed to gain insights into the functioning and significance of DRLs, demonstrating its potential as a valuable tool for both researchers and practitioners in the field of design and innovation.

The Design Research Lab, affiliated with the Berlin University of the Arts (UdK) since 2010, is a collaborative network involving UdK, the Einstein Center Digital Future, the German Research Center for Artificial Intelligence, and the Weizenbaum Institute. This network defines itself as “a network of individuals, organizations, and non-human entities engaged at the intersection of technologies, materials, and social practices” (Design Research Lab, 2023). Their objective is to create socially and ecologically sustainable tools, spaces, and knowledge that promote people's participation in a digital society, with a foundation in inclusiveness and respect for the environment. Their mission is to democratize technology development by fostering collaboration across academia, industry, politics, art, design, activism, and the public, making “technology development a participatory social practice” (ibid.). They are structured around four theme-

based working groups (material interaction, smart textiles, social design, and digital sovereignty). Their interdisciplinary approach incorporates “critical human-centered design, technology hacks, prototyping, public interventions, and strategies for inclusive discourse” (ibid.) and aims to introduce innovative forms of transdisciplinary research.

The Parsons Design for Social Innovation and Sustainability Lab (DESIS Lab) was founded in 2009 at The New School in New York City and is part of the DESIS Network, a global group with around 50 design labs. It describes itself as an “action research laboratory” that “works at the intersection of design and social theory, applying interdisciplinary expertise to sustainable practices and social innovation” (The New School, 2023). The vision and mission of the lab revolve around the advancement of design-led social innovation, with the aim of creating more equitable and sustainable cities and practices. In response to the intricate and interrelated global challenges, the DESIS Lab concentrates on issues like indigenous sovereignty, planetary interdependence, diversity, natural systems, societal inequities, and the commons. To achieve these goals, the lab employs “integrated design practices,” placing a strong emphasis on “service design as a practice based on social justice principles” (ibid.). The lab actively seeks interdisciplinary collaborations, both with local partners in New York City and global partners within the global DESIS Network.

The Delft Design Labs (DDLs) were created in 2017 at the Faculty of Industrial Design Engineering (IDE) of TU Delft. They describe themselves as “platforms for design innovation and knowledge development in which staff members of IDE, students of TU Delft, and external partners work together” (TU Delft, 2023). Their main aim is to involve IDE students in research to contribute to design research while addressing a broad range of societal challenges.

These DDLs are organized in a flexible, open setting framed by four main themes: sustainability, health and well-being, mobility and urban living, and artificial intelligence, which form the basis of a total of 17 theme-

based labs. These labs “are driven by the passion of individual educators and researchers” and follow a practice-based understanding that “shows concrete examples of how issues are studied, insights are gathered, and challenges are addressed through design interventions” (ibid.). The open structure of the DDLs encourages collaboration across disciplines and allows adaptation to changing societal needs.

The Social Design Lab (SDL) was established at the School of Design Innovation Department at Victoria University of Wellington, NZ. The SDL is driven by the acknowledgment that “over the past decade, the role of design and designers has undergone a major shift as the discipline re-evaluates its contribution to society and the environment” (Victoria University of Wellington, 2023). SDL aims to promote the evolving role of design in contributing to more positive, equitable, and sustainable outcomes for society and the environment. Against this background, SDL focuses on enhancing students' critical and creative thinking, communication skills, and cross-disciplinary collaboration to prepare them as socially responsible designers and leaders. As a key characteristic, SDL integrates local and indigenous knowledge into its research and employs ethnographic and participatory approaches to develop design solutions for pressing social and cultural challenges. The SDL is organized around three “research pods”, defined as social design, social impact, and social innovation and form the basis of three different research projects.

Even though these four examples exemplify different approaches and thematic focuses of DRLs, they also serve as compelling illustrations of the fundamental commonalities that underpin the diverse landscape. In the ever-evolving field of DRL, where novel techniques and applications continue to emerge, it is essential to distill the core principles that guide and unite these endeavors. These principles, summarized in the following section, form the bedrock upon which the broader DRL framework is built. By recognizing and understanding these shared foundations, researchers and practitioners can not only appreciate the richness of DRL's possibilities, but also effectively contribute to its advancement and innovation.

3.3 Four Principles of Design Research Labs

The four principles that emerged from this approach should be viewed as coexisting and shedding light on various facets, rather than having a hierarchical relationship.

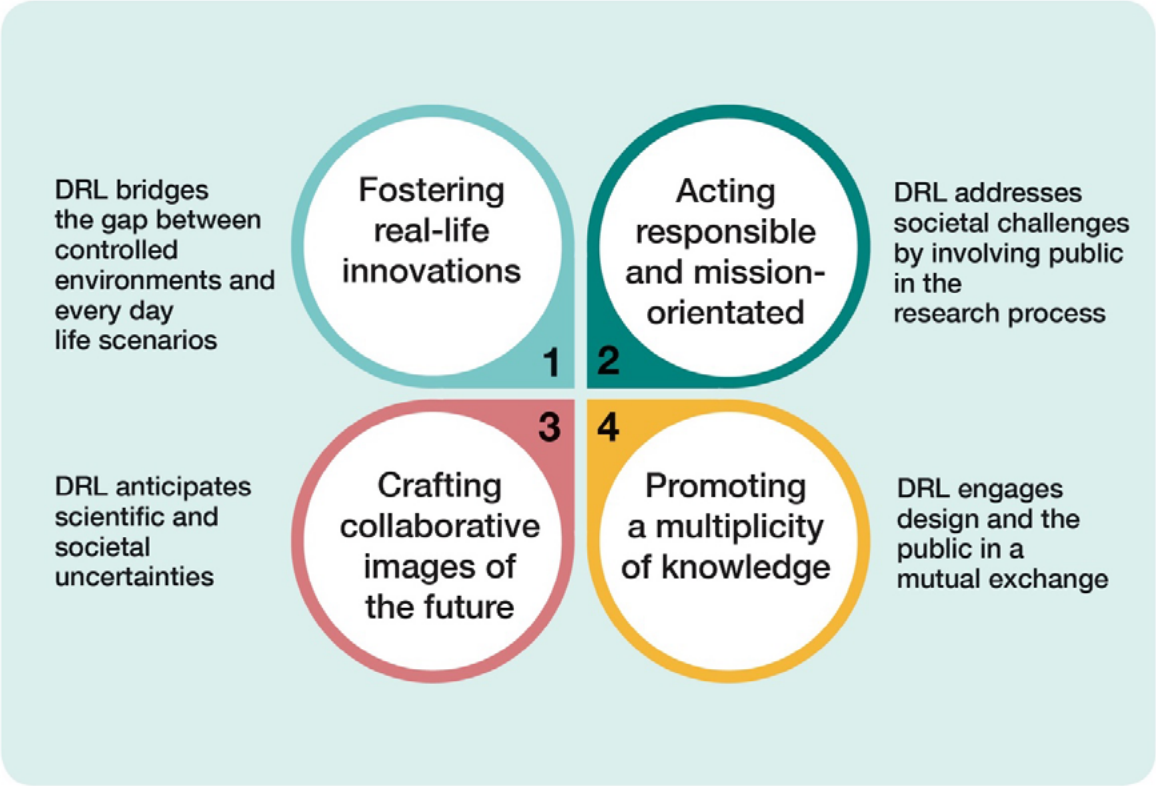


Figure 1. The DRL-framework by the authors (Harles & Augsten), 2023.

1. Principle 1: Fostering real-life innovations

   DRLs metaphorically embrace the concept of scientific labs, characterizing them as controlled environments where knowledge is generated through experimentation and measurement (Binder & Brandt, 2008). Unlike the traditional scientific notion of exclusive access for eligible researchers within an institution, DRLs are seen "as platforms for collaborative inquiry" (Binder & Brandt, 2008, p. 121). It is evident that case studies within DRLs often occur beyond the confines of design faculties' studios and lecture halls. Instead, they are situated where the interventions are intended to be applied. Consequently, the individuals and groups directly affected, as well as strategic relevant collaborators, actively participate in the knowledge production process. What is even more significant is that these activities occur directly in real-life, everyday environments. Prototypical solutions are developed, where they are needed. For instance, considering the case of the Malmö Design: Lab (Binder & Brandt, 2008), employees and managers from one company collaborated directly with external healthcare consultants during on-site sessions at the production factory. This approach ensured that everybody actively participated in the lab, where inquiries regarding healthcare for workers were addressed directly with the workers in their actual work environment.
   Another example by Reynolds-Cuéllar (2020) illustrates how coffee farms can become a DRL, framed as a design course, where design students are relocated geographically to rural Colombia, where they are immersed into the everyday life of coffee farmers to comprehend their routines, needs, and challenges. This served as an essential basis for a co-creation process between students and local communities.

The first principle extracted after analyses is to bridge the gap between controlled environments and everyday life scenarios through the sometimes unforeseen collaboration of various stakeholders. In addition, this exemplifies how DRLs blend the structured, controlled environment of a lab with the realities of the field, creating open and inclusive spaces for collaborative knowledge production.

2. Principle 2: Acting responsible and mission-orientated

DRLs focus on societal issues rather than theoretical aspects of the design discipline. They align their research agendas with specific socially relevant topics like healthcare, mobility, or sustainability (Delft Labs), indigenous sovereignty and human-nature interaction (DESIS Lab, Social Design Lab), digital sovereignty (Design Research Lab UdK) as well as the societal implications of technological innovations, interactions, and interfaces. The goal and motivation of the described examples are to address societal challenges by initiating new paths for knowledge production and socially oriented innovation processes through design. They can be described as mission-oriented, meaning they follow a consensus- and value-oriented research framework like Responsible Research and Innovation (RRI), as proposed by Von Schomburg (2013). The RRI framework encourages researchers, innovators, and organizations to consider the broader societal and ethical implications of their work, actively involving the public and stakeholders throughout the research and innovation process (see also Timmermans et al., 2020). DRLs are inherently aligned with this framework in several ways. First, they aim to foster interdisciplinary collaborations with organizations, governments, scientific institutions, and academia. Second, they aim to engage with diverse audiences, including the public, local communities, marginalized groups, and even non-human entities, incorporating them into the innovation process. Finally, they aim to promote non-academic modes of knowledge as well as methods of knowledge production that are not exclusive to academic research, such as everyday expertise and indigenous knowledge. As a result, DRLs promote a comprehensive and forward-thinking approach to research and innovation, with the objective of ensuring that the outcomes of these activities benefit society, adhere to ethical standards, and contribute to sustainable, long-term developments. As a second principle, we identified that a DRL addresses societal challenges by involving the public, as well as specific and marginalized target groups, in the research process.

3. Principles 3: Crafting collaborative images of the future

Drawing from their mission-oriented approaches, DRLs are notably characterized by their emphasis on uncertainties. These uncertainties stem from the fact that many technological advancements (ex.g. artificial intelligence), but also geopolitical and ecological developments (like wars, pandemics, or biodiversity loss)

often bring about unforeseen transitions or transformations and, consequently, unforeseeable social implications. To ensure that technological potentials are early aligned with societal needs, adapt quickly to an ever-changing world, and that probable long-term consequences are considered, DRLs must anticipate and intertwine technological, societal, and political with ecological trends and project them toward probable future agendas. This necessitates the creation of exploratory spaces where diverse stakeholders can examine future developments while anticipating desirable societal progress, all without immediately providing final short-term solutions.

Within this context, the design discipline holds immense potential in addressing uncertainties and managing “non-knowledge” within interdisciplinary knowledge production processes (Harles &

Heidingsfelder, 2022). These potentials are particularly evident in design-based approaches that evolve from Critical Design, including Design Fiction (Bleecker, 2022), Speculative Design (Auger, 2013; Dunne & Raby, 2013), and Design for Debate (Heidingsfelder et al., 2019). Their shared objective is to extrapolate societal, technological, and ecological developments within everyday scenarios, facilitating mutual knowledge transfer. Through the creation of fictional narratives and tangible "as-if" prototypes such as speculative objects, services, or systems (Wensveen & Matthews, 2014; Boer & Donovan, 2012), these approaches embody potential developments in tangible scenarios for a non-expert audience.

These interventions, often referred to as "speculative enactments" (Elsden et al., 2017), have the power to reveal ambiguities and immerse participants in "as-if" situations to provoke reactions and feedback. By initiating social discussions at an early stage of innovation, DRLs facilitate the negotiation of ideas, needs, and common visions among various stakeholders that are not experts in the field. These future visions are the starting ground for creating fields of action in the present. Consequently, DRLs represent a distinct understanding of design as a critical practice, detached from the market-oriented utility of design thinking. In this way, DRLs function as transition spaces or "hypothetical places" (Binder & Brandt, 2008), where the foundation of the innovation process is not ideas but needs, with results emerging gradually throughout the process.

4. Principle 4: Promoting a multiplicity of knowledge

DRLs enable a novel mode of knowledge production that extends beyond traditional academic knowledge generation, often referred to as "Modes 1 and 2" (Nowotny., 2006). "Mode 1" characterizes the traditional, discipline-specific approach with specialized research and academic discourse, while "Mode 2" represents an interdisciplinary, problem-oriented approach that emphasizes collaboration among diverse experts from different fields (Nowotny et al., 2006). However, design-based knowledge processes, as observed in DRLs, go even further, addressing what is also described in the literature as "Mode 3" (Carayannis et al., 2016; Sandstrom, 2014). This is characterised by highlighting the co-production of knowledge involving a diverse array of actors, including both experts and non-experts. This distinction is a central aspect of DRLs. DRLs serve a dual purpose in knowledge production. Firstly, they encourage knowledge production through design. By creating inclusive spaces for both experts and non-experts, DRLs simplify complex issues through visualizations, tangible experiences, and design-based methods. These methods engage multiple senses and encourage experimentation, allowing participants to transcend verbal and existing knowledge constraints (Heidingsfelder et al., 2019). Moreover, DRLs promote knowledge production by facilitating design-based public engagement. In this capacity, they empower the public and non-expert stakeholders to actively contribute to the innovation process, essentially becoming co-designers. This inclusive approach enables the transfer of various forms of expertise, including general, inclusive, and indigenous knowledge, thus broadening the scope of the innovation process. DRLs effectively extend design methods into areas traditionally outside the purview of designers (Binder, 2008). In this way, DRL introduces an essential peculiar characteristic in which they challenge conventional authorship structures in favor of shared authorship between the lab stakeholders (Binder 2008, p. 121).

In essence, DRLs redefine knowledge production by emphasizing collaboration, inclusivity, and the integration of diverse perspectives, ultimately reshaping traditional scientific outcomes. Thus, DRL engages design and the public in a mutual exchange.

4. Perspectives and Challenges from DRL to Public Innovation Labs

The given examples of DRLs demonstrate that, given various application scenarios, a uniform definition remains elusive. More intriguing than the question “What is a DRL?” is the query “What actually defines a DRL?”. In contrast to traditional scientific research laboratories, DRLs are not understood as static, hermetically sealed, non-public spaces. Instead, they are characterized by a distinctly human dimension in which they operate. In this regard, they represent a significant counter-design while simultaneously meeting the demands for interdisciplinary and socially oriented innovation processes (e.g., Open Science). The framework of DLR (see 3.2) introduces various aspects that may spark how public sector innovation labs can benefit from the DLR framework.

The DRL fosters real-life innovations to bridge the gap between controlled environments and everyday life scenarios. So far, most innovation labs in the public sector have been acting shielded. Opening up to a more human-centered reality would support them in becoming more relevant to the challenges of citizens. Observations highlight a different approach to innovation. DLRs prefer a bottom-up approach to innovation, while in the public sector a rather hierarchical, top-down innovation approach is still distributed. That goes along with the recommendation to open up the innovation process and collaborate with multiple stakeholders to focus on socially relevant issues serving the public interest.

DRL addresses societal challenges by involving the public in the research process to act responsibly and mission-orientated. Instead, most public innovation labs are oriented primarily on the political agenda. Involving multiple stakeholders, and taking their perspectives profoundly, might help to stabilize their contribution to a valuable transformation.

Many public innovation labs have been much closer to implementation than visioning due to governing time frames and horizons. DRLs, on the other hand, design speculative visions of the future that act as examples for discourse, as artefacts for a common understanding, and as spaces of possibility. Understanding this vision as a starting point for action is an offer that DLR can make to innovation labs in the public sector to broaden the degree of exploration and openness to include uncertainties.
The relevance of promoting a multiplicity of knowledge demands for integration of multiple stakeholders and the acceptance of the co-existence of multiple forms of knowledge (cf. Mode 3). This view would provide a new form of openness beyond individual expertise and responsibility.

5. Outlook

In conclusion, this paper presents a framework as a systematic approach for analyzing the potential aspects of structural development, responsible research approaches, and various modes of future-oriented knowledge transfer within the domain of DRLs. However, the gap between theoretical principles and practical implementation highlights the existence of blind spots and challenges that need to be addressed:

To the design discipline:

- Affiliation with Design Schools:
  Being associated with design schools provides structural freedom and political independence for a DRL. However, the accessibility to external stakeholders beyond the discipline should be questioned to involve external stakeholders in the process and recognize their added value.

- Beyond traditional scientific outcome:
  Design-based interventions produce implicit knowledge that is not measurable data in a traditional scientific sense. Furthermore, the data collected from such processes is often not evaluable as quantitative, representative datasets in the traditional sense. Thus, these different forms of knowledge generation also demand new types of research results, approaches to evaluation, and impact measurement.
- Knowledge transfer and science communication of Design Research:
  The need for knowledge transfer and science communication leads to the question of how the added value of design research and the knowledge production processes behind it can be conveyed and transferred to other disciplines. For instance, the natural sciences make their research widely accessible through science communication formats, whereas the specialized discourse in design research often remains confined to the design discipline itself, even when interdisciplinary collaboration occurs.

To the public sector:

- Stakeholder expectation management:
  The lack of knowledge transfer regarding design-based research processes and methodologies can lead to misguided expectations from external stakeholders. The aim of DRL often goes beyond quick ideation and prototypes. They foster societal debates to formulate questions, needs, and collaborative visions to define a strategic and ethical framework. They also take structural, cultural, and legal into question, which leads to more long-term processes that are crucial to upscale and implement outcomes.
- Openness towards implicit knowledge and exploration:
  The most enduring challenge innovation laboratories are facing is based on the inherent conjunction of implicit and explicit knowledge, which in processes of public administration serves as one aspect to determine. Innovation laboratories should take on the role of exploring different questions of measuring, judging, and planning need to be deferred so as not to destroy the innovation capacity before it arises.
- Diverse skill sets and new profiles:
  The public sector is driven by clear structures and linear logic that led to bureaucratic hurdles and a culture that is rarely open to new skill sets and multiple profiles. More flexible structures and higher diversity, as a DLR provides, would unfold the innovation capabilities, and help to overcome the upcoming shortage of skilled workers and the demands of younger generations entering the public sector.

Since the development and establishment of public sector labs is an ongoing process, we propose a two-fold approach: Firstly, it would be intriguing to test the framework by investigating more DRLs (see acknowledgments). Secondly, while in this paper we have approached the public sector from a design perspective, it is worth noting that within the public sector, a scattered pattern of labs has been identified, which would also be of interest for further investigation.

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P/REFERENCES OF DESIGN

REGENERATIVE DESIGN IN THE CIRCULAR ECONOMY: AN OXYMORON?

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KEYWORDS | REGENERATIVE DESIGN, INTERDISCIPLINARITY, DOUGHNUT ECONOMICS, ANTHROPOCENE, ONTOPOLITICS

ABSTRACT | The Circular Economy (CE) model considers the life cycle of material goods and examines its journey from cradle to cradle; it tries to put human beings in the same species picture as other living things and focuses on design of materials and systems. The Ellen MacArthur Foundation (EMAF) argues for an industrial economy that is restorative or regenerative by design and aims. Regenerative design requires a multi-disciplinary approach which transcends the disciplines of design only. Despite the use of the terms restoration and regeneration, these have not been readily defined in the context of a circular economy. In this paper we critique the term 'regenerative' from different interdisciplinary perspectives. Interdisciplinarity analyses, synthesises, and harmonises links between disciplines into a coordinated and coherent whole. Regenerative design has acquired different meanings and outcomes in different disciplines. Regenerative design is a key component of heterodox economic models such as the circular economy and doughnut economics which contend that the current orthodox economic model of indefinite linear growth is not compatible with 21st century needs. Regenerative design is proposed as a key tool in meeting the needs of the heterodox economic models. This paper uses case studies to illustrate the different understandings of regenerative design from different disciplinary backgrounds, leading to a unifying definition. This paper argues that regenerative design in context of the Circular Economy is misunderstood and needs clearer definitions that support a genuinely restorative economy, one that will need a new politics, fit for the conditions of the Anthropocene.

1. Introduction

We examine the role of design in shaping governance, business, and innovation by exploring the emergence of designing for alternative economic frameworks through the lens of regenerative design as a design process that aims to repair, recreate, or restore the ecosystems in which it operates and on which it relies. It has been applied mostly in the built environment. The fields of Design and Architecture, conscious of their roles in the creation of demand for and consumption of natural and synthetic resources, have been at the forefront of the call to reimagine how we design our society and how economic systems may be optimised to respond to the climate crisis. In this paper, we incorporate understandings of 'regenerative' from other disciplinary perspectives, such as marine science and computer science. We contend that regenerative design in the context of the Circular Economy is misunderstood and needs clearer definitions and policies that support a genuinely regenerative economy.

Scientific consensus has, unusually, unanimously concluded that the climate is changing and that it is 'unequivocal[ly]' due to human activities affecting every part of the globe at an unprecedented scale (IPCC 2021). The Anthropocene, a concept originating in the Earth Sciences (Crutzen and Stoermer 2000a, 2000b), posits that the impact of human activity on the Earth's systems can be clearly observed and measured in climatic changes, geological findings such as sediments and ice, and a steep decline in biodiversity (58%) in the last four decades which has led scientists to call it the Sixth Extinction (Kolbert, 2014).

The pursuit of scientific knowledge driven by the Enlightenment values of the seventeenth- and eighteenth centuries and the attendant 'improvement' of the social and natural world gave birth to the Industrial Revolution in the Western world and the emergence of design as an instrument of industry and commerce. Whilst Modernity led to a general improvement of (some) human ecosystems, this came at the cost of systematic destruction of human and non-human habitats, decimation of many other species, and decline in the quality of the Earth's ecosystems. The term 'Anthropocene' thus provides a shorthand to describe the planetwide condition of anthropogenic environmental degradation and climate change coupled with the capacity of human societies to effect those changes. We are positing that the Anthropocene has heralded the end of Modernity and its associated focus on progress. The Anthropocene offers the opportunity to reframe the conceptual framework in which we think about what constitutes progress, the economy and design.

The earth's climate is at a critical juncture, with urgent action needed to avert catastrophe on a planetary scale. Yet, commitment to the necessary actions remains elusive, and a clear gap remains between the stated intentions of governments, and the actions that are required to achieve this target. A lack of concrete outcomes from the latest COP 28 meeting of the UNFCC is only the most recent of successive missed opportunities (House of Commons Library, 2024). The ambition of Net Zero targets by many governments, including in the UK (2021), is undoubtedly welcome, but academics, practitioners, and activists concerned with climate change have increasingly concluded that, given the already-degraded state of the environment, sustaining Net Zero is not enough. Instead, we must adopt a regenerative mindset that rethinks how systems, products and services are designed to service and operate a circular economy that not only sustains but replenishes the ecosystems on which it depends: through regenerative doughnut economics (Raworth, 2017).

Regenerative design, then, critiques the concept of Net Zero for lacking ambition to positively contribute to the environment's restoration. Regenerative thinking can avoid some of the risks associated with the rush to embrace Net Zero; risks include centuries of ecological thought, particularly that of indigenous peoples, being disregarded, or that environmentalism is framed simply and exclusively as the technological optimisation of lower-carbon manufacturing, distribution, and servitisation.

Our arguments have been informed by a workshop held in June 2023 (see acknowledgments) that examined the term 'regenerative' in context of regenerative tourism, drawing from different interdisciplinary perspectives spanning ecology, biology, design, literature, craft, computing, business

studies, and tourism. In the rest of this paper, we begin by presenting an overview of the framings which intersect with regenerative design: design theory, critical studies, heterodox economics, and ecology. We critique the circular economy through the examination of the term 'regenerative', expanding its interdisciplinary meanings beyond a design lens only, and go on to describe our proposals for the benefits of regenerative design. These will be descriptions of regenerative design in other disciplinary contexts such as marine ecology and computing. Finally, we end with a provocation that perhaps regenerative design is ultimately an oxymoron: is it possible to design in a truly regenerative way within the constraints of the current economic system?

2. Introduction and Background

What is design? If design is the process of applying creativity to solve problems (Design Council, n.d.) then 'everything not made by nature, has been designed' (Design Council, n.d.). The expansive notion of design as 'design thinking', from product to service design, landscape design to architecture, software and interaction design, was originally framed by Richard Buchanan (1992) where he outlined that the subject matter of design is potentially universal in scope. Buchanan expanded on Horst Rittel's idea of 'wicked problems' (1972), which are 'a class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where ramifications in the whole system are thoroughly confusing' (Buchanan, 1992, p. 15). For Buchanan, design can be applied as an iterative process to solving 'wicked problems'. Climate change has been defined as a wicked problem (Termeer *et al*, 2013) to which design thinking can be applied to help solve some of its intractable difficulties.

To begin with, *sustainable design* can be situated in a tradition first expressed by Victor Papanek in *Design for the Real World (*1972), which urged designers to take responsibility for the external consequences of their work on users, society, and the environment, rather than see themselves only as service providers to industry, which inherently 'defutures' (Fry, 1999). Sustainable design entailed a 'first do no harm' ethos, arguing that the manifestations of our designed and engineered enterprises should sustain the natural environment that provides the raw materials to realise them, as well as the ecosystems necessary to maintain those environments. The landscape architect John Tillman Lyle (1996) first outlined *regenerative design* for sustainable development. He argued for design to be understood in 'a large and inclusive sense' in the conceiving and shaping of complex systems in which 'the earth and its processes join with human culture and behavior to create form' (1994, p. ix). He argued for a collaborative, interdisciplinary design process that is inherently self-renewing.[1] Lyle was aware that complex multi-goal regenerative systems that involved both natural and social processes, which might not be entirely understood by designers would be challenging for the design process. Lyle outlined strategies for regenerative design:

1. letting nature do the work;
2. considering nature as both model and context;
3. aggregating, not isolating;
4. seeking optimum levels for multiple functions, not the maximum or minimum level for anyone;
5. matching technology to need;
6. using information to replace power (i.e. work smarter, not harder);
7. providing multiple pathways (e.g. not just one source of energy but several renewable options),
8. seeking common solutions to disparate problems;
9. managing storage as a key to sustainability (e.g. storing water, ready for replenishment and release);
10. shaping form to guide flow (e.g. design to support natural air ventilation rather than mechanical one);

[1] In the Center for Regenerative Studies which John T. Lyle ran, the core team of twelve people included two architects, two landscape architects, two agronomists, an anthropologist, an aqua culturist, an energy analyst, a geologist-hydrologist, an agricultural economist as well as two graduate assistants. (Lyle, 1994, p. 31)

11. shaping form to manifest process (e.g. windmills as an integral part of the landscape rather than a hidden infrastructure); and
12. prioritising for sustainability.

The issues Lyle identified arguably qualify as 'wicked problems'. Lyle argued that systems should be designed for optimum levels across multiple functions, rather than one. His regenerative strategies extended beyond Papanek's arguments but have not had the same level of influence on design; in this paper, Lyle's strategies represent some principles on which we build.

Papanek's influential work appeared in the same year as the seminal Limits to Growth (Meadows *et al*. 1972, 1992, 2004) reports which raised profound warnings about the ecological and social limitations of linear growth of the economy. The Meadows reports also contained a message of hope outlining that if humankind could create a society which imposes limits on growth and the production of material goods, then humanity and its interdependent ecosystems of non-humans could achieve a sustainable state and live indefinitely on Earth in a carefully-managed dynamic process of balancing human and non-human flourishing and uses of resources and spaces. Early challenges to the orthodox neoclassical economy that underpinned the indefinite linear growth model, argued for a more devolved, localised and connected economy which supported (local) labour and resources (Boulding, 1966; Schumacher, 1973). More recently, the case for 'prosperity without growth' (Jackson, 2010), 'a new green deal' (Pettifor, 2019), or 'doughnut economics', 'offers a vision of what it means for humanity to thrive in the twenty-first century' (Raworth, 2017).

We suggest that the doughnut economy model, outlined by economist Kate Raworth (Fig. 1), resonates with Lyle's ethos for regenerative design. In the doughnut economy model, the nine planetary boundaries set out by Rockström et al (2009-) form the ecological ceiling which, if crossed, pose a significant risk of irreversible ecological changes. In 2023, six of the nine global boundaries assessed were crossed (Stockholm Resilience Center, 2023). The safe space for humanity is one which is based on a solid social foundation and which operates within the ecological ceilings of our global ecosystems. The doughnut economy model thus provides a framework within which regenerative design makes sense.

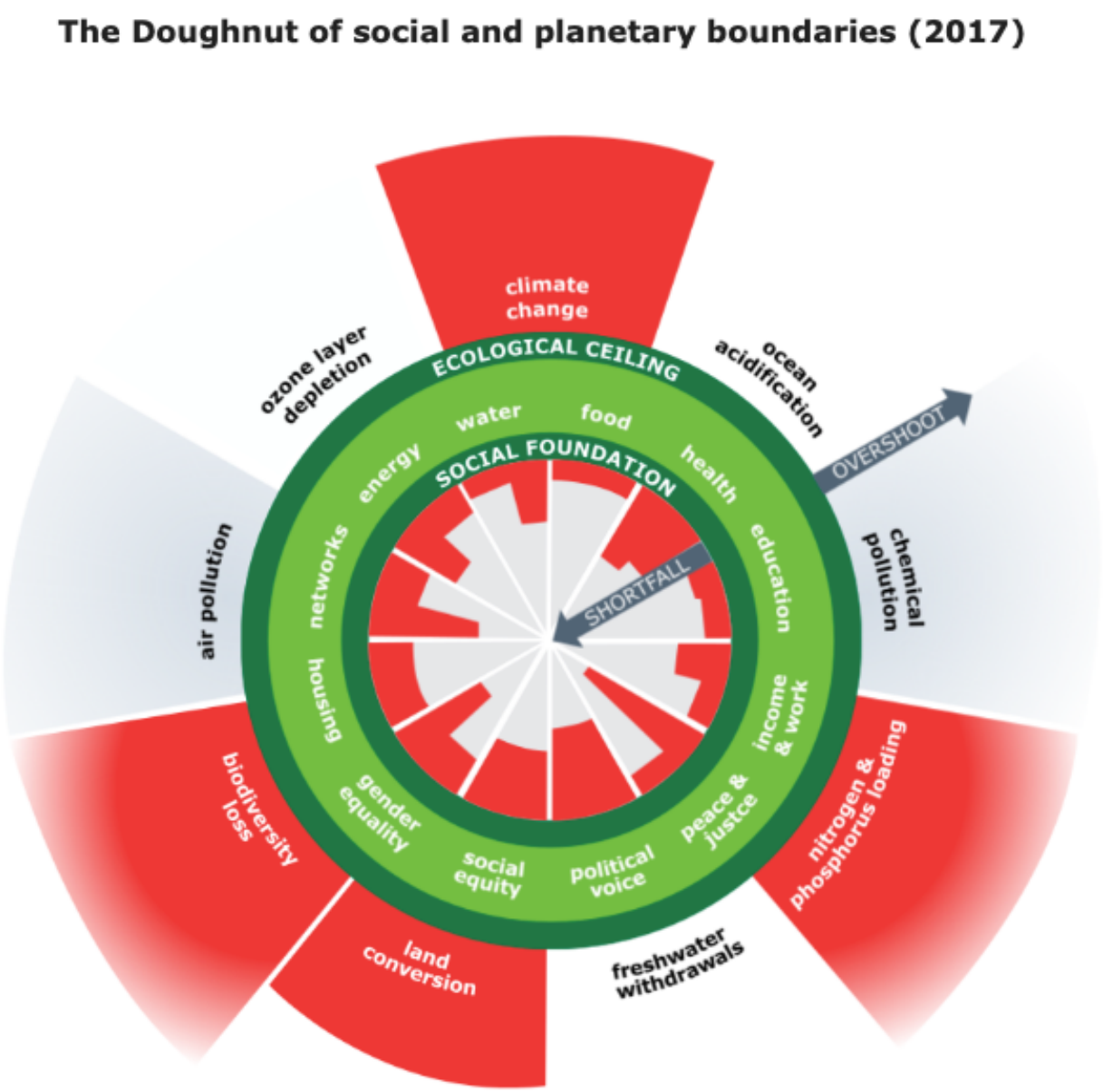


Figure 1: The Doughnut of social and planetary boundaries (2017) Credit: Kate Raworth and Christian Guthier. CC-BY-SA 4.0. Source: https://www.kateraworth.com/doughnut/#.

However, designing within planetary limits poses significant challenges and requires insights and understandings which go beyond design. To achieve its potential, regenerative design requires a multi-disciplinary approach which transcends the disciplines of design only and requires supportive and integrated policy approaches.

The correlation between financial, social, and environmental sustainability had already been made in the 'triple bottom line' concept (Elkington, 1994) but the circular economy as outlined by the Ellen MacArthur Foundation (n.d.) (EMAF) argues for 'an industrial economy that is restorative or regenerative *by design and aims*'. The concept of the Circular Economy (CE) cannot be attributed to a single author or date (Wautelet, 2018). It describes a closed loop economy, that favours re-use and repair over new goods and delivers positive impact for not only job creation and economic competitiveness but also resource savings and waste prevention (Stahel and Reday-Mulvey, 1981), based on the understanding that there is an extensive

interdependence between the economy and the natural environment (Pearce and Turner, 1990). The CE came to prominence with the publication of a study by the EMAF (2013) with consultancy firm McKinsey at the global economic forum in Davos in 2012 (BBC, 2012), which outlined the significant financial benefit of a CE (Lacy and Rutqvist, 2015; Stahel, 2020).

The CE considers the life cycle of material goods and 'tries to put human beings in the same "species" picture as other living things"'(Braungart and McDonough, 2002); it tends to focus on design of materials and systems. Braungart and McDonough's (2002) 'cradle to cradle' ethos promotes a circular *design* approach that examines the life cycle journey of material goods. The butterfly diagram of the circular economy model (Fig. 2) articulates the 'technical cycle' which involves the management of stocks of finite materials into a circular economy through repair, reuse, redesign, redeployment, and refurbishment. The 'biological' cycle instead focuses on the flow of renewable materials into the generation of nutrients as part of the natural ecosystem.

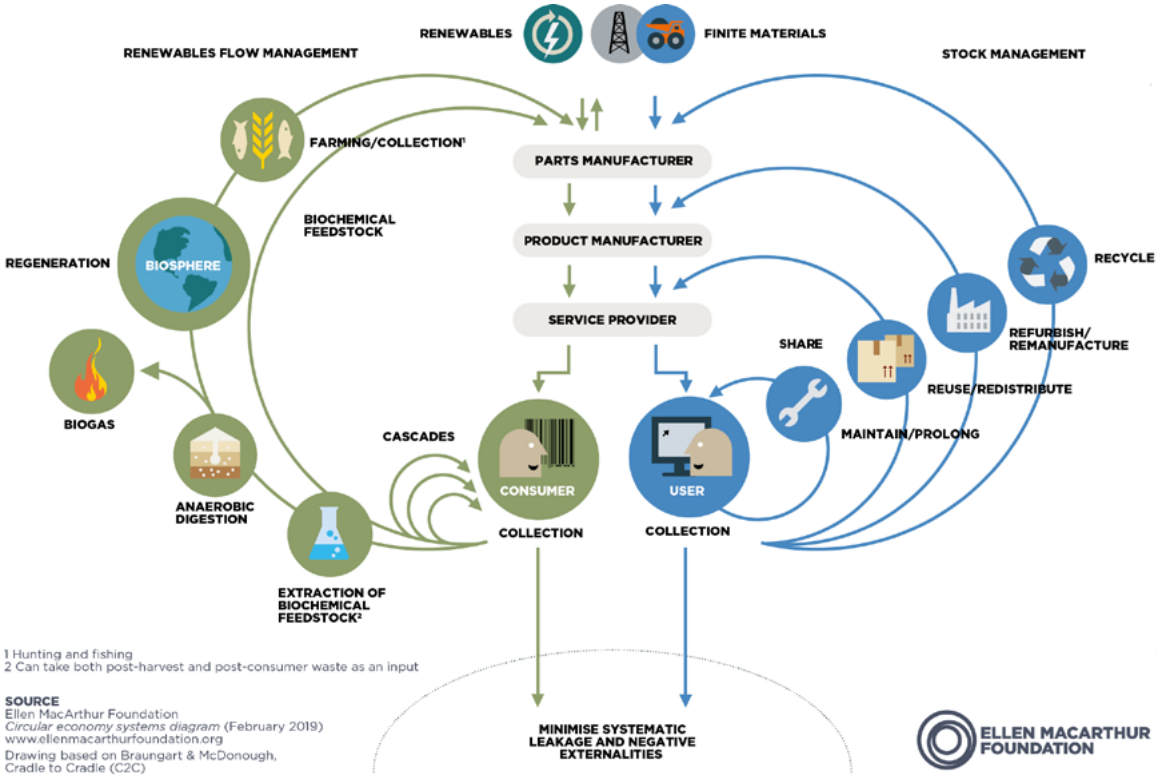


Figure 2. The Circular Economy Butterfly Diagram. Ellen MacArthur Foundation (February 2019) – drawing based on Braungart and McDonough Cradle to Cradle. Source: https://www.ellenmacarthurfoundation.org/circular-economy-diagram.

Critiques of the CE have argued that it does, however, not address ontological and epistemological questions, such as what might be considered the ethical value of design, or what is or who the economy is for? Temesgen et al (2021) posited that the CE foregrounds efficiency and resource management, which they contrast with the paradigm of 'Ecological Economics' where the goal is to achieve and secure a higher quality of life. This arguably aligns with the doughnut economics outlined earlier. Furthermore, the CE tends to fail to acknowledge either the impossibilities of a 'closed loop' in terms of biophysical limitations or the difficulties in implementing CE principles in policy and business models that are dominated by corporate thinking, lack holistic approaches, and ultimately do not challenge the growth agenda of the current capitalist system (Corvellec, Stowell and Johansson, 2021). We will return to this need for a new 'ontopolitics' (Chandler, 2018) in our discussion later on. This 'depoliticization agenda' (Valenzuela and Böhm, 2017) of the CE is challenged in the concept of 'regenerative design'.

The distinction between technological and biological cycles in context of a CE is useful in discussion of regenerative design. Morseletto (2020) argues that most CE activity focuses on *restoration* as products are repaired, upgraded, refurbished, or remanufactured which restores them rather *regenerates* them. As Pawlyn (2019) argues, 'Sustainability hasn't made enough headway to ensure our society persists beyond the middle of the century. We need to start doing more.' Regenerative design therefore aims to create outcomes 'in which whole-system health and wellbeing increase continually' (Gibbons, 2020). In other words, it is no longer enough to do no harm, we must also design to repair the harm we have done. As design relates to both 'technical' – use of technology, equipment, infrastructure etc. – as well as 'biological' cycles – use of natural resources – this framing is helpful to explore the different interpretations of 'regenerative' from different disciplinary perspectives. Despite the use of the terms restoration and regeneration, these have not been readily defined in the context of a circular economy (Morseletto, 2020).

In response to criticisms that design risks accelerating the technological optimisation of carbon manufacturing (business as usual) and ignores other ways of knowing and doing that are more in tune with ecological living, such as indigenous knowledge, design scholars have proposed Responsible Design (Hernandez and Goñi,2020) as a framework for research and practice that is both regenerative and inclusive (Fig.3).



Figure 3. Six Principles of Responsible Design (Boehnert, Sinclair, and Dewberry, 2022).

The Six Principles of Responsible Design (Boehnert, Sinclair, and Dewberry, 2022) are that design should be 1) ethical, 2) pluriversal, 3) planet centric, 4) decolonial, 5) transdisciplinary, and 6) optimistic. Designers can be valuable agents of social change, but, as the Design Council (2021) notes, 'for the most part, designers are not yet using their skills and knowledge to deliberately support the green transition in the way that they should and could'. Responsible Design requires that designers accept '(a) the responsibility to avoid harm, (b) the responsibility to do good, and (c) the responsible governance of the design process' (UAL, 2019). In so doing, it demands that designers engage in transdisciplinary practices, that they avoid proposing discrete, single-issue 'solutions' and instead confront a key aspect of ecological theory, namely the systemic nature of the earth's problems and the efforts necessary to address them. Regenerative approaches recognise that humans are active agents in ecosystems (global and local): a key tenet of the Anthropocene.

3. Case Studies

The three case studies we present are drawn from different disciplinary perspectives. They are collated here to highlight how 'design' is applied in different contexts to encourage restorative and regenerative practices and how these terms have different interpretations for different stakeholders. The first case study is taken from marine science where restoration programmes are designed to support the regeneration of depleted ecosystems. The second case study looks at regenerative design applied within the craft industry but from an ecological restoration perspective. The third case study outlines regenerative design practices applied to robot design. These three disciplines all outline regenerative design but have different understandings of what it means in practice.

3.1 Regenerative Design for Mangrove Restoration

Mangroves support the livelihoods and well-being of millions of coastal inhabitants globally by providing coastal protection, regulating water quality, providing food security, and sequestering large quantities of carbon. They are in short, key ecosystem infrastructures. Mangrove degradation and loss (20-25% globally) has impacted communities and economies worldwide. The successful restoration of these ecosystems has been the result of both failures and successes of restoration projects and these learnings are collated in a 'best practice guidelines for mangrove restoration' by the Global Mangrove alliance (Beeston et al, 2023). Following the earlier description of design as the process of applying creativity to 'everything not made by nature', we argue that the restoration process can be considered a design process which has resulted in restoration guidance documents and tools to design and create the right conditions for mangroves to grow back naturally. If the 'most successful way to restore mangroves is to create the right biophysical and socio-economic conditions' (Beeston et al, 2023, p. 18), then creating those conditions is a process of design.

The key stages in this process are as follows: 1) setting goals and assessing feasibility, 2) project design, 3) engagement and implementation, and 4) monitoring and evaluation.

The guiding principles for successful restoration are summarised in six key core principles:

1. safeguard nature and maximise biodiversity;
2. employ the best information and practices;
3. empower people and their needs;
4. align to the broader context – operate locally and contextually;
5. design for sustainability; and
6. mobilise high-integrity capital.

The principles outlined above support a restoration process that should enable the mangrove ecosystem to look after itself without any further human intervention. The impact of restorative practices on the connections between ecological, social, and economic systems has been evidenced repeatedly and is captured in these guidelines. Getting the hydrology right optimises the chances that the mangrove will not require any more intervention because it will function autonomously in balance.

The ecological restoration here facilitates ecological regeneration. The restoration process in turn supports the reversal of coastal erosion, increased biodiversity, increased natural stock, and thus improved economic benefit. Restoration is defined here as the 'act of bringing an ecosystem back as near as possible, to its original condition' (Beeston et al, 2023, p. 7). It is, however, not always clear or defined what the original condition might have been, in which timeframe, and by whose definition. Ecologists, however, call this process restoration rather than regeneration even if the system has been restored to such a level that it can now repair and sustain itself after having been improved, if degraded, and is in better condition than it was before. Conversely, natural regeneration is defined as 'a process where propagules or seeds of mangrove (or other ecosystem components) are naturally recruited. This may occur in both degraded and non-degraded areas' (p. 6). The differentiation is that restoration has an implied human intervention, and

regeneration has an implied non-human process. All of Lyle's twelve strategies for the *regenerative design* process have clear resonances with the restoration processes outlined in the design methodology of the regeneration of mangroves. In this context, then, regenerative design describes and informs the conscious planning of ecological restoration that takes into account the relationships of ecological, social, and economic systems and leads to self-sustaining ecosystem flourishing.

3.2 Regenerative Design in Crafts Industry

The demise of traditional knowledge and its concomitant social values in the wake of industrialisation and globalisation was observed by the nineteenth-century British industrial designer, social activist, and proponent of the Arts and Craft Movement William Morris (1834–1896) who perceptively noted in 1884 that the globalised market economy affected craftworkers adversely globally. Yet, many indigenous communities retain strong connections with their local environments through artisan products and practices such as textiles, pottery, basketry, and blacksmithing which are made of, and speak of, place. The tensions between producing craft products that attract a global audience and their associated carbon footprint have focused attention on local markets and maintaining local customs and traditions which often encapsulate multi-generational knowledge of materials, habitats, and ecosystems. Truly regenerative design has been most successful where initiatives to restore habitats have incorporated social and material innovations (Watson, 2020; Panneels, 2023).

One such example is the Khoriya ko Kagaj project: the planting of broom grasses on the bare hills of the Mahabharat mountains in central Nepal by the Chepang community to stop erosion.[2] The 'amliso', or broomgrass, is traditionally used to produce 'brooms' for the domestic market and generates income for this marginalised community. As only the flowers are used for the brooms, the stems were a waste product which has now been developed into a higher value product by working closely with traditional paper-making artisans to develop a new, robust handmade paper from this waste material, thereby generating a new income stream. Although the waste produce could be easily absorbed back into biological cycle, here the natural waste is used to create more product that generates income as much as it restores the local ecosystems. The project has thus incentivised the Chepang community to restore the hills with broomgrass, stopping erosion and landslides and creating income streams. The system was designed to thus optimise the restoration of both the ecological habitat and the social community which depends on it. The design process followed several of the twelve principles of regenerative design outlined by Lyle by 1) letting nature do the work, 2) considering nature as both model and context, 3) aggregating, not isolating, 4) seeking optimum levels for multiple functions rather than one, 7) providing multiple pathways, 8) seeking common solutions to disparate problems (erosion and ecological degradation and poor economic prospects) and 12) prioritising for sustainability.

A key argument in sustainable design is to re-connect and re-evaluate traditional knowledge and indigenous ways of knowing which often harness nature's inherent restorative capacities and was recently captured in the phrase 'Lo-TEK' coined by designer Julia Watson, as radical indigenism (2020). She argued for a design movement to reconnect with lesser-known, local (Lo) technologies, both traditional and recent innovations, borne from Traditional Ecological Knowledge (TEK) to design and build climate-resilient infrastructures. This intersection of innovation, conservation, and indigenism, she argues, could offer a new path to 'exponentially shrink the ecological footprint of humankind and mitigate the forecast collapse' (p. 18). Like Lyle, her perspective is from a built environment point of view but, we argue, its principles of design are universal and can also be applied to other sectors of the economy.

[2] This project was supported by the British Council in Nepal through the In Our Hands programme in that supported nature inspired innovation in the creative economy. A short video of the project can be viewed here: https://www.youtube.com/watch?v=_Dmq5OIQYhQ&t=6s.

3.3 Regenerative Design for Robots in a Circular Economy

The CE distinction between technological and biological cycles are critical in the discussion on regenerative design. The previous two case studies have unequivocally engaged with natural ecosystems and their intersections with social ecosystems and economies. In this last case study, we briefly outline the use of regenerative design in the context of a technological cycle: the concept of regenerative design for robots. Robots have often been designed in a linear way: when parts break, they cannot be replaced, and the robot becomes obsolete. A circular design approach would 'fix' the problem by implementing a design approach that enables the repair and replacement of broken or faulty parts until no further repairs can be enacted. All parts are to be designed to be taken apart and recycled into the waste stream. Recent developments have included robots that are able to 'fix themselves' with built-in automated repair functions, mostly driven by the deployment of robots in hostile or inaccessible environments (e.g. deep-sea mining or outer space) where human intervention and repair might not be possible. A second development is that with the increased miniaturisation of robots, existing power infrastructures such as motors and gas engines are no longer serviceable and engineers. Designers have increasingly turned to 'biohybrid' robots which integrate living cells into mechanical bodies, 'benefiting from the intrinsic microscale self-assembly of living tissues and high energy efficiency, which, among other unprecedented properties, also feature flexibility, self-repair, and even multiple degrees of freedom' (Lin et al, 2022). Mini robots have been deployed in search and rescue situations, or in medical procedures, where they can enter the human body to perform noninvasive surgery for example. New research, however, is also exploring how robots might not only be able to use biomimicry (Benyus, 1997), but also combining bioengineering, nanotechnology and 3D bioprinting (Lin et al, 2022), for example bio hydrogels which expand and contract using ultraviolet light to propel a swimming robot (Shi et al in: Lin et al, p. 119). Increasingly biomaterials are being used to develop robots which have a high biocompatibility and biodegradability, which is important in medical situations for example. Thirdly, robot design has now included the use of biomaterial for robots to self-replicate (Kriegman et al, 2021). This approach is considered regenerative design because it enables the robots to maintain themselves autonomously without further demand on scarce resources.

This third example further demonstrates how the principles of regenerative design operate productively in a range of disciplines and industries. Here, too, several key strategies of Lyle's framework for regenerative design can be aligned; 1) letting nature do the work, 2) considering nature as both model and context, 3) aggregating, not isolating, 4) seeking optimum levels for multiple functions, not the maximum or minimum level for anyone, 6) using information to replace power, 8) seeking common solutions to disparate problems, 9) managing storage as a key to sustainability, 10) shaping form to guide flow, 11) shaping form to manifest process, and 12) prioritising for sustainability.

4. Discussion

This paper argues that regenerative design in context of the Circular Economy is misunderstood and needs clearer definitions that support a genuinely restorative economy. If 'regenerative design' is to be a tool for facilitating a truly circular, regenerative economy which restores the ecosystems on which it depends, and which by implication relies on interdisciplinary collaboration, co-operation and understanding, then a universally understood definition of regenerative design needs to be agreed on. As outlined in our case studies, the concept of regenerative design has acquired different disciplinary understandings.

Regenerative design as understood in the context of our case studies enables an ecosystem to look after itself without any further human intervention: mangroves, bare hillsides, or human and robotic bodies. Critically, it also highlights the 'agency' of humans in this process – a very Anthropocenic approach indeed.

The idea of the Anthropocene has particularly highlighted how human ecosystems (economic, social, and political) are irrevocably enmeshed with ecological ecosystems. However, the emergence of critical theory in the twentieth century as a philosophical approach has provided a kaleidoscopic lens of feminism, critical

race theory, post-structuralism, queer theory, and post-colonialism of the kinds needed to shift the conceptual understandings of Modernity and its concomitant drive for human-centred enlightenment and progress towards a more nuanced understanding that makes space for other ways of knowing and doing. Critical theory has refocused attention on alternatives offered by traditional, indigenous, or artisanal approaches, which often preceded industrialization (Haraway, 2008). Modernity and its process of globalisation had profound implications not only for the loss of traditional knowledge and practices but also for the social values they embodied. For the anthropologist Anna Tsing, the Anthropocene makes it possible to realise that Modernity itself is a barrier to living fuller lives:

> "Progress is a forward march, drawing other kinds of time into rhythms. Without that driving beat, we might notice other temporal patterns. Each living thing remakes the world through seasonal pulses of growth, lifetime reproductive patterns, and geographies of expansion. [ ] Instead, agnostic about where we are going, we might look for what has been ignored because it never fit the time line of progress." (Tsing, 2015, p. 21)

These multispecies, pluriversal (Escobar, 2017) insights are needed to respond to the challenges of climate change in the Anthropocene.

Scholars from International Relations have focussed attention on the implications of the Anthropocene on international governance, which commands an 'ontopolitics' (Chandler, 2018): new forms of governing and new conceptual frameworks which are more at home with 'discursive framings of contingency and complexity' (Chandler, 2018, p. 4) that acknowledge that the world is complex and interdependent. The U.N.'s *Our Common Future* – also known as the Brundlandt Report (WCED, 1987) – argued for sustainable development (growth) that 'meets the needs of the present without compromising the ability of future generations to meet their own needs' and called governments, civic society, and businesses to action. The Report laid the groundwork for the Earth Summit in 1992, which led to the establishment of the U.N. Convention on Climate Change (UNFCC), which established the Convention of the Parties (CoP) as the decision-making arm. Despite the early scientific warnings in the 1980s, such as those of NASA chief scientist John Hansen (Kolbert, 2018), it took until the landmark Paris Agreement (UNCC, 2015) at COP21 in 2015 for a first legally binding document with widespread international agreement on the need to reduce emissions to a level that limits global temperature rise to 1.5 degrees (IPCC, 2021, 2023) by 2030, requiring sustained international collaboration and co-operation.

It is clear, however, that several decades of climate policymaking through the U.N. COPs has failed to deliver these goals. Governance will require a new ontopolitics. We argue that this new ontoplitics will require regenerative design to be embedded at all levels of policymaking, funding and innovation strategies, and economic development. Regenerative design has been adopted by establishment organisations such as the Royal Society of Arts, the Royal Institute of British Architects, and the 1851 Commission3 and carries an inherent critique of the concept of Net Zero. As outlined earlier, the Net Zero targets by many governments to stop emissions of greenhouse gases into the atmosphere are hopelessly inadequate. Emissions are currently at record levels but would need to be halved by 2030 (IPCC, 2021) if we are to achieve Net Zero. A circular economy as currently proposed, which has no theoretical energy loss and is biophysically impossible, suggests an improvement on current manufacturing but does not improve the status quo in ecological or social terms. The 'depoliticization agenda' (Valenzuela and Böhm, 2017) of the CE is challenged in the concept of 'regenerative design'.

The case studies we put forward outlined how regenerative design in mangrove restoration has resulted from explicit regeneration policies, whilst the regenerative craft example operated on the fringes of a creative green economy policy, and the regenerative robots emerged from innovation policies. The term 'regenerative' thus needs to be claimed firmly as a more robust terminology to describe design processes

[3] Royal Commission 1851 was established in 1850 to specifically support advanced study and research in science, engineering and design. It established a Fellowship in Regenerative Design to support the research of regenerative design in the built environment. See: https://royalcommission1851.org.

that should be applied to any industry or sector to describe a process that a) supports both environmental and social regeneration, of which the economy is a defacto by-product – thus flipping the CE mode, and b) which explicitly challenges the continued growth model, which is implicit in the CE.

If regenerative design principles are understood to improve the conditions of the ecological, social, and economic conditions in the context of which this is applied, then this is often achieved by applying Nature-based solutions or Biomimicry which require interdisciplinary knowledge. Furthermore, in order to be able to argue that regenerative design principles have been successfully applied, an understanding of what constitutes a baseline from which conditions can be improved needs to be agreed on. It is clear from our discussions with ecologists that knowing the baseline from which to start are not always clear, nor universally agreed on by all stakeholders.

Instead, we must adopt a regenerative mindset that rethinks how systems, products and services are designed to service and operate a regenerative doughnut economics which serves ecosystems rather than economies. It is worth remembering the ancient Greek origin of the word economy where ‘oikos’ refers to ‘house’ and ‘nemein’ refers to ‘manage’.

5. Conclusion

We have argued in this paper that applying genuine restorative design principles in different disciplinary and economic contexts might simply not be possible. It requires us to move beyond ‘business as usual’ and beyond a circular economy which, although aspires to be regenerative, is inherently an oxymoron: a contradiction of terms. In this paper, we suggest that the lens of regenerative design is a useful way of introducing the embodied complexities and interconnected nature that is the wicked problem of climate change, which requires a new ontopolitcs of the Anthropocene. In order to devise policy frameworks that support complexity, and contingency, we suggest that regenerative design frameworks need to be firmed up to support the development of governance structures which can cope with the unpredictability and urgency of the climate crisis. We are suggesting that regenerative design needs to be re-framed and articulated by trans-, inter- and multi-disciplinary teams in the context of the new ontopolitics of the Anthropocene. Regenerative design goes beyond sustainability and seeks instead opportunities for re-imagining society.

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P/REFERENCES OF DESIGN

SENSE OF POSSIBLE: A DESIGN PROCESS MODEL BASED ON EFFECTUATION AND SENSEMAKING.

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KEYWORDS | DESIGN PROCESS, BRICOLAGE, EFFECTUATION, SENSEMAKING

ABSTRACT | In this conceptual article, I propose a new design process model based on bricolage, sensemaking theory, effectual thinking, and Donald Schön's idea of reflective practice. The design process is the most researched topic in design studies, and introducing a new perspective is challenging. As the design paradigm undergoes a shift and the role of the designer transitions from being merely an expert to becoming more of an enabler, it becomes imperative to explore the ways in which designers engage with innovation My experience suggests that rational and linear normative models do not support constructive design thinking through practice. Reflective design process models, on the other hand, may struggle to guide what should be done in each situation. The designer's "superpower," however, lies in incorporating embodied and intuitive expertise into rational innovation activities within an organization. What new insights can sensemaking and effectual thinking bring to normative design thinking? What does a constructive design process look like when removing rational-analytic elements to make room for designer-like intuitive actions? The contribution of the article is to complement those previous perspectives where design and its practices are linked to the pragmatic paradigm. Design can be described as a visually and materially oriented embodied imaginary service that utilizes imperfect information to integrate meanings for the future. The result can be an unpredictable, surprising, and unique concept. A design process that involves stakeholders in innovation progresses through the integration of stakeholders, imagination, action, reflection, and learning towards achieving a common purpose.

1. Introduction

The role of the designer in innovation activities can be summarized as follows: developing new, unexpected solutions, tolerating uncertainty, working based on imperfect information, applying imagination and constructive anticipation to practical problems, and using drawings and other modeling tools in problem-solving (Cross & Clayburn Cross, 1995). Roberts (2023), drawing on Rittel and Webber's (1973) ideas, lists various general problem-solving strategies as follows: competitive, authoritarian, rational-analytical, taming, and collaborative. In addition to these, a design strategy is also possible for approaching wicked problems.

In design research, two ways of doing design stand out: the linear "rational" model prevalent in product development and innovation activities, and the constructive, reflective model based on Donald Schön's (1983) ideas of design as an intuitive, dynamic, and iterative process. The rational model sees design as one phase in a linear process, whereas the reflective model sees design as an active process throughout the entire innovation process. In this article, I start with this binary framework, where on the one end of the spectrum is a positivist-managerialist worldview and another end is a critical-constructionist (Tienari & Meriläinen 2012) worldview (Figure 1). The vertical axis of the figure represents design practice done independently versus collaboratively.

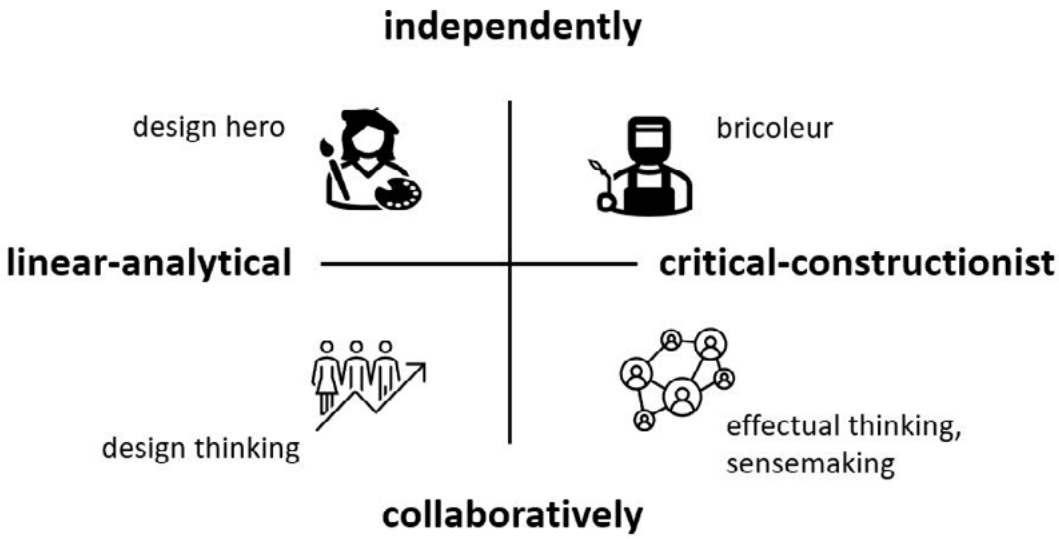


Figure 1. Designer's worldviews: rational-analytical versus critical-constructionist.

My aim with this conceptual article is to contribute to the discourse on the constructionist worldview of design, complementing Schön's reflective perspective with insights from bricolage, sensemaking, and effectuation. This article addresses two questions:

How can design be understood and defined from the perspectives of effectuation and sensemaking?

How can the approach of bricolage, effectuation and sensemaking to design be formulated into a normative process model?

2. Theoretical Framework

2.1 Rational-Analytical Design Thinking

There are dozens of versions of rational models available for the development of new products (look at, for example, Dubberly, 2005). These models typically involve progressing from defining goals and problems to generating alternative solution proposals, then refining and testing them. These normative models are used to guide and manage the creative process in time-bound product development. Interdisciplinary product development teams and novice designers benefit from clear guidance on how to proceed in situations requiring open-ended creativity.

Criticism towards these models has been raised regarding their failure to account for the designer's intuitive thinking or the significance of the social aspect of the design process. Rational models are based on the idea of a predictable future towards which one progresses through consciously planned stages. Over the past decade, the term “design thinking” has gained significant popularity, as it provides an easy way to describe the contribution of designers to product development and innovation activities.

Design thinking is understood to refer to the use of design-oriented approaches in the discourse of business, management, and even social innovation. Books on the subject are often referred to as manuals, toolkits, workbooks, or playbooks, offering how-to guides for design thinking. The term has allowed design or business consultants to capture, commercialize, and trivialize design into a few methods, tools, or process models.

Some design researchers criticize the use of the term “design thinking” to describe this mechanized process, which diminishes the broad knowledge, skills, and expertise of professional designers. Critics argue that mechanical design thinking produces highly conservative thinking and may even make genuine innovation and real change impossible. Thus, design thinking can be seen as belonging to the rational-analytical category, at least in terms of how it is often taught and applied in business settings. Design thinking is just a new name for the old “rational-experimental” approach to problem-solving (Iskander, 2018).

Kimbell (2011) argues that design thinking suffers from several issues: 1) it relies on a dualism between thinking and knowing, as well as acting in the world, 2) generalized design thinking does not depict the diversity of designers' practices, and 3) the designer is seen as the primary agent in design. According to Kimbell, attention should instead be paid to the situated, embodied routines of designers and others.

The activity that occurs in the professional practice of design, in studio work, could be referred to as designerly thinking (Cross, 2023). It is based on thinking through making, intuition, alternating between divergent and convergent thinking, and perhaps empathy. This also includes designerly practices, interventions, interpretations, discourse, as well as linear, artistic, and bricolage-type approaches. Designerly thinking is also not something that can be mastered by reading a workbook, attending a seminar, participating in a one-day workshop, or completing a Design Thinking MOOC course.

2.2 Reflective Design Practice

Donald Schön's (1983) book “The Reflective Practitioner” introduces the design process as reflective action, providing an alternative to rational models. Schön was influenced by the thinking of John Dewey, who argued that habitual action and intellectual reflection occur simultaneously: in competent action, thinking happens precisely within the process, not outside it. The designer creates a situation according to their understanding, and the situation “talks back.” The designer shapes their own environment and must react to it, thus engaging in reflection-in-action. This dialogue often takes place, for example, through sketching and model-building. Action can lead to unintended, even surprising consequences. By reflecting, the designer learns more about the design subject and their own actions, evolving as a designer.

Schön's reflective perspective overlooks the bodily and social dimensions of design activity, including design activities that occur within an innovation-producing organization; the designer often engages in conversation with others simultaneously with the situation. Schön's ideas have also been criticized for presupposing a negative starting point – a problematic situation. However, a designer can act even in the absence of a problem.

The reflective model is descriptive, depicting, and does not instruct novice practitioners on what to do in a situation or how to progress in creative problem-solving. According to the model, one must do something to reflect on their actions. Where does this impulse, this pre-understanding of action, come from?

2.3 Pre-Reflective Thought

Rylander Eklund, Dixon & Wegener (2023) propose – based on the thinking of John Dewey – that pre-reflective thought forms a continuum with reflective thinking (as per Schön's reflection-in-action). Design practice is seen as regular participation in conversations with one's own actions and others, combined with pre-reflective "design artistry." Observation and imagination skills are central here, and the designer develops these skills through sketching and model-making, seeking cues from the environment. Imagination relies on sensations, emotions, and meanings, which together form something new.

The results of observation and imagination cannot be seen in advance, so the designer must immerse themselves in a state of uncertainty, focusing on constructing present meaning through sketching and model-making. Over time, these techniques can be seen to cultivate the designer's "adventurous attitude," where awareness of the environment and sensitivity to impulses grow. Design studio practices, imagination, and improvisation – starting from imitation of more experienced designers – develop the designer's sensibility, which is a key essential skill for the designer (Rylander Eklund, Aguiar & Amacker, 2022).
Designers should not only reflect introspectively but also interact with colleagues. Outward-facing reflection brings together the collective perspectives of collaborating individuals, generating social, political, and emotional material. Parties learn together and form a collective understanding of what is desired (Tan, Kocsis & Burry, 2023). Social practices in studio design shape the collective sensemaking of the parties involved in producing innovation: efforts to build equal peer relationships among stakeholders, openly presenting sketches, facilitating collaborative composition, and continuously narrating the ongoing design process, critically reflecting on the design task given at the beginning of the work (Kettunen, 2014).

2.4 Bricolage

Schön (1983) proposed that architect Quist has constructed a repertoire from examples, images, understandings, and actions encompassing material from various circles of design. It includes places he has seen, buildings he knows, design problems he has encountered, and solutions he has produced. All these are part of his repertoire, insofar as they are available to him for understanding and action. The repertoire is a concept very close to that of the bricoleur's stock of materials.

Bricolage is about tinkering, building, and assembling. It is a concept developed by Lévi-Strauss (2004) for the activity in which a "bricoleur" uses whatever materials are at hand to solve a problem through improvisation. It is an event where the maker wants to express themselves and their identity by using whatever material happens to be available and by creating various signs from different contexts. Materials can be physical, mental images, solution patterns, or social cues.

Louridas (1999, p.522) argues that "design in all its forms is a form of bricolage." Design is not equivalent to bricolage, but we can look at design like bricolage. Weick (2001, p.62) states that designing is synonymous with bricolage, and the designer acts as a bricoleur: "Design is clearly a sensemaking process that gets by using whatever materials are at hand."

The first practical step of the bricoleur in an inspiring project is retrospective. He examines what materials and tools are available before deciding which of them he will utilize to solve the problem. The materials, of course, refer to those he has used previously. The broader their use has been and the more widely they have been understood, the more innovative the bricoleur is in improvising new forms from his stock of materials. He doesn't know the materials because they were useful; rather, the materials are useful because he knows them (Weick, 2001). The bricoleur's thinking diverges from rational logical analysis and planned ways of thinking. The engineer seeks a solution from the universe, while the bricoleur searches for it in his own scrapyard. The engineer dissects and analyzes; the bricoleur reassembles (Louridas, 1999).

A designer becomes a bricoleur when he uses the means at hand to solve a problem, whether these means are concrete in model building or waste pieces or parts of other products found in the corner of the workshop in prototype construction, which have no connection to the product being designed. The designer also operates according to the bricolage model when he draws on his stock for solutions, ideas, and new assemblies. He uses as his stock images, shapes, methods, or solutions from other fields than the one in which he is currently working. The “materials” at the designer's disposal also include the forms he has encountered previously and which he can try to apply to new problems. In this case, the result approaches mannerism, which is a stereotypical, ingrained way of using familiar solutions.

Designers are known to continuously gather material and visual material as a background process for inspiration for new concepts (Keller, Pasman & Stappers, 2006). One conscious method is mood boards; these collections of images serve as stimuli and solution patterns from which the designer can pick parts for their own problem-solving (Baxter, 1995). This strategic skill of the bricoleur – wayfinding – is opposite to the pre-planned navigational strategy (Chia & Holt, 2009).

2.5 Effectual Thinking

Effectuation theory (Reed, S., Sarasvathy, S., Dew, N., Wiltbank, R., & Ohlsson, A-V., 2011; Sarasvathy, 2022), which has emerged in the discourse of entrepreneurship and business studies, also offers a potential perspective on interpreting design events; after all, there are many similarities between entrepreneurship and design. An entrepreneur shapes a company, continuing from where the product designer left off. Like the designer, the entrepreneur is interested in “what could be” (Nielsen & Christensen, 2014).

Managerialist leadership, including design management and partially design thinking, assumes that the future can be anticipated and approaches the future through analysis, strategic planning, and rational reasoning. Effectual thinking often views that the future cannot be predicted but unfolds as a result of our actions. These different logics are like oil and water. The effectual worldview describes the future as malleable and full of unforeseen opportunities, whereas the prevalent causal-rational analytical worldview in many professional contexts focuses on predetermined goals pursued through forecasting and reducing variations (Hanson, 2020). Causal logic considers how to reach the goal or vision. Effectual, or let's say interactive logic, asks what I can do, who I know, and what I want to do, and then begins to do something (see Figure 2). In the process, new parties, partners, who bring in new skills or new goals, come into play. Entrepreneurs do not know in advance where they will end up; they cannot act according to pre-defined strategies. The same applies to the designer who seeks something non-existent. The future is not found; it is made.

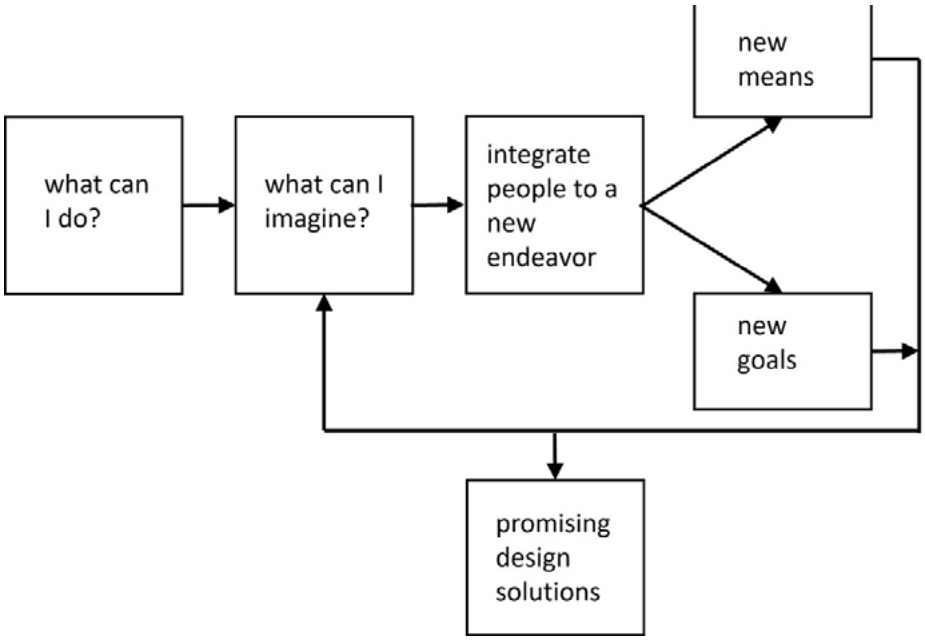


Figure 2. The Effectual Process (adapted from Reed et al. (2011) and Nielsen ja Christensen (2014).

The model (Figure 2) illustrating entrepreneurship, appears familiar to the designer: that's exactly how design progresses. Its logic is guided by the available means and skills, and it materializes if the right people become interested and committed to the presented opportunities. One just has to start from somewhere, and you can't always know where it will lead.

Effectual partnership differs from causal partnership in the belief that those who decide to join the project and choose themselves to be part of it make the project what it is. This sharply contrasts with selecting partners for the project based on how they fit into a given goal. Effectual partnership shapes the project, and the project does not dictate the partnership. Metaphorically, an effectual project is more like a patchwork quilt than a jigsaw puzzle. In a patchwork quilt, there is a broader range of possibilities for solutions, whereas in a jigsaw puzzle, there is only one correct solution. Extensive patchwork projects are communal. Contributors bring their own perspectives, preferences, workflows, and means to the project and must adapt their work to others' contributions.

The willingness of partners/parties to commit to building the process is paramount—not their suitability for a predetermined vision or opportunity. Each participant shapes the vision and brings their own means and tools to its realization.

2.6 Sensemaking

The design process can be examined through the lens of sensemaking, popularized by Karl Weick (1995), to better understand what happens during the design process. Weick's roots of sensemaking lie in his attempts to understand the framework of organization process from a social psychological perspective, which is an alternative to the analytical view where an organization is seen as a rational entity (Helms Mills, 2010).

Sensemaking comes into play when a change in the flow of routines occurs, forcing us to think about what is happening and how we should act. In product design, sensemaking is emphasized, for example, when it becomes apparent that the world has changed so that current products are no longer selling. Now more than ever, the question arises: what is this situation all about and what should we do now?

Sensemaking involves continuous, backward-looking development of plausible images so that the images make sense of what people are doing (Weick, Sutcliffe & Obstfeld, 2005). Sensemaking is ongoing, with no beginning or end, but the efforts of sensemaking become clearer when the current state of the world is

perceived to be different from the assumed state. People break moments from the continuous flow of events and pick up clues from past moments, attempting to make things rationally explainable (Weick, 1995).

Sensemaking is primarily a conversational and narrative-based social process, manifested in negotiations, storytelling, rumors, and gossip (Brown, 2000; Brown, Stacey & Nandhakumar, 2008). Informal discussions serve as arenas for creating meaning, partially reducing the ambiguity that people experience (Engwall & Westling, 2004). Physical cues and signals, such as expressions, gestures, behavior, and actions, also help in making interpretations and assigning meanings (Balogun & Johnson, 2005).

The sensemaking process is a learning process and depends entirely on the learner's collective sum of knowledge, emotions, and past experiences, thus entirely depending on their perspective (Kolko, 2010). Another perspective is organizational sensemaking, a collaborative process in which people attempt to understand the situation and the best way to act in a changing, unclear, and uncertain environment.

Action is essential to sensemaking. Only when we say something out loud do we know what we are thinking. Only when we do something can we understand what it means. According to Weick (1995), we enact our environment productively. Reality appears as a continuous interpretation and updating of our experiences. We crave order, but reality gives us exceptions to prevailing rules, and these exceptions make us reshape our order (Minzberg, Ahlstrand & Lampel, 2009).

Simultaneously, *sense-giving* can affect both the actor and the target audience equally well. “When you hear yourself speaking, you see more clearly what is important and what you had hoped to say” (Weick et al., 2005, p.416). For designers, drawings and prototypes are also tools for sense-giving, albeit in a quite tangible form. The model provides others with the opportunity to create their own meaning, but at the same time, it “sells” the designer's vision. Designers often soften the direct selling of their vision by presenting multiple alternative solutions, allowing others to participate — at least in narrowing down the options.

Rylander Eklund et al. (2022) view sensemaking as the underlying logic of design practice, with improvisation and imagination being core activities of design practice, developing the designer's sensibility. The authors divide philosophical background assumptions into two paradigms: design as problem-solving and designing as sensemaking (Table 1). They depart from rational-analytical thinking about design as problem-solving. As an alternative paradigm, they offer designing as sensemaking, whose pillars are the designer's cultivated sensitivity, imagination, and improvisation.

Table 1. Perspectives on designing. Adapted from Rylander Eklund et al. 2022.

Design as problem solving	**Paradigm**	**Designing as sensemaking**
Cognitivism	Theory	Pragmatism
Deliberate, causal	Practice	Imanginative, improvisational
Cognitive operation	Creativity	Embodied, situated, social
Methods	Pillars	Sensibility
User experience	Empathy	Embodied experience of the designer
Tame chaos	Uncertainty	Embrace chaos
Problem solving as a cognitive act: methods essential	Experimentation	Sensemaking improvisational and imaginative: sensebility essential

Sensemaking begins in chaos, where the situation is unclear and ambiguous. What is this situation? What should we do next? The designer often cannot do anything but immerse themselves in the situation and start acting based on existing premises: sketching and ideating. In these situations, imagination is essential because it gives shape to unknown things, and its necessary modus operandi is improvisation.

3. Design Offering

Design is difficult to define because the perception of it is constantly evolving. Heskett (2002, p.7) proposes the task of design to be "to shape and make our environment in ways without precedent in nature, to serve our needs and give meaning to our lives." However, this generic and human-centered definition does not fully convey what design as an activity can offer to innovation. I submit that there are six major principles of design: it is doubt and imagination-driven, based on incomplete information, is visual and material-making reliant, and future-oriented sensemaking service. Figure 3 summarizes the design offering based on reflective thinking, bricolage, effectual thinking, and sensemaking.

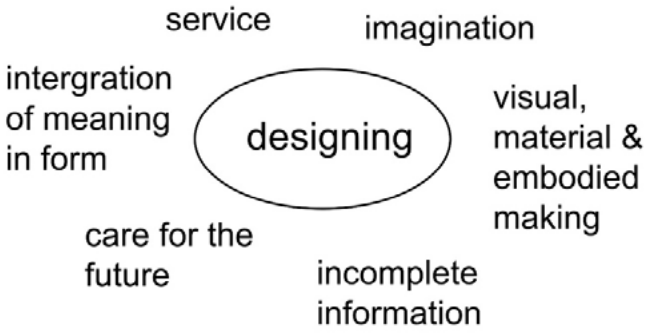


Figure 3. Summary of the design offering based on collective and constructivist worldview. Design is a service that arises from incomplete information, doubt, and imagination, producing sensemaking of the desired future.

3.1 Service

Design can be seen as a cognitive or technical performance, but also as a social activity within an organization. The stakeholders include the client who commissioned the design work, the company's management, marketing, product development, design team, partner and subcontracting companies, and external stakeholders - the end user. The discussion in design often focuses on consumer needs and behavior. However, the customer – the innovation producer – is the most important social contact for the designer. There is no design project without a client who pays the designer's fee and bears the risk of the product's success.

Design activity is a service relationship between the client and the designer. Whereas art and science are self-serving, designers serve others – a broader innovation process (Nelson & Stolterman, 2012). Design service differs from normal service in that it is not about helping the customer by creating something they know they want. The customer may not always fully know what they want from a new product. The designer must address and surpass the customer's often loosely defined goal of the desired outcome: "now that I see this, I know this is what I wanted." It is not about finding meaning in the sense that an idea or concept would await its discoverer or inventor somewhere. The designer cannot ask the customer what this designed outcome would be, but must empathetically ascertain the customer's desires, which focus on the product's utility, form, and technology. The designer's role is to act as a midwife to the original desire, which could not have been imagined in the form realized by either the customer or the designer's individual actions, and deliver a result that is contradictory, unexpected. The outcome is something new to the customer, but they also recognize that it is suitable and useful for their own interests in a specific situation.

3.2 Imagination

Imagination is a basic human capability. When imagining, we bring forth images or concepts that are not real or present to our senses but appear in our mind's eye. The psychologist Lev Vygotsky views imagination as the basis of all creativity and "an important component of absolutely all aspects of cultural life, enabling artistic, scientific, and technical creation alike." (Roberts, 2023, p.129)

Although imagination seems essential to the production of design, it has received little attention in design research. Imagination is often seen as a hidden source of creativity; designers often seek something not yet existing or never-before-seen solutions. The role of knowledge thus comes into the design process: how do we seek the new without simply repeating what already exists. Folkmann (2014) views imagination to be vital in design, as it is in all human thinking and creation. When we imagine, we obtain a visually oriented abstraction that can take us in new directions and lead us to examine new possibilities. Nelson and Stolterman (2012) maintain that in order to create something, one must have the ability to imagine what the something is and how it can be made real. Imagination is required within all fields and all phases of design. Gopnik (2010) suggests that the basis of knowledge lies in a lively imagination. Knowledge and imagination are not separate things. Indeed, imagination, or envisioning possible things alongside real ones, is a precondition for human culture as a whole, not just for artistic creativity and comparable special activities.

Folkmann (2014) suggests that the perspective of imagination can be a useful way to explore the construction of meaning in the design process; and how design objects are positioned, perceived, and conceptualized as tools for creating new meanings. Imagination not only materializes new forms of meaning like products and solutions, but it also reflects and integrates elements of the unknown. Therefore, a key element of the designer's work is to work on the invisible boundaries of the unknown as the designer creates something new and not yet existing.

3.3 Incomplete Information

The designer often has to work based on incomplete background information; it is not always clear *ex-ante* which pieces of information to pay attention to and which not to. The product or service to be designed may not have existed before this moment. Leaders may be unable to envision the future between technological developments and the significance-giving desires of consumers.

The rational-linear approach attempts to acquire and analyze information, anticipate possible futures. This information is fed into a predefined process assumed to generate new innovations. In contrast, the emergent (constructionist) strategy changes along the way; there are always multiple futures, and there is no information about the future, only predictive models. The environment and the actions of customers and competitors cannot be known for certain. Yes, some futures are more certain than others, but as a general rule, the more certain a future is, the less potential it offers for innovation (Compo, 2021).

The rational-linear approach seeks to analyze and define the problem and the goal as precisely as possible. This may succeed in taming problems, but according to Rittel and Webber (1973), for wicked problems, a definition is impossible: there is no stopping rule, all problems are unique, problems are the symptoms of other problems, the description of the problem defines the solution, etc.

On the other hand, as Sarasvathy (2022) suggests, the effectual problem space consists of at least three elements: 1) goal ambiguity - preferences are not given or well-organized; 2) it is not clear which environmental elements to pay attention to and which to ignore, and 3) calculating the probabilities of future consequences is impossible.

The effectual approach relies on the belief that a possible path will be found along the way; the most important thing is just to get started; there is no need for prediction, doing itself becomes the strategy.

Designers work on the things they can control. Goals may not be clear, but values, tastes, and preferences can all be means that guide action. Goals are not committed too rigidly. Design does not try to adapt to the existing environment; instead, committed parties create the environment themselves. This means that in concrete commitments with reasonable risk, the information that emerges is more important than previous background knowledge or feedback received. (Sarasvathy, 2022.)

3.4 Visual, Material, and Embodied Making

The designer's "superpower" in producing knowledge and material change is continuous, embodied, improvisational, visual, material, and social making – thinking through doing (Ingold, 2013; Nielsen & Stolterman, 2012; Bergen, 2009). Designers are makers; they sketch and build, giving form to ideas as solutions. They take that faint glimmer of possibility and make it visible and real to others. The designer sketches and builds models, ideates through bodystorming, and experiments with prototypes and service paths themselves. They display their sketches in the corridors of the workspace for everyone to see and can facilitate participatory, hands-on workshops for representatives from various parts of the organization. According to Krippendorf (2006), 80% of a designer's work is preparing and delivering various presentations. The designer also constructs their own workspace as part of their creative environment; space is a tool for sensemaking (Kettunen, 2014).

The brain operates in our bodies; movements, senses, and social interaction are crucial. The brain always seeks to predict the future, based on the past, it seeks a predictive coding model, forward-looking. Hari & Kujala (2009) talk about the action loop, where the brain in the body affects the world through motor skills, we receive sensory information, and action produces new information. Movement, motor skills, and doing is the driving force of everything. The senses are in the service of action. Knowledge is conveyed through movements. Motor skills are essential in human thinking, like sound and speech; insight requires motor action.

Design processes include embodied knowledge even in the cognitive and immaterial stage of creating mental images of the intended physical designs. Making may be seen as a way of negotiating meaning through interaction between the embodied mind and the material environment, thus it may affect intrapersonal growth and provide a useful platform in educational settings (Growth, 2017). The above sounds like Karl Weick's (1995) sensemaking theory, in which he says: "Only when I have said it do I know what I am thinking." In design, it would mean: only when I have built a model do I know what I am doing.

3.5 Care for the Future

Design is a future-oriented, purposeful activity, a conscious effort to seek the new. When a product or service designed by a designer is launched on the market, the designer has already moved on to the next product to be launched in the future. Instead of examining what is, the designer examines what could and should be.

The designer's initial visualization of the future may be a mood board, reflecting the desired style, quality, and user experience of the product under development. As the name suggests, with a mood board, the designer seeks to create and present a coherent image of the desired direction in which the development could lead.

An ethical attitude can easily be associated with the work of a designer, so in addition to asking themselves whether design provides a solution to human needs, whether it can make money, or whether it is economically feasible to produce, they should also, according to Wendt (2016), ask themselves: "Does this contribute to a future that promotes a positive existence for humans and their environment?" If not, perhaps it should not be designed (see also Roberts, 2023, p.267).

3.6 Integration of Meaning in Form

The designer integrates and creates the first visualization of the desired future. The designer then makes and gives sense. Of course, each participating person understands the visualization, model, or prototype through their own perspective and goals, thus differently, but the designer's concept can be the first concrete, non-textual expression, action towards the realization of the new. Nelson and Stolterman (2012) speak of the concept of desiderata (i.e., desires) as an inclusive whole, combining three approaches: aesthetics, ethics, and reason for that-which-is-desired.

Lee (2023) talks about the designer's role in our post-digital era as an enabler. Thus, the designer becomes an integrator, who in the stages of the design process seeks to consider different parties to ensure the progress of the project. Designers are integrators, "responsible for piloting company activities and identifying new potential segments" (Borja de Mozota, 2003, p.124).

4. Design Process

The designer's task shifts from offering a 'perfectly' finished product to becoming an enabler, continuous facilitator of incomplete possibilities and sensemaking (Borja de Mozota, 2020; Mortati, 2022; Lee, 2023). Rylander Eklund et al. (2023) call for the designer's sensitivity, which develops through the training of imagination and improvisation. Tan, Kocsis & Burry (2023) complement Schön's (1983) reflective idea with a pre-reflective 'designerly artfulness' or 'adventurous attitude', which helps the designer to become more attuned and observant to reality. The abductive process of design is triggered by an embodied experience of doubt, fueled by imagination (Misak, 2004; Rylander Eklund et al., 2023).

The proposed *Sense of Possible* model (Figure 4) has drawn influences from Kolb's (2015) *Experiential learning theory*, which describes how individuals learn by doing through four scenarios: active experimentation, concrete experience, reflective observation, and abstract conceptualization.

Somewhat surprisingly, Figure 4 resembles Resnick's (2018) model of the "*kindergarten approach to learning*," which is characterized by a spiraling cycle of imagine, create, play, share, reflect, and back to imagine. Resnick's model contains almost identical elements.

The Figure 4 model also takes cues from Tan et al. (2023, 8) reflection cycle for designers. Both it and Kolb's experiential learning theory cycle are divided into two phases: designing phase and reflecting phase. This article's contribution is to complement the previously mentioned descriptive models with a bit more normative form and to link the phases of design and reflection to the perspectives of effectual action and sensemaking.

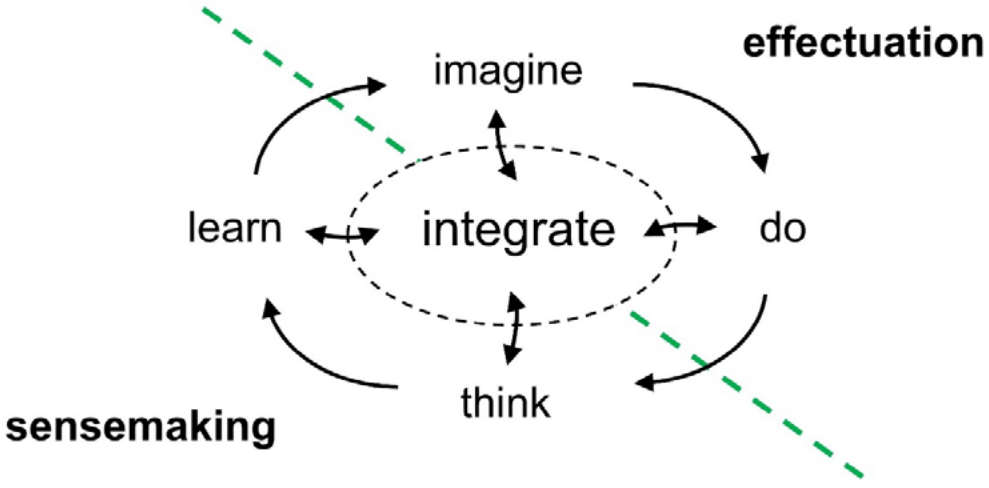


Figure 4. Sense of possible: the design process model based on effectuation and sensemaking.

4.1 Integrate

Design is fundamentally a social process (Bucciarelli, 1994). During the process, designers often perceive their work as both an outcome and a social interaction (Lufti, 2023). Designers are often seen as individuals within organizations who strive to seek, distil, and visualize what kind of innovation is desired. The social sensemaking practices in design, though, manifest in the continuous seeking of peers' input, presenting sketches, engaging others in design activities, and ongoing storytelling – focusing not solely on the outcome, but on the shared process leading up to the present and the near future (Kettunen, 2014). Designers integrate stakeholders to ensure the progression of the innovation process.

The myth of the solitary genius designer persists, but in practice, today's products or services are designed by teams rather than individuals. Designers interact with many people throughout the design process. These may include individuals close to the organization, such as customers, users, subcontractors, etc. Decisions about the direction of design are not made in a vacuum but rather within a social context.

A product that a designer creates exists only in relation to people. A product becomes real only when it is seen, used, interpreted, and owned by people. Designers must consider multiple stakeholders and collaborate with people from different professions. They need to become skilled negotiators who, perhaps through their visual expertise, naturally act as mediators between different perspectives.

Equality among project stakeholders – or at least the temporary illusion of it – is a necessary starting point for opening up and exploiting opportunities. As a designer, innovator, and entrepreneur, you must create opportunities for fruitful collaboration between your clients and various stakeholders. Innovation and business building are social processes; involving another person in the process is essential, as it is difficult to accomplish anything alone. New committed partners bring new means or new goals; you may end up somewhere you didn't know you were going.

Others often have a different way of understanding the situation or problem at hand. They bring not only their own knowledge but also their perspectives, assumptions, goals, and ambitions, making opportunity recognition, process of negotiation and consensus among parties.

4.2 Imagine

The design process can begin with doubt, criticism, and imagination. This entails a pre-reflective artistic design attitude, abductive reasoning, enthusiasm, and an adventurous approach, which materializes as thumbnail sketches and rough models or prototypes. The designer does not seek the right solution to the problem but may develop multiple viable solutions and pathways simultaneously. It can be said that the heart of design is the need to mobilize collaboration and imagination (Telier, 2011).

4.3 Do

Through making – sketches, models, and prototypes – the designer can now reflect (Schön, 1983) on their own actions and their outcomes, and invite stakeholders – colleagues, clients, etc. – to participate in making and reflecting. During the process of making, the designer simultaneously experiments and experiences the design action. Experimentation occurs when the designer makes a move in the situation, whereas experiencing happens when the designer understands how the situation has changed as a result of their actions. Reflection-in-action is iterative (Tan, Kocsis & Burry, 2023).

4.4 Think

Thinking occurs when the designer takes a step back from the situation to observe and reflect on their own actions. Sensemaking emphasizes reflection *on* design action (Schön, 1983) rather than the actual act of designing. At this stage, the designer thinks not only about the design of the product but also about their own design process, reflection-on-design-action. The outcome and the significance of the process (sensemaking) are always constructed retrospectively.

This stage must be distinguished from the previous two stages to avoid “analysis paralysis” (Tan, Kocsis & Burry, 2023). While engaging in design – intuitively, bodily, improvisationally, and imaginatively – the designer cannot critically evaluate their own outcome and actions because the delicate creative process may be stifled by analysis.

4.5 Learn

In this reflection-in-practice stage, the designer takes a further step back and considers how to shape their entire practice critically and conceptualizes a different approach for future design projects (Tan, Kocsis & Burry, 2023). If the designer does not learn from their own actions, if they do not change themselves and their actions through their reflection and thinking, they will end up repeating their mannerisms or mistakes – perhaps successfully – in the next project.

5. Discussion

My goal with this conceptual article is to introduce the discussion of design's constructive worldview, complementing Schön's reflective view with the dimensions of sensemaking and effectuation. How can design be understood and defined from the perspectives of effectuation and sensemaking, and how can the theoretical lens of effectuation and sensemaking be used to formulate design into a normative process model? However, this goal was not fully achieved. The presented model (Figure 4) is not a comprehensive normative guideline on how designers should proceed, but rather an encouragement for intuitive, artistic design action and justification for a designerly way of doing to other stakeholders.

Tan, Kocsis, and Burry (2023) proposed a reflection cycle model for individual designers, while Kolb (2014) introduced the experiential learning theory cycle. Both models consist of two distinct phases: the designing phase and the reflecting phase. This article aims to enhance these descriptive models by introducing a more normative framework and by connecting the stages of design and reflection to the perspectives of effectual action and sensemaking.

Effectuation is more a thought and decision-making process than a method, and its primary purpose is to help explain how truly entrepreneurial thinkers make decisions and create value in highly uncertain environments (Duening et al., 2012). Effectuation also fits well with describing a designer's action in a common situation where initial data and customer desires are not yet clear. Design thinking practices bring the cognitive principles of effectuation to life, it adds a normative dimension to effectual decision-making, as claimed by (Klenner et al., 2022).

The sensemaking aspect of the model depicts the desirable integration of shared meaning – the emergence of desiderata – among different parties with the designer acting as an enabler and integrator. The designers or the innovation-producing organization must step back and reflect on their actions and practices to ensure the success of their innovation endeavors.

Entrepreneurs and designers immerse themselves in situations where they must create shared meaning before they know the criteria for decision making (Weick, 2004). This is akin to the phenomenon known in design research as “intuitive reasoning” (Friedman, 2003). The design profession can be significant because

it has ways to address challenges that are not just technical but also social and creative. Design can complement and bring added value to the efficiency-driven rationality of economists and engineers. Perhaps design can rise to the role it has always wanted to play, building bridges between technological research, economics, ethical and sociocultural responsibilities, and new innovations.

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P/REFERENCES OF DESIGN

ENVIRONMENTAL SUSTAINABILITY PRACTICES IN PRODUCT DESIGN FIRMS.

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KEYWORDS | DESIGN FOR ENVIRONMENTAL SUSTAINABILITY, IMPLEMENTATION, CHALLENGES, COMPANIES, PRODUCT DESIGN

ABSTRACT | In the quest for sustainable production and consumption and the shift towards an alternative economic framework, design emerges as a crucial actor. Design discipline significantly influences the creation of products, services, and businesses. This study explores the adoption of environmental sustainability and circular economy principles in product design companies, examining the application of strategies, methods, and tools. Through a recent semi-systematic literature review spanning 2018-2023, this research analyses the practical challenges design firms face in the real world. Interviews with six Italian professionals from five product design companies were also integrated, presenting an overview of current applied practices, emphasising the gap and similarities between academic theories and industrial implementations. This paper concludes by suggesting actions and possible directions to design for low environmental impact, drawn from contemporary literature and practitioners' experience. Furthermore, this work calls for design research efforts to be more connected to applicable design practices, be monitorable over time, and tackle significant advances concerning a transition towards sustainability.

1. Introduction

As an evolving field, design is increasingly acknowledged for its potential to drive the transition towards more sustainable economic models (Ceschin & Gaziulusoy, 2019; Moreno et al., 2016). In the last decade, design integration into business configuration and innovation has been recognised as a strategic way to achieve and maintain a competitive advantage (Brown, 2012; Design Council, 2011; Martin, 2009). Today, the role of design goes beyond problem-solving and product innovation. The design practice is progressively seen as a catalyst for sustainable solutions ranging from material and artefact creation to positively influencing sociotechnical systems (Ceschin & Gaziulusoy, 2019). Furthermore, the ability of design to guide companies in aligning with government policies and adopting the circular economy paradigm is an area of active exploration.

In product development firms, design is primarily recognised for decision-making that defines the characteristics of the artefacts. The product design decisions, which encompass material selection, form, and processes, profoundly influence user experiences and behaviours and, significantly, the environmental impact of products. Public sources like the Ellen MacArthur Foundation (EMF, 2013) and the European Commission (EC, 2022) often remark that 80% of a product's environmental impact is determined by choices made in the design phase. As a result, designers, academics, and governments have been developing approaches to implement environmental requirements in the product development process (Ambrosio & Vezzoli, 2019; EC, 2005, 2009; UNEP, 2006). Furthermore, directives and consumer awareness push for design solutions that adopt approaches and strategies that reduce environmental impact (Delmas & Burbano, 2011) and align with the circular economy.

There is a growing interest and development of methodologies, frameworks, and tools created to align industrial product design with sustainability (Rossi et al., 2016). These approaches are widely discussed in academia and scientific literature (Clark et al., 2009; Vezzoli & Sciama, 2006; Vezzoli, 2018); however, they still pose several challenges in practical implementation for corporations and entrepreneurs.

Our study provides an overview of design approaches for environmental sustainability, here intended as Design for Sustainability (DfS) (Vezzoli, 2018), and their practical rolling-out to inform the challenges faced by product design firms in their implementation. We combine a contemporary semi-systematic literature review (from 2018-2023) with insights from five product design companies. This dual perspective enables an in-depth exploration, unfolding reflections on the real-world effectiveness of academic concepts. As a result, we highlight the practical aspects and limitations of design approaches for sustainability and circularity, fostering reflections for developing and implementing new practices that can overcome these limits. We aim to identify and share DfS approaches used in companies and the causes that limit their implementation, offering insights into new directions and bridging the gap between theory and practice.

The study is guided by two research questions: What is the current situation of product design firms in implementing environmental sustainability practices? and What are the practical limitations of applying the theoretical approaches (related strategies, methods, and tools) in business contexts?

The remainder of this paper is structured as follows: Section 2 provides the groundwork for our study. Section 3 describes our methodological approach. Section 4 presents the results and discussion suggesting new directions. Section 5 concludes the paper, summarising the research and limitations.

2. Theoretical Foundations

The earnest attempt to support companies in implementing environmental requirements in product and service design is increasing (Rocha et al., 2019). This tendency has been augmented by consumer awareness (Testa et al., 2021) and stringent global legislative reforms (Shahbazpour & Seidel, 2006). This phenomenon calls for a closer examination of the relationship between business models and product and service design, as they are inevitably linked to production and consumption.

Integrating environmental and social factors into design criteria now stands alongside traditional considerations like profitability, functionality, aesthetics, and ergonomics (Gaziulusoy, 2015). Although the discussion on DfS is not new, the current context requires more than ever solutions towards a future that preserves the Earth's systemic stability (Richardson et al., 2023).

For several decades, environmental sustainability in design has been considered a critical issue (Papanek, 1971). The 1980s saw the introduction of green design concepts in product design firms, paralleling a rise in public ecological awareness. At the product level, these interventions were desired to mitigate the environmental impact of individual products (Madge, 1997). From the 1990s, the focus shifted to designing products with minimal environmental impact. This perspective started to be commonly recognised as Design for Environment (DfE), Ecodesign, product Life Cycle Design (LCD), or product Design for Environmental Sustainability (Manzini & Vezzoli, 2003; Sarkis, 1998; Sun et al., 2003; C. Vezzoli, 2014; C. Vezzoli & Sciama, 2006). These perspectives evolved by broadening the scope to more social approaches, and Design for Sustainability emerged. DfS start to gain popularity, encompassing the social component with the expectation of significantly advancing sustainable development (UNEP, 2006).

Although DfS adopts social factors, these strategies gained recognition from companies seeking to reduce the environmental impact of their products while considering the broad perspective of sustainability. In this regard, the early 2000s saw a popularisation of philosophies for designing products with low environmental impact (Rossi et al., 2016). These approaches intend to guide the design process through associated strategies, methods, and tools. The European Commission directives (EC, 2005, 2009) reinforced these concepts, targeting manufacturers of energy-related products to promote energy efficiency and reduce consumption. Following this, directives and international standards like ISO 14006 (ISO, 2011) were aligned to ensure global best practices in sustainable product life cycle management.

Recently, the European Commission launched a proposal called Ecodesign for Sustainable Products Regulation (ESPR) (EC, 2022), representing a notable progression towards sustainable and circular product designs. This regulation redefines product design to align with ecodesign principles and the Circular Economy (CE) (EMC, 2013). The CE model minimises resource extraction and maintains resource value within the system for as long as possible (Suárez-Eiroa et al., 2019). The CE promotes design practices focusing on durability, reparability, and resource efficiency. This model encourages firms to embed Circular Design (CD) into their development processes. In this context, CD can be defined as creating products focusing on material cycles and the intended business model to ensure sustainability and resource efficiency (Moreno et al., 2016).

Under the CE framework, CD has been established to protect economic and environmental values by moving away from the take-make-waste model (EMF, 2013). At the same time, ecodesign or DfS (focus on ecological requirements) encompasses a spectrum of activities that aim to reduce the impact of products (and services) to facilitate the transition to sustainable production (Vezzoli, 2018). Even if DfS has a more robust background and CD in business is in its early stages, this study considers both valid approaches to support companies in transitioning towards low environmental impact design.

3. Methodological Approach

To comprehensively understand the implementation and limits of DfS and CD in product design firms, this study adopts a dual-method approach, combining (a) a semi-systematic literature review (SSLR) complemented by (b) semi-structured interviews. A gap was identified in the literature, where structured theoretical frameworks were found, but there was also a lack of detailed information on how companies apply these theories in practice and their challenges. To bridge this gap, interviews with practitioners were conducted to directly explore the real-world application of sustainability practices. Prioritising peer-reviewed literature ensured academic rigour and established a solid theoretical foundation in environmental sustainability within product design. Although industry reports offer insights into current practices, their varied methodologies and transparency levels could introduce inconsistencies in the theoretical basis of this research. Semi-structured interviews were chosen to capture the practical applications of theoretical approaches, aiming to gather qualitative insights not typically available in public or academic reports.

3.1 Preliminary Studies and the SSLR

Preliminary desk research was performed using secondary data to analyse the general ground (Verschuren & Doorewaard, 2010). Literature databases and online sustainability reports from product design companies were considered to map the interest and efforts on low environmental impact. This information provided a conceptual background for the study. However, a lack of information about the current challenges of theoretical frameworks was found in this process, driving the formulation of research questions (Jeyaraj, 2023). The following inquiries motivate the study: (1) What is the current situation of product design firms in implementing environmental sustainability practices? (2) What are the practical limitations of the theoretical approaches (related strategies, methods, and tools) in real business contexts?

For a more systematic understanding, ensuring consistency to the study's scope, a SSLR, as described by Snyder (2019), was undertaken. This qualitative approach began with a selection of keywords derived from the preliminary desk research and motivated by the research questions.

Database and Search Syntax

The keywords were combined using Boolean operators to create strings and conduct the SSLR process. The selected databases were Scopus, ScienceDirect, and Google Scholar, which were chosen for their comprehensive coverage of academic research. The timeframe for the search was deliberately set from 2018 to 2023 to encompass recent literature. The process was finally conducted between November and December 2023. Only peer-reviewed documents were searched, given their academic rigour. Limit source types were articles, reviews, and conference papers. Furthermore, English language publications were selected to ensure the accessibility of the literature.

Titles, abstracts, and keywords of documents were the target. The search terms were tailored to each database's unique syntax and search capabilities. For Scopus, one string was used. In ScienceDirect, two variations were tested for effectiveness. In the case of Google Scholar, the search was restricted to review articles to exclude non-peer-reviewed material such as books or student theses, which may not meet the scholarly criteria required for this study. A global search was conducted to capture diverse, worldwide practices. Table 1 presents the tailored keywords and search strings for each database.

Table 1. String used for each database.

String	Database
(("compan*" OR "firm*" OR "SMEs") AND ("product design") AND ("ecodesign*" OR "circular*" OR "sustainab*") AND ("challenges" OR "barriers" OR "implementation") AND ("strategies" OR "tools" OR "methods"))	Scopus
("company" OR "SMEs") AND ("product design") AND ("eco-design" OR "sustainable") AND ("challenges" OR "barriers") AND ("tools" OR "methods")	ScienceDirect
("company" OR "SMEs") AND ("product design") AND ("eco-design" OR "sustainable") AND ("challenges" OR "barriers") AND ("tools" OR "methods")	
intitle: (("company" OR "companies") AND ("product design") AND ("sustainable design" OR "ecodesign") AND ("challenges" OR "barriers" OR "implementation") AND ("strategies" OR "tools" OR "methods"))	Google Scholars

Selection Criteria

The databases yielded varying articles. They were refined by excluding irrelevant subject areas and using the available automatic filters. The focus was explicitly on physical products within various product design sectors, excluding digital-only products. One hundred forty documents were imported into Zotero to speed up the process. Initially, duplicates were removed. The documents were skimmed by titles, keywords, and abstracts, with those considered outside the scope immediately discarded. This process prioritised studies involving tangible products across diverse yet interconnected domains, such as consumer goods, industrial equipment, and furniture.

The remaining articles were assessed against selection criteria, focusing on:

- Design for environmental sustainability approaches and/or circular practices in product design firms (or real-world projects) enhancing low-impact solutions;
- At least one approach to environmental sustainability or circular practice implementation in product design real-world;
- Specific challenges or barriers in adopting sustainable and circular design approaches;
- The gap between theories and practical implementation.

A more thorough examination of abstracts and keywords further narrowed the final selection of articles for a full review. The selection process is illustrated following a PRISMA flow diagram (*PRISMA*, 2020)

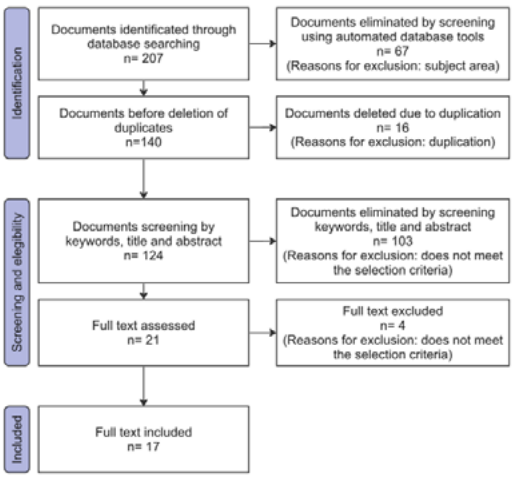
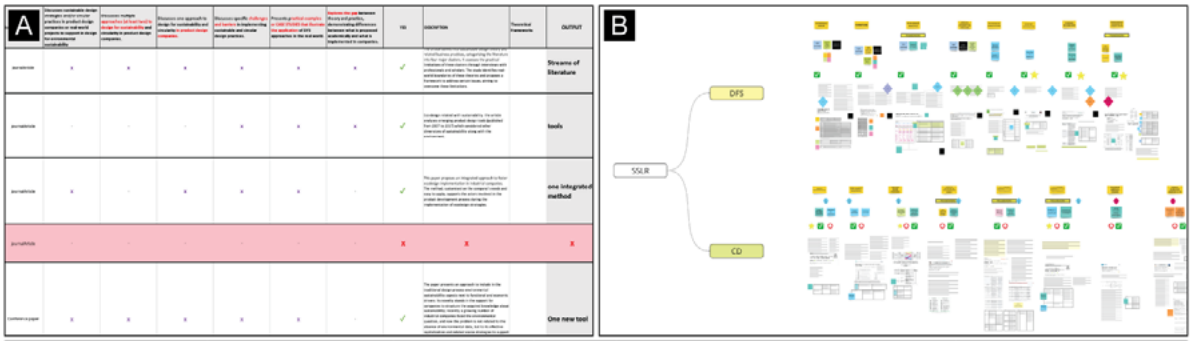


Figure 1. PRISMA flow diagram adapted for this research.

Content analysis was employed to synthesise the collected data outlined by Duriau et al. (2007). Excel spreadsheets and Miro boards were used to catalogue the documents and construct mind maps, aiding in the reflection and categorisation of the findings. Colour coding enabled a more systematic identification and reporting of patterns.



C

Author and year	Sustainable and/or circular design approach in product design company to enhance environmental sustainability	Challenges or limits for sustainable and/or circular approach implementation	Theory-practice gap discussion	Research approach and focus	Outcome	Type		
(Ahmad et al., 2018)	x	x		Literature review of tools that consider environmental sustainability and other dimensions.	Classification scheme	Literature review		
(Sousa-Zomer et al., 2018)	x	x		Case-based research to understand cleaner production for circular product design	Insights for application	case based		
(Rossi et al., 2019)	x	x	x	A multi-criteria approach to integrate ecodesign in industrial companies	Method	approach		
(Ruy et al., 2019)	x	x	x	Literature review for applying DfE in designing new product development concepts.	Framework	Literature review		
(Baldassarre et al., 2020)	x	x	x	Literature review and interviews about sustainable design theory integration in business practice.	Framework	Literature review		Interview
(Bressanelli et al., 2020)	x	x		Study of cleaner production practices within houshold appliances design.	Detaild analysis		Case studies	

Figure 2. Screen capture of the data organisation and analysis process. (a) Excel spreadsheet for selection of articles. (b) Miro board mind map and colour coding. (c) Excel spreadsheet for content analysis and categorisation.

3.2 Semi-Structured Interviews

After collecting insights from the SSLR, semi-structured interviews were conducted to gain a profound and real-world understanding of the issue under study. As Adams (2015) described, this method allows for an in-depth exploration of professional experiences, opinions, and knowledge. These interviews aimed to uncover details outside of the literature. As Gugiu and Rodríguez-Campos (2007) indicated, an interview protocol was designed to guide the data collection and increase the reliability of the study.

The selection criteria for companies were highly pragmatic. Although they do not represent the whole sector or a worldview, they constitute a relevant sample for the study. Firms with proven readiness and consent to share in-depth information about their sustainability efforts in design, challenges, and achievements were selected. Furthermore, the geographical location was essential to allow fast communication and the possibility of face-to-face follow-up meetings.

Interviews were programmed remotely via video conference software to accommodate participants' locations and schedules. The interviews were carried out during December 2023 and February 2024. Each session lasted approximately 50 minutes and was audio-recorded with participants' consent. Transcription, coding, and thematic analysis were conducted to identify patterns and results.



A

	transcript	note
08.10	Ci impegniamo a ridurre l'impronta di carbonio. Ad esempio, stiamo aumentando l'uso di energie rinnovabili nei nostri stabilimenti.	Sostenibilità. Investimento in energie rinnovabili e riduzione
	Abbiamo iniziato un programma di riciclo dei rifiuti di produzione.	Riciclo. Programma di gestione e riciclo dei rifiuti
08.20	Abbiamo investito in nuove tecnologie per il riciclaggio e lavoriamo con partner locali per minimizzare gli scarti. Tuttavia, è un percorso difficile. Anzi, richiede lavoro e spesso non siamo sicuri di come procedere.	Tecnologia. Investimenti in tecnologie di riciclaggio avanzate
		Difficoltà

B

Figure 3. Interview analysis processes. (a) transcription and thematic identification. (b) coding and pattern identification.

4. Results and Discussion

4.1 General Analysis

Seventeen documents met the eligibility criteria. Each contributes to the discourse on low environmental impact practices in product design companies. The selected documents illustrate approaches, their implementation in practice and the challenges of their adoption. A direct discussion of the theory-practice gap is not uniformly presented. Nevertheless, the complexity of applying theory in practical settings is a recurring theme in all contributions. Table 2 illustrates an overview of the result of the selected literature, highlighting the research method, outcome, and lens.

We divided the literature selected between studies under the lens of circularity, with nine results and those over environmental sustainability, with eight results. This parity suggests that both concepts are acquiring equivalent attention among companies in the discourse on designing with a reduced environmental impact.

Table 2. Overview of the literature included in the semi-systematic review.

Reference	Research approach	Outcome	Lens	
			Circularity	Sustainability
(Ahmad et al., 2018)	Literature review	Classification scheme		x
(Sousa-Zomer et al., 2018)	Case-based research	Insights for application	x	
(Rossi et al., 2019)	Method development	Method		x
(Ruy et al., 2019)	Literature review	Framework		x
(Baldassarre et al., 2020)	Literature review and interviews	Framework		x
(Bressanelli et al., 2020)	Literature review	Detailed analysis	x	
(Bumgardner and Nicholls, 2020)	Literature review	Literature analysis		x
(Lindkvist Haziri and Sundin, 2020)	Mix methods approach	Framework	x	

(Benabdellah et al., 2021)	Literature review	Model		x
(Boorsma et al., 2021)	Literature review and interviews	Method	x	
(de Kwant et al., 2021)	Literature reviews and case studies	Framework	x	
(Hansen and Schmitt, 2021)	Literature review and case studies	Framework	x	
(Hildenbrand et al., 2021)	Case study research	Insights for application	x	
(Valusyte, 2021)	Literature review and case studies	Explanatory diagram	x	
(Boorsma et al., 2022)	Literature review and co-design sessions	Method	x	
(Delaney et al., 2022)	Literature review	Framework		x
(Rossi et al., 2022)	Method development	Method		x

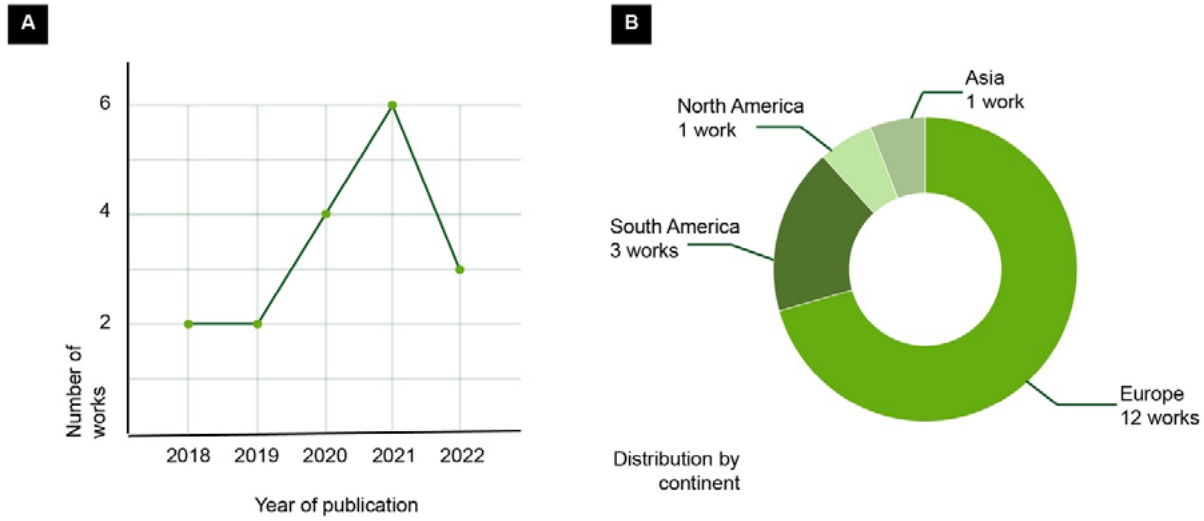


Figure 4. Literature reviewed general analysis: (a) publications per year; (b) publications by continent.

Figure 4A outlines an increasing growth in the studies on low environmental impact within design companies, with most publications from 2020 and 2021. Furthermore, while the discourse aimed to be analysed globally, Figure 4B demonstrates a concentration of research in the European continent.
The analysis revealed frequent interchangeable use of terms such as 'approaches,' 'strategies,' 'methods,' and 'tools,' potentially leading to ambiguity. To clarify, we adopted the following definitions:

- Approach: A perspective-driven way to address a problem. The most general of these terms;
- Strategy: A structured plan to achieve specific goals;
- Method: A systematic procedure applied to a task;
- Tool: An instrument that facilitates the application of methods or techniques.

From the seventeen identified documents, ten were primarily focused on strategies, three concentrated on methods, two examined specific tools, and two offered a broad overview of the evolution of approaches relating to design application in firms. In the next section, we present the SSLR results divided into the abovementioned terms and under the sustainability and circularity lenses.

4.2 Literature Review

Sustainability Lens

As outlined in the introduction, the concept of environmental sustainability has been recognised in the product design industry for a considerable time, manifested through different labels. Two perspectives representing low-impact design in the literature review are DfS and Design for the Environment. DfS (focusing on environmental requirements) involves a more comprehensive approach, considering social, economic, and environmental goals in product design, demanding broader changes in business and society. DfE focuses on reducing environmental impacts through specific technical improvements (Delaney et al., 2022).

Delaney et al. (2022) and Bumgardner and Nicholls (2020) have extensively contributed overviews on this topic, identifying numerous approaches for embedding these perspectives into the product design process. The former provides a holistic view of recurrent factors when designing for environmental sustainability. They emphasise the integration of DfS in products and the use of tools like LCA, checklists, and software, underlying the challenges in integrating them, such as the significant time and quantitative data required and the need for specialised expertise. In this regard, they present a new design process for and from product designers, integrating stages on how and when to consider the identified environmental sustainability factors. The latter, instead, present DfS practices in wood furniture, remarking on the complexities these principles impose, for instance, adding steps and costs to the design process. They investigate approaches like green manufacturing, green supply chains, ecodesign, sustainable materials, biomimicry, and eco-labelling, highlighting their influence on firm competitiveness.

Three articles propose strategies as innovative DfS frameworks. Baldassarre et al. (2020) discuss the need to integrate DfS theory into business, noting the challenges of abstract philosophies in ecodesign, product service systems, business models, and collaborative ecosystems. The problems they highlight are linked to specific, actionable guidance, the enormous change needed in the operating company system, the financial costs, the lack of stakeholders' commitment to sustainable goals, and the rebound effects of poorly studied strategies. Furthermore, the limits in communication and language between the academy and industry are evidenced. In this regard, they integrate existing DfS theory into a new framework within business concepts and give some recommendations to deal with these issues. Ruy et al. (2019) describe a framework for implementing DfE in the conceptual design phase, highlighting the need for environmental assessment approaches applicable across product concepts. His framework is based on an analytical hierarchy process for conducting product concept evaluation, determining which approaches will help achieve environmental performance. This framework is mainly based on strategies related to the physical dimension of the product, represented by the use and consumption of material resources. Lastly, Benabdellah et al. (2021) acknowledge the lack of specific classification to consider suitable methods for DfS. To overcome these challenges, they suggest a strategic framework to integrate Design for X with knowledge management (KM) techniques. The authors propose using KM and an ontology-based approach (Ali et al., 2020) for a more structured environmental consideration when designing.

Rossi et al. (2019) and Rossi et al. (2022) present new methods to improve the practical application of ecodesign in industry. In the first article, it is noted that prioritising legal, performance, cost and aesthetic factors over environmental considerations creates a barrier to integrating sustainability into business and design practices. The authors suggest the "Product Impact Index" method for aligning these priorities with environmental objectives, improving the evaluation and comparison of possible solutions. On the other hand, the second article discusses the need to support companies in integrating their productive data related to environmental, functional, and economic aspects into the design process. They propose using this information and making more environmentally aware decisions.

Finally, Ahmad et al. (2018) analyse existing tools for DfS, noting their failure to integrate environmental, social, and economic sustainability, evidencing the need for approaches encompassing a broader sustainability scope in the design processes. They classify tools published from 2007 to 2017, highlighting an inconsistency in using those tools and suggesting a gap in similar, more recent research.

Circularity Lens

The analysis shows that CE and CD, aiming for zero-waste products, are still in the early adoption stages in product design companies. Furthermore, the review suggests a broader consideration of strategies to reach CE through CD and less focus on tools or methods. Indeed, Sousa-Zomer et al. (2018) note that the ground of CE and CD is still unexplored in business. They claim that using cleaner production (CP), a known principle, can help the CE, especially in product design (even if it is not a strictly design-related area). They found CP practices key for CE at both product optimisation and micro-level production stages, linking to broader CE aspects like waste management and other organisational processes.

Lindkvist Haziri and Sundin (2020) and Boorsma et al. (2021) both advocate for the design of a remanufacturing (DfRem) strategy to improve environmental sustainability within CD. The former proposes a framework addressing DfRem challenges, particularly the feedback loop from remanufacturing to design, aiming to systematise this feedback into the product design phase for better DfRem application. The latter stresses the need for early integration of remanufacturing principles in design, citing challenges like technical integration and scalability. They note a disparity between the theory and practice of DfRem, suggesting that design management is crucial for bridging this gap. Both studies initially validate their proposed frameworks but emphasise the lack of additional testing and refinement.

Bressanelli et al. (2020) review CD strategies in the appliance sector, noting their ineffective integration in the design process. They stressed the incremental adoption of strategies like the 4R hierarchy, servitisation, and digital tech use. However, they identify challenges such as reduced efficiency from incomplete 4Rs implementation, issues like the complexity of service-based models, operational challenges, scalability difficulties, and investment risks in new technologies. On the other hand, Valusyte (2021) presents an overview of the implementation of CD strategies in manufacturing, noting their growing recognition but limited real-world use, especially in SMEs. The author points to a reactive rather than preventative approach to value chain impacts. Key challenges include terminological confusion across different fields and insufficient information on the practical application of CD.

De Kwant et al. (2021) and Hansen and Schmitt (2021) introduce strategies to facilitate CD implementation, addressing its underexplored role in business models and product innovation. De Kwant et al. focus on a framework to identify cost, cultural, and policy barriers and integrate DfS theory with circular business principles. On the other hand, Hansen and Schmitt identify barriers like designer mindsets and supply network issues, proposing "innovation communities" for more humanistic and collaborative solutions to circular product innovation challenges. They suggest collaboration and networking with diverse stakeholders are necessary for succeeding in sustainability-oriented innovation.

Introducing methods, we found Boorsma et al. (2022) that decided to evaluate circularity at the product level, reflecting on the designers' readiness level for implementing CD. They state that transitioning from linear to CD demands a new designer mindset for developing multi-use cycle products. They propose the "Circular Product Readiness" method to compare CD scenarios and apprise designers' capabilities in CD, identifying strengths and areas for improvement.

Lastly, regarding CD tools, Hildenbrand et al. (2021) point out that most existing products are not designed and manufactured with circularity concepts that consider consumer use, nor the existing tools for design. Thus, they examine the implementation of two tools within real-world case studies to understand strategies within CD that consider users and the end of use. They emphasised user interaction and feedback as fundamental to achieving circularity.

4.3 Interview Findings

The interview results consolidated empirical information gathered from six testimonials from Italian practitioners within Italian design firms (two for the same company). We explore their approaches for design with low environmental impact and the challenges of incorporating these principles into their business.

Table 3. Summarised information about the companies (and participants) in the survey.

Company size (workforce)	Design Category	Recognised sustainability and circularity efforts	Role of the interviewer
10,001+ employees	Power suppliers – Technical products – Products for electrification	Application of Life Cycle Thinking (LCT). Transparency and communication.	Global Sustainability Specialist. Senior Designer Engineer in R&D.
201- 500 employees	Design furniture for home and working environments	Sustainability strategies in its production and design process. Certifications and transparency. LCA and redesign.	Sustainability Design Manager.
51-200 employees	Home furniture with meaning – Interior home decor	Application of sustainability as a business philosophy. Incorporation of ESG and SDGs targets.	Product Marketing and R&D projects.
201-500 employees	Notebooks, bags, and accessories	Durable products. Certified materials. Use of recycling or reprocessing strategies. Social programmes.	Global Marketing Manager and ESG team member.
501-1,000 employees	Light Design, Outdoor lighting, and Architectural Lighting	Certifications and transparency. LCA and redesign. SDGs targets. Materials, energies, and health.	Head of Innovation Design and Sustainability team member.

The interviews illustrated the feasibility of addressing sustainability through design and the possibility of rolling-out DfS and CD approaches. However, they underlined the complexities and the need for a deep organisational commitment and a change of mindset not only of individual practitioners but of the whole organisation. The interviewers highlighted that one of the current strategies is the creation of sustainability teams (most of them have achieved this in the last four years or less), recognising the complexity of sustainable decision-making and execution. These teams often include people with extensive knowledge of the company and young professionals from diverse areas. Today, they are proving to be strategic in integrating DfS into the corporate culture and addressing the progressive evolution of practices. Multidisciplinary collaboration was recognised for fostering robust dialogue on sustainable challenges and innovations.

A demand for new professionals with a holistic understanding necessary for pragmatic implementations was revealed. There is a growing inclination towards internalising designers with technical skills, like LCA proficiency, to enhance in-house capabilities and create bespoke sustainability models. Indeed, despite the struggle to find such candidates, four of six participants recognised the implementation of this knowledge internally and the development of tools for their design development process. Participants underscored

that firms are developing customised toolkits, guidelines, and checklists and using LCA to measure the impact with external consultancy support. LCA emerged repeatedly, evidencing an essential first step for guiding design, processes, impacts, and ensuring the consistency of successful strategies across various product lines.

LCA was also related to compliance and the standards or certificates companies aim to achieve. For example, participants emphasised following ISO 14040:2006 for Life Cycle Assessment and ISO 14006:2020 for environmental management systems and incorporating ecodesign (ISO, 2006, 2011).

Participants point out annual training courses as necessary, emphasising effective communication on sustainability topics across different practice areas. Furthermore, most of them expressed that agenda creation for sustainability and KPIs related to product development issues were considered necessary. Indeed, the interviewers say there is a need for strong partnerships with other companies and alignments with suppliers, sharing their sustainability objectives.

Unique insights include forming "good practice books" and "material libraries" and suggesting tools for archiving and learning from past successes and collaborations. Participants define this approach as instrumental in fostering continuity and progress in DfS practices.

Materials design and innovation, particularly the exploration of emerging, bio-based and recyclable options, surfaced as a strategic priority for sustainable and circular design strategies. Yet, reconciling environmental benefits with aesthetic and durability standards presents a significant ongoing challenge and an area ripe for further research that, as interviewers claimed, is already on their agendas. Indeed, in some cases, creating product-service system options is necessary to keep materials in the loop.

Despite progress, ongoing and evolving challenges report the need to continually develop skills, tools, and collaborative efforts to integrate sustainability fully into product design and business strategy.
The resulting practices adopted by companies to advance the design of low environmental impact are the following:

- Formation of multidisciplinary and transversal teams equipped with specialised skills;
- Onboarding of professionals with related expertise and internalisation of such competencies;
- Measure impacts as a starting point for undertaking sustainable initiatives;
- Creation of tailored tools and methodologies;
- Create/propose services that complement sustainable product offerings;
- Continuous internal training and knowledge updates;
- Clarifying internal terminology related to sustainability;
- Engaging partners and suppliers in shared sustainability objectives and KPIs;
- Creation of a sustainability agenda;
- Compiling best practices;
- Adhering to legislative requirements and pursuing relevant certifications and standards.

4.4 Integration of Findings, Reflection, and Future Directions

We discovered convergence in implementation and challenges but also recognised a gap still evident within theory and practice.

The literature review reveals a critical paradox: the abundance of conceptual frameworks, strategies and tools focusing on environmental requirements in product design contrasts with few long-term reports on their application in companies. On the other hand, the growing literature on CE shows a limited and superficial focus on the physical part of the product design, even though it is essential in this new economic model (Heras-Saizarbitoria et al., 2023).

Within the literature, we found that despite admirable but isolated efforts, DfS and CD often fail to create meaningful impacts that can effectively integrate product design with strategic business objectives. The theoretical exploration of DfS and CD is well documented, but practical applications in business are sporadically reported, leading to a fragmented understanding of its application. While case studies may shed light on specific instances of practice, they provide only snapshots, leaving a notable gap in longitudinal research (or long-term approaches) that could reveal how organisational practices and strategies evolve over time. We recommend that future literature integrate sustainable product design principles within company culture objectives and practical operations.

With the review, we identified multiple (less or more complex) tools and methods, such as LCA, sustainability checklists, and software packages, to aid low-impact design. Nonetheless, these tools encounter significant barriers, including complex data requirements and the need for designer expertise, pointing to a misalignment between tool availability, their practical use in design processes, and the practitioners' skills. More simplified methods and tools are often criticised for not being sufficiently accurate. The specific ones, instead, receive criticism for not being scalable. Additionally, a prevalent issue of terminological confusion on definitions among sustainability and circularity concepts and the usefulness of methods and frameworks often limits effective communication among academics, educators, and practitioners. These findings are consistent with interview testimonials. Participants encountered challenges performing LCA or using ecodesign softwares without consultant support or dedicated professionals. They also expressed that academic or generic tools and methods are not always efficient, but creating their own following the firm requirements and values demonstrates more effectiveness. It is therefore suggested that developing flexible, updatable ad hoc models inside firms could be a good direction for future development.

Furthermore, interviewers also indicate confusion in vocabulary. However, they were mostly aligned with terms of Ecodesign directives (EC, 2009). This repeated claim suggests that even with the present efforts for alignment in communication, more rigour is necessary. A good initiative could be to vigorously implement the terms indicated by the "International Organization for Standardization" (ISO, 2006).

The literature review and interviews continuously stressed that stakeholder involvement is crucial for successfully adopting DfS and CD and establishing R&D partnerships with shared KPIs. Furthermore, collaborative environments, multidisciplinary teams, and visionary management were repeatedly found essential for achieving environmental requirements in product outcomes. It would be interesting to analyse and share more information about these teams' formation and work to propose companies' new models. However, they are still emerging, and it is unclear where and how they will operate.

An expected result was confirmed with the literature review, i.e., the importance of incorporating sustainability and circularity principles from the initial stages of the design process. The authors highlighted that this incorporation requires equipping designers with skills and knowledge to navigate DfS solutions effectively within the business implications. In contrast, interview participants emphasise this need differently. They explained that the challenge is integrating sustainable and circular principles into the company's culture and making them imperative in the design process, production, and marketing. Both approaches seem to be valid and compatible. Additionally, some practitioners underscored materials design and innovation as fundamental, advocating that materials are central in all DfS and CD strategies, and there is a growing need for more standardisation and recognition around emerging materials and their potential applications (Duarte Poblete et al., 2024). Future research should analyse them in depth to bring more specific data and results.

Recent literature highlights that barriers such as consumer disinterest and weak regulatory frameworks are progressively being overcome thanks to growing consumer awareness and improved environmental regulation. Indeed, the older literature was characterised by these limits. At the same time, the interviewers revealed that today's consumers, customers, and new legislation are putting pressure on companies to propose design solutions to existing problems and anticipate and prevent new challenges. In this regard, three participants acknowledge that the best way to face this challenge is to see it as a competitive

advantage, where investments will pay off through future innovation. We argue that, despite the difficulties in complying with regulations and standards, they are valuable strategies for achieving concrete goals in environmental sustainability.

While the literature on these fields is broad, empirical research is still needed, emphasising longitudinal studies and deeper engagement with practitioners. This approach could overcome the gap between theory and practice, fostering a more synergistic and impactful collaboration among academia and industry. Sustainability concerns in design business practice are not new (Gaziulusoy, 2015). However, the continuous emphasis on addressing them in recent literature highlights the urgency for industry and academia to join forces. Furthermore, the slow pace of change in business sustainability underscores a need for accelerated action, not just in product design.

By analysing the literature results and the interviews' findings, we address the research questions, i.e., the current situation of product design companies in implementing environmental sustainability practices and the constraints they face in the business world. By examining the data, we have identified key trends, challenges, and strategies for pursuing low-environmental impact design within the industry.

Table 4. Summary of implemented aspects and challenges in product design companies.

Implemented aspects	Common challenges and limitations
Traditional DfS and CD approaches (guidelines, tools, and methods).	Too general. Lack of scalability. Insufficient integration within company culture and operations factors. Complexity of use or understanding of the results. Extensive data requirements. Time consuming. Lack of commitment from users. Complex vocabulary. Expertise required.
Tailored guidelines, tools, and methods.	Time consuming. Large investments. Expertise required.
Principles (e.g., recycle, reuse, reduce, etc.) and strategies (DFX, design for disassembly, design for circularity, etc.)	Incorporation from the initial design stages. Consistency in all projects. Coherence with company culture.
Materials Design & innovation	Harmonise environmental benefits with aesthetic and durability standards. Lack of specific professional profiles. Progressive updates and uncertainty in time.
Directives and standardisation guidelines.	Time consuming. Complex terminology. Lack of knowledge about its success. Continuous updates and insecurity.
Training and awareness regarding sustainability and circularity.	Isolated implementation (just one area of the company). Terminology confusion and ineffective communication across sectors. Time consuming. Lack of a visionary perspective.
New entries, multidisciplinary teams, and collaborative environments.	Lack of specific profiles. Deficit in transdisciplinary skills. Time and resources.
Strategic Partnership	Lack of responsible partnering. Stakeholders' commitment to sustainable practices. Lack of shared objectives and KPIs.
Visionary ESG management	Difficulties in finding experts with holistic/transversal and visionary management vision. Large investments.

5. Conclusions

The literature and testimonials on environmental sustainability approaches and their rolling-out in product design firms were systematically collected and analysed as part of this study. The main aim was to assess the current situation of product design companies in adopting low environmental impact design practices and to understand the practical limitations of the theoretical approaches within the related strategies, methods, and tools. Seventeen works between 2018 and 2023 were analysed following a semi-systematic review process that depicted the literature's contemporary frameworks of DfS and CD. In-depth interviews with practitioners from five Italian companies provided further real-world context. As a result of the study, current practices of DfS and CD adopted by companies to advance low environmental impact design were identified and reported. It also offered insights and possible future directions for companies and academics to enhance DfS and CD and bridge the gap between theory and practice.

Reflecting on our work, future research may address this study's limitations. The literature review was limited by a keyword-based search within scientific databases, potentially excluding emerging studies. Additional methodologies, such as snowballing, could broaden the research scope in future work.

Moreover, the qualitative data collection through the interviews was confined to the Italian industrial sector. Thus, further research in other companies, countries, and continents should be conducted in future studies. The data collected from the interviews does not encompass the entire industrial sector but provides a snapshot of various aspects from different design categories. Additional interviews and observational studies across a broader range of companies are recommended to deepen the understanding of the industry's current state.
Lastly, while structured, the study's qualitative approach to data interpretation is subject to the possibility of alternate analytical perspectives. However, the insights derived from this process contribute meaningfully to the ongoing discourse on implementing sustainability and circularity in design for business practices.

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P/REFERENCES OF DESIGN

BRIDGING BY DESIGN: A DESIGNERLY APPROACH FOR CITIES TO SUPPORT INNOVATION PROCESSES IN THE URBAN CONTEXT.

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ABSTRACT | Transformation of the urban context is a continuous process of change, in which different interests and forms of rationality are converging. It is often the ground for agonistic forces that negotiate their values, projects and future views. (Concilio & Tosoni, 2018; Mouffe, 2000) However, in relevant innovation processes, such as urban or large scale projects, a design approach is crucial, as it helps to stay on course towards the ultimate purpose of the whole innovation process. In many urban innovation processes however, this approach is often overshadowed by considerations related to administrative or operative issues. This paper is based on the experience in an ongoing EU project, Climaborough, which is promoting a number of innovative initiatives in 12 European pilot cities in a Net Zero perspective. The first learning from this project highlights the designer's role in foregrounding the value of design in an innovative project. It does so by defining a design-based innovation process to promote initiatives for urban innovation. The paper will describe the three phases of the process: challenge definition, innovative procurement process and experimental sandbox and propose reflections on how the knowledge coming from those phases can be distilled, replicated and reused.

1. Introduction

Cities are complex systemic aggregations in a continuous process of transformation, which involves a multitude of actors, rules, infrastructure and natural or artificial agents (Colclough et al., 2019). To add complexity, multiple temporal perspectives configure evolutionary paths, which follow different temporalities: financial, strategic, ecological, social and political. The urban context is the ground on which different forces are converging and confronting. Cities are, at the same time, a problem lab, a resource pot, a market, a political arena and a place where new ideas emerge and mature (Concilio & Tosoni, 2018). In this continuous process of change, agonisms and antagonisms emerge between groups and rationalities that negotiate or fight and generate new, ever-changing forms of hegemony (Mouffe, 2013)[1].

A design approach plays a crucial role in mediating or creating the logical, material, and technical conditions for the interaction among different rationalities and different economic, social, cultural and political instances.

In relevant innovation processes, such as urban or large-scale projects, a design approach is extremely valuable to support innovation processes by framing them into the general and ultimate purpose of those processes. This is particularly evident in those cases in which urban transformation is led by the ambition of a complex systemic change, which is supposed to transition cities towards radically different scenarios (Concilio et al., 2018).

In large systems, and for the multiple actors involved in their change, design is not only an approach used to plan and direct major infrastructural changes but also a general and diffused attitude (Manzini, 2015) that must be mobilized at different levels to produce changes in small communities (niches), in urban systems (regimes) or even in the broader cultural, social, legal and economic landscapes in which cities are placed (Geels & Schot, 2007).

The challenge for design, however, is to learn how to work in such contexts and how to mobilise people, technologies and legal or organizational infrastructure to address this transition. In the last decade, several scholars have been focusing on the design perspective on this challenge (Ceschin, 2016; Gaziulusoy & Ryan, 2017; Irwin, 2015, 2018), while others have specifically focused on how niche or punctual design initiatives could be scaled up or framed in larger systemic changes (Manzini & Rizzo, 2011; Author, 2015a, Author 2015b).

2. The Net-Zero Challenge and the Climaborough Project

One of the most relevant challenges in urban sustainability transition is represented by the Net-Zero Cities (NZC) initiative. Cities are accountable for more than 70% of the global CO2 emissions (Mukim & Roberts, 2023), but they are also at the forefront of innovation, even though they are far from having consolidated methods to govern such complex innovation processes. For this reason, acknowledging the significant impact urban areas can have, the European Union identified cities as a key leverage point and the place to start a radical change in lifestyles and resource use, with the ultimate aim of reducing carbon emission by 55% by 2030 and achieving climate neutrality by 2050 (netzerocities.eu). Within the mission-oriented European program, which aims at creating interconnected actions that link climate challenges, policies,

[1] Chantal Mouffe conceptualises agonisms as a productive force that can lead to the articulation of diverse perspectives. In an agonistic democracy, the goal is not to eliminate conflict but to foster a respectful and inclusive space where competing viewpoints can engage. Antagonism instead, represents a deeper and more irreconcilable form of conflict that arises when there is a fundamental clash of interests or identities that cannot be resolved through dialogue or negotiation. Mouffe also discusses the dynamics of power and conflicts in democratic society through the concept of hegemony, a concept drawn from the work of the philosopher Antonio Gramsci. Hegemony refers to the dominance of a social group or class, based on consensus and the articulation of a dominant “common” sense. Mouffe points out that hegemony is a contested and unstable condition.

urban planning and scientific/technological change, *Climate-neutral and Smart Cities* is, in fact, one of the missions of the EU for the years 2021 – 2027. Among other initiatives, NZC has mobilized 112 European cities to accelerate the climate neutrality objective to 2030, thus becoming leaders in the effort towards the 2050 mission challenge. The 112 mission cities have been selected after a call for expression of interest launched in 2021.

The NZC initiative has mobilised a big effort in several European cities, thus helping to raise awareness of the meaning, as well as the political, social and infrastructural issues emerging from this challenge. Even those cities not funded by the NZC initiative had a chance to reflect upon policies and strategies to mitigate their CO2 emissions or adapt to the inevitable consequences of climate change.

In line with raising awareness for the Net-Zero challenge, the EU-funded Climaborough project has been designed to support NZC or cities that have applied for the NZC challenge, even when not successful. Climaborough supports 12 of those cities by employing a double cycle of public procurement for innovative project proposals that implement part of the urban climate neutrality strategy. The idea is to support projects that could generate significant changes in the pilot cities by working on different aspects, from technical feasibility to social, regulatory, cultural, or organisational issues.

In its four-year duration, the Climaborough project team will coordinate the two cycles of the procurement process by making sure that: a) the cities recognise the challenge the NZC goal represents for their specific development plans and translate this challenge into concrete actions, b) the procurement process is addressing those challenges and c) the results of the procurement process are integrated into the dynamics of change of the urban context.

The complexity of the work in these cities could be analysed in two directions:

- a vertical direction: any intervention in this project will necessarily target a niche, i.e., a very local and specific issue related to the general challenge of climate neutrality. The vertical connection between the specificity of this initiative and the more general target of (urban or regional or global) climate neutrality should, however, never be forgotten, to frame any possible intervention within scalability strategies;
- a horizontal direction: every single change in the complexity of the urban context implies the interaction of different competencies, cultures, stakeholders and technologies;

Any activity of change in this context, i.e., any design or planning activity, should take into account this complexity and raise the question of the role of a design approach in coordinating actions, navigating complexity and connecting horizontal and vertical issues.

3. An Overview of Existing Literature

This Climaborough project focuses on a specific challenge within a larger challenge referring to a wider disciplinary landscape. The larger challenge concerns urban planning and the need to integrate the inevitable instances of climate change in the design or redevelopment of urban areas. Such a challenge is characterised by a tension between mitigation and adaptation strategies (Davoudi et al., 2009). Combining the two strategies often implies an interaction between global perspectives that are implied in mitigation strategies, with specific challenges, i.e. local interventions, often related to adaptation. The challenge of climate neutrality is therefore to be framed at different scales, between the local intervention and the larger scale perspective (Shabb et al., 2023; Wu et al., 2023).

In defining the mission of Climate-Neutral and Smart Cities, the European Commission referred to an approach to multi-scalar challenges inspired by Mazzucato's mission-oriented innovation policies(Mazzucato, 2017, 2019). Mazzucato proposes such policies as a response to the most urgent global challenges. She does so by articulating the missions in a framework that mobilises different economic and

technical sectors through the promotion of mission projects (Miedzinski et al., 2019). This approach creates a framework for policymakers to address investments into meaningful innovations, creating a clear alignment between the scale of each proposed solution - the lower scale challenge -with the larger goal of climate neutrality.

The transition towards climate neutrality can be described through Geels multilevel perspective (Geels, 2010). Geels describes large transitions, such as the transition to climate neutrality, as a dynamic process that connects: (1) innovation in niches, e.g. small, protected environments in which innovation may happen and develop; (2) change in institutional regimes, i.e. the set of rules, norms and practice that shape the current system and (3) transitions to new socio-technical landscapes, which represent the broad socio-technical, economic, and cultural context in which niches and regimes operate. Design and urban planning operate at different scales in this process: while design has often been focused on interaction at the niche level, e.g. among individuals, or communities, the planning scale often refers to the regime level, as it concerns the entire set of tools, measures, and actions that cities may provide to the climate neutrality mission. (Arcidiacono et al., 2023). The role of design in innovation processes in cities has been explored in the work of policy and innovation labs (Thorpe et al., 2016; Thorpe et al., 2018; Voytenko et al., 2016) and in different projects, some of which have directly influenced the definition of Climaborough paradigmatic view and methodological approach. Among them is, for instance, the Designscapes project, which studied the role of design in the innovation processes between niches and landscape transitions (Concilio, De Götzen, et al., 2018); and the T-factor project, which suggested participatory design approaches to mission-oriented urban regeneration processes (Marmo et al., 2023). The methodological approach in the Climaborough project is the result of a combination of the theoretical frameworks derived from those projects and the operative experience of innovation assessment in cities (Colclough et al., 2019).

4. Methodological Approach

The working cycle adopted in Climaborough is based on a continuous conversation between the cities and the Climaborough design team. An overview of the process could be articulated in three phases:

1. **Challenge definition**: an initial phase in which each city's challenge is collaboratively crystallized and defined, main stakeholder groups that are affected by, or affect the challenge, are identified, and a number of use cases that elicit the details of the challenge and the institutional, infrastructural, social and data-related are developed. This phase serves as a foundational preparation for the public procurement process.
2. **Innovative public procurement**: the Climaborough project uses a preliminary market consultation, based on a preliminary negotiation dialogue with potential solution providers.
3. **Exploratory Sandbox**: this phase consists of preparing an experimental playground for awarded solution providers and municipalities to experiment with ways to apply the proposed solution to the urban context of the pilot city. A sandbox is a tool legally recognized by the EU (European Commission, 2023). The experimentation conducted within a sandbox can extend into regulatory, technical or societal realms.

It is worth noticing that the team involved in those phases had different competencies that have been used according to the phases of the project. In the challenge definition phase, the conversation with the pilot cities has been mediated by an innovation expert and by the '*city angels*' (i.e. two partner organisations: an association of municipalities and a lab working on urban transformation projects and have long-term experience in working with public administration) and designers, who collaborated to the definition of facilitation tools. The procurement process has mainly been coordinated by partners with long administrative experience. The nature of the experimental sandbox is still to be fully explored and will possibly involve designers, the above-mentioned innovation experts and the city angels.

At the time of the redaction of this paper, the cycle is not yet closed, therefore, this paper will explain the work in the three phases and propose some reflections about the learning in the first two phases and the forecast on the work to come.

4.2 Challenge Definition

In the first phase, the Climaborough consortium worked on the definition of a framework for the whole innovation cycle. This phase started about four months before the launch of the tender and continued during the tender. The purpose of this phase is to frame the whole innovation process, in preparation for the public procurement. In this phase, the pilot cities are engaged in a series of meetings, in which they are asked to identify:

- **A challenge**, concerning the main net zero objective for the city;
- **The innovation potential**, e.g. the ecosystem that can support (or hinder) the innovation process, the assessment of such potential was based on four pillars: Framework conditions, network enablement, innovation in action and sustaining value. The conversation with the pilot cities consisted of exploring the components of those pillars (the hexagons in Figure 1);
- **The actors in the ecosystem**, i.e., the users of the solution, but also the relevant stakeholders, such as business or public sector, the ecosystem has been mapped taking into account the level of interest and opinion of the stakeholders (figure 2);
- **Relevant datasets,** that are needed to build and evaluate the solution and will be integrated in a project platform;
- **Use cases**, which define possible scenarios for addressing the defined challenge and that elicit requirements, specifications and details that can be used especially in the description of the challenge as well as for helping the city representatives adopt a citizen-centred point of view (figure 3).

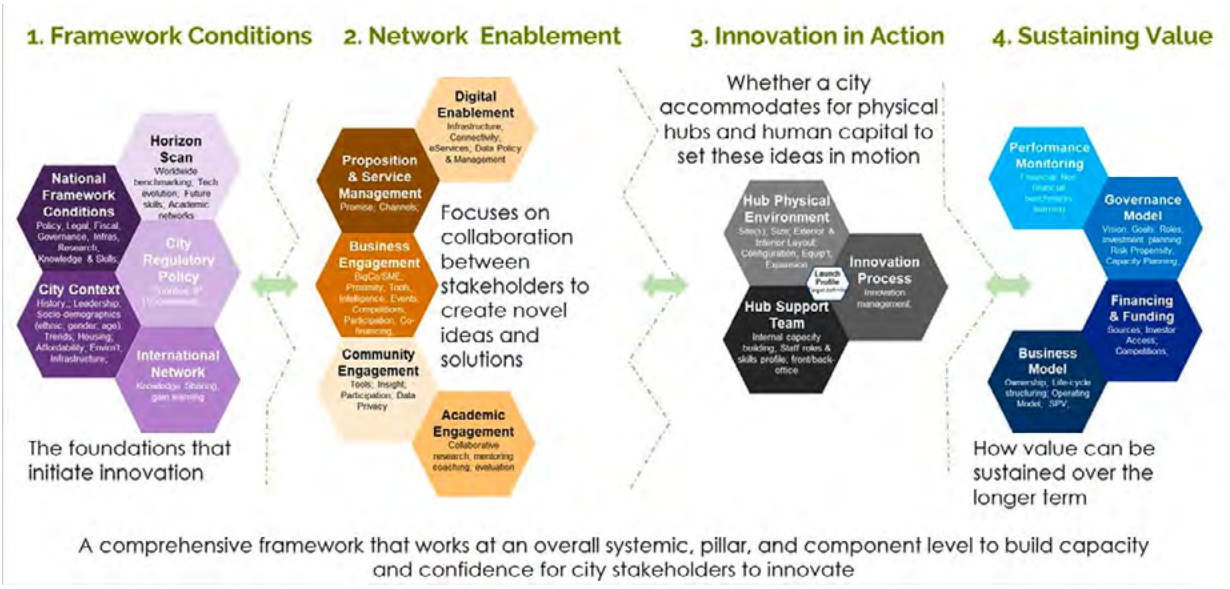


Figure 1. The 4-pillar systemic urban innovation framework. Source: (Colclough, 2023).

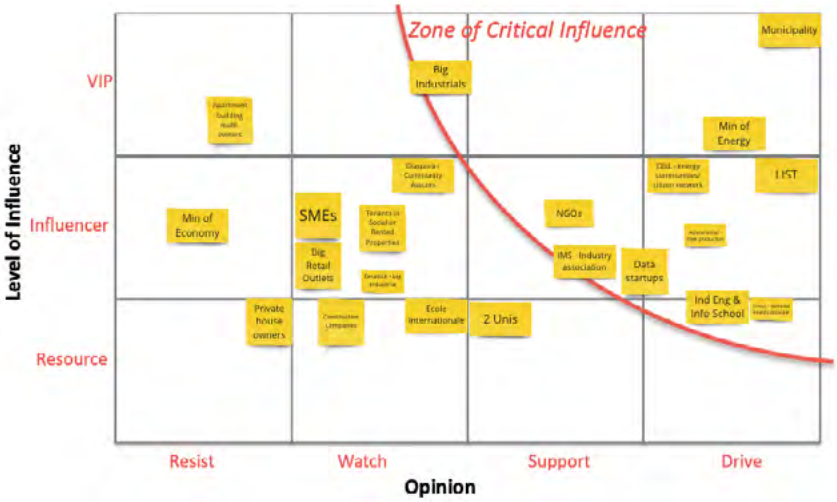


Figure 2. Map of the ecosystem actors by level of influence and opinion.

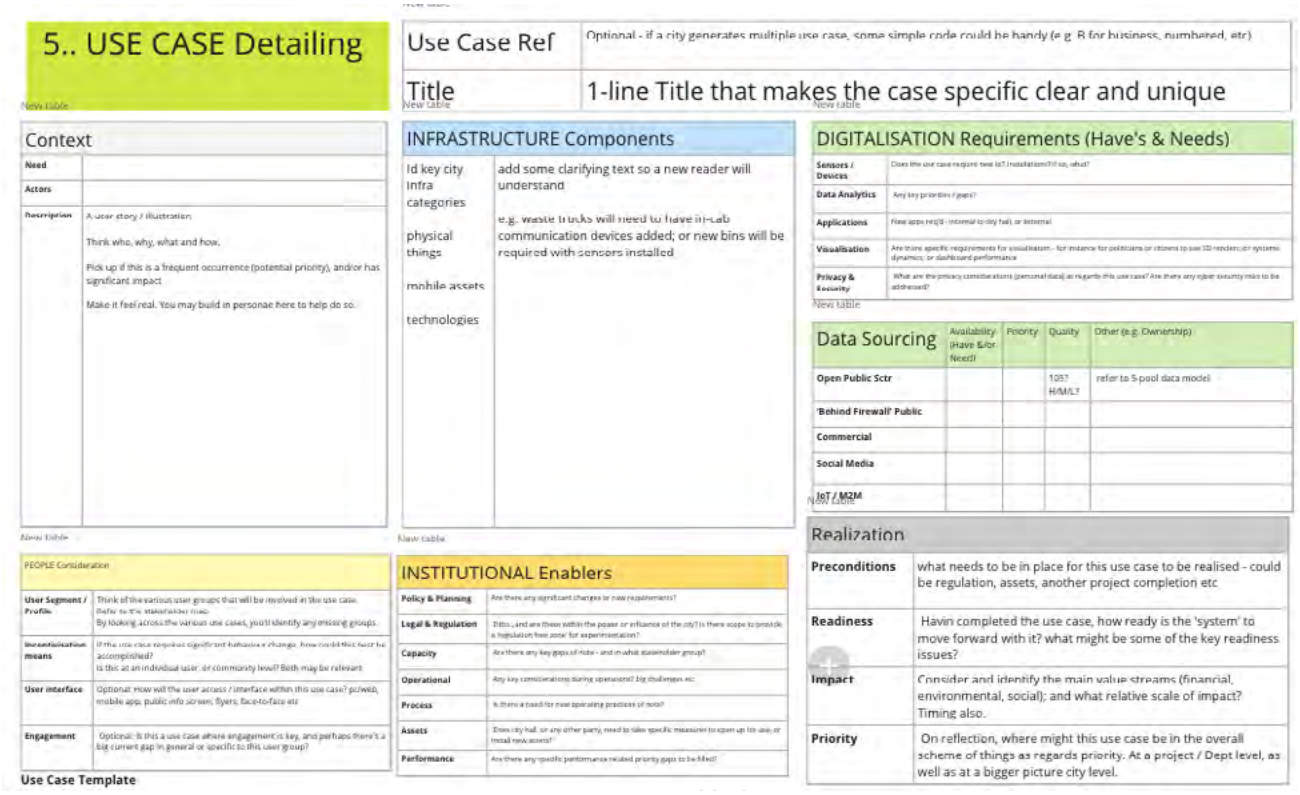


Figure 3. Use case template.

The project defined two *Climhubs*, i.e., two thematic areas: one hub focuses on urban challenges related to energy and mobility, while the second focuses on waste and circularity. Each pilot city's challenge can be associated with one of the hubs. The hubs are meant to support knowledge generation and exchange between cities addressing thematically similar challenges.

The pilot cities are either working through individual interactions with the design/research team or by exchanging knowledge with other cities in the same hub. Each meeting, whether individual or within the hub, has been facilitated by design-driven frameworks that supported the discussion on each of the themes identified above.

4.3 Innovative Public Procurement

Unlike the normal tender processes, the Climaborough project used an EU legally recognized tool, the preliminary market consultation, which makes it possible for municipalities (launching the tender) to open a dialogue with possible participants to the tender before they send the final offer (Sorokina, 2022). The preliminary market consultation consisted of a general information meeting with the potential applicant in each city. The knowledge acquired in the challenge definition phase is used in this phase to provide the applicants with all the necessary information to participate in the tender. This knowledge, together with the requirements elicited in the challenge definition phase, is distilled in the tender call and specified in one of the appendices of the call.

The public procurement process is divided into two phases: in the first phase, proposals are presented without specification of the budget, to be discussed in a one-to-one negotiation between the city and the proponent. It is crucial, at this point, that the city has a clear picture of the most relevant implications of the solution on the city ecosystem. In this phase, cities can propose changes that the proponent can include in a second submission (the second phase), which will also include budget details.

4.4 Exploratory Sandbox

This phase consists of preparing an experimental playground for innovators and municipalities to experiment with how to include new initiatives in the urban environment. In experimental contexts, a "sandbox" typically refers to a controlled environment where researchers can test hypotheses, explore ideas, and conduct simulations without risking any significant consequences that could instead occur on a real-world or a city-wide scale. This concept is often used in fields like computer science, where sandbox environments provide a safe space for testing software or algorithms without affecting the broader system, or in game development, where designers use sandboxes to test game mechanics, level designs, and player interactions before integrating them into the final product. Generally, the concept of a sandbox in experiments allows researchers to iterate, refine, and validate their ideas in a controlled setting before applying them in real-world scenarios. It provides a valuable tool for experimentation and innovation across various disciplines.

The European Commission provided some guidelines for the definition of the concept of sandbox (European Commission, 2023); The experimentation conducted in a sandbox can span regulatory, technical or societal realms. Regulatory experimentation may involve a temporary loosening of existing legal and regulatory frameworks to enable the testing of innovative technologies, products, services or approaches, which are not fully compliant with these frameworks. While the term sandbox has often been referred to the regulatory aspects of the experiment (Nesta, 2019), the European Commission also considers other experimentation tools to foster learning and experiments: testbeds and living labs. The former mostly focuses on technical aspects, whereas the latter refers to the social aspects.

All the aspects, regulatory, technical and social, should be tested through prototypes, or demos: the conversation with the cities is aiming at highlighting the most relevant technical, social and regulatory aspects that are expected to be tested and evaluated. Figure 4 is a snapshot from the conversation with one of the pilot cities, using a Miro board.

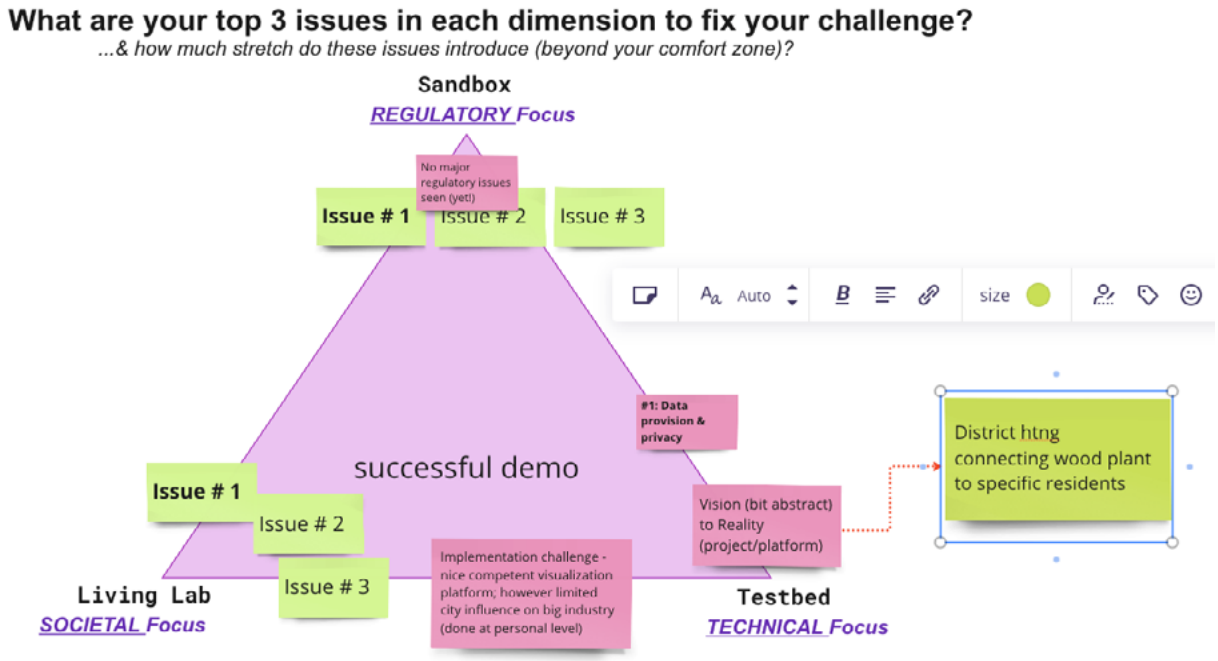


Figure 4. Graphic representation of the characteristics of the experimental sandbox in one of the cities.

The three aspects of the experimental sandbox refer to different disciplinary areas: for years, living labs have used specific methods and tools, such as design jams, design sprints, workshops and systemic prototypes to engage communities in co-creation activities (Leminen et al., 2017; Schuurman et al., 2012). Technical aspects have also been used with different forms of modelling or prototyping. Regulatory sandboxes are used in healthcare, energy, transport, fintech and data (Nesta, ND), but they represent a relatively unexplored domain explored in the design discipline. Relevant explorations in this area have been undertaken by Nesta (Nesta, 2011, 2019, ND)and IDEO (I. Nesta, 2016), and suggest the use of different prototyping strategies to address different levels of complexity, from individual interactions to large regulatory systems.

5. Discussion

At the time of writing this paper, the project is far from being completed. The preparation phase has led to the preliminary market consultation and the preparation of the call for tender. A good number of solutions have been proposed and will be evaluated according to the appropriate procedure, as required by EU regulations.

As previously mentioned, this paper is the first opportunity to get an overview of an ongoing design research project, looking at what worked or not and the challenges to come. This is an *insider* overview, as the authors of this paper are directly involved in the design of the various phases, in the interaction with the city and in the negotiation of the process with all the partners in the project's consortium. This implies that, rather than a completed experience, the authors intend to propose a discussion about the perspectives and the learning from this first phase of the project.

5.1 Different Perspectives

The Climaborough project includes twelve cities, eight of which are *leader* cities (i.e. those that participate in the first cycle of the procurement processes), whereas four other cities are participating as *followers* (meaning that they will be involved in the second call for tender). Furthermore, leader cities in one hub will become followers in the other hub, which means they may be able to promote some activities in areas that have not been included in the first procurement process. Some of the cities are relatively large (Torino, Grenoble, Sofia, Athens), whereas others are much smaller. The administration structure is, therefore, quite

different, as different are the roles of the personnel participating in the project, from public servants working in offices dealing with specific problematic areas (e.g. urban waste, mobility, energy), to external consultants working with the municipalities. Finally, the different sizes of the pilot cities imply a different decisional structure: the big cities are obviously bounded by a more structured decisional process, whereas the smaller have a thinner, possibly more agile organization, but some of their decisional processes must be coordinated at the regional level. The diversity of perspective implies the need to find different *languages* to talk to cities and a unified strategy to organise the dialogue in those languages. The graphic format and the templates have been valuable boundary objects to support the conversation.
The different perspectives also impact on the capability to react on the pilot cities side, which means that the capability to influence decisions at the municipal level is different. This will possibly affect the way the sandbox can be organised. A regulatory sandbox, in which certain regulations are suspended to support experiments, may not be possible when the point of contact between the project and the city is not embedded in the municipal administration. On the contrary, personnel who work on specific municipal missions, such as waste reduction or digitalisation of public transport, may be more *embedded* in the administrative logic, thus they may find it hard to accept a different perspective, such as a broader view towards a circular economy, of models of mobility that support the reduction of circulating cars. The challenge in designing the sandbox will therefore consist of balancing the perspective on the specific problem and the connection with the overall themes of the Net Zero Strategy.

5.2 The Complexity of the Topics

To be compatible with the NZC goal, the change the Climaborough project is expecting to bring about in the pilot cities must be systemic, meaning that it needs to involve several aspects of the technical, social and organisational infrastructure of the city. On the other hand, the point of contact from the city is a person, or a small group, with specific competencies. What the project asks them is to enlarge their perspective beyond their competencies: experts on waste, for instance, are asked to provide information about available urban datasets or to invite other municipal public servants to the conversation. In this case, the role of design has been to provide tools for identifying relevant information about data, infrastructure, stakeholders, and institutional enablers, as for the use case templates in Figure 3.

5.3 The Drop and the Ocean

Experimenting in cities is not a new practice in urban projects, especially in EU-funded projects. Other projects tried to engage some pilot cities in the introduction of innovation and in following up on the transformation that this could cause. The level of engagement of cities, however, did not always live up to expectations, especially when the experimental phase required a complex and systemic effort. The advantage of having a procurement process as part of the Climaborough project has been to keep the interest of public servants and participants alive because the process implies very specific legal responsibilities and obligations for the cities.

On the other hand, the tangibility of the objective (the solution coming from the tender) risks narrowing the attention of the pilot cities partners on the technical, organisational or legal practicality of the solution, rather than extending the perspective to the systemic goal of climate neutrality.

The project team used the metaphor of the drop (the specific solution coming out from the procurement process) and the ocean (the systemic goal of climate neutrality at the urban level). The dialogue with the partners in the pilot cities always started from the representation of the interaction between the specific intervention, for which the procurement process was mobilised, and the climate neutrality framework and roadmap, trying to frame all the phases (challenges definition, identification of users, identification of datasets and the application of solutions) into the broader Net-Zero Goal, that should validate the pilot city strategy (Figure 5). It is clear that the single solution is not going to have any significant quantitative impact on the positioning of the city with respect to the climate neutrality goal, however, it is important to validate the solution with respect to the infrastructural changes they may require and the opportunities to amplify

the impact of the single initiative. This also implies eliciting considerations about the horizontal scalability of the solution (i.e. its reproducibility) and its vertical scalability (i.e. the possibility of integrating each solution in the institutional framework of a NZC strategy)(Moore et al., 2015).

This challenge is also very relevant in designing the sandbox. At this stage, a sandbox is a unique opportunity for designers to support experiments and test visions that can go beyond the existing regulatory, technical or societal limitations. However, the challenge for the design team is to keep the vision alive during and after the experiment, test and validation phases, possibly proposing forms of systemic prototyping or exploring scalability strategies to amplify the outcome of the experiment.

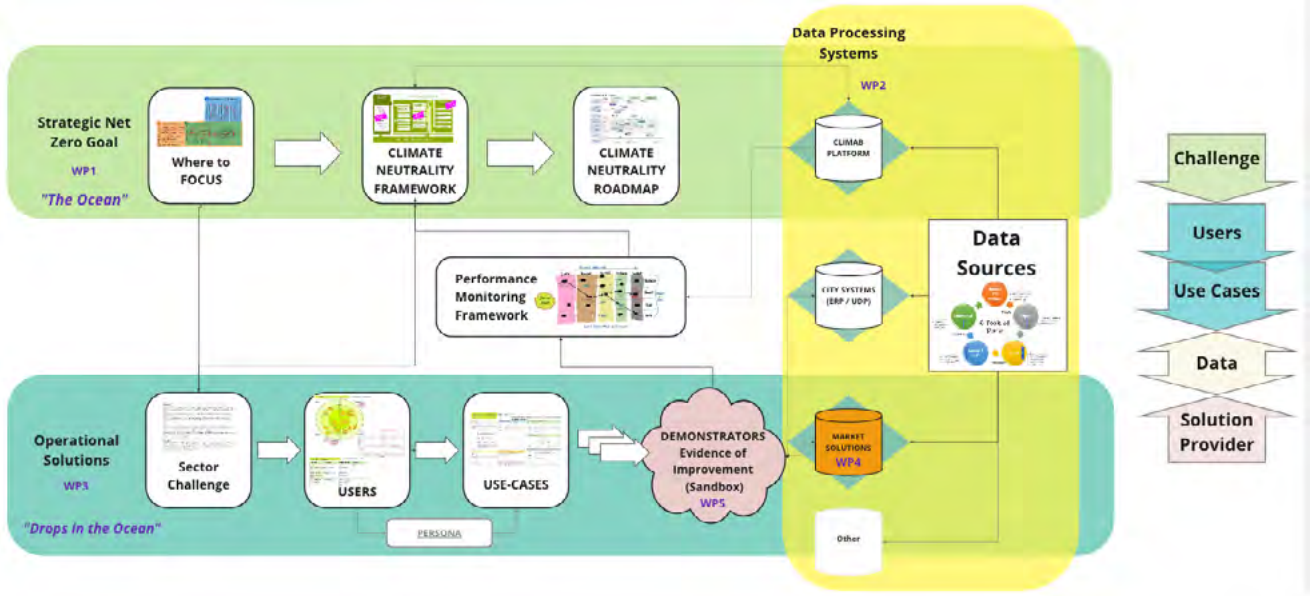


Figure 5. Linking the phases and investigations in the project with the systemic Net Zero Strategy.

5.4 The Hubs

As mentioned above, the twelve cities involved in this project are divided into two *Clim*hubs, focusing on 1) energy and mobility and 2) waste and circularity. So far, the work in the hubs consisted in sharing experiences and information in co-creation workshops. Hubs have worked as thematic areas, but also to facilitate the workshop organisation. However, the hubs are meant to have a broader scope in the project, namely to become an opportunity to develop and exchange specific knowledge, coming from the learning and the experiments in the sandbox. An activity of co-creation among the sandbox could also be proposed, that could amplify the result of each single sandbox or could test solutions across the pilots.

The hubs could become the legacy of the Climaborough project, after the funding period, possibly including new cities and becoming a repository of knowledge for cities that aim at implementing climate-neutral strategies. However, this poses some questions about the legacy of this design research project: the knowledge exchange in the Climhub is strongly supported by the project team, in particular by the city angels and the mediation of the design and innovation experts. The question emerging from the scenarios of a design research project like Climaborough is: to what extent is this knowledge reusable without the mediation of the experts and the design team? Can one assume that the collaboration between the team and the pilot cities develops a sort of *diffuse design capability* in the public administrations involved in the project? Can one assume that the knowledge repository represented by the Climhubs is effectively used also by cities that have not participated in the project? To what extent is the mediation of design and innovation experts essential to support climate neutrality innovation in cities? Finally, can the interaction for the design process be codified (for instance through a roadmap that indicates the necessary steps in the process and the tools used in each step) to distill the knowledge from the perspective of its replicability?

Those questions suggest an investigation of the model of support to design and innovation to large public systems, like cities, a question that has already been discussed in relation to the role of policy and design innovation labs around the world (Bailey et al., 2016; EUPAN, 2018; Holierhoek et al., 2019; Kimbell, 2015; Siodmok, 2017), but also in relation to the role of living labs (Nesti, 2018; Steen et al., 2017).

6. Conclusions

This paper is approaching a design problem, that concerns two levels of complexity: the complexity deriving by the convergence of multiple social, technological, organisational and political issues in the urban context and the complexity related to the multi-scalar dimension of the problem of climate neutrality.

The first dimension implies the role of design in the development of innovation at the systemic level, making sure that innovation processes are properly metabolised by the urban ecosystems and integrated into a sustainable transition process. In this sense, the paper reveals the valuable role of design in preparing the ground for procurement processes and in envisioning possible experimental conditions for innovation to be prototyped, tested and developed.

The second dimension concerns the scalability of the process, which means its replicability within the same urban context or in other urban contexts and the creation of a social, technical and institutional context that would support the replication and the diffusion of innovation. In this sense, design knowledge is valuable in defining collaboration tools, that help the actors involved in the process to scan the innovation capacity of the ecosystem, and to figure out relevant innovation conditions and the institutional enablers (e.g. through use cases and ecosystem maps, as mentioned in section 4.2 of this paper).

Since, as mentioned, the Climaborough project is an ongoing process, this paper has to be seen as a reflection in action, that aims at starting a conversation within the design community, but also beyond it. One of the most relevant questions emerging from the experience in the Climaborough process is whether the design knowledge emerging from the process so far can be codified, replicated and become part of the diffuse design capabilities of an institution, such as a city administration, rather than being an expert design competence.

Beyond the design community, the conversation this paper could suggest would also involve city representatives, or institutional stakeholders working on urban innovation and procurement processes, in the perspective of integration of design within the existing package of legal/technical competencies that support the processes of decision making in cities.

As mentioned, this paper is the first step of an ongoing project, but it is also a possible introduction for future research and a debate related to the design capability to support the innovation processes related to the mission approach, inspired by Mazzucato (2017, 2019), that the EU is adopting to structure large innovation processes for the coming future.

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P/REFERENCES OF DESIGN

CULTURAL VALUE CHAIN: STRATEGIES FOR ACTIVATING CULTURAL VALUE IN MADE IN ITALY PRODUCTS AND SERVICES.

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KEYWORDS | CULTURAL VALUE CHAIN, MADE IN ITALY, INTANGIBLE VALUE, DESIGN-DRIVEN APPROACH, APULIAN WOOD-FURNITURE SECTOR, ECONOMICS

ABSTRACT | The research is part of 'Made in Italy circolare e sostenibile' macro-project, financed by PNRR, with the objective of promoting innovation in Made in Italy production chains. The 'New and consumer-driven business models for resilient and circular SCs' project aims to develop circular and resilient supply chain strategies to support the furniture sector. The contribution presents the first outcomes of the 'Cultural value chain. From local traditional production districts to a new country of origin effect' project, focusing on the discipline of design and its critical role in the cultural valorisation of goods. The objective is to identify a strategic design-driven approach to support the competitiveness of local production systems by valorising the identity of culture-based products and services. The concept of the *cultural value chain* emerges as an interpretative key, placing cultural value inside supply chains. The research investigates the change in the Italian manufacturing sector, emphasising the reconfiguration of industrial districts and the innovative impact of the digital revolution; in fact, the decentralisation of production phases by leader companies activates possible innovative dynamics in the industrial context and presents opportunities for micro-enterprises. In particular, the research focuses on the context of the wood-furniture supply chain in the Apulia, with a specific attention on the upholstered sector, presenting case studies to support the critical reasoning exposed. The discussion highlights the need to shift the focus towards social and cultural well-being, with design called upon to support socially sustainable enterprises. The thesis argued is that design should assume a central role in the development of new design strategies oriented towards the *cultural value chain*, considering cultural capital as a key element for the competitiveness of local production chains.

1. Introduction

The paper is part of the 'Circular and Sustainable Made in Italy' macro-project financed under the PNRR, which intervenes in encouraging the innovation of Made in Italy production chains, with particular reference to 2F Furniture and Fashion. Specifically, the project to which 'New and consumer-driven business models for resilient and circular SCs' refers deals with the research of circular and resilient supply chain strategies in order to support the Made in Italy fashion, furniture and automotive ('3A') sectors. On the other hand, the objective is to face the challenges of SMEs for a sustainable and resilient reconfiguration of global value chains by adopting strategies of re-shoring, redesigning and enhancing the cultural dimensions of local supply chains.

In particular, this contribution presents some of the outcomes of the "Cultural Value Chains: From Local Traditional Production Districts to a New Country of Origin Effect" project. The research, assuming a critical point of view, for the discipline of design, with reference to the role of the entire supply chain in the identification of the cultural value of goods, photographs the current panorama of the Apulian wood-furniture supply chain and analyses the case studies related to the context of investigation, with the aim of useful exploration for the future design of sustainable project strategies consistent with the peculiar capacities of the entrepreneurial fabric of reference.

The broader objective of the study is to identify the design-driven strategic approach to support the competitiveness of local, resilient and circular production systems, enhancing the role of the identity of culture-based products and services, also in relation to the social context and target communities. In particular, criteria are defined for locating cultural value in supply chains, in what we call the *cultural value chain* (Di Roma et al., 2024). In this chain, the cultural value generally attributed to the product is identified in the stages and actors associated with the entire process, although each stage of the entire supply chain contributes to implementing the value. The contention is that the growth of economic value in the supply chain (Porter, 1998), is also valid in cultural terms and that knowledge of the value of the product is expressed in every part in the final product.

The concept of 'made in supply chains' constitutes a paradigmatic element in the identification of the cultural capital associated with the supply chains of goods and services, finding its foundation in the complex structure of the industrial and manufacturing sector, characterised by the presence of numerous small and medium-sized enterprises specialised in various production phases, source of the considerable competitive advantage associated with the distinctive Italian territoriality (Bettiol et al., 2010; Accetturo et al., 2013). In fact, following the period of delocalisation in the 2000s, the phase of re-investment by national and international companies in the re-localisation of supply chains in their own territories has led to a reconfiguration of industrial districts that is very different from the historically consolidated one. This reconfiguration, significantly enriched by the innovative impacts of the digital revolution (Bertola et al., 2018), has been facilitated and characterised by the presence of a production structure rooted in the territory, characterised by a relevant social and cultural heritage (Porter, 1998; Berger, 2013). This phenomenon assumes great relevance with respect to recent trends concerning innovation in the manufacturing sector, considered a crucial driver of value and competitive advantage: innovation is seen as a fundamental element to improve product quality and promote customisation, as each industrial production process can generate new opportunities for learning and innovation, derived from practical experience (Bettiol et al., 2022).

In order to respond to the growing need for flexibility, the district's leader companies implement a process of decentralisation of the production phases outside, concentrating on the design, marketing and coordination of external production. A clear division of labour is thus determined, on the basis of which the commissioning companies are essentially engaged in creative activities and administrative management, while subcontractors take care of the production specialisation lines in the various phases, guaranteeing a high degree of production elasticity (Cagliano et al., 2000). The innovative dynamics occurring at the top of the industrial context can thus act as a driving force for micro-enterprises, but can sometimes also represent an obstacle or limitation to their natural growth. The introduction of complex and systemic

innovations radically transform the entrepreneurial formula and organisational model of traditional district companies, such as the regeneration of processes, the renovation of management models and the adoption of new managerial tools (Guelpa & Micelli, 2007). The difficult possibility of updating their know-how and production infrastructures in a short time, as well as the difficult access to economic measures to support them compared to industrial players, characterise small manufacturing companies. Despite the fact that innovation is one of the most efficient competitive drivers, it is considered not to be the only way in a context where the risk of leaving behind or causing micro-enterprises to fail is high.

The research, therefore, reflects broadly on the problem from an economic and political point of view as it reflects on the relationship between the local level of technical know-how and supply chain management, and cultural value. It is believed that in the context of the Italian company system, which is characterised by the capillary presence of small individual companies, in which the wood-furniture sector in Apulia is an emblematic case, it is necessary to shift the focus towards the social sphere, in work practices, as well as towards instances of innovation which, often guided by markets or politics, place these companies in a disadvantaged position. Therefore, today's design discipline has the responsibility, through oriented design, to support manufacturing companies with the construction of sustainable design strategies. These must belong to the capacitive strings of the company to adopt models and carry them forward over time, in favour of a socially sustainable enterprise.

The structure of the article, outlining this perspective, includes the general framework outlined, the analysis of the reference context and the *cultural value chain*, the focus in relation to the Apulian wood-furniture supply chain (and in particular in the upholstered product considered among the most complex and characteristic of Italian design), the enunciation of case studies drawn from the new local entrepreneurship, the conclusions and the prospects of the research.

2. Reference Scenario

The success of the 'Made in Italy' phenomenon during the 1980s and 1990s was characterised by the adoption of new organisational configurations by Italian companies across the country. These models, characterised by flexibility and resilience, were based on the division of labour between different companies operating in the same sector rather than between individual workers within the same production process, giving life to the first industrial districts (Bettiol & Micelli, 2005; Sforzi, 2008).

The national law no. 317/1991, subsequently modified by law no. 140/1999, initially defined industrial districts as homogeneous local production systems characterised by a high concentration of industrial enterprises, mainly small and medium-sized and a high degree of productive specialisation. However, an indication that reflects only two of the organisation's essential requirements such as location in a limited territorial area and reference to a specific product or production sector. It neglects two fundamental aspects of districts, namely the 'network' production model, which is based on the organic interdependence (Pyke & Sengenberger, 1991) between different companies, linked together within the supply chain (Grandinetti & Passon, 2004), and the opportunity to benefit from a relational issue characterised by the sharing of a common 'industrial atmosphere' (Marshall, 1890; 1919), that is, a shared culture and language (Marchi & Nardin, 2008). This vision of the district characterised it as an intersection between productive and social dimensions (Beccatini, 1991), facilitating inter-organisational relations, reducing transaction costs (Dei Ottati, 2003) and facilitating knowledge transfer (Camuffo & Grandinetti, 2011).

This organised strategy allowed companies to better adapt to market fluctuations by specialising and managing their production processes through collaborative networks, providing greater flexibility and operational efficiency (Becattini, 2007). The industrial district model has represented and still represents a fundamental pillar within the Italian economic system (Varaldo, 2003), having allowed small and medium-sized enterprises to develop an intense specialisation of products, then of production processes and, more recently, a redefinition of business models in a national and international context.

In this last perspective, the emergence of new countries in the global market, such as Asia, Brazil and more recently China, has led to a phase of modernisation of industrial strategies and the business model. These include the relocation of production to countries with low labour costs and the redefinition of supply networks resulting in different forms of labour organisation on a transnational scale. In this globalised scenario, we try to understand the extent to which small and medium-sized companies insert themselves into supra-local value chains, such as Global value chains (Gvc), in order to achieve long-term competitive advantage. The challenge frequently resides in the continuous development of new business ideas, creating competitive trajectories and offering strategic and response alternatives to competitors (Romano, 2004). The reorganisation of the division of labour at the global level (Ponte, Gereffi & Raj-Reichert, 2019) particularly emphasises the role of some enterprises in defining the governance of relations between Gvc actors and coordinating large-scale iter-firm networks. Many studies in the literature emphasize the positive impact that the development and upgrading of Global value chains can have on the growth of local companies and production systems in terms of employment, market development and innovation processes, encouraging upgrading processes both at company and territorial levels (Bettiol et al., 2018). However, despite the benefits of opening up to the global context, the internationalisation of activities can undermine the internal cohesion of the cluster due to the substitution of local suppliers with international ones, potentially causing leakage of knowledge and expertise at the territorial level. From this perspective, internationalisation may have a negative impact on innovation processes by separating production from innovation, an element that traditionally constituted a fundamental binomial for the success of many industrial clusters in the past.

The change required is systemic (Varaldo, 2003), since the ability of companies to relate to the external environment depends both on their operational capacity to diversify their offerings and on their strategic capacity to fit into transnational production and distribution networks. This systemic aspect is particularly relevant for small and medium-sized enterprises considering their district context that over time has made them repositories of competitive production skills and knowledge, to the point of transforming them, in recent times, into nodes of a distributed network of specialised operators beyond the local context (Micelli, Chiarvesio, Di Maria, 2010). In these enterprises, corporate intangible assets play an essential role in product, process and organisational innovation processes, distinguishing and characterising the enterprise and its offer with resources that are difficult to replicate or monetise (Romano, 2004). Image, cohesion, trust, production organisation, technological know-how, product reliability are the resources influencing the strategic orientation of the company and its identity.

In the context of the systemic context, the creation and perpetuation of organisational capabilities are based on learning processes that support the introduction of innovation. Leader enterprises are distinguished by their ability to introduce complex and systemic innovations that profoundly revolutionise the business formula and organisational model of traditional district enterprises, such as the regeneration of processes, the renewal of management models and the adoption of new managerial tools (Guelpa & Micelli, 2007). By initiating these processes of change, industrial players outline original evolutionary paths that influence the overall development of the local system towards the transition from a closed local network model to one that is more permeable to the competitive environment and interconnected with international economic circuits (Grandinetti & De Marchi, 2012). A binomial of innovations takes place, those complex and systemic innovations typical of industrial players, and the more punctual process and product innovations characteristic of the district context. Therefore, in this increasingly competitive arena, access to innovation, considered one of the fundamental pillars for business success, is not uniform between leader companies and small and medium-sized enterprises operating within production chains. Disparities in financial resources, access to knowledge networks and investment capacities create a significant gap. Leader companies, often characterised by a solid financial base and an extensive network of strategic partnerships, can afford to invest in long-term research and development, creating new technologies and advanced solutions that maintain their position of advantage in the market, as well as acquire knowledge from outside and internalise it. Furthermore, industrial players often have better access to external economic measures to support them, such as public funds or investments. On the other hand, small supply chain companies, despite their crucial role in the local economy and value chain, have difficult access to innovation due to their limited financial capacity, lack of connections, difficulty in updating

knowledge and external resources. These structural changes come within the production chains, where leader companies adopt new processes for which small companies are unable to adapt their workforce and skills. In fact, the updating of specific know-how with specialised skills and training is not easily accessible or sustainable in the short term.

The transmission and preservation of cultural knowledge represent crucial elements for the continuous evolution of the district and for the development of Italian small and medium-sized enterprises. Thus, the focus shifts from new technological innovation to that of cognitive capital and the entire organisational structure, exploiting the social human capital of the context in which it operates (Varaldo, 2003). The impact of this change influences the capabilities of the company not only in the operational phase of the production chain, but also, and above all, in many other areas, such as vision, strategies and tactics.

The research, therefore, reasons on the relationship between the local level of technical know-how and supply chain management, and the cultural value, and considers the need to shift the focus towards the entire supply chain, characterised by the capillary presence of small individual companies, towards socially sustainable business design-oriented strategies. Design must, therefore, today think about what is the longest dimension of time that can, through oriented design, support such enterprises that otherwise only have the prospect of being excluded from the possibility of following the industrial players: to build sustainable projects from the point of view of what are the capacities of the company to adopt models and carry them forward over time and with a certain degree of comfort and "well-being", in favour of a socially sustainable enterprise. New project strategies reconfigure a new concept of value, especially at a time like the current one, where innovation in a sector with a high degree of tradition is considered to be mainly associated with the result of a renewed focus on technology, towards an environment of dialogue between innovation and socio-cultural aspects.

3. Cultural Value Chain

The identification of Made in Italy (MII) as a product characterised by a high cultural value and permeated by that country of origin (Schooler, 1965), has historically distinguished the furnishing sector, connoting it with values such as attention to detail, quality of workmanship, elegance, and lifestyles referring to practices of use (Fortis, 1998), however, attributed mainly to the finished product. From an opposite perspective, which is not always effectively valorised, the MII manifests itself in supply chains and knowledge that are peculiar, distinctive and exclusive to Italy, closely connected to the territory of reference. In this context, the circular and sustainable approach to product and process innovation considers the entire chain of goods and services intermediate to the production of the finished product, such as sub-supply of materials, sub-supply of production processes, sub-supply of services, thus recognising the crucial and distinctive role of know-how historically consolidated in the territories.

To this chain, management associates a value chain (Porter, 1985) consisting of the activities that generate value in the economic sense of the amount that the end customer is willing to pay. Involving all production processes from raw materials to end use, this value is transferred and perceived in products and services, creating a competitive advantage. A value system is thus effectively created if, through the synergetic operation of actions supported by the company, an increase in profit is generated.

The research argues that the growth of economic value at each stage of the supply chain is also translated in cultural terms, coining the original concept of *cultural value chain*. The cultural value socially attributed to the product is identified in the downstream stages and actors associated with the entire process, taking a value-oriented perspective on the finished product. However, each stage of the chain is considered to contribute to the overall value of the good. In this context, knowledge of the value of the product is therefore incorporated into every part of the final product (Losciale et al., 2024). Therefore, a supply chain approach is adopted rather than an individual product approach, shifting the focus to the know-how that characterises all material processing and production steps associated with the finished product (Martinuz & Soldini, 2021). It is thus proposed to value the satisfaction of the social wellbeing of the community,

dissociating it from the exclusive objective of generating profit that does not consider the solidaristic, civil and social interests of the entire community (Mollona et al., 2021).

The expression *cultural value chain* is declined with respect to the dimensions that are responsible for creating value for the customer, considering the concept of value associated with the philosophical ideals that guide actions (Tappolet & Rossi, 2015). However, these are tangible and intangible elements on which people implicitly or explicitly base their value judgements, and thus about what they like or prefer (Figure 1). In fact, in this context, the term 'culture' refers to the values, principles, customs, practices and habits shared within a social group, in line with the contemporary design trend oriented towards the recovery of the local dimension of production, especially in traditional manufacturing contexts. This approach attaches importance to redefining the relationship with objects from a cultural perspective (Di Roma, 2020).

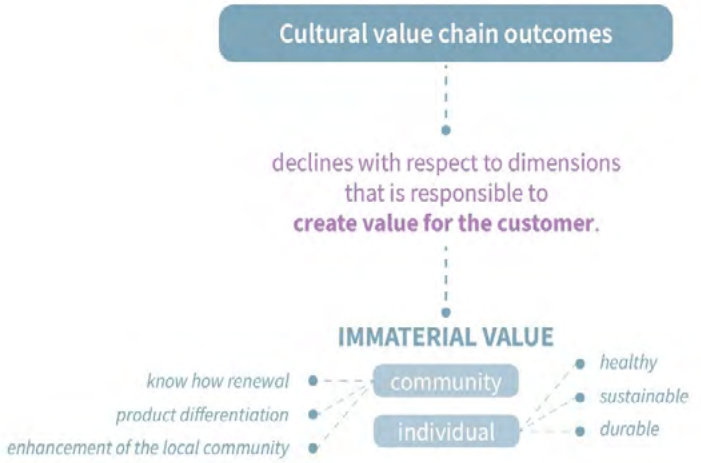


Figure 1. Cultural value chain outcomes.

The definition of the *cultural value chain* thus considers the complex relationships and social practices found in tangible and intangible artefacts (Landowski & Marrone, 2002), which thus become "cultural products" (Volonté, 2009), enriched in terms of meaning, experience, aesthetics, sharing, participation and having the role of main actors in defining the collective identity of social communities. This concept is rooted in the territory as a spatialisation of social facts (Dematteis, 1995), a mine of culture, knowledge and practices that give rise to an authentic tradition of know-how. Each territory is associated with a cultural capital understood as a "capital that incorporates, preserves and provides cultural value in addition to whatever economic value it possesses" (Throsby, 1999).

The strategies of the cultural value chain focus on implementing aspects of social and cultural sustainability aimed at preserving, maximizing, and highlighting the cultural value of a product or service across all phases of the primary production chain. Consistent with the circular economy, which promotes the efficient use of resources throughout its entire lifecycle through sustainable strategies (such as reuse and recycling), the cultural value chain operates on culturally sustainable strategies feasible in all phases of the primary production chain but which impact the value aspects attributed by users to products and thus the durability of the asset. The circular economy and the cultural value chain are both approaches aimed at maximizing the value of resources, both material and cultural, through sustainable practices and a long-term vision.

The furniture and fashion industries, including in the historical sectors of the MII, traditionally associated with the concepts of authenticity, excellent craftsmanship, high production skills and quality (Temperini et al., 2016), are therefore considered paradigmatic cases demonstrating the fundamental role played by *cultural value chains*. Specifically, these are also representative of local production systems: supply chains located in specific geographical areas characterised by the material and immaterial cultural heritage of traditional

communities of practice and relevant in the MII sectors for their characteristic production traditions, local know-how, social proximity, tacit knowledge, small business dimension, incremental innovation and flexibility of the production process (Quadrio Curzio & Fortis, 2000; Rullani, 2000; Beccatini, 1998).

Currently, as a result of globalisation processes and dramatic global events, local production systems are under significant competitive pressure (Benini, 2019; Giumelli, 2019). These systems are called to review the assumptions on which their value is based: intangible values such as knowledge, culture and creativity are emerging as sources of competitive advantage (Sbordone, 2020).

In the following section, this paper analyses the emblematic case of the wood-furniture supply chain in Apulia, demonstrating the capillary presence of small and medium-sized enterprises with a district character in the area and the need for new strategies oriented towards a *cultural value chain*.

4. Research Methodology

The research methodology included an initial phase of framing the general theme concerning the broad phenomenon of Made in Italy, with its peculiar characteristics and evolutions. Subsequently, a non-systematic but traditional literature review aims to explore and define the concept of the cultural value chain as a design-driven strategic approach to enhance the competitiveness of local production systems in Italy. In support of the proposed theoretical approach, based on the importance and uniqueness of cultural identity in Italian products and services as well as the peculiar distribution and size of local enterprises, the research proposes the macro case study of the Apulian wood-furniture supply chain, considered an emblematic example.

The research addresses the proposed case by elaborating raw data from updated reference databases (AIDA) and translating them into information, utilizing original infographics. It discusses the emergence from this analysis of the widespread presence of SMEs in the territory, a characteristic extendable to the entire Italian territory, and the challenges faced by SMEs in adapting to the dynamics of the global market. Subsequently, aware that the emerged peculiarities require ad hoc strategies accessible to the dimensions of the companies involved, it is believed that the role of design can promote innovation and sustainability in the cultural value chain. Therefore, the research aims to identify strategies that leverage cultural heritage and knowledge to create competitive advantages for Italian companies. As a result, a wide-ranging excursion into case studies in the Apulian wood-furniture sector was necessary, involving new entrepreneurship, such as startups, in order to enable thinking towards the design of such effective strategies (subject of an upcoming scientific contribution). This allows reflection on how to reference models do not come from established macro-enterprises but rather from smaller-sized ones, which support realistic and goal-oriented innovation models. The selection of case studies drew from mappings conducted in the reference territory, as presented in online reports (A.R.T.I. report, 2023), and from an exploratory analysis on traditional web search engines, also at national level.

5. The Wood-Furniture Supply Chain: The Apulian Case

The wood-furniture sector represents a complex of activities that covers the design phase, through production, to the marketing of products in an extended production chain. This chain includes both the primary sectors (wood industry for furniture and construction, production of semi-finished products and furniture components) and the subsequent sectors of the furniture industry (furniture for domestic and professional use, lighting equipment, and furnishing accessories). The wood furniture sector has shown signs of vitality and unprecedented growth over the last ten years, with a turnover of more than €478 million on international markets in 2022, an increase of 57% compared to 2019, the year before the crisis (Redazione Sistema Puglia, 2023).

The production chain, known for its marked specialisation in the manufacture of armchairs and sofas, is mainly made up of the core component, represented by the enterprises identified in "Divisione Ateco 31", relating to the "Manufacture of furniture", and some sub-categories of Group 16.2 within "Divisione Ateco 16", called "Manufacture of products of wood, cork, straw and plaiting materials" (ARTI Outlook Report, 2023).

A Unioncamere Puglia report shows a total of 3,438 companies operating in the Apulian wood-furniture sector at the beginning of 2020, of which 1,891 work in the wood industry and 1,547 in the production of furniture and sofas, with a total of approximately 18,740 employees. Contrary to what would be expected from the number of companies, it is the production of furniture and sofas that provides more employment and not wood production (12,805 people compared to 5,935 in wood) (Figure 2). For the region of Apulia, wood furniture is basically the manufacture of sofas and armchairs, with 569 companies alongside the 909 furniture production companies (bedrooms, kitchens, offices, outdoor furniture and intermediate production of parts and accessories or intermediate finishing or processing activities). Also upstream in the supply chain are the 640 building carpentry enterprises, 385 involved in the manufacture of doors and windows and 313 in wood carpentry (Figure 3).

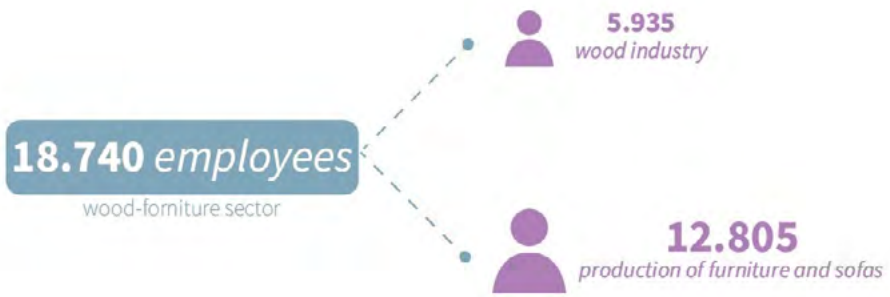


Figure 2. Apulian wood-furniture division.

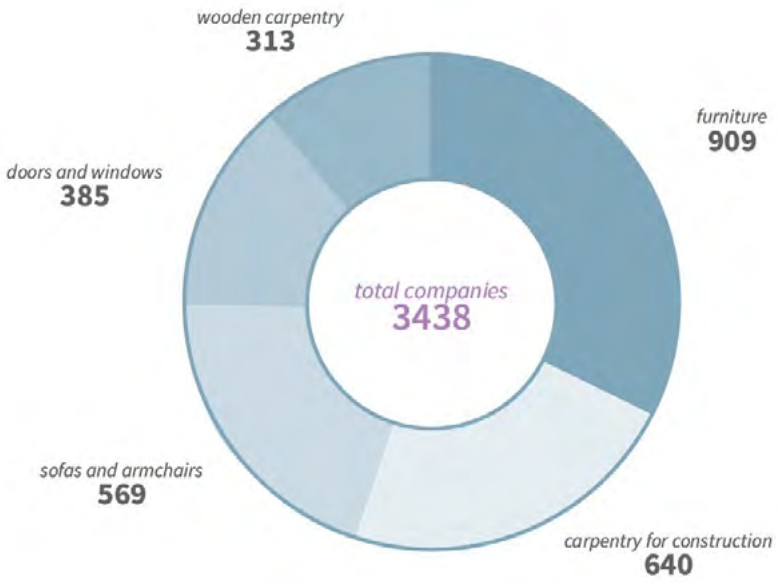


Figure 3. Division of companies by type of manufacturing in the Apulian wood-furniture sector.

Also dating back to the year 2020, the wood-furniture sector consists of 3 large companies, 22 medium-sized companies, 410 small companies and 2,992 micro-enterprises (Figure 4), which are basically represented by craftsmen and subcontractors involved in the intermediate processing of furniture factories: upholstering of living room frames or making tapestries, cutting and planing wood, manufacture of veneer sheets and panels, making wood packaging, etc.



Figure 4. Size of companies in the wood-furniture sector in Apulia (turnover and number of employees).

The Apulian supply chain shares with the national one a production offer largely made up of micro and small enterprises: in the mobile component, about 99% of the total number of enterprises in 2020, a figure substantially in line with the 98% at the national level. It is noteworthy that the greater resilience of the mobile component of the regional production chain is attributable to the positive performance of micro and small enterprises, which have shown an increase in the number of employees between 2012 and 2020. The situation at the regional level presents a significant contrast to the national average situation, which is characterised by a marked decrease in the number of employees employed in enterprises of a similar size. This trend is accompanied by a significant reduction in employment in medium-sized enterprises, while there is a significant increase in the number of employees employed in large enterprises.

The upholstered furniture sector constitutes one of the specialised segments within the wood-furniture industry. It includes the entire cycle of design, production and marketing of armchairs, sofas, seats and chairs made using techniques and materials that guarantee softness and adaptability to body shapes. This sector, within the wood-furniture industry, is configured as a supply chain characterised by several peculiarities according to the " Mappatura del settore legno-arredo in Puglia: analisi di settore e traiettorie di sviluppo, 2014" such as the relative difficulty in industrialisation, with relatively low barriers to entry for competitors, the high labour intensity and orientation towards containing production costs, the high impact of transport costs, the significant presence of both large leading companies in the sector and small and medium-sized companies generally specialised in subcontracting and sub-supplying.

In Apulia, most of the companies specialised in the production of upholstered furniture are concentrated in the Murgiano industrial district, identified by the regional administration through a study commissioned to IPRES (1999) as an area with a high specialised production vocation. According to AIDA data collected between 2019 and 2022, there are 196 companies spread over the regional territories of Apulia (163) and Basilicata (33) with a total of 5,819 employees.

From a dimensional point of view, there are 2 large companies, with a number of employees greater than 249, 11 medium-sized companies, with a number of employees between 50 and 249, 100 small companies, with a number of employees between 10 and 49, and 83 micro-enterprises, with a number of employees less than 10. Of these, most of the companies, in particular 180, have an annual turnover of less than 10 mln (144 of them even less than 2 mln), 13 companies have it between 10 mln and 50 mln and only 3 exceed the latter (Figure 5).

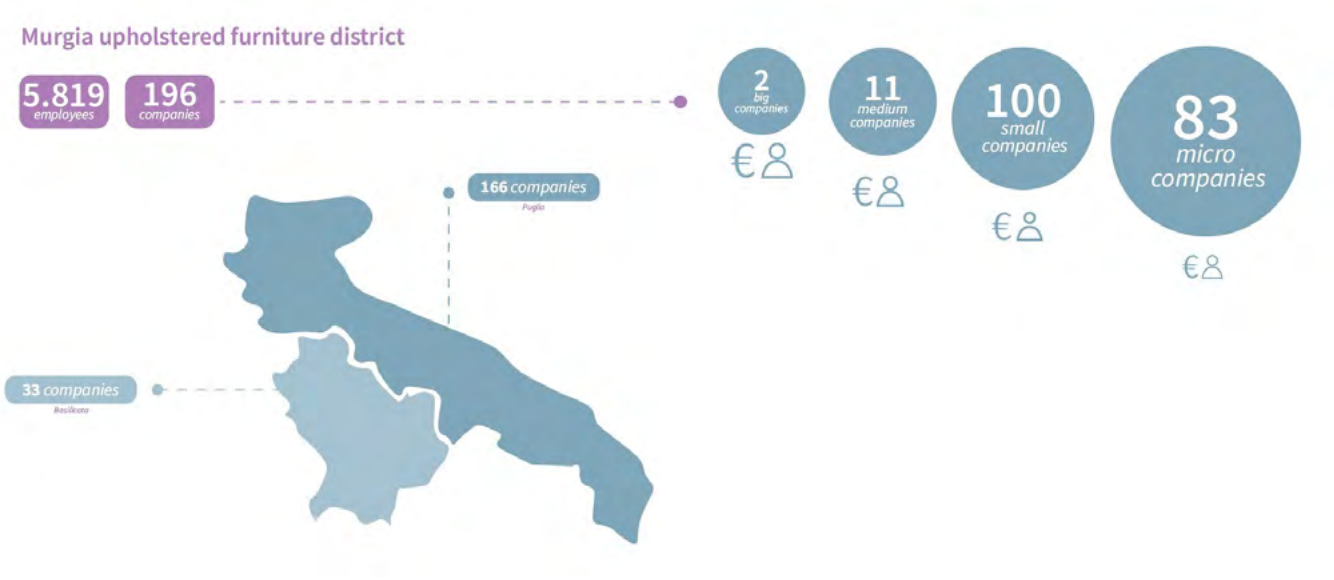


Figure 5. Murgia upholstered furniture district (location and size of companies).

The wood and furniture production chain in the Apulia region, in line with national trends, has undergone structural changes over the years that have influenced, at least in part, the sector's growth and development prospects. Some key processes that have exerted and continue to exert a significant impact include:

- For the furniture component, a relocation to Eastern European economies and then to areas outside the European Union, which have significant competitive advantages, especially in terms of lower labour costs.
- Changes in demand characteristics, with the entry of low-cost brands, including the notable impact of IKEA, characterised by distinctive style lines, affordable prices, products that can be easily assembled without assistance and innovative distribution and sales methods.
- Changes in sales channels, with an increasing presence of online trade.

Nevertheless, it is possible to detect a low propensity to innovation on the part of the sector, which is also confirmed by the marginal presence of start-ups and innovative SMEs not only at Apulian but also at national level, despite the important tax breaks and public funds specifically earmarked for them.

5.1 Case Studies

The paper broadens the exploration of case studies from new entrepreneurship, such as start-ups, in order to reflect on how the emergence of the new enterprise relates to the current state of established enterprises in the area, supporting realistic and oriented models of innovation. In addition, the reported cases were studied and selected because they enable critical reasoning about design aimed at social and environmental well-being and the enhancement of territorial and identity dimensions.

According to the WOOD AND FURNITURE report produced by ARTI (2023), at the end of the third quarter of 2023, there were only two startups in the Apulian region in the wood-furniture sector, a number that extends to 10 for the entire Mezzogiorno area and 50 for the entire Italian territory. Most of these companies operate in the furniture manufacturing sector, accounting for 50 percent of startups in Puglia, 80 percent in the Mezzogiorno and 82 percent nationwide.

Notably, Revì recovers and gives new life to furniture and furniture objects. According to the principles of the circular economy, it recovers, revitalizes, and puts products back into circulation, attributing to design the means through which to extend the life and redesign the identity of furniture and objects that would

otherwise be discarded or neglected. The project, developed by an eco-designer in the own homeland, aims to work independently, while also valuing the skills of others, without negative impacts on the environment. Fully realized in 2019, it makes each artifact unique and creates an inducement for all craft workers who contribute to the outcome. Revì is committed to recovering manual labor and revitalizing craft skills, which are in decline, by enhancing local know-how (Figure 6).



Figure 6. Artefacts from the Revì start-up [https://economiacircolare.com/dallo-scarto-alla-nuova-vita-revi-e-il-design-per-tutti/].

Legno di Puglia is the first company that uses as raw material the enormous variety of wood species that the Apulian territory offers, through the design of furniture elements. A promoter of Puglia's first wood supply chain, the company has triggered a process of enhancing the value of the tree heritage in a land that stands out for its low quantity but high biodiversity, among the highest in Italy. The start-up recovers the trunks of those trees that for various reasons are cut down and would have as their destiny only destruction and processes them to design artifacts of high craftsmanship value. In addition to the artifacts, the creation of the first Xylotheque in Italy with a regional vocation enhances and enables the knowledge and dissemination of Apulia's woody heritage through the exhibition of the different woody species (Figure 7).



Figure 7. Artefacts from the start-up Puglia Wood [https://www.legnodipuglia.com/].

On a national scale, the case studies of start-ups Wood-skin and Draw Light are considered interesting because the former empowers design thinking, and the latter focuses on stimulating awareness and knowledge through immersive technologies to promote change toward holistic wellness (although it involves the textile industry, it is believed to be assimilated to the context of interest). Through a manufacturing process patented by Wood-skin, sheets of rigid materials are modified into programmable composite materials by milling to create panels that can fold along origami-like "digital hinges." These materials can go from flat to three-dimensional form, and the process is reversible. The company produces optimized elements with minimal material waste because the production process can be studied and tested virtually: a simple assembly mechanism allows local workers to install the finished cladding themselves, limiting intermediate substructures (Figure 8)



Figure 8. Wood-skin start-up artefacts [https://wood-skin.com/products-and-services].

Get in SYNC Shade is an immersive installation designed for White Show Milan. The goal is to inform and tell, through sensory involvement, about the most polluting phases of textile production: fabric development and the dyeing and finishing phase on average account for more than 30 percent of the total impact of a garment. Get in Sync Shade was therefore preparatory to an additional sensory experience involving contact with unconventional but responsible fabrics, dyes, and fibers such as chocolate and coffee. It raises community awareness of the environmental and social impacts that certain common materials possess, stimulating change (Figure 9).



Figure 9. Get immersive experience in SYNC Shade [https://www.drawlight.net/].

6. Conclusions and Research Developments

In recent years, the analysis has revealed a weakening sense of belonging to the local and territorial community, attributed to the changes occurring in the districts, which have led to clusters characterized by a limited number of leading companies with a cosmopolitan outlook (Grandinetti & De Marchi, 2012), compared to medium-small enterprises.

The criticality of the current situation stems not only from globalization and relocation phenomena but also from the structural limitations of the district model. This inherently emphasizes the theme of flexibility, without questioning the typically industrial serial approach, with innovations and modular programs (Chiarvesio & Grandinetti, 2002) that generate moderate standardization incapable of competing with global logics (Tapscott & Williams, 2006). Subcontracting relationships among district enterprises, characterized by an exclusively productive culture, have transferred a rigid mentality that, along with dimensional, economic, and political obstacles, hinders access to innovation.

The analyzed case studies explore the current strategies proposed by startups in the wood-furniture sector to enhance cultural and territorial aspects, linked to the theorized concept of the cultural value chain. Specifically, Revì values and revives manual labor and the resurgence of declining craftsmanship skills and know-how from a product perspective. Differently, Legno di Puglia enhances the Apulian wood supply chain through the design of furniture elements with high artisanal value, as well as through the dissemination of knowledge about Apulian wood heritage through the first Xyloteca in Italy with a regional vocation. The startup Wood-skin focuses on social sustainability through digital product design, allowing local workers to install the finished covering themselves, limiting intermediate substructures. Lastly, Get in SYNC Shade, through an immersive experience, raises awareness in the community about the environmental and social impacts of some common materials.

It is believed that design today has the task of providing tailor-made design strategies for small and medium-sized businesses, spread throughout the Italian territory, enhancing their capital of experience and knowledge. To support this, the research envisages a future phase of field analysis in the current Apulian upholstered furniture supply chain, through a direct qualitative study of small businesses and their stakeholders. The research, therefore believing that sustainability is found in the valorization of the cultural value chain, is working on designing strategies that start from the knowledge of local know-how and production characteristics and develop innovative product models based on them.

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P/REFERENCES OF DESIGN

CO-DESIGN SESSIONS AT REVIGRÉS: WORKSHOP 2.0 TO NURTURING DESIGN-LED INNOVATION IN THE INDUSTRY.

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KEYWORDS | CO-DESIGN SESSIONS, CHIEF DESIGN OFFICE, INNOVATION, DESIGN-ORIENTED CULTURE, EMPATHY

ABSTRACT | This article presents Workshop 2.0's findings from the Co-Design Sessions at Revigrés, a prominent Portuguese ceramic tiles manufacturer. The workshop, part of an ongoing Ph.D. research, was held in March 2023, and involved stakeholders from industry, retail, and research. It tested assumptions about the Chief Design Officer's (CDO) strategic role in evolving a company's product range, educating stakeholders about design value, and enhancing creativity through open communication and collaborative activities. Aligned with design thinking principles, Workshop 2.0 focused on "kinetic tiles" and "smart tiles" themes, aiming to envision innovative ceramic products to position Revigrés as an industry leader.

Facilitated to nurture creative freedom and diverse perspectives, the workshop emphasized empathy, user-centricity, and creative problem-solving. The practical outcome included the ideation phase of four ongoing project proposals.

The hypothesis suggests that design thinking is a potent tool for meaningful connections between brands and users, fostering brand loyalty and innovation rooted in real-world needs. A well-implemented design function cultivates collaboration and creative problem-solving, essential in today's evolving business landscape. Workshop 2.0 exemplifies design thinking's role in shaping a design-oriented culture guided by a CDO for innovation at Revigrés. It highlights the collaborative nature of design thinking as a common practice employed by CDOs, mediating between design and business objectives. The workshop explores empathy, innovative solutions, and a transformative mindset as key elements fostering a culture of design-driven innovation at Revigrés. As Revigrés continues its co-design journey, Workshop 2.0 serves as a visionary experiment offering insights for innovation and design excellence.

1. Introduction

1.1 Building Design-Led Innovation at Revigrés: A Journey of Co-Creation

This study fits into the scope of ongoing Ph.D. research led, aiming to explore and affirm the role of a Chief Design Officer (CDO) in a corporate environment, having Revigrés as a platform for strategic experimentation.

In the prototyping length of the Ph.D. research, a series of four co-creation design sessions were organized by the research team, engaging various stakeholders from industry, retail, and research fields. Under the format of workshops, they were designed with a focus on innovative product development, and leveraged design principles, techniques, and methodologies to explore two distinct themes within the context of Revigrés, a prominent Portuguese manufacturer of ceramic tiles. The overarching goal of these sessions was to experiment with how to drive design-led innovation and to show the potential strategic role of a CDO within the company. Held between January and May 2023, in three different locations, these workshops aimed to test key assumptions, foster a design-oriented culture, and develop groundbreaking concepts that could shape Revigrés' future product range.

Since these activities are part of a study in which the goal is to assert the CDO role in businesses, the research team approached the workshops with specific assumptions to validate. Previous studies and activities such as case studies and interviews have shown some practices applied in the design function of companies like Philips, 3M, PepsiCo, and J&J, led by CDOs [1; 2; 3]. The inputs gathered in these studies and the literature review prompted several research questions and hypotheses that have since been tested by the research team.

The first assumption aimed to explore how the CDO's strategic responsibility for evolving the product range could lead to more creative solutions and broaden the company's offerings. The second assumption examined whether the CDO's role in educating stakeholders about the value of design would enhance their understanding of the design function and its activities. The third assumption sought to determine if open communication with multidisciplinary participants in the design process could improve creativity and lead to more innovative concept generation. Finally, a fourth assumption delved into the challenge of embedding and scaling up a design culture within the organizational context, making it a key goal for the CDO.

Furthermore, in the organizational context of Revigrés, the Co-Design Sessions emphasized two central themes devised by the research team. The first theme focused on the development of kinetic energy ceramic tiles, exploring how this technology could enhance the product range and boost the company's innovative performance. The second theme, centered around "smart tiles," sought to envision new products, services, and experiences integrated into intelligent ceramic tiles that optimize spaces and fulfill multiple functions. These themes emerged from the research team's design vision to develop multi and plural-function products for Revigrés, as a catalyst of innovation aligned with the strategic guidelines defined to implement a design function within the business environment.

These themes embedded in the Co-design sessions were aligned with the assumptions related to the leadership role of the CDO. Specifically, they test how to rapidly prototype to expand the company’s offerings and range of products through design-led processes and innovative concept generation. The construction of the sessions also aimed to educate stakeholders about design processes by incorporating design thinking tools and mindsets into the equation. This approach aimed to achieve quick concepts within the four sessions, ultimately leading to a showcase of the value that design can bring to a company. As a strategy, the overarching goals of this Co-Design Sessions initiative were threefold. Firstly, the research team aimed to build design-oriented innovation processes for Revigrés, ensuring that design played a central role in driving innovation within the company. Secondly, the team sought to explore the implementation of design culture within Revigrés, fostering a mindset of creativity, collaboration, and user-centered thinking. Thirdly, the initiative aimed to develop a range of concepts for innovative multi and plurifunctional products that would position Revigrés as a leading player in the market.

The research team anticipated gaining valuable insights into the impact of collaboration, multidisciplinary practices, and design thinking on product innovation at Revigrés. Specifically, it is projected that the set of workshops establishes an approach to demonstrate the importance of collaboration and multidisciplinary approaches in the creative process. By bringing together stakeholders from various backgrounds, the research team intended to showcase the transformative impact of incorporating design thinking methodologies into project and corporate development. Through a co-creative design-driven process, the workshops were dedicated to developing the concept of “kinetic tiles” and "smart tiles." It’s anticipated that the sessions capitalize on a wide range of know-how and perspectives by involving stakeholders with diverse expertise.

Observations and feedback gathered during the sessions were expected to provide significant contributions to the understanding of creative processes and design culture. Ultimately, the workshops were envisioned to yield two or more distinct product concepts, arising from collaborative processes with various stakeholders. These concepts were intended to form the foundation for potential final products, showcasing the CDO's contributions through both a contributory structure, guided by designers and specialists, and a collaborative structure, driven by all stakeholders. Additionally, the research team intended these sessions to be a vehicle for the application of new design-led innovation processes within the organizational culture at Revigrés, fostering a transformative design-thinking culture that permeates the entire company.

2. Research Methodology

This study explores the experimentation of a process of building design-led innovation at Revigrés through a journey of co-design and multidisciplinary workshops, according to the following research methodology. The co-design sessions were promoted both within the university where the doctoral research undergoes and within Revigrés. The workshop promotion included a detailed description of the objectives of the co-design sessions, the specific objectives of each workshop, the agenda, duration, location, and facilitators' descriptions.

For the university participants, enrolment was open to students, teachers, and researchers from any course or degree. The workshop had a limited capacity of 15 seats and the selection process was based on a first-come-first-served basis. The aim was to encourage a diverse range of perspectives and expertise among the university participants.

For Revigrés’ employees and stakeholders, the remaining half of the workshop seats were reserved. The selection process for this group was based on nominations and recommendations from the company's management to ensure representation from different departments and roles within the organization.
The research methodology adopted a mixed-methods approach, integrating qualitative and quantitative data collection methods to gather comprehensive data on the impact of design thinking and the role of CDOs in enhancing the innovation process within the company. Data was collected through participant observation, feedback surveys, and interviews.

The research applied a sequential exploratory strategy, which involved an initial qualitative phase (participant observation, document analyses, and interviews) followed by a quantitative phase (feedback surveys) to corroborate the qualitative findings. This approach allowed for a holistic understanding of the co-creation process and the participants' perspectives. The main data collection methods were:

- Participant Observation: participant observation was conducted during the co-design sessions to capture real-time interactions, collaboration, and problem-solving processes among the participants. This method allowed the researchers to immerse themselves in the co-creation environment, facilitating and gaining deep insights into the dynamics of the workshops, the facilitation process, and understanding the participants' experiences and interactions.

- Interviews: Semi-structured interviews were conducted with some participants, including Revigrés' employees, students, researchers, and workshop staff, to gather in-depth insights into their perceptions, experiences, and learnings from the co-design sessions. These interviews explored participants' attitudes toward design thinking and the impact of the workshops on their creative thinking.
- Feedback surveys: post-workshop surveys were administered to assess participants' satisfaction with the co-design sessions, the effectiveness of the design thinking methodologies, and their perceptions of the value of design-led innovation at Revigrés. Questions like "What worked well?", "What could be improved", "Ideas?" and "Questions?" were set.
- Document Analysis: Documentation of the co-design sessions, including canvases, brainstorming results, and prototype designs, was analyzed to identify themes, patterns, and innovative concepts that emerged from the workshops. Document analysis provided valuable qualitative data that complemented the interview and survey findings.

Qualitative data from participant observations, interviews, and document analysis were analyzed. The data were transcribed, coded, and categorized into themes and patterns, capturing participants' experiences, challenges, and creative outputs during the co-design sessions. The quantitative data from feedback surveys were analyzed using descriptive statistics, providing insights into participants' overall satisfaction and perceptions of design thinking methodologies.

Triangulation was employed to ensure the validity and reliability of the research findings. Data triangulation involved cross-verifying information from multiple data sources, including participant observation, interviews, surveys, and document analysis. The convergence of findings from different data collection methods added credibility to the research outcomes and was converted into infographics to be communicated to the company and design community.

Ethical considerations were given due importance throughout the research process. Informed consent was obtained from all participants before data collection. Anonymity and confidentiality were ensured to protect participants' privacy and identities. The study complied with the ethical guidelines outlined by the company ethics board.

The research faced some limitations, including a significant diversity of participants, which may limit or influence the generalizability of findings. Additionally, the four-hour duration or even the different participants per challenge of each co-design session may have constrained the depth of insights that could be obtained. Nevertheless, efforts were made to mitigate these limitations and draw meaningful conclusions from the available data. Each workshop data analysis helped to improve the next one, contributing to a continuous improvement in the facilitation procedure and in the session structuring.

3. Empathy in Design: A Multifaceted Exploration

Over the past decade, Design Thinking has emerged as a catalyst for fostering innovation and creativity, particularly in addressing complex, "wicked" problems and driving product and service innovation [4;5]. Central to the potency of Design Thinking is its unique ability to harmonize the desirability experienced by users with the economic viability and technical feasibility of innovative ideas [6]. Design Thinking leverages rapid prototyping, abductive reasoning, and empathy as propelling forces for generating innovative outcomes.

The discourse on empathy in design spans 50 years, with a recent intensification over the last quarter-century. Defined as the ability to perceive the world through others' eyes and feel what they feel [7;8], empathy holds a pivotal role in human-centered design processes. The empathize stage in Design Thinking mandates a collection of experiences, insights, and observations to establish a robust foundation for subsequent design phases.

Empathy, as elucidated by IDEO [9], transcends mere understanding; it involves a profound grasp of the problems and realities faced by the target audience. It necessitates learning about their challenges, latent needs, and desires, emphasizing the importance of understanding their environment, roles, and interactions.

The historical evolution of empathy, as detailed by Lanzoni [10], reveals shifting meanings across disciplines. The methodological incorporation of empathy into design has emphasized explicit cognitive and affective efforts to interpret users' perspectives [11]. Designations such as “complex” [12;13], “re-enactive” [14], or “higher-order” [15] empathy highlight its interpretive and reflective forms.

In the realm of design responsibilities, empathy aligns with beneficent and egalitarian design, often associated with democratic approaches like Co-design and participatory design [16;17;18]. Linked to care work and ethics [19], empathy fosters inclusivity, especially where diverse needs are poorly met by standard features [20].

Empathy proves integral to product and service relatability and sustainability [21; 22]. In business solutions, it becomes a strategic component for remaining relevant in the market, preventing the creation of solutions that miss the mark [23]. Across this angle, in design processes, empathy operates as both a tool for designing and a means of gaining insights into users' needs [24]. Design Thinking, as a collaborative approach, naturally integrates participants' empathic insights into the process, fostering social sensitivity [25].

Despite varied definitions, empathy in design is methodologically perceived as a deliberate and reflective tool. Recognizing its passive dimension elucidates its foundational, automatic role before becoming an intentional activity. For effective design methodologies, emphasis on the passive side of empathy is crucial, understanding that it operates tacitly before becoming a consciously intended activity enabling reflective and imaginative techniques for user research and concept development [26].

In inference, the multifaceted exploration of empathy in design reveals its indispensable role in fostering innovation, inclusivity, and user-centered solutions within the design thinking framework. Understanding its nuanced dimensions and embracing both its passive and intentional facets enriches the design process, ensuring a clearer view of how empathy operates and can be harnessed in design practice.

4. Workshop 2.0: Nurturing Creativity through User-Centered Design

The second workshop in the Co-design Sessions series marked a crucial juncture in the journey toward design-led innovation at Revigrés. Held on the 22nd of March at Aveiro University, this workshop strategically bridged the gap between the inspirational spark ignited in Workshop 1.0 and the concrete prototypes that would take form in Workshop 3.0. In Workshop 2.0, the mission was clear: to delve into the world of ideation, with a keen focus on understanding users and the contexts in which they interact with products, services, or experiences.

Particular emphasis was placed on cultivating empathy among participants, turning it into a cornerstone for ideation. Empathy in this context goes beyond mere sympathy; it entails immersing oneself in the user's world, understanding their perspectives, and feeling their needs. Despite the workshop's short duration, this approach underscores the criticality of thorough user research in design projects. The workshop emphasized the imperative for designers to immerse themselves in users' needs, aspirations, and challenges.

Workshop 2.0 employed immersive activities to encourage participants to envision scenarios from the users' perspectives. Its foundation was laid in Workshop 1.0, where participants were introduced to the main themes and framed proposals, serving as inspiration for this session [27].

4.1 The Attendees

Anchored in the larger mission of design-led innovation, Workshop 2.0 laid the groundwork for transformative product development and was a dynamic convergence of minds, drawing participants from diverse backgrounds. This cohort included 16 individuals who brought unique perspectives and expertise to the table. Among them were students, educators, and researchers spanning a multitude of academic disciplines. Complementing this academic cohort were Revigrés employees, representing various facets of the company's operations. This eclectic blend of participants formed the very bedrock of Workshop 2.0, guaranteeing a rich spectrum of insights and experiences.

Participants were thoughtfully grouped to ensure equitable representation across various dimensions, including the gender balance, with an equal distribution of 50% male and 50% female participants, as shown in Figure 1. Furthermore, these groupings considered different areas of expertise, thereby reflecting a comprehensive cross-section of knowledge domains. The represented areas spanned the realms of design, sea sciences, commercial operations, material engineering, production, logistics, financials, product management, quality, and R&D.

Team configurations mirrored the themes explored in the Co-Design Sessions and reflected the diversity of proposals generated during Workshop 1.0. In teams A and C, the Smart Solutions challenge took center stage, while teams B and D embraced the Kinetic Tiles challenge. These teams retained the same names as the proposals that had emerged from Workshop 1.0, even though the composition of team members had changed.

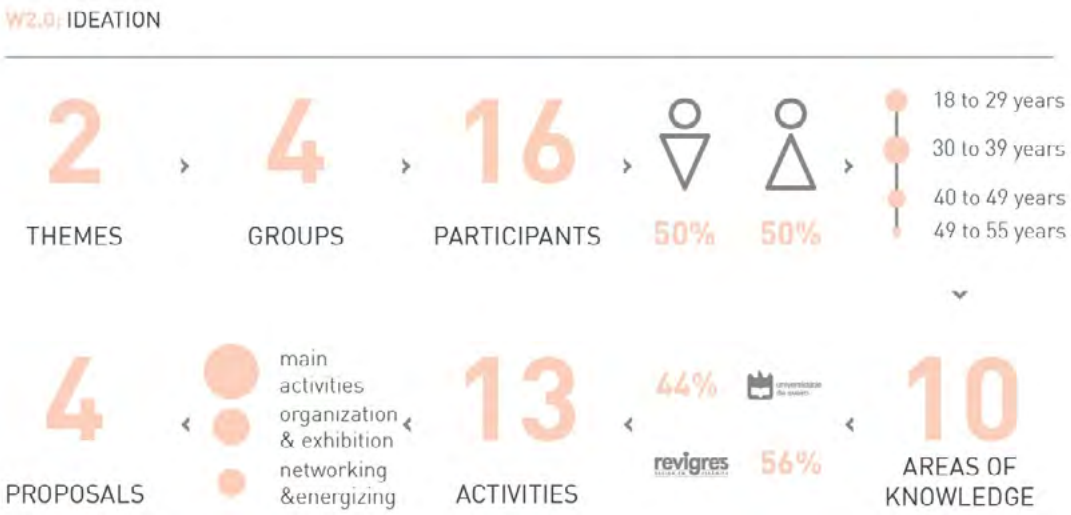


Figure 1. Workshop 2.0 in numbers (source: authors).

4.2 Program and Methodologies

Workshop 2.0 adhered to a well-defined schedule to ensure optimal utilization of time and resources as illustrated in Figure 2. The workshop spanned a focused four-hour duration, with each phase meticulously structured to facilitate the exploration of user-centered scenarios and the application of design methodologies.

To initiate the workshop, participants were greeted with an introductory presentation. The facilitator, a member of the research team, set the stage by providing context about the Ph.D. project and the objectives of the Co-design Sessions. This initial presentation offered participants a clear understanding of the workshop's scope and objectives. A concise definition of design thinking methodologies and a set of workshop rules set the foundation for creative exploration with a design mindset. These rules included directives like staying focused on tasks and time constraints, ensuring that all voices were heard and respected, and emphasizing active participation and recording of ideas. The aim was to encourage a mindset of exploration, experimentation, and learning, fostering a space where all participants felt

comfortable and confident in sharing their ideas without hesitation, even seemingly unconventional ones. Following an engaging Superpower Icebreaker activity was led. This exercise aimed to break the ice and introduce participants to the group. Each participant was given a card and a colored marker and asked to create a superhero persona, complete with a name, superpower, and visual representation. This activity set a creative tone for the workshop.

After group formation, at their respective tables, participants immediately gained access to a card detailing the initial challenge and the proposal relevant to their group. Participants spent approximately 10 minutes analyzing and discussing the proposal description that had emerged from the previous workshop. Subsequently, participants embarked on a structured brainstorming session using the Ox tool [28]. They were tasked with understanding their assigned proposal, defining its purpose, target audience, and potential development and implementation methods. This ideation process encouraged participants to think critically about their proposals.

To maintain enthusiasm and stimulate creativity, a dance-based energizer activity was employed, playing a vital role in keeping participants engaged and motivated throughout the workshop.

Participants were dared to create personas aligned with their challenges. Using a canvas, participants defined persona traits, created visual representations, crafted biographies, identified expectations, needs, and frustrations, and even gave their personas a voice. This exercise promoted empathy and a deeper understanding of potential users.

To avoid fatigue a diverse and engaging coffee break was set, allowing participants to recharge, interact, and network. This break provided a conducive environment for informal discussions.

Afterwards, scenarios were generated using the AEIOU methodology [29]. Participants defined scenario elements, including activities, space, interactions, and objects, and their relationships with users using the materials offered. This structured approach enabled teams to transform their ideas into tangible scenarios. The Six Thinking Hats methodology was followed, aiming to help participants generate ideas considering the personas and scenarios previously created. Participants donned different "hats" representing distinct thinking perspectives (white, green, red, blue, yellow, and black). Each perspective encouraged diverse thinking about their proposals, fostering the generation of creative solutions [30].

After this exercise, each group had the opportunity to present their generated ideas and inputs achieved during the workshop to all participants. This phase allowed for the sharing of concepts and provided a platform for feedback and discussion among participants.

The workshop concluded with a feedback session, where participants reflected on the activities and shared their thoughts. An after-work drink offered an informal setting for further networking and discussions. This feedback loop was essential for refining future workshop sessions and improving the overall design process.

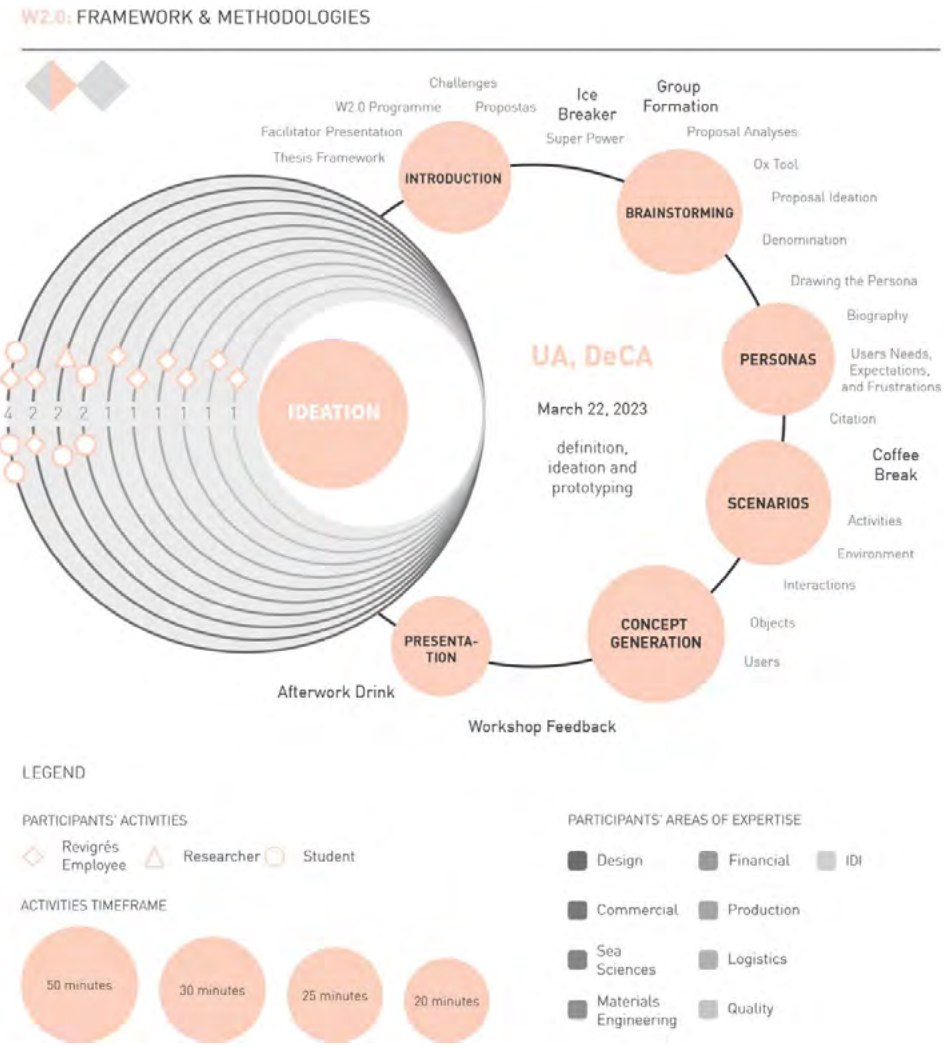


Figure 2. Workshop 2.0 framework and methodologies (source: authors).

4.3 Space Organization, Ambiance, and Materials

The spatial organization of Workshop 2.0 was purposefully curated to stimulate creativity and facilitate immersion in design methodologies. The chosen classroom at Aveiro University, with its proximity to the department overseeing design curricula, was a strategic choice. This location not only provided an ideal setting for ideation but also embodied the workshop's commitment to the principles of design. Inspirational visuals adorned the walls, serving as catalysts for creative thinking and imaginative exploration.

An array of selected materials was thoughtfully provided to catalyze the ideation process. Over 600 Playmobil figures, including human and animal figurines, were available to participants, enabling them to craft dynamic and interactive scenarios. Additionally, a rich Playmobil collection of scenery components spanning living rooms, bedrooms, kitchens, bathrooms, outdoor spaces, markets, operational machines, workshops, and factory tools, offered a rich tapestry for scenario construction. These materials were carefully arranged to encourage participants to blend and adapt pieces to construct their own unique interpretations of the scenarios.

Further, 150 rectangular cardboard pieces were available, which, when folded, formed hats. In addition to this, 16 canvases, one for each group, were supplied for exercises such as brainstorming, personas, scenario generation, and the six thinking hats exercise. A card containing the Co-design session themes and proposal descriptions was distributed to each group from the outset, tailored to their specific theme and proposal. Plus, 24 small cards were provided, each describing the characteristics of the hats in the Six Thinking Hats exercise, facilitating idea generation.

This selection and organization of materials created an environment where participants could unleash their creativity and explore innovative ideas in a structured yet open manner.

4.4 Workshop 2.0 Core Activities: Exponentiating Empathy and Critical Thinking

Workshop 2.0 marked its commencement with a crucial exercise aimed at facilitating a profound comprehension of proposed ideas and their target audiences. The principal objective was to elucidate the rationale underpinning each proposal, its intended beneficiaries, the potential for development, and the strategies to accomplish it. This exercise was allotted 25 minutes, underscoring the centrality of ideation within stringent time constraints.

During this phase, workshop participants embarked on a collaborative journey of ideation, steered by what the OX Tool [28]. This tool was designed to establish a comprehensive perspective of each proposal. Participants engaged in a rigorous and structured discussion, addressing the tool's predefined queries, encompassing the "why", "how", “with whom”, and "for whom" dimensions of the proposal. This multifaceted exploration entailed a comprehensive exploration of the proposal's purpose, feasibility, anticipated benefits, and distinctive attributes. Participants probed into the reasoning behind the proposal's potential effectiveness and the logistics to execute it. This encompassed delineating requisite tools and resources.

Participants cultivated an understanding of the proposal's target users, by scrutinizing the users' tasks, areas where the proposal could aid, and the associated pain points and challenges. This inquiry illuminated user needs, and aspirations, grounded in benefits and challenges.

The exercise also considered potential collaborators and partners, including external entities and pertinent Revigrés departments, which might play pivotal roles in the proposal's realization.

The comprehensive knowledge garnered during this phase was essential in laying a solid foundation for subsequent design and development phases. Additionally, participants were encouraged to utilize visual aids, such as drawings or low-fidelity prototypes, to effectively communicate their ideas within the group. Subsequently, the workshop introduced the Personas methodology, reinforcing the significance of comprehending users and cultivating empathy. Workshop participants were tasked with defining representative user profiles pertinent to their assigned proposals, thereby establishing a profound connection with these personas to engender more impactful solutions. This exercise was accorded 25 minutes, allowing participants to immerse themselves in the creation and exploration of user personas. The structured approach encompassed several key steps: defining general traits, “drawing” the persona, shaping a biography, and quoting them. Throughout the exercise, participants were reminded that this process was dynamic, with elements influencing each other. The numbering of the steps in the canvas merely served as a guide, allowing flexibility within the exercise structure.

While this exercise fostered a deep understanding of users and their needs, it was crucial to realize that comprehending the design proposal should go beyond users. It should encompass the broader context, including the interactions between users, activities, environments, interactions, and objects [29]. This underscores the importance of constructing scenarios, the third core exercise of this session. The overarching objective was to empower teams unfamiliar with the design process by leveraging the AEIOU tool, which provided structure and guidance This exercise was time-constrained, allocated to a 20-minute time frame to encourage efficient knowledge gathering and scenario construction that holistically incorporated user experiences.

Participants commenced by delineating scenario elements: activities, environments, interactions, objects, and users. They analyzed activity sequences, spatial characteristics, interaction dynamics, object impact, and user roles. This process unveiled the scenario's complexities, prompting inquiries into user motivations and needs.

Simultaneously, participants commenced the construction of the scenario, placing it at the center of the canvas. This visual representation was facilitated with Playmobil figurines and scenario pieces, lending a tangible dimension to the visualization of the scenario's key components.

The latter part of Workshop 2.0 beckoned participants to venture into solution and decision space, initiating a phase of collaborative ideation. This phase relied on Edward de Bono's Six Thinking Hats methodology, renowned for its capacity to stimulate innovative idea generation by encouraging problem-solving from six distinct yet complementary perspectives. This methodology is extensively employed in design leadership and various corporate and problem-solving contexts, since it harnesses different modes of thinking, offering a systematic approach to arrive at effective conclusions efficiently [30]. The scientific basis of this technique introduces structured thinking into group discussions, countering unstructured and biased thinking, which often leads to irrational decisions and favoritism toward specific ideas [31].

Likewise, the methodology advocates parallel thinking, where team members collectively focus on specific aspects of an issue, ensuring systematic consideration of diverse perspectives. It assigns specific thinking roles, symbolized by colored "thinking hats." Each thinking signifies a unique approach [30], depicted in Figure 3.

This exercise unfolded over 50 minutes, comprising specific stages for each thinking hat. Since each thinking hat represented a distinct mode of problem-solving, it ensured a structured and comprehensive exploration of ideation and idea generation.

This structured approach emphasized adherence to allotted times for each stage, fundamental to the exercise's success. It also encouraged participants to document their thoughts to expedite the process. Notably, all participants donned the same thinking hat (thinking approach) simultaneously, minimizing personal biases and conflicts. The exercise unfolded through structured stages, promoting diverse thinking and collaborative problem-solving. This approach offered participants a systematic framework to explore the proposal's problems comprehensively, stimulate creativity, and analyze both benefits and risks, ultimately leading to well-rounded and innovative solutions, which resulted in a set of ideas to be pursued in workshop 3.0.



Figure 3. Six Thinking Hats methodological structure applied in Workshop 2.0 (adapted by the authors).

5. Insights Gained from Workshop 2.0

Building upon the foundational sparks ignited by Workshop 1.0, Workshop 2.0 served as the fertile ground where inspiration metamorphosed into tangible ideas through a meticulous exploration of users and contexts. The workshop was governed by directives emphasizing focus, time management, and inclusivity, fostering an environment conducive to experimentation, exploration, and learning. The main insights achieved in this workshop were “Empathy as a Central Driver of Innovation”.

Empathy as a Central Driver of Innovation

Empathy emerged as the keystone of innovation during Workshop 2.0, substantiating its indispensable role in the design process. The personas exercise, deeply rooted in design thinking principles, facilitated a profound comprehension of users that transcended conventional demographic boundaries. This empathic approach, as advocated by design scholars like Brown [5], Liedtka and Bennett [32; 33], reached beyond surface-level user needs, delving into their motivations, aspirations, and challenges. The personas exercise not only provided a practical tool but emphasized empathy as a pragmatic necessity in designing products intricately attuned to human experiences.

Even though it is recognized that to be effective this exercise needs to be deeply explored, the exercise unfolded with a fluid, non-linear dynamic, enabling participants to adapt persona profiles as necessary. This malleability allowed for nuanced storytelling based on action, enriching the understanding of personas' experiences and interactions. Furthermore, the integration of personas in group projects brought a human touch to the design process, ensuring technical solutions resonated with users on a profound level.

Decision-Making Dynamics in the Process of Innovation

Design thinking, intricately woven into Workshop 2.0, provided the methodological scaffold for innovation. The Six Thinking Hats methodology, a prominent tool, showcased its applicability in design strategy. Drawing from Bono’s [30] insights, the methodology fostered collaborative thinking, systematic problem-solving, and diverse perspective exploration boosting the decision-making process. This methodology encourages participants to metaphorically put on different hats, representing various lenses of analysis applied to a single problem, opportunity, or challenge.

Drawing from design leadership literature, particularly from Boland and Collopy [34], the methodology's impact on collaborative thinking, innovation stimulation, and conflict resolution aligns seamlessly with the demands of managing design processes, strategies, and teams through technology-enabled systems. In the context of Workshop 2.0, the Six Thinking Hats methodology not only streamlined collaborative efforts but also enhanced the decision-making process by offering a structured approach to problem-solving. The method encourages participants to view challenges from different angles, promoting objective thinking and minimizing counterproductive interactions. This approach not only ensures efficiency but also addresses conflicts inherent in design teams, leading to well-rounded evaluations and, ultimately, significant outcomes. As a crucial tool in the design leader's arsenal, the Six Thinking Hats methodology exemplifies how different perspectives can imprint various reactions in decision-making, a fundamental aspect of strategic design leadership. From a facilitator's standpoint, this approach proved to be instrumental as highlighted by the participants in workshop feedback uncovered in Figure 4.

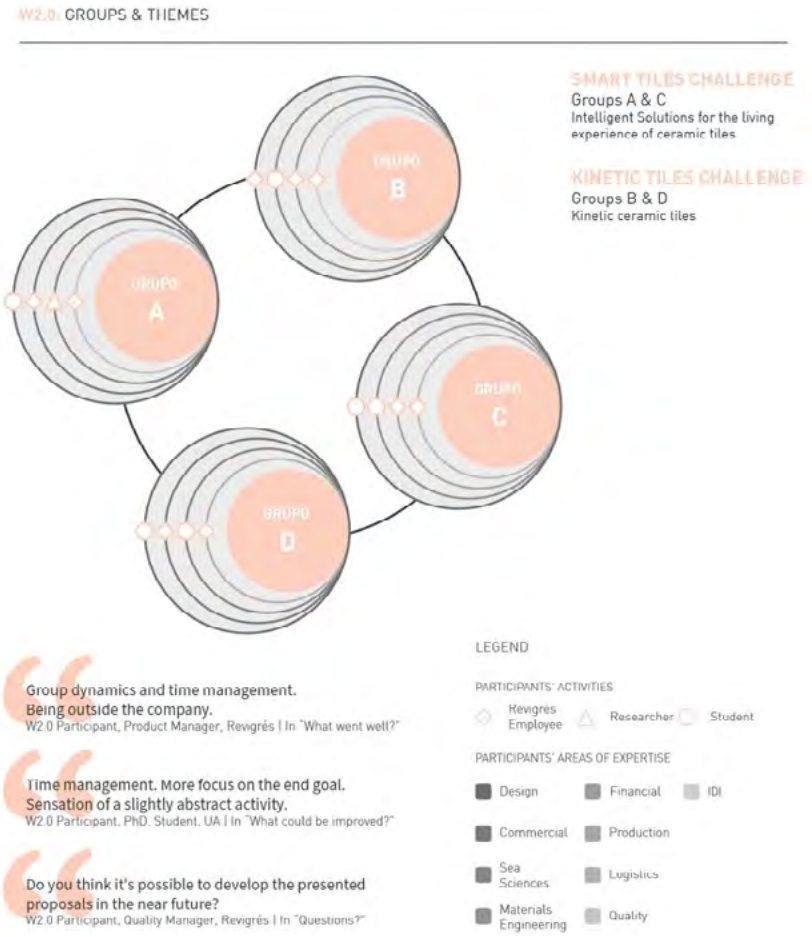


Figure 4. Workshop 2.0 group structure and participants' feedback (source: authors).

Holistic Approach of Design in Innovation

The holistic approach surfaced prominently in Workshop 2.0, extending beyond technical considerations to embrace societal, economic, and environmental implications. This holistic perspective, harmonized with multidisciplinary collaboration, aligns with design scholars like Cross [35]. Analyzing users and constructing scenarios showcased how a multifaceted examination enriches the design process. This holistic view resonates not only in the design domain but also reverberates in the strategic role of CDOs within organizations. A CDO, as a strategic leader, should integrate this comprehensive approach into the company's ethos, addressing design as a key player in business strategy and innovation [36].

Within the course of the workshop, all groups demonstrated a holistic approach to their projects, considering not only the technical aspects but also broader societal, economic, and environmental implications. Several scenarios crafted by the groups went beyond the immediate technical application of the ceramic products. They considered how these products would fit into and enhance users' lives, creating a more enjoyable, sustainable, and efficient lifestyle. This goes beyond functionality to address the emotional and experiential aspects of design. This holistic perspective is crucial in the field of design, especially when proposing innovative solutions that are intended to have a real-world impact. It reflects an awareness that a successful design isn't just about the product itself but also about how it fits into and transforms the larger ecosystem.

Creating and Aligning Values to Innovate

The imperative of aligning project values with societal, economic, and business values emerged as a guiding principle in Workshop 2.0. Market viability, a central concern for businesses, was ingrained in the analytical fabric of the workshop. Sustainable innovation, responding to global trends and crises, unfolded organically

in the projects, underlining the contemporary emphasis on environmentally conscious practices. Global applicability, another facet explored, aligns with the strategic goals of internationalization, a pursuit often integral to companies' growth strategies. The workshop revealed that creating and aligning values is not just a design consideration but a strategic move that resonates with the *zeitgeist*, emphasizing the profound impact design can have on business and society [37].

During the workshop, group questions and considerations delved into market feasibility, technology readiness, and economic viability indicating a pragmatic awareness of the challenges in implementing innovative solutions. This business-oriented thinking is crucial in ensuring that the proposed designs are not just creative exercises but have a practical pathway to implementation and success in the market. All groups showcased a commitment to sustainable innovation. Whether it was in developing tiles with clean energy-generating capabilities, reusing water vapor in manufacturing processes, or promoting a circular economy, the projects aimed at advancing not just product innovation but also sustainable and environmentally conscious practices in their respective domains.

The recognition of the international scale in project indicates an understanding of the global nature of design and innovation. It suggests that these projects are not confined to local contexts but are envisioned to have applicability and impact on a broader, potentially global, scale.

The Strategic Role of Facilitators in Workshop 2.0

Workshop 2.0 at Revigrés brought forth a crucial insight into the role of a facilitator in steering multidisciplinary groups toward a design-led process. The intricate dance between aligning values and workshop goals with diverse participant perspectives emerged as a cornerstone for success, akin to aligning society values with the goals of a corporation. The challenge lay in harmonizing the diverse thoughts of participants, each carrying their professional and disciplinary nuances, into a coherent and purposeful design narrative.

The workshop emphasized the paramount need to instill empathy among participants. Facilitators played a pivotal role in fostering an environment where participants shifted from a mindset of rapidly seeking solutions to a thoughtful contemplation of users' needs. This shift, though fundamental to design thinking, proved challenging, highlighting the resistance to moving beyond conventional problem-solving approaches. Participants needed guidance to navigate this mental shift, showcasing the facilitator's influence in shaping mindsets toward a user-centric approach.

Moreover, the difficulty in encouraging participants to view projects holistically became apparent. The innate inclination to focus on specific aspects or individual contributions hindered a comprehensive understanding of the project's broader impact. Facilitators, acting as orchestrators, skillfully guided participants to embrace a holistic perspective, linking diverse elements into a coherent and impactful design strategy.

The facilitator's role extended beyond guidance—it was about creating a well-organized workshop ecosystem. This structure incentivized dynamic and proactive ideation, steering participants away from siloed thinking. A well-orchestrated workshop, much like a well-structured company, cultivates an environment conducive to collaboration, innovation, and adaptability.

6. Discussion

Workshop 2.0 at Revigrés emerged as a crucible for testing the fundamental assumptions and hypotheses integral to the Co-design Sessions' overarching goal — affirming the strategic role of a CDO. This workshop, strategically positioned between inspirational ignition and tangible prototype creation, provided profound insights into the dynamic interplay of design leadership and facilitation.

The Co-design Sessions sought to understand how a Chief Design Officer could strategically steer the evolution of a product range, educate stakeholders about design value, and foster open communication for enhanced creativity. Workshop 2.0 unveiled the intricate dance of the CDO as a design leader. The methodology grounded in design thinking principles validated the hypothesis that design thinking is not just a methodology; it's a potent tool for establishing meaningful connections between the brand and users. The CDO, as a proponent of design's value, emerged not merely as an educator within the company but as a transformative figure within the corporate ecosystem.

The insights gained underscored the facilitator's pivotal role in steering multidisciplinary groups toward a design-led process. This role echoed the broader responsibility of a CDO in bridging, balancing, and giving voice to diverse perspectives — be it business goals, users' needs, or team decisions. The facilitator's influence in instilling empathy, fostering holistic perspectives, and guiding mindset shifts mirrored the challenges faced by a CDO in harmonizing diverse thoughts into a coherent design narrative. The well-organized workshop ecosystem, essential for dynamic ideation, mirrored the need for structured leadership within organizations.

The workshop illuminated the imperative of implementing more empathic, holistic, and decision-making methodologies into the innovation process. Design thinking principles served not just as tools but as transformative agents. The Six Thinking Hats methodology showcased its applicability in design strategy, aligning seamlessly with the demands of managing design processes and teams. This emphasis on structured problem-solving methodologies validated the hypothesis that design-led approaches equip companies to respond effectively to evolving market trends, emerging technologies, and shifting consumer expectations.

The user-centric approach, cultivated through immersive activities and empathic exercises, became the bedrock for ideation. This aligned with the hypothesis that placing the user experience at the heart of innovation fosters brand loyalty and fuels innovation rooted in real-world needs. Furthermore, the workshop showcased that design, when integrated into corporate culture, propels a transformative shift toward collaboration and creative problem-solving.

In summary, Workshop 2.0's insights serve as a blueprint for future Co-design Sessions, transcending the boundaries of technical proficiency. The dynamic interplay of design leadership and facilitation emerges as a guiding light for the CDO's strategic role. The emphasis on empathy, holistic methodologies, and a user-centric approach resonates with the broader goals of the Co-design Sessions — building design-oriented innovation processes, fostering a design culture, and developing concepts positioning Revigrés as a market leader. These insights serve not only as markers for the journey but as transformative elements shaping a design narrative that extends beyond individual workshops, steering Revigrés into a future of innovation and design excellence.

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P/REFERENCES OF DESIGN

KICKSTARTING CULTURAL ENTREPRENEURSHIP VIA CROWDFUNDING. DISRUPTING FROM BOTTOM UP.

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KEYWORDS | ECOSYSTEM, CROWDFUNDING, DEMOCRATISING ACCESS TO CAPITAL, INNOVATION, SOCIAL CAPITAL, SUPERDISCIPLINE

ABSTRACT | Crowdfunding is most probably the best go-to-market strategy for the entrepreneurs or creators in the cultural and creative industries (CCIs), as it unfolds, leverages and innovates the network effect easily by unlocking fan-, trust-, and social capital to establish the new brand. As often emphasized, it democratizes access to resources, innovates processes, reinvents, and pivots business models. The somewhat unusual "Prologue" is motivated by personal experiences, but it extracts 25+ years across capital markets and findings from academia and industry. Illustrating Hungarian and international cases, this study adds further depth to the phenomenon of how creative power that implies innovation and spillovers can unlock economic growth by measurably building an interconnected ecosystem for small- and medium-sized enterprises (SMEs) to overtake shortcomings of monetary policy. This study is built on three propositions: on the micro level, it presents crowdfunding as a simple, innovative service pivotal for validating, fundraising, marketing, and community building for creators, on the meso level, as a marketplace or project webshop, on a macro level, the uprise of ecosystems versus economies. Considering recent regulations that render crowdfunded equity a secure, cross-border, disintermediated investment asset class, this study adds further to how crowdfunding can function for CCI entrepreneurs, ecosystem participants, and policymakers.

1. The king is naked. Prologue

On June 21, 1990, as a first-year student hostess, I witnessed the reopening of the first stock exchange of the communist block after its 42 years of imprisonment. The five-day-long mesmerizing ceremony of the Budapest Stock Exchange (BSE), from now on referred to as the Ceremony, paid tribute to the regime change. The launch of the trading of one single share, IBUSZ, which would hardly reach the headlines today, captivated a global audience. This momentum, combined with the incomparably rich bourse history of 85 years under the Monarchy (1864-1948) –50 years during which the Budapest Commodity and Stock Exchange's yields outperformed (!) that of London and New York (Radnai & Szatmári, 2024; Korányi, 2014) – should have secured an everlasting competitive advantage.

But Hungary did not succeed in winning the game. Despite echoing the 'We are the first' slogan for decades, it de facto lost all its competitive advantage within a few years (Reininger & Walko 2020; Szeles, 2000).

What went wrong?

This question has been the central focus of my research in the past twenty years, but since I have been deep diving into the startup subculture, newer and newer layers seem to be unfolding. Still researching the answer since, even after my first books on the history of the stock exchange (Szeles, 2004; 2015), an opaque factor seems to be crystallizing that *one of the fatal reasons for this failure is negligence of the unsupported innovation ecosystem that led to the underperformance the pre-IPO pipeline*.

During the 34 years since the Ceremony, the lack of innovative, long-term-minded governmental policy (except for a few periodic or sporadic top-down economic policy successes) has led to a definite economic lag (Jaksity et al., 2023; AFME, 2023; Balogh & Langmar 2024). Stuck in the middle-income trap (Karsai, 2022) rounds up the drama of this small, export-oriented, traditional (aka non-digital) economy with its systematic global exposure[1]. This period of economic transition attracted significant academic attention (Reininger & Walko, 2020; Lucey & Voronkova, 2006) that detected underlying factors that hindered competitiveness. Thus, the rise of successful ventures and sociological patterns like paternalism (Kornai, 1995) have also been studied that withheld the accumulation of social capital that could enable and even finance organic, bottom-up initiatives ecosystems to outperform the old economy.

Now, it’s time to disrupt this legacy digitally.

2. Introduction

Inspired by the central themes of the Cumulus conference, first of all by “bridging design and economics” but including "centers and peripheries,” “converging bodies of knowledge," "systemic complexities," and "challenging societal structures," I attempt to present how crowdfunding resonates with these concepts. Considering the concise format of the conference paper, and as a professional in capital markets and crowdfunding, I have opted to present a pragmatic approach grounded in empirical experience.
One major impact of internet-based digitalization is that, on a gross scale and at an accelerating rate, it ensures increasingly easier access to information and services for mankind. This progress leads to the mass decentralization of services, which have been overwhelmingly dominated by intermediaries.
Disintermediation poses a significant competitive challenge for traditional institutions, such as banks: non-institutional, competitive service providers threaten their century-old market positions (Parker et al., 2016).

[1] The scope of this paper precludes a detailed inclusion of Wallerstein's world-systems theory, a notable concept in mainstream social science. However, it is pertinent to briefly mention the semi-periphery phenomenon within the centre-periphery model (Wallerstein, 1974). This model articulates the division of labor and resource exchange between core and peripheral nations, underscoring how 'emerging' semi-peripheral economies continually evolve. This paper aims to contribute to the hypothesis that if ecosystems can supersede economies, it might alter this semi-peripheral dynamic as well.

This change opens up new opportunities in design, particularly in interaction design, as it is a crucial element in the user journey and a key aspect of digital competitiveness. Digital growth and scalability largely depend on software, while user acquisition ultimately hinges on the user experience, which is shaped by design (Norman, 2014). This relationship creates a spillover effect that influences digital competitiveness and entrepreneurship, leading to the emergence of novel "alternative economic frameworks" such as the "sharing economy" and "peer-to-peer networks," which can be viewed as ecosystems. In contrast to an economy, which is organized and institutionalized from the top down, an ecosystem employs a bottom-up approach, characterized by having interconnectedness and "fluid borders" – as opposed to being institutionalized or regulated (Tiwana, 2013). This concept paper argues that crowdfunding, as a digital fundraising tool, has the natural capacity to connect, catalyze, and bridge the previously mentioned domains by disintermediation and reconnection and fuel interconnectedness, the major characteristics of an ecosystem.

I believe that contrary to the misconception that crowdfunding is merely a fallback option for cultural entrepreneurs who have failed to secure an industry leader's support, it should be recognized as a first choice. This paper shall introduce crowdfunding's unrecognized potential as an ecosystem driver.

As described by the entire mainstream literature, crowdfunding democratizes access to resources for creators on a mass scale, such as information, services, communication, marketing, and capital. It empowers creators to connect to their target audiences, yet in the critical early phase of a venture called Death Valley (see Figure 3), it ensures abundant independence and enables self-sustainable, innovative, efficient strategies, which in a critical mass can empower the cultural entrepreneurs to breakthrough and leverage their effect on micro-, meso- and macroeconomic competitiveness. This has been recognized. However, as a renewed approach, this article argues that crowdfunding is not only a tool but a driver that liberates creators from the constraints of a conservative industry structure. As ecosystems are to be fueled with capital, ultimately, crowdfunding is an organic ecosystem builder. This third type of ecosystem driver can change the traditional CCI ecosystem landscape that is yet dominated by i) a monopoly (state) or ii) monopolistic (dominant market player)-driven ecosystems. Crowdfunding is the most organic or bottom-up driver and, therefore, the most sustainable. This proposition, which I actively advocate in my role as a capital market professional, will hereafter be referred to as the 1st proposition.

If policymakers recognized crowdfunding as a vital cog in innovation, if they could support, accommodate, and take advantage of it, then they could speed up the dynamics of creative and innovative production at lower costs. If incumbent capital market service providers, including stock market operators and institutional investors, recognized and supported this renewed approach as an innovation funnel, that could lead to more IPO-ready ventures, whose founders as alumni startup founders would be best recognized upon their reinvestments into early phase ventures. Taking this alumni factor into account, in concluding with Figure 7, I will summarize by presenting how to develop the famous bell curve (World Bank, 2013) into a circle.

Within the framework of the track Bridging Design and Economics and the format limits, I consciously simplify the model to focus on the primary purpose of this paper, which is to demonstrate the power of crowdfunding as a relatively new tool rather than the products funded through crowdfunding or borderline financial products such as NFTs. As the cited literature elaborates on many aspects of economic history to contextualize the Prologue and extensively on crowdfunding, I narrow the scope to focus on demonstrating the potential of crowdfunding as an instrumental and creative tool for CCI entrepreneurs in their go-to-market strategies. Additionally, I aim to show how ecosystems with high interconnectedness and "fluid borders"—though less visible—could function more effectively than traditional institutional economics. As always, I cannot resist including some healthy sarcasm or humor. As a startup founder myself, who takes risks on my account to kick bricks off walls to make things happen, I mean it well.

3. Reframing core paradigms: innovation = ecosystem + investments

The United Nations Conference on Trade and Development (UNCTAD) defines the creative economy as "activities centered on fostering development by combining cultural, social, and tourism goals with the application of technology and the exploitation of intellectual property" (UNCTAD, 2022). To add more dynamics and to distill this approach further, in this paper, we would call these "activities" power and regard **creative power as an innovative, aesthetical, efficient, diffusive, spillover-generating, sustainable progress**. (As a distinction from art, which can be described as more self-oriented). This long-term progress can be efficiently financed by short-term crowdfunding campaigns. This study aims to capture the essence of this phenomenon rather than delving into the extensively discussed factors of campaign success.

In this short paper, the following factors of CCIs are considered:

- **The value added** of CCIs represents approximately 3.95% of EU value added and employs around 8 million people, including around 1.2 million firms, over 99.9% of which are small and medium-sized enterprises (SMEs) (EU, 2024). Besides this ratio, CCI, taking advantage of its social dimension, plays a great part in driving innovation and creativity across other industries. This cultural impact element or power is measurable. The Creative Economy Outlook 2022 report by UNCTAD highlights that the creative economy is one of the world's fastest-growing sectors, creating employment and income, promoting innovation, and contributing to societies' well-being;
- **the resilience** of the creative economy also translates to economic security in the form of **soft power**. The UNCTAD report also notes that creative industries were more resilient during the COVID-19 pandemic than other service sectors, with creative services exports only falling by 1.8% in 2020 compared to a 20% fall in exports of all services. For example, the French creative economy includes over 300,000 businesses and generates twice the revenue of the automotive industry (Runde et al., 2020). The pandemic had a significant negative impact on these industries, with substantial job losses and revenue declines. Governments, in response, initiated recovery plans and provided support to stimulate the revival of the cultural and creative sectors. The United Nations designated 2021 as the International Year of the Creative Economy for Sustainable Development, emphasizing the role of creative industries in enabling global economic growth and social and cultural development. This recognition extends to G20 leaders who have identified culture and creative industries as drivers for sustainable development and economic resilience (UNCTAD, 2021);
- **the innovative impact of CCIs** on the growth of other sectors and innovation is a measurable effect. CCIs stimulate business, technology, and society, driving innovations and knowledge transfer (Klein & Spychalska-Wojtkiewicz, 2020). Although most CCI projects are not innovations as determined by the Oslo Manual (OECD 2018), CCIs play a strategic role in bridging art, business, and technology, thus affecting external industries. The creative sector is defined by its dynamic nature and its focus on producing original or unique goods, often organized online. Design-based innovation creates new markets and facilitates the adoption of new meanings, highlighting the sector's potential to address further societal challenges like climate change and demographic shifts. As a solution to the traditional center-periphery problem that describes the gap as a social product between regions, today, digitalization and communication can help solve and enhance the growth of social capital and participation (Horányi, 2006).

Rykkja elaborates on the broad and complex concept of creative and cultural innovation as follows (Rykkja 2023, p.2).

„A rationale for studying the use of crowdfunding within the creative economy is that the CCI drives innovation and generates spillovers across the wider economy (Cunningham & Potts 2015; Potts & Cunningham 2008). It has been argued in the management literature that studying managerial innovation and experimentation in the creative economy (Bonet & González-Piñero 2021; Lampel & Germain 2016) may provide templates for the coordination of economic activity in other sectors (Bakhshi & McVittie 2009; Boix-Domènech & Rausell-Köster 2018). Crowdfunding adoption in the CCI is one such example because it was within the CCI that crowdfunding as a practice first emerged (Agrawal et al., 2013; Dalla Chiesa & Handke, 2020). This process of diffusion from the CCI towards the wider economy is also acknowledged in the general literature on crowdfunding. Contributions highlight the usefulness of empirical findings of 'early-stage creative projects' (Agrawal et al. 2015) for a better understanding of the adoption and use of crowdfunding in '… other, non-artistic projects and business ventures' (Macht & Weatherston 2015, p. 193). In other words, there is a vetted tradition for utilising findings from studies that use the CCI as an empirical context for understanding the adoption and development of crowdfunding as a business model in general."

- **Alumni culture is key:** Provided that the ecosystem develops and nourishes an alumni culture where successful entrepreneurs give back to prospective entrepreneurs and newcomers can access the experiences of alumni (for example, through mentorship), then sustainability is ensured. In Chapter 3, the "startup mafia model" is introduced. Notably, but not detailed further herein, education and communication are the pillars of its sustainability. This key concept is visualized in **Figure 7**.

And here comes the 2nd proposition, or the vision of the concept: by viewing digital economic ecosystems as informal yet transparent networks with low barriers to entry but with high added value through inclusive and efficient participation and innovative culture, ecosystems can transcend traditional economies based on regionalism, traditional culture, and physical resources, generating sustainable growth to bridge the gap between centers and peripheries, or between inefficient economies.

The real question is how to make it work. The 2nd proposition suggests that venture capital shall fuel the ecosystem to produce innovative products and services and argues that crowdfunding is the most accessible and, therefore, the most efficient and resilient form of capital "to do the job" (Christensen, 2015). Being a relatively new digital tool, it will not instantly create impact, but in the long term, it can certainly reach the critical, resilient mass from the bottom up. First, a short overview is presented about the venture capital industry.

4. Innovation as a function of venture capital investments: a short overview of the institutional, the private and the crowd capitalists

Innovative and creative ventures, often lacking collateral for traditional bank loans, have historically relied on alternative funding sources if bootstrapping or using personal capital and revenues does not suffice for competitive growth. This is where institutional venture capital comes into play, offering capital in exchange for equity. The concept of venture capital has been around since the Renaissance (Gompers, 1994), but its prominence surged with the advent of the Internet. This technological revolution particularly benefited businesses focused on technology or software (e.g., Software-as-a-Service, SaaS) by enabling them to scale rapidly while reducing unit costs. For the sake of growth, startups sacrifice profitability in their early years, and robust growth must be financed with external capital (Karsai, 2020). The relevance of venture capital in this context is not just to illustrate how thousands of companies, including CCIs, have utilized venture capital for growth: "Without significant venture capital investments in the risky early stages of a project's lifecycle, innovation in the economy would be stifled" (Khan et al., 2021). The rule is very simple: if there are no risk-takers, then there is no innovation. Banks aren't risk-takers. The state, on a mass and democratic scale, only temporarily takes risks. Thus, the accessibility to venture capital is crucial.

For a standalone but comprehensive conclusion, the following section will shortly summarize the well-known advantages and disadvantages of each financial service in the context of the discussion.

4.1 Non-institutional investors: clubs and mafias

The distinction between institutional and non-institutional investors is not based on whether they are incorporated but rather on whether they manage their assets or those of clients. The latter is always regulated. Non-institutional venture capital is available from business angels and family offices that decide over their own money, most usually within their business domains, building up portfolios with smaller ticket sizes and actively mentoring the investees.

- **Business angels** are usually solo entrepreneurs who earn their wealth from exiting successfully from former companies. Their cheque is much lower than that of the VCs but referred to as smart money: their mentorship is usually worth as much as the money that they offer. Angels voluntarily join semi-public clubs, known as BAN's (business angel networks), that collect and curate inbound funding requests in the form of pitches and where they can syndicate investments with fellow angels.
- **Family offices** are incorporated private wealth management companies that manage single or multiple portfolios as a cross-generational heritage and often use a fraction of their wealth to start investments. Their visibility is even less, and accessibility is even harder than that of the VCs: if they handle only their private capital, then they do not fall under regulation.
- So-called **Startup Mafias** (Deep Ecosystem, 2022) are excellent examples of alumni-based ecosystems. Undoubtedly, the most known example of that is the outlier success of Skype in 2011, when – 20 years after the Ceremony – it was bought up by Microsoft (earlier by eBay), making the six founders, including Estonian developers, billionaires, and they all reinvested a large part of this capital in local startups. The world learned that Estonia is a country. Seeding this fertile ground, Estonia today – despite, or independently from, its little physical size and without almost any tradition in capital markets – is per capita and GDP one of the leading digital economies, marked by the largest number of unicorns[2]. These types of ecosystems also rely on fandom and need, using tools of communication, leadership, marketing, and branding. Another good example is the Paypal story. But even the birthplace of Paypal, Silicon Valley's flourishing started with Hewlett and Packard's legacy. Spotify and Pixar built up an ecosystem as well.

Twenty years after the Ceremony, a former communist Baltic culture succeeded in accommodating the ecosystem concept of the 1st proposition. Well, daring to oversimplify the question, why couldn't IBUSZ, or the first Hungarian tech prospect unicorns, LogMeIn, and Prezi[3] catalyze the growth?

4.2 Institutional investors: rare venture capital in CCI

Venture capital investment in the CCI is a challenging issue. CCI entrepreneurs often struggle to attract venture capital due to factors like a lack of investible and scalable business models, limited tangible assets, and difficulties in assessing and protecting intellectual property. Monopol or monopolistic ecosystems dominate most segments of the industry. Foundations, grants, collectors, philanthropists, and crowdfunding are available for the arts. Industrial design in branded serial production, e.g., fashion and luxury goods, lifestyle companies have better access to venture capital as

[2] See the full list: https://investinestonia.com/the-full-list-of-estonian-unicorns/
[3] LogMeIn and Prezi are very successful, now US-based, Budapest-born tech companies.

- Computer-aided design (CAD) and streaming-based music platforms are investable: among the 1000+ startups that are priced above a billion USD[4], aka unicorns, among the strongest brands, there are a few from the CCIs: Canva, Design, PicArt, and Pixar. (Spotify is often referred to, but shall not counted herein; that is a tech company.)
- Extra profit from love brands and celebrity brands is also appreciated by venture capitalists. Mejuri, a direct-to-consumer jewelry company, secured $28 million. Depop, a platform for fashion items, received $105.6 million. Skims, founded by Jens Grede and Kim Kardashian, raised $399 million. Allbirds, a sustainable shoe brand, secured $202.5 million in several rounds.

1. **Non-transparent and not accountable decision-making**: just as in the case of each institutional investor, VC's investment policy is regulated therefore, it easily excludes targets due to strategic reasons, but that can be better forecasted based on their public profiles than their opaque decision-making processes that makes it inefficient for project owners to count on VC funding. For example, the now-billionaire CEO of Canva, Melanie Perkins, was turned down over 100 times by VCs.

2. **Geographic gaps:** Venture capitalists typically invest in nearby companies, leading startups to gravitate toward investors. This pattern affects the global distribution of VCs, creating distinct regional disparities, as shown in Figure 1. This distribution perpetuates a divide between central and peripheral areas. Post-1990, Central and Eastern Europe, previously viewed as a homogeneous region, no longer fits this description due to new digital divides. Countries benefiting from "digital territorial expansion" and the influence of alumni ecosystems and growth-focused VCs are on the successful side of this divide.

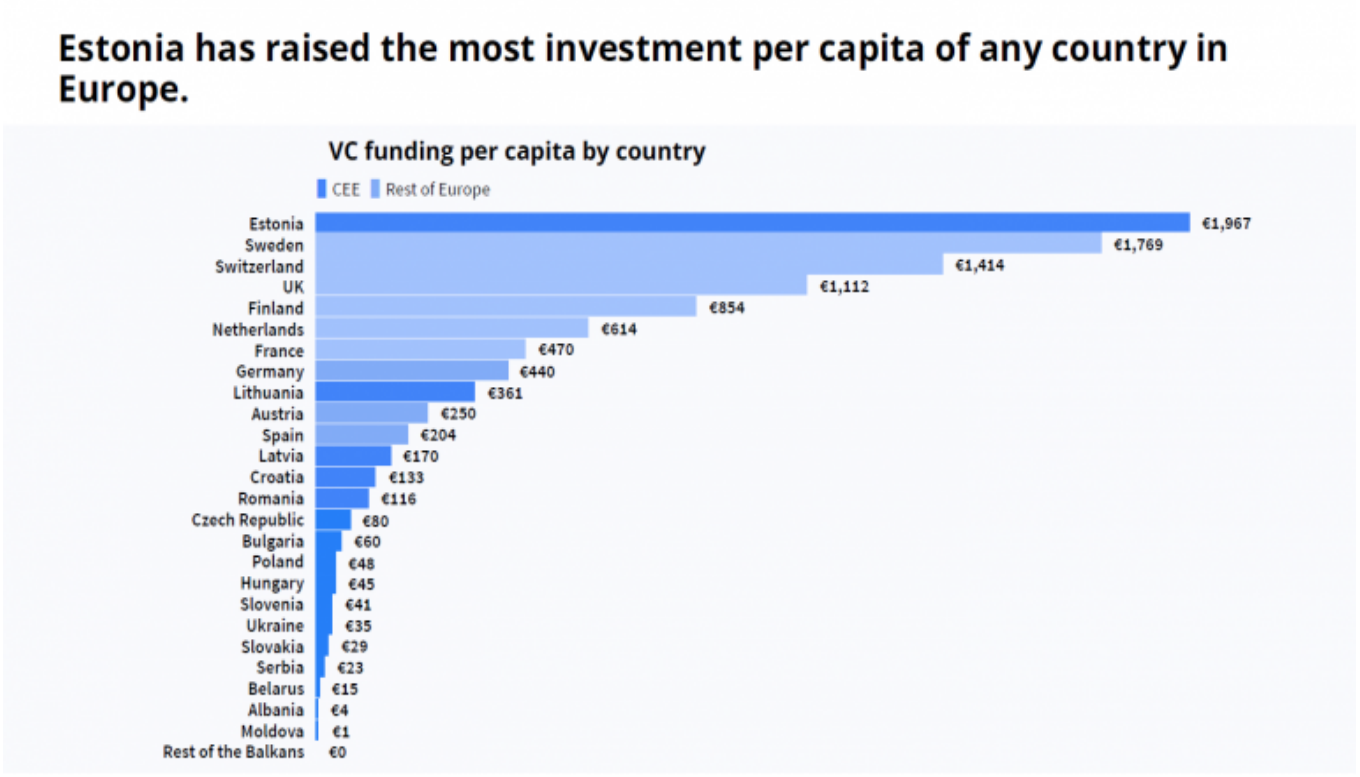


Figure 1: Venture funding per capita by country until 2021 Source: Dealroom.

[4] See the full list here: https://www.cbinsights.com/research-unicorn-companies

3. **Cyclicity:** the significant risk of institutional investors, such as those from venture capital firms, lies within their cyclical nature. Their investment activity, just exactly like bank loans, can be dramatically affected by economic cycles. In an economic downturn, deal flows can halt abruptly. In times of crisis, they generally prefer holding cash and sustaining their existing portfolio by follow-on or bridge finance. This is what exactly happened in the 2008 financial crisis, exemplified on September 15, 2008,[5]., which took the US Congress under pressure to invent a tool to stimulate the economy and halt the downturn (Szeles, 2022).
4. **Regulation**: Realizing the rise of the internet and motivated by the early successes of digital crowdfunding marketplaces such as Artistshare and Kickstarter, or – today's largest reward-based crowdfunding platform of creators[6] –, in 2012, Congress passed a landmark regulation, the JOBS Act, that legitimized investment crowdfunding, a potential natural choice for even a CCI entrepreneur in a more mature phase – perhaps, after having completed a reward-based crowdfunding campaign.

4.3 Let's go crowd: platform-based communities and platform economics.

The Regulation Crowdfunding provision within the Jumpstart Our Business Startups (JOBS) Act – deliberately named to emphasize its goal of job creation – eased the requirements for costly prospectus authorization within specified limits. Among the first equity crowdfunding platforms established in response to this change was Wefunder, founded "to address the funding gap left by institutional investors' rejections" – as referred thereto earlier. Since then, Wefunder, along with other equity U.S. platforms, has collectively raised over $ 700 million from more than 3 million individuals (Wefunder, 2023).

The European Crowdfunding Service Providers Regulation (ECSPR) came into effect in 2022. Since November 10, 2023, only licensed platforms are permitted to offer investment-based crowdfunding. Reward-based and donation-based crowdfunding remains unregulated, as these fundraising methods do not involve regulatory risk and information asymmetry, those factors that necessitate regulated investor protection. With the JOBS Act and ECSPR, the last regulated physical investment asset class is born, that of the pre-IPO companies, but crypto assets are also being regulated (Tokeportal.com, 2023). With the introduction of new regulations, for the first time in history, so-called non-sophisticated or everyday investors are safeguarded when investing in startups or early-phase companies. For creators who plan to develop alongside the alternative finance lifecycle, as exhibited in **Figure 3**, these regulations not only enhance safety and transparency in planning the financial strategy but reduce costs and risks in cross-border strategies and allow crowdfunding up to € 5M per year without further, costly legal arrangements. This ticket size is very much competitive with any other form of institutional capital, not to speak of the secondary market service that enhances the liquidity of the crowdfunded securities, thus reducing investors' risks. (Without stressing too much vision into this short paper, blockchain-based tech trends like tokenization will most probably soon compete even with traditional IPO markets such as stock exchanges.)

[5] The collapse of Lehman Brothers led to widespread panic in the financial markets, significantly impacting the availability of venture capital as well: many VC firms faced reduced funding from Limited Partners (LPs), which drastically limited their ability to support SMEs and startups. This situation was exacerbated by the near freeze of the entire banking system, leaving the economy in a dire state without finance. The aftermath saw a surge in bankruptcies and unemployment reaching unprecedented levels. It took global economies more than five years just to stabilize from this shock. Venture capital funding, according to data from the National Venture Capital Association, dropped from $28.3 billion in 2008 to $17.7 billion in 2009. Unemployment rate more than doubled, peaking above 10% in late 2009, reaching a high not seen in over 20 years. Early-stage companies and SMEs were cut off from traditional bank financing. High costs of public offering of shares, including the need for an authorized prospectus disabled them to sell shares. The JOBS Act made a significant mark in financial history by enabling early-stage companies to be investable by the public, effectively regulating, thus creating the last segment of physical asset classes (Epstein 2016).

[6] To clarify, while Kickstarter remains unregulated, it, along with other existing platforms at the time, demonstrated the online platform-based mechanism of directly connecting creators with clients.

So, what is crowdfunding exactly? In itself, it is as old as mankind: an open call for friends, family, and unknown prospective investors/donors to finance something. People with an idea but without money always went around the corner to ask for money. Mozart sought funding for three piano concertos by proposing a subscription model to potential investors. The Liberty statue was financed by newspaper advertisements. But that was local. With the rise of the internet, crowdfunding experienced a digital reincarnation, expanding its reach on a global scale. The key to success in these projects lies in **their internet-based, computer-mediated, asynchronous communication campaigns (**Dematos & Maehle, 2023), **with the addition of efficient targeting of the audience in social media.** This mechanism has now become a prominent subject in communication theory research. In this paper, we add further developments as also observed in a survey (Szeles, 2023): the more synchronized the communication between the campaign owner and the potential supporters or investors is on the campaign page, social media, or at online/offline events, the greater the backers' or investors' engagement, and their sense of reaching agreement, which can be called participation (Horányi, 2006). **Successful campaigns are those that have reached an agreement with their audience, an investment agreement**. This is the conversion mechanism of crowdfunding.

While social capital is a macro-level approach, on the meso-and micro level, network capital, including friends, family, fans (or fools, often added sarcastically, but it stands for followers in social media (FFF) is the cornerstone from where a project or startup can kickstart its go-to-market strategy. Using crowdfunding not only as a periodic tool but as a business model (Rykkja, 2023) by converting FFF — also referred to as fan-capital, Direct-to-fans (D2F) (Tosatto et al., 2022), or affective marketing (Hills 2015) — into users and donators/backers/investors; and by uniting audiences with the platform audience, crowdfunders can build a strong brand, a legacy- or a love brand. And as Figure 2 demonstrates, this can spill over into the wider economy.

"Bűvös Kocka [7]of Crowdfunding"

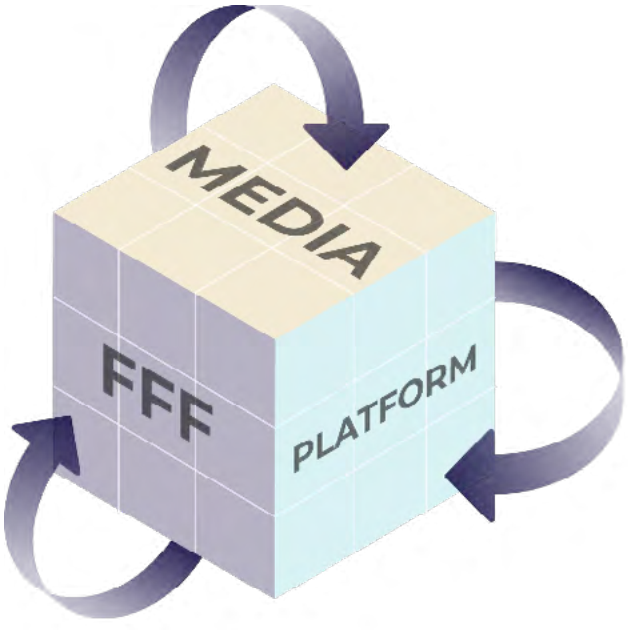


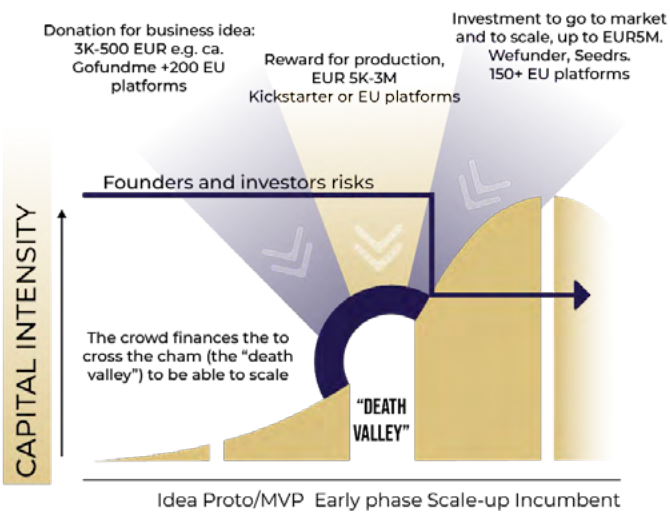
Figure 2: The inception points of the spillover effect of innovation.

[7] The Rubic Cube or Magic Cube is a Hungarian invention (1974)-is applied here just to visualize how to make sense of crowdfunding-as-communication, as a mathematical model.

The magic lies within the sustainable conversion mechanism of crowdfunding: on the meso-and micro level, network capital —including FFF, is the cornerstone from where a project or startup can kickstart its go-to-market strategy. By momentum-building communication strategy, further and further layers can be reached, new audiences can be added, and the wisdom of the crowd can be insourced (World Bank 2013). The original, creative, innovative project idea can, through crowdfunding, diffuse and create spillovers in the wider economy.

Paschen (Paschen, 2016) conceptualized the 2nd proposition eight years ago that the four types of crowdfunding can fill the gap in traditional financial services such as bank loans. Since then, evidence of platform performance and regulation has solidified the concept that I exhibit in Figure 3. Further highlights of the World Bank study (World Bank 2013) and findings from recent studies are added.

Table 1. How crowdfunding covers the financing needs of startups and SMEs. Inspired by the chart of the World Bank (World Bank), 2013.

Figure 3. **2nd Proposition: Crowdfunding can completely replace the traditional financial services throughout the company life cycle**	**Types of crowdfunding for a cultural entrepreneur (not exclusively for b2b)**
	Donation campaigns: creators ask for donation without offering rewards. Mostly used by nonprofits. Platforms like GoFundMe support business ideas, raising thousands of euros for projects that resonates with emotional, philanthropic and impact / difference making motivations of the donors. The stronger the social media presence, the higher the chances are – all through the crowdfunding journey. Reward campaigns collect donations of backers in exchange for piloting/prototyping/launch pre-sales via rewards for future products. Counts as post-market validation. Platforms like Kickstarter, Indiegogo can multiple and engage fans and unlock fan capital and convert it to cash, build fame and even a love brand. Investment campaigns: after succeeding reward-based sales, creators as ventures with investible business plans can get accepted by licensed platforms to launch equity campaigns that unite fans, clients, FFF's and investors as early-phase, high risk companies offer high potential returns. This is the multiple conversion effect. More mature, creditable ventures can launch debt campaigns. Purposely, only the growth curve is shown of the bell curve that is covered by crowdfunding. However, investment crowdfunding can also be interesting for mature companies, and with the planned upgrade to the €8 million limit, and with the secondary trading function, the platform can practically function as a stock exchange.

There are two further key takeaways from Figure 2:

- The World Bank proposed that crowdfunding is a key tool for early-phase companies to bridge the "Death Valley" — the critical phase where they run out of capital and are not yet attractive to institutional investors or banks (World Bank 2013). But the crowd can be a source of capital for them. Therefore, crowdfunding can attract dormant capital into the economy and also serve as a mechanism for crowd diligence, where potential backers collectively assess and comment on the legitimacy of a campaign: if any fraudulent or contradictory information is detected, interest in the campaign can rapidly decline, leaving the untrustworthy founder without support. This crowd-based vetting process, called crowd diligence, is essential in mitigating fraud in crowdfunding platforms.
- The curve exhibits another famous concept, that of the “crossing the chasm,” which can be regarded as the Death Valley of growth (Moore 2014). The concept proves that in the above-pictured interdependency with novelty adoption by customers—which begins with early adopters and continues with early majority, late majority, and laggards—the critical chasm lies between the early adopters and the early majority. Most early-phase companies fail with their go-to-market strategy or product-market fit at a mass scale. To conquer this risk, crowdfunding can help innovators validate their concepts with a large amount of feedback during a reward campaign and get better prepared for crossing the chasm.

To conclude, the 2nd proposition to reflect the CCI entrepreneur, major, research, and evident-based advantages follow, related to platform economics.

- Reward- and donation-based crowdfunding practices are most used within the culture sector (Shenor et al. 2020; Rykkja 2023). More and more cultural entrepreneurs utilize this experience in upgrading their crowdfunding experience and launching equity campaigns successfully. Reddit is a famous example.
- Crowdfunding is a process by which new value is added to the process of production, distribution, and creation of exchange and use value) constitute innovation. According to standard OECD/Eurostat definitions and measurement procedures, the use of crowdfunding may create and lead to the diffusion of another potential innovation (Banet-Weiser & Castells 2017).
- Entrepreneurs’ dream across sectors is to build a love brand. Due to their fan base, love brands are the most resilient and independent from market shocks due to their domesticated resources. Crowdfunding is the tool to maximize fan capital for financing as it allows a fan to renew their connection to the brand and be part of its journey (Scott 2015). Fashion brands, and for example, new food (e.g., craft beer like Brewdog, lots of beverages, vegan food brands), new industries such as fintech, and impact-driven sustainability projects maximized crowdfunding for this purpose.
- Crowdfunding platforms operate in a webshop model. As online marketplaces, they need to develop both sides of the market and match supply with demand. For campaign owners using crowdfunding as a business model, not merely out of necessity, it's crucial to apply e-commerce-like marketing and communication strategies. Campaign owners need to utilize network effects through effective marketing (Hills 2015), framing (Moradi & Dass 2019; Entmann 1993), and Direct-to-Fan (D2F) mechanisms to foster engagement effectively (Tosatto et al. 2022). The widely applied and researched online marketing strategy includes leveraging social media to build the campaign momentum. Achieving near-synchronous communication, aka participation, is key to creating this momentum. This is the **3rd proposition** that adds further depth to the well-established herding effect that is the other key driver of momentum building (Agrawal et al. 2015; Petit & Wirtz 2021).

- For platform operators or crowdfunding service providers, entry barriers are significant. Typically, these platforms adopt a success-fee-based B2B model and earn 5%-15% of the capital collected, which entails risks, given the success rate is 40%-80% of the campaigns launched. Their revenue increases with the quantity of capital, therefore, with the quality of campaigns they attract, and top campaign creators often favor platforms with larger user bases. Liquidity attracts liquidity, as in all segments of capital markets. This is how Kickstarter corned out the market (Rykkja 2023). While this study does not delve into detailed platform economics, considering the industry's current state and its oligopolistic market structure, this business model in a relatively new market—where intensive education is necessary to evangelize prospective clients across diverse financial cultures—demands substantial capital expenditure (CAPEX). For investment-based platforms, achieving ECSPR license readiness incurs additional costs of €100-150k, besides expenses on application development, marketing, staffing, and legal costs, including user verification tools (Know Your Customer, KYC) and anti-money laundering (AML) measures.

5. Meanwhile in Hungary

Thirty-four years after the Ceremony, one year after the BSE's IPO, the Hungarian economy is now in the latest laggard phase as measured by decisive mainstream capital market-related economic factors, as published by the National Bank of Hungary and AFME as well (MNB 2022; AFME 2023). Within this study, only a few of these are presented, embedding them into a well-elaborated phenomenon and concluding with the current status of venture capital and crowdfunding[8].

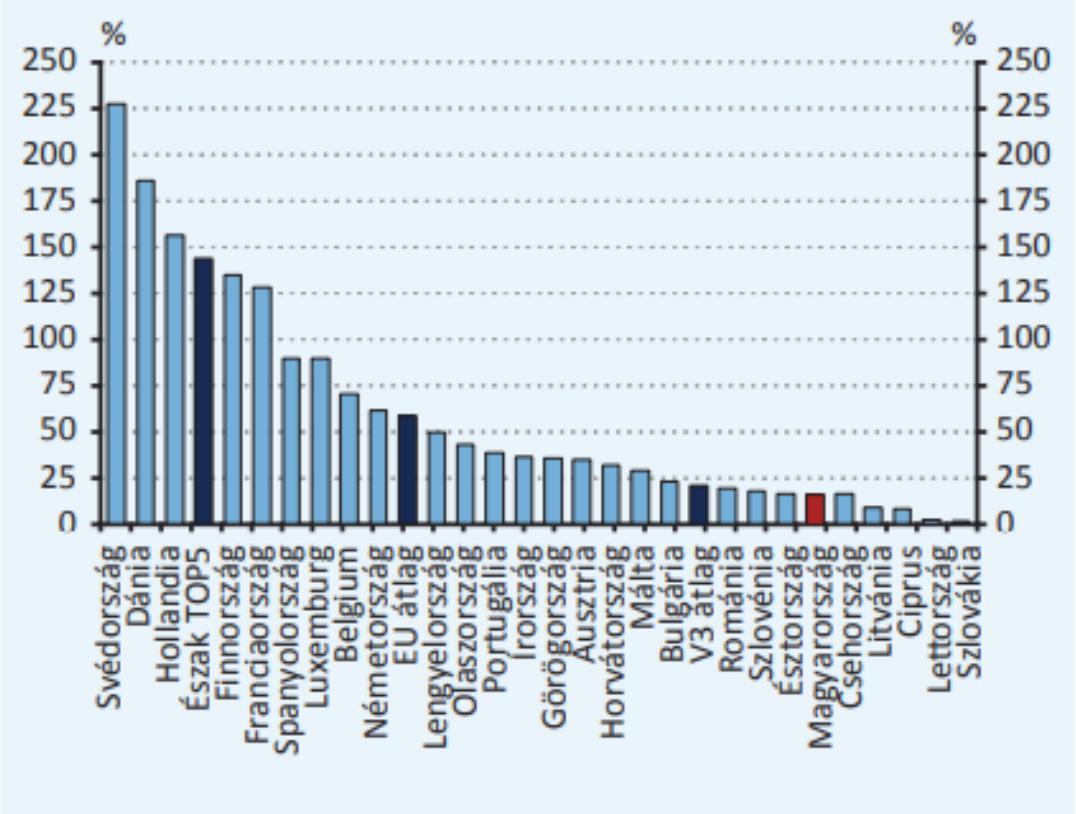


Figure 4: Stock market capitalization in comparison to GDP in 2021

[8] This late laggard phase is also explained by the BSE's lack of strategy to integrate into the European capital markets in that regulation-driven consolidation (Szeles & Marosi 2000; Szeles et al. 2001). The impact of the missed opportunities is another important factor but would not fit within the scope of this paper.

> “In Hungary, stock market capitalization as a percentage of GDP is low in international comparison, at 16.5%. This places Hungary behind Poland in the regional context, but ahead of the Czech Republic and Slovakia. In Western European and Scandinavian countries, market capitalization often exceeds 100%. A diversified financial system underpins competitive economies and sustainable growth. In contrast, financing in Hungary primarily occurs through banking channels, creating significant vulnerabilities, especially during credit crises, as it complicates access to resources for companies. Achieving a 30% capitalization ratio could potentially increase the economy's potential output level by 0.2-0.3 percentage points.”
> (Source: MNB, 2022)

The transformation following the Hungarian regime change led to significant societal and economic shifts. Research indicates an increase in risk averseness among the population, a trend often attributed to the uncertainties of the post-regime economy, resulting in a decline in social capital. Traditional networks were disrupted, and new forms of social organization were slow to develop (Sik, 1994). Moreover, the transition period reinforced top-down cultural norms, reflecting a continuity of paternalistic attitudes from the previous regime, which hindered the development of more participatory and democratic organizational cultures (Kornai, 1995). This paternalism, deeply ingrained in the societal fabric, continued to influence both public and private sector dynamics, impacting decision-making processes and leadership styles (Karsai 2020).

According to Dealroom's research (Balogh & Langmar, 2024), Hungary's peak in the stock market was in 2020, supported by European S3 funds and incubators. In 2020, the investment ratio was 45 euros per capita. This figure was five times higher in Austria, ten times in Germany, and 43 times in Estonia. Research also shows a growing reliance of the region on state or EU funds for venture capital, increasing from 25% to 40% from 2016 to 2020 while remaining stable at about 6% in Europe. This suggests these countries are gaining more influence in state funds, unlike Western countries where risk capital is privately funded to the market. The limited availability of venture capital particularly affects the growth of high-potential, young, innovative companies (Karsai, 2020): 31% of startups valued over one billion dollars did not or could not use venture capital, compared to only 7% in the whole of Europe. In the CEE, five countries received 82% of the total investment value: Estonia, Czech Republic, Poland, Hungary, and Romania. Currently, Hungary lags far behind Estonia in terms of startup investments relative to GDP per capita: whereas in Estonia, GDP is €27k / capita and investments are €2k/capita, in Hungary, GDP is €18k/ capita, and investments are as low as €7/capita.

So where is the money? As highlighted by the World Bank, crowdfunding is a tool to unlock dormant (uninvested) capital and make it work. (World Bank 2013). Dormant capital mirrors distrust in the state (which is not contradictory with paternalism) and lack of investment possibilities and preserves the gap. Hungary is recorded in this negative trend: Figure 5. shows that "in the European Union, only Greece, Latvia, Lithuania, Portugal, and Slovakia had a higher GDP ratio of cash in circulation. In the CEE region, only the Slovak value exceeded the Hungarian." (Hungarian Banking Association, 2019).

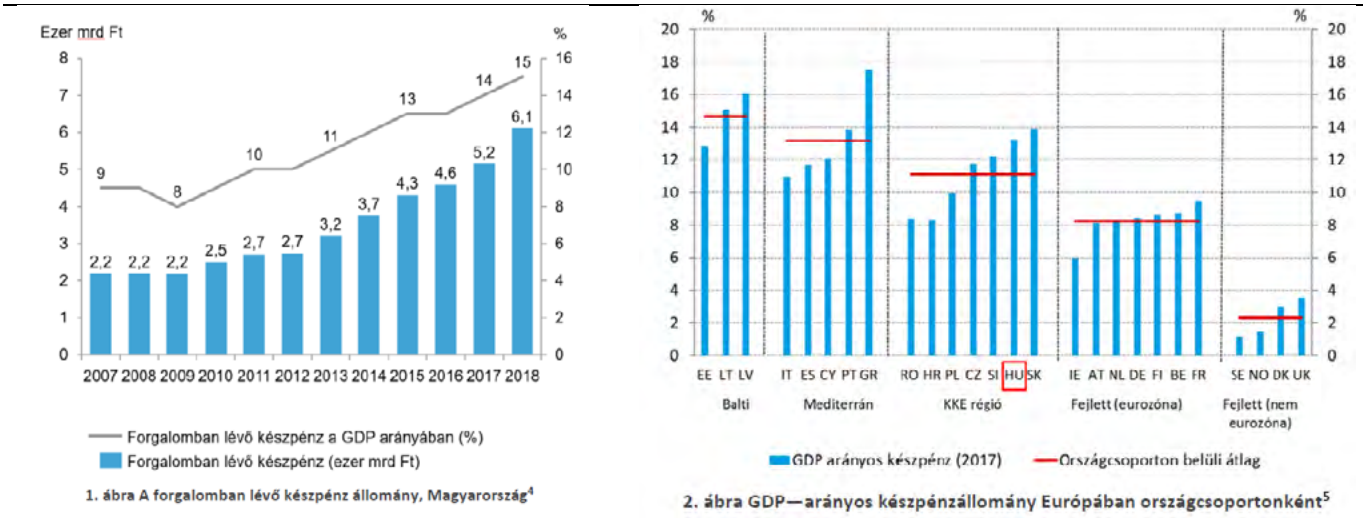


Figure 5: Cash (as non-working, aka dormant capital) versus working capital, Hungary vs the EU (2019).
Source: Association of Hungarian Banks
The left graph shows the cash in HUF billion in proportion to GDP in 2019. The right shows it in regional comparison.

Crowdfunding in Hungary has appeared, but yet underdeveloped. Launching services and breaking grounds as a small startup within an ecosystem-poor environment resulted in its valid yet slow growth. Without further analysis within this article, Figure 6 provides the first published overview of Hungarian platforms.

Table 2: Hungarian crowdfunding platforms.

Crowdfunding Platform (service since)	Type	No. of Campaigns	Capital raised
TokePortal.com (2020)	Equity, donation	25	HUF 1 bn
Adjukossze.hu (2013)	Donation, NGO	260	N/A
Sharity (2020)	Donation, CSR	N/A	N/A
Brancs (2022)	Reward	35	HUF 56,4M
Goood.hu (2015)	Donation	N/A	HUF 95,83M F

Platforms that ceased operation: Creativeselector.hu, Stagehive, Indulj. be, kezdheted.hu.

6. The king is dead, long live the crowd (funding, as a superdiscipline). Concluding remarks

Access to capital is a global demand. In 2024, private economy participants, from the cultural entrepreneur through SMEs to large incumbent companies, creative and innovative ecosystems are weaponed to reassemble the economy to make it more sustainable and more resilient. In countries where traditional, top-down approaches are prevalent and do not actively promote digital initiatives for the broader economy, bottom-up economic strategies can be energized by tapping into dormant capital directly from the population, a concept that the World Bank has already advocated for since 2013.

Before summarizing why, we should consider crowdfunding as a superdiscipline, Figure 7, an updated, enhanced version of the original diagram from the World Bank, shall be viewed. This revised diagram projects the creative power of the alumni-based ecosystem that ensures the driving power and the circularity of capital that will diffuse over the wider economy.

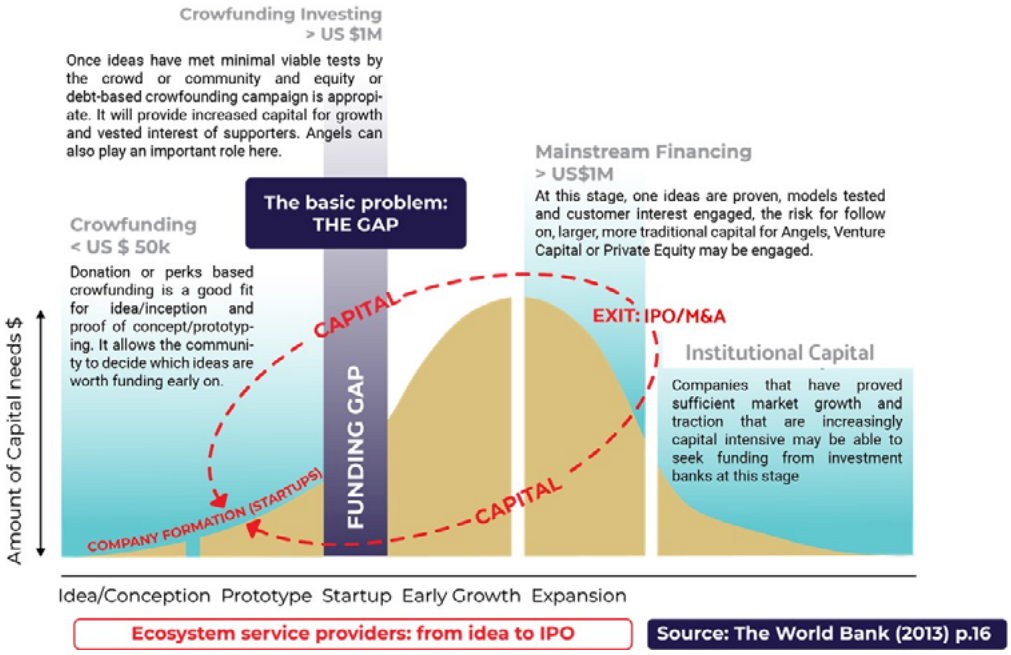


Figure 6: “Crowdfunding fills in the gap” – revised (Source: own figure, based on the World Bank figure).

Crowdfunding can be regarded as a "superdiscipline" because it integrates various elements of economy, culture, and technology. As a conclusion of this paper for the CCI entrepreneur, the value propositions 1-3 are introduced in this paper and are summarized.

1st: the meso-proposition is that crowdfunding is the most sustainable, most democratic funding bottom-up driver and, therefore, the most sustainable. More than a platform: an ecosystem-builder.
2nd: the macro-proposition concludes that ecosystems can transcend traditional economies based on interconnectedness and alumni cultures that contribute to capital circularity
3rd: the micro-proposition relates to participation in creating the campaign momentum and synchronizing the campaign communication with its prospective investors/backers.

Summarizing the multifaceted role of crowdfunding:

1. Interdisciplinary nature: Crowdfunding inherently involves finance, marketing, technology, and social networking.
2. Economic impact: crowdfunding mobilizes dormant capital, allowing it to flow into new and innovative projects. This influx of funding can stimulate economic growth, support new businesses, and create jobs.
3. Cultural impact: crowdfunding can contribute to a new type of ecosystem where crowd capital is fueled into CCI. As the network effect determines that successful platforms act as central marketplaces of capital, social capital, and knowledge capital and distribute these goods more inclusively and democratically, artistic projects might not otherwise receive funding, therefore, crowdfunding influences cultural development. This, in turn, serves as an inception point for spillovers into the wider economy and offers a real choice for the cultural entrepreneur between monopoly-, monopolistic, and democratic ecosystems.
4. Design innovation: crowdfunding allows designers to bypass traditional funding constraints, bringing innovative products directly to the market.
5. Regulatory aspects: Investment-based crowdfunding is regulated and fully passported within the EU, ensuring higher investor protection while raising the barrier of entry, leading to market consolidation and higher efficiency.

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About the Author

Nora Szeles is an award-winning economist, university lecturer, and capital market professional recognized for her further contributions to entrepreneurship, project management, competitiveness, venture capital, and crowdfunding. Starting her career at the Budapest Stock Exchange, she pioneered the launch of derivatives trading and related research. Since 2014, she has been enrolled at MOME; earlier, she was a lecturer at Corvinus University and the International Centre of Banker's Education. Holding an MBA from Purdue University, USA, now in her PhD research, she is exploring crowdfunding as a transformative business model for entrepreneurs in the creative industry. As a practitioner, she is a co-founder of the first Hungarian crowdfunding service provider, Tokeportal. Winner of the Joseph de La Vega Award of the Demjan Scholarship.

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P/REFERENCES OF DESIGN

ENTREPRENEURSHIP THROUGH DESIGN: RECOMBINING THE DESIGN PROCESS WITH METHODS AND TOOLS FROM OTHER DISCIPLINES IN PROJECT-BASED ACTIVITIES.

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KEYWORDS | ENTREPRENEURSHIP THROUGH DESIGN, DESIGN PROCESS, STRATEGIC DESIGN, INNOVATION AND DESIGN, SOCIAL RESPONSIBILITY

ABSTRACT | This paper wants to present how our programs in Design support the next generation of Designers to be system game-changers, encouraging our students to work in an interdisciplinary way, combining tools and mindsets from different disciplines in project-based activities. Innovation is the temper of business design, but Innovation is not “only” in the solutions most of the time, it stays in the process of creating the right “environment” for ideas generation.

The paper presents how the Master in Business Design wants to create connections between the worlds of business and design, showing our didactic methods and, as applied research, some students’ projects that present new business models and strategies. Business Design, by definition, is a course that taps into different disciplines (e.g., marketing, design, sociology, law, etc.), creating an ever-changing didactic context and pushing us, as professors, to create an open context to push the spillover of ideas.

The projects were developed during our “Entrepreneurship Through Design” workshop, a laboratory-based course of two months in which our students, who come from different backgrounds, working experiences, and cultures, can create their ideas for new businesses from zero with the help of professors and professionals. We recognized the importance of creating a framework that is open and can accommodate the differences within heterogeneous teams and takes advantage of the strengths and potential offered by varied backgrounds and cultures. We aim to guide our students to become connectors, translators, integrators, or “chameleons.” During the workshop, they test themselves with new methods and tools, decoding and recombining them during the design process. They envisioned new scenarios, pushing the boundaries of the creative industry, but, in the end, they developed their ideas taking into consideration the real needs and feasibility of the design solutions.

The projects selected for this paper, both on Social Responsibility and on “Inclusivity and Overcoming the Stigma,” will show how important it is to contaminate our experience working with a transdisciplinary approach, sharing ideas, and pushing brainstorming activities. The outcomes, most of the time, are completely different from what one would expect from the addiction of the students’ competencies because the students tested themselves in new challenges, hybridizing their design process with new visions and tools. Still, most of all going through the process together as a team.

The main topics of this paper will be Entrepreneurship and Innovation in Design Culture, decoding, integrating, and recombining methods and tools into the Design process, and Inclusivity and Social Responsibility in new projects as Design goals.

FOCUS:

How Can We Push Innovation by Design?

- Decoding and recombining the design process in project-based activities.
- Supporting the next generation of designers to be game-changers.
- Encouraging our students to learn, decode and experiment.

CONTEXT:

Create a Fertile Context for Ideas Generation

The format:

- Combining multidisciplinary teams
- Pushing the spillover of ideas
- Teaching different methods and tools
- Giving the structure of the workshop



CONTEXT: Multidisciplinary Teams



DISCIPLINE:

Business Design

Bridge between **Business and Design Studies**

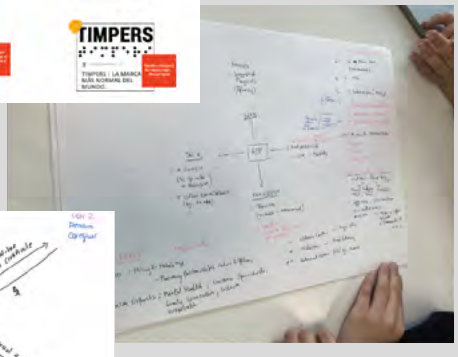
With the aim of training “Hybrid Designers, Translators and Connectors”,
the **New Entrepreneurs**
through a **Transdisciplinary Approach**

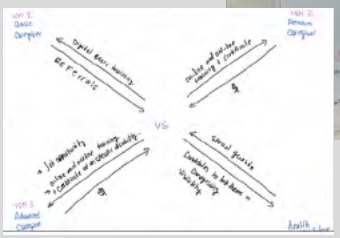
HOW:

Entrepreneurship Through Design

Project Based Activity:
students need to design strategies to launch in the market new business ideas, through means of design methodology, sensitivity and entrepreneurship culture with the help of professors and experts.







HOW:

Entrepreneurship Through Design

The structure of our workshops:

5 weeks
4 design phases
Launch/MID/Final Presentation
8 Theoretical-Practical Lectures/9 Revisions
1 Project leader
Multidisciplinary teams
Company Led/ Internal challenge

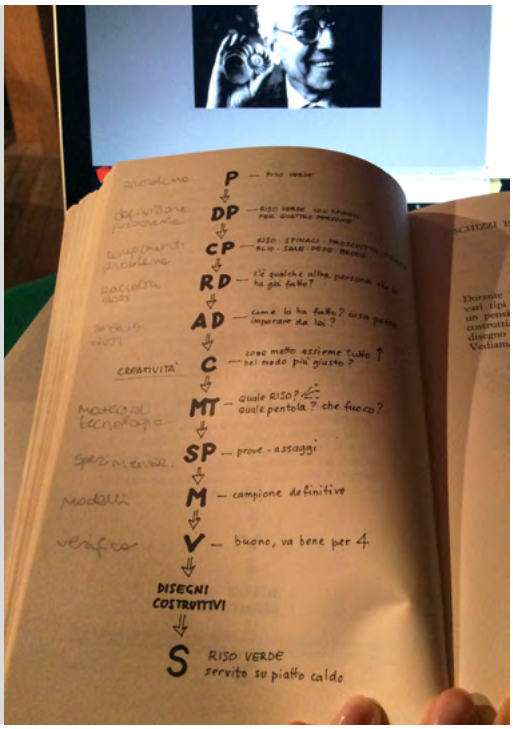


HOW:

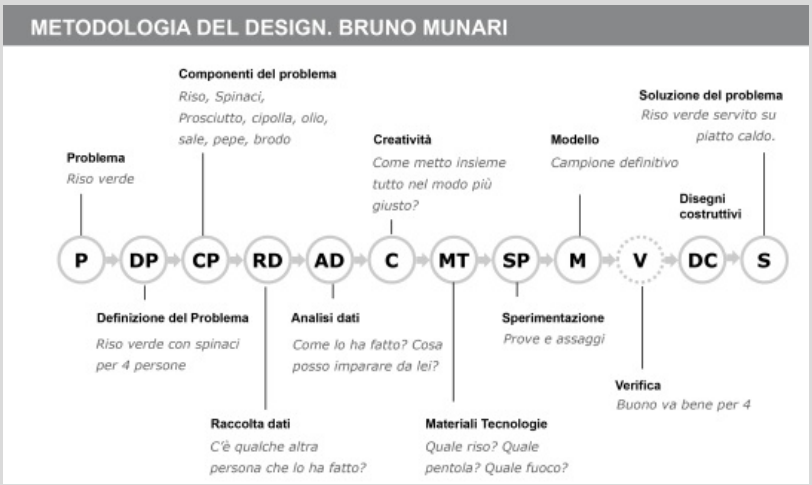
The Process! From Bruno Munari Method to us

"Il metodo progettuale non è altro che una serie di operazioni necessarie , disposte in un ordine logico dettato dall'esperienza"
"The design method is nothing more than a series of necessary operations arranged in a logical order dictated by experience"

Munari (2018, pp. 16–17)



HOW:



P // problem - Green rice
DP // definition of the problem - Green rice with spinach for four people
CP // components of the problem - Rice, oil, spinach, ham, onion, oil, salt, pepper, broth
RD // data collection – Is there anyone else who has already done this?
AD // data analysis – How did you do it? What can I learn from her?
C // CREATIVITY – How to put everything together in the right way?
MT // materials technology – Which rice? Which pot? What fire?
SP // experimentation – Tests, tastings
M // models – Final sample
V // verification – Good, good for 4
Construction drawings
S // solution – Green rice served on a hot plate

Munari (2018, pp. 62)

CREATIVE PROCESS:

Decoding, **I**ntegrating, and **R**ecombining **M**ethods and **T**ools into the Design **P**rocess

Starting from a Model. An example: the Double Diamonds process by the Design Council.



First and Second Phases: Discover and Define
customers profile analysis , customer journey analysis, competitors arena, market trends, market size, insights, critical success factors, ideas generation, …

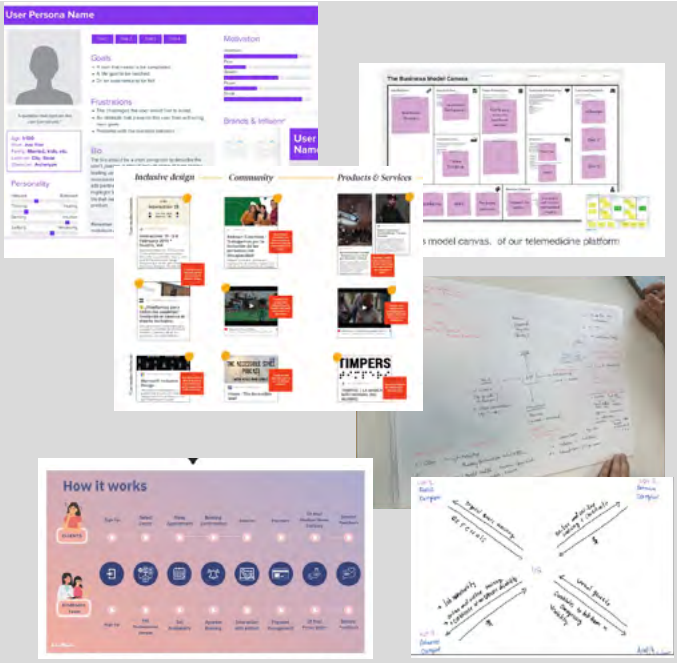
The result is to create a design brief which clearly defines the challenge based on these insights.

Third and Final phases: Develop and Deliver
value proposition, business model, organizational structure, branding, feasibility aspects,
social and business KPI, prototyping, go to market strategy, communication strategy, business pitch(…)

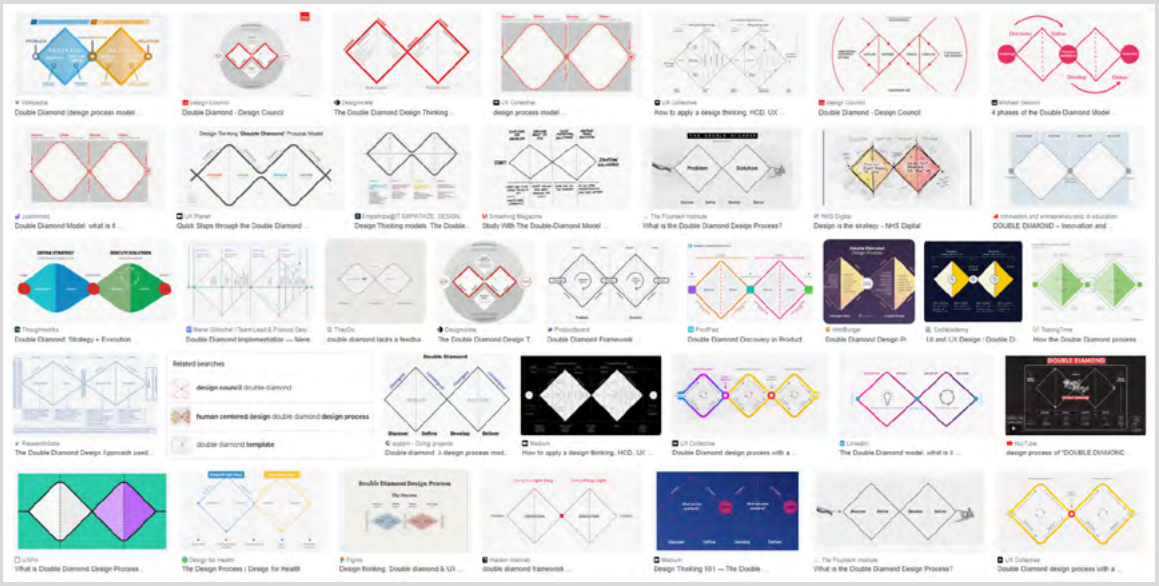
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CREATIVE PROCESS:

Tools chosen based on the challenge and the Industry, trying to give different perspectives and methods to inform and nurture the design process.



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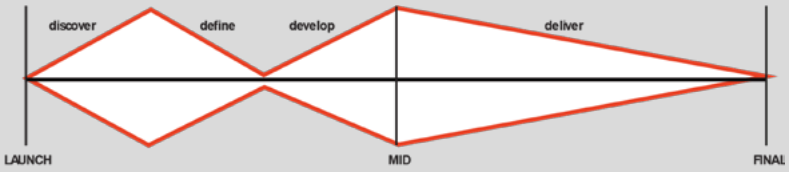
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HOW: Double Diamonds Adapted within the Format of our Workshops

Entrepreneurship Through Design



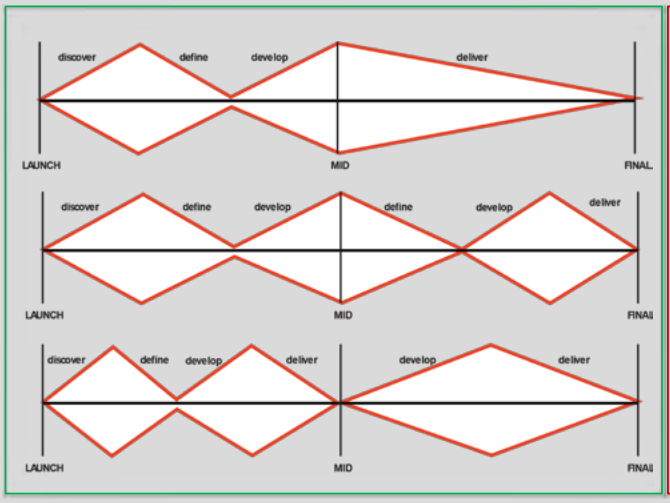
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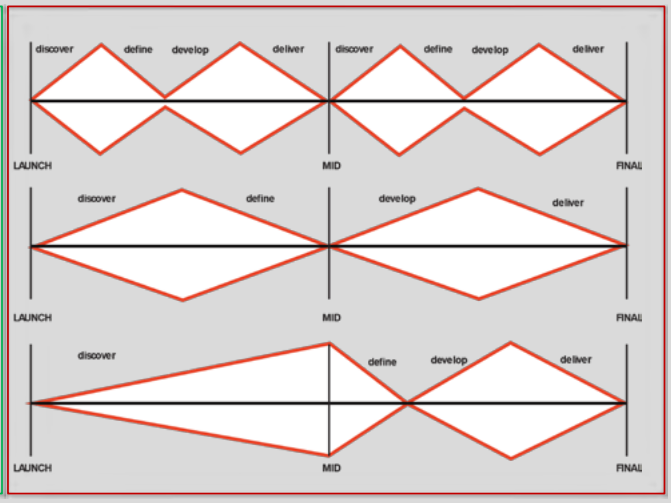


TO THAT

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HOW: Examples of Emerged Patterns

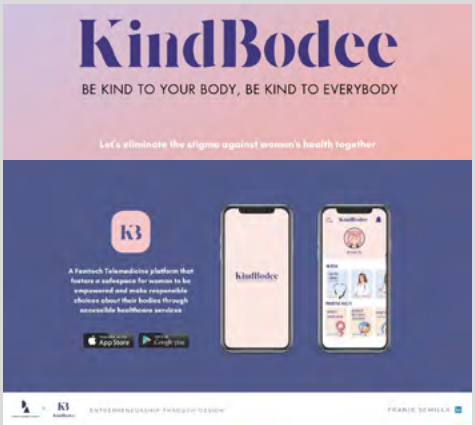




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STUDENTS' PROJECT EXAMPLE:





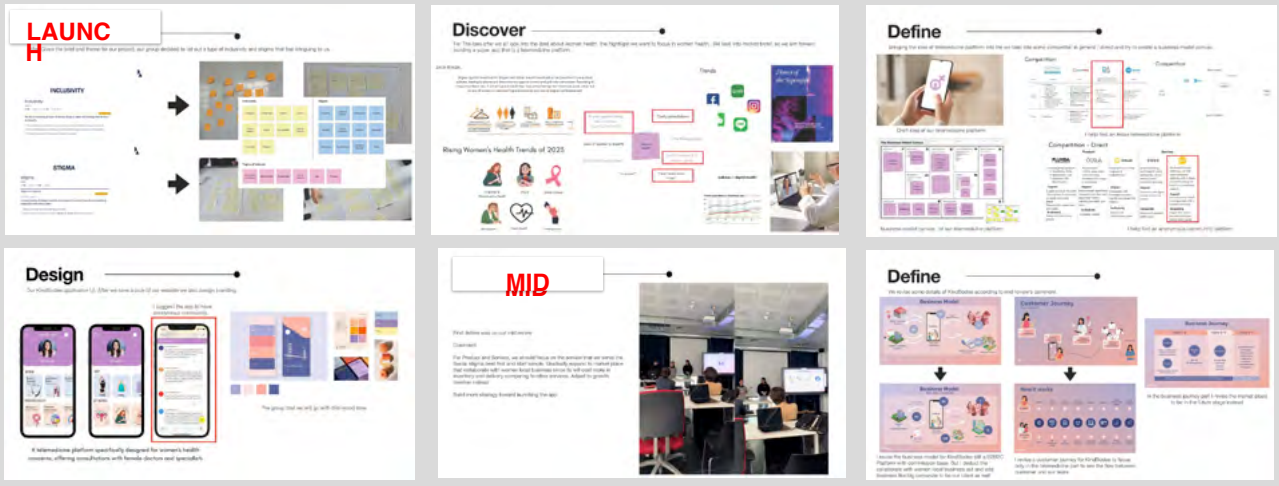
STUDENTS' PROJECT EXAMPLE:



"This commendable project addresses a genuine societal concern, namely the stigma surrounding topics related to women in the Asian market. It amalgamates design and strategic elements within a compelling business model and service framework."
Academic Committee (internal and external faculty)



AN EXAMPLE OF OUR STUDENTS PROCESS BOOK: Learning and Decoding Methods, Design and Business Tools

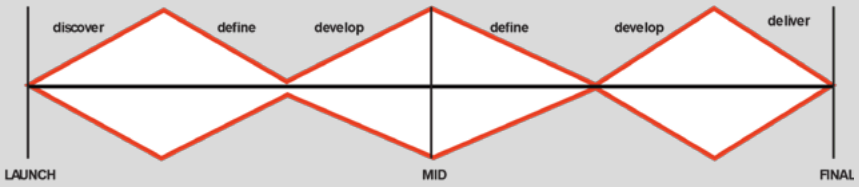


AN EXAMPLE OF OUR STUDENTS PROCESS BOOK:
Learning and Decoding Methods, Design and Business Tools







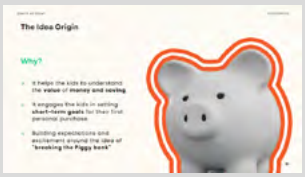


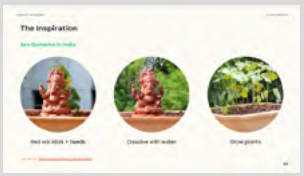
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STUDENTS' PROJECT EXAMPLE:







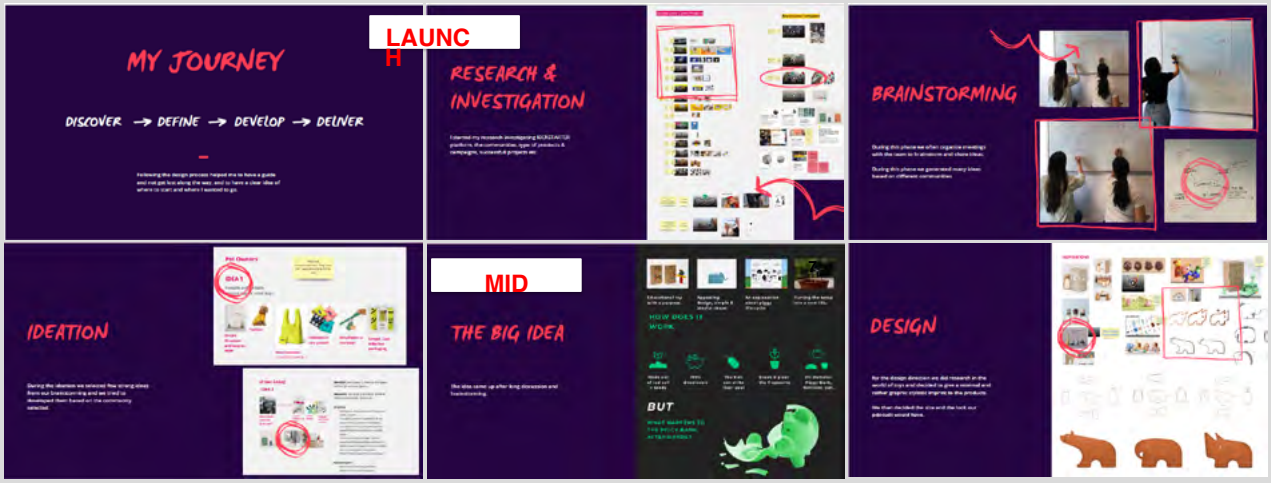






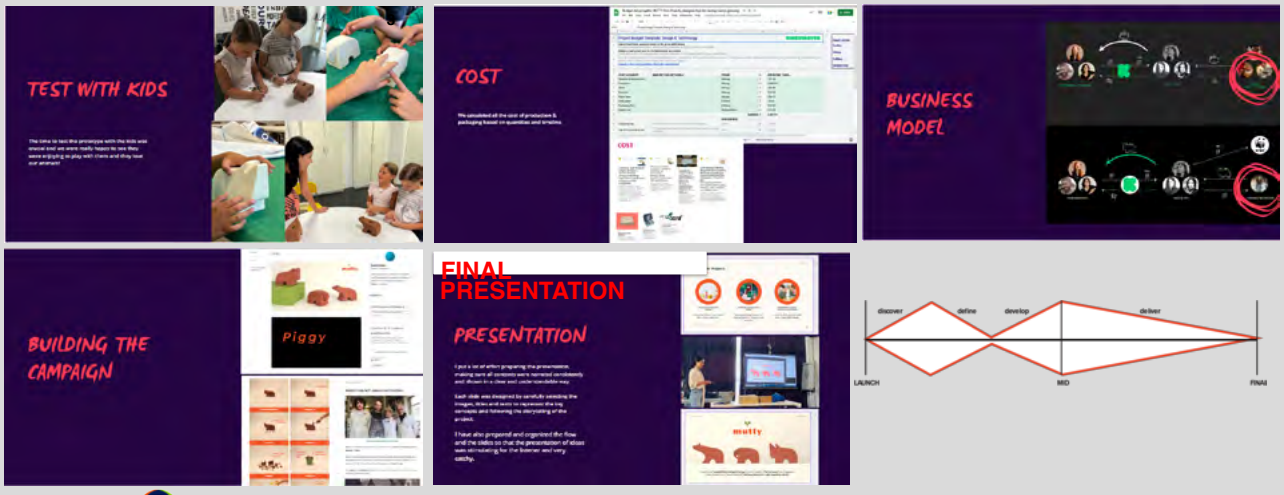
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AN EXAMPLE OF OUR STUDENTS' PROCESS BOOK:
Learning and Decoding Methods, Design and Business Tools



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AN EXAMPLE OF OUR STUDENTS' PROCESS BOOK:
Learning and Decoding Methods, Design and Business Tools



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How Can We Push Innovation by Design?

- Working in **Multidisciplinary Teams**
- Providing a **Format**, the workshop, with custom tools
- Giving a **Process** and its components as “building blocks” that could be adapted by the students and reinterpreted within the format to achieve the goal.

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Mutty by Laura Loria, Enkhjin Ariunbold, Chandana Koganty.

P/REFERENCES OF DESIGN

DESIGN IN THE CONTEXT OF BIOECONOMY: AN EXPERIENCE IN THE AMAZON FOREST.

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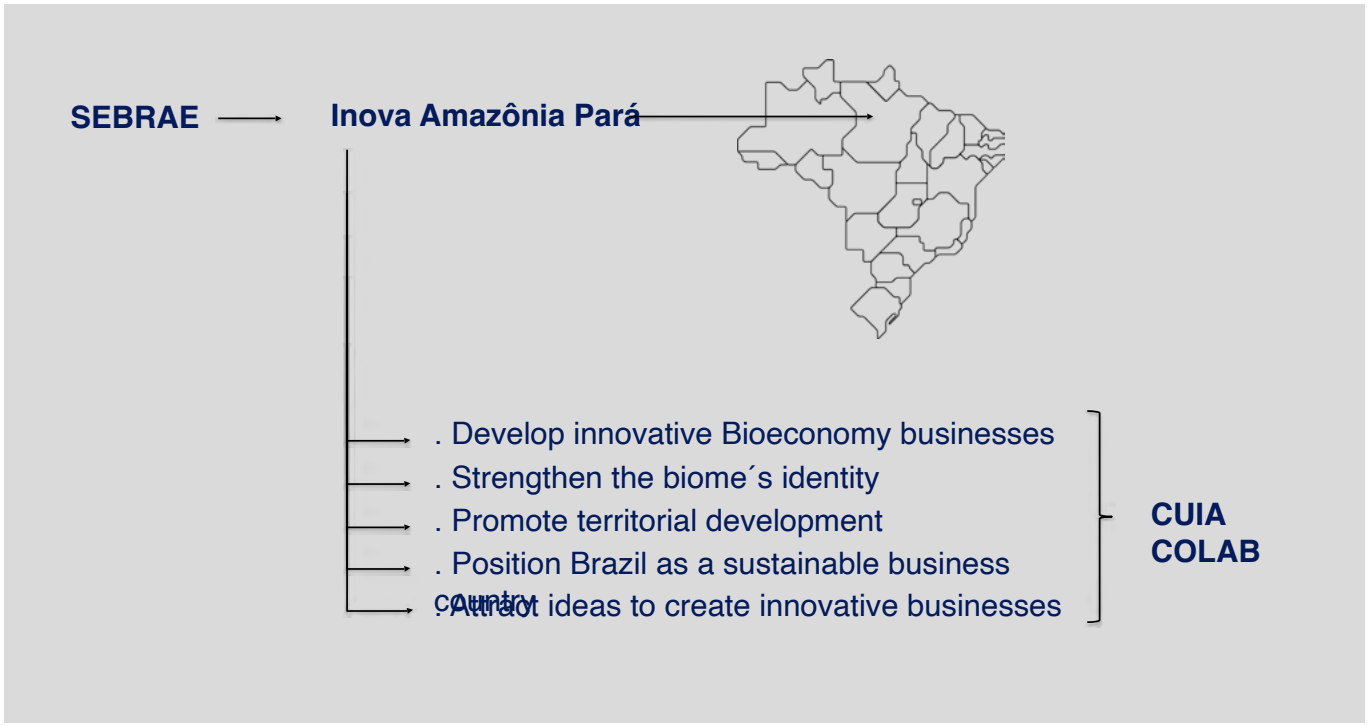
DOI: 10.63442/CXJD1023

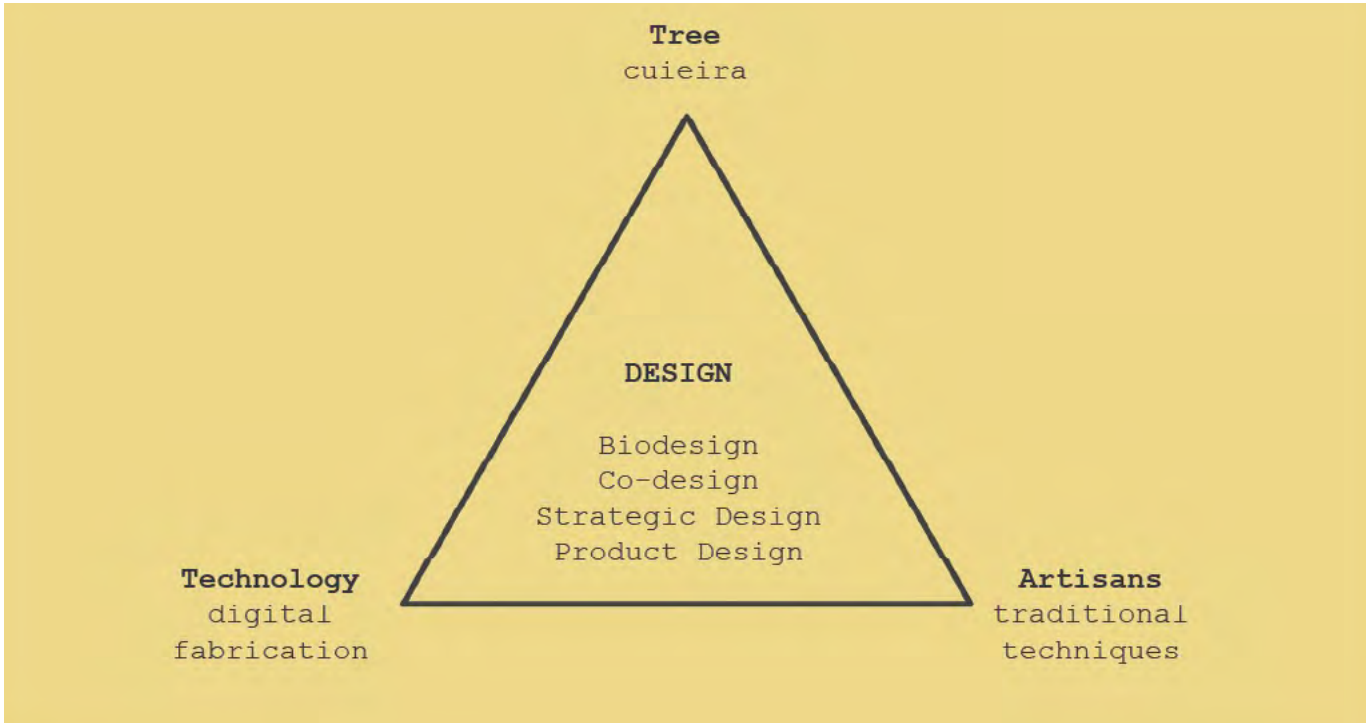
KEYWORDS | BIODESIGN, BIOECONOMY, ANCESTRAL KNOWLEDGE, AMAZON FOREST, HUMAN AND NON-HUMAN INTERACTION

ABSTRACT | In 2021, SEBRAE, the Brazilian Service of Support to Small Entrepreneurs, initiated a call for projects entitled “Inova Amazônia Pará.” Situated in the northern region of Brazil within the context of the Amazon Forest, the primary objective of this call was to stimulate entrepreneurship and innovation through training for the development of products (commodities and/or services) or pioneering processes. The initiative’s goal was to facilitate the transformation of inventive concepts into sustainable enterprises, concurrently fortifying small-scale businesses that integrate novel technologies within sectors related to the bioeconomy. This study scrutinizes the Cuia Colab project (CCp), a design initiative selected as a startup under the abovementioned initiative. CCp centers around a regional item native to Pará: the cuias. They represent traditional artisanal objects crafted from an Amazonian tree, predominantly employed as bowls, vases, and containers. The fundamental objective of the Cuia Colab project was to integrate innovative practices into the cuias’ production process, leveraging their inherent qualities while preserving and promoting the cultural significance of these traditional Amazonian artifacts. It was a collaborative process between technology, artisanal communities, and trees facilitated through design.

Our research question is ‘How does the Cuia Colab project align with biodesign/bioeconomy intentions? Within this framework, Biodesign is a strategic collaborative approach that integrates living beings into developing alternative sustainable materials or products. Meanwhile, the Bioeconomy sustainably produces commodities and services in all economic sectors using biological resources, processes, and techniques. In CCp, we strengthened its Bioecology vision, prioritizing ecological processes, optimizing energy and nutrient utilization, and supporting biodiversity. Our methodological approach encompassed a literature review of these concepts to establish the theoretical/conceptual framework for the subsequent case study analyses. Then, the Cuia Colab process was described, delineating the intervention effects, particularly those that impacted the stakeholders (the artisan communities, the Amazon trees, and the forest – defined as a human and non-human interaction). We explored CCp activities and their correlation with the concepts already defined, providing a structure for critical reflections.

The Cuia Colab adopted a collaborative ethos with trees, viewing them as active agents that modified the initial design procedures. It also advocated forest vitality, fostering positive environmental and social impacts, departing from traditional industrial practices that mainly assert control over resources and prioritizing standardization. Therefore, it moved away from the maximized production pressure to corroborate with the forest’s economic viability. In conclusion, Cuia Colab exemplifies the imperative for reevaluating fundamental design principles and sustainability within the bioeconomic landscape. It can be seen as an example that illustrates the intricate balance between ecological preservation, socio-economic imperatives, and innovative design paradigms. In pursuing a bioeconomy enterprise imbued with ecological design principles, we suggest adopting bio-situated approaches prioritizing biodiversity over scalability. Additionally, it is imperative to demonstrate respect for and a deep understanding of the environment’s custodians and local knowledge systems. By prioritizing these considerations, designers can ensure their endeavors contribute to ecological sustainability while fostering harmonious relationships with local communities and ecosystems.


SEBRAE
Inova Amazônia Pará
. Develop innovative Bioeconomy businesses
. Strengthen the biome´s identity
. Promote territorial development
. Position Brazil as a sustainable business country
. Attract ideas to create innovative businesses
CUIA
COLAB


Tree
cuieira
DESIGN
Biodesign
Co-design
Strategic Design
Product Design
Technology
digital
fabrication
Artisans
traditional
techniques

CUIA
COLAB

objects that grow on trees

How Does the Cuia Colab Project Align with Biodesign/Bioeconomy Intentions?

A strategic collaborative approach that integrates living beings into developing alternative sustainable materials or products.
(Myers, 2018)

A sustainable initiatives that establish, develop, and revitalize economic systems based on the sustainable utilization of renewable biological resources.
Bugge et al. (2019)

Research Methodology

1. Literature review on: _Brazilian Amazon Context
   _Biodesign and Bioeconomy
   _Human and non-human interactions
2. Cuia Colab project as a Case Study
3. Critical reflection, analyses and discussion
4. Conclusions



Artisan Silvane Maduro harvests a cuia in her backyard

Cuia Colab Project PIVOTAL QUESTIONS

_Is producing objects within a paradigm divergent from conventional norms feasible, as was coined by Ginsberg and Chieza's (2018) Biodesign expansive view or even the Bioecology vision by Bugge et al. (2019)?

_How will the project deliver tangible benefits for all stakeholders, including designers, artisans, trees, and clients, respecting Haraway's (2016) notion of 'companion species'?

_How can logistical challenges associated with an Amazonian product be handled ecologically?

_Should the Cuia Colab project persist solely as a business entity producing objects, as Silva et al. (2018) crave when addressing Amazon's potential for Bioeconomy?

_Are there alternative activities or pivots worth considering to embrace Watson's (2019) definition of design as a repository of sustainable practices responsive to environmental challenges?

CONCLUSIONS

. Situated Biodesign and Bioeconomy practices

. Biodiversity before scalability

. Social regeneration before economic growth

SPECU-
LATIVE
PERSPEC-
TIVES

P/REFERENCES OF DESIGN

CUMULUS BUDAPEST 2024

SPECULATIVE PERSPECTIVES: NAVIGATING LIMINALITY.

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b Institute of Advanced Design Studies, Hungary
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DOI: 10.63442/DYTO4166

This year's Cumulus theme began with the understanding that, in an age of polycrisis (Morin and Kern, 1999), refining existing practices is not enough; we must also critically reevaluate the foundational preferences and references of modern design at a systemic level. Our track aimed to gather diverse perspectives on speculative design, pushing the conversation beyond its traditional limits.

Designers have long been seen as problem-solvers, addressing a wide range of human needs and desires. However, as ecological and technological shifts challenge the market-driven, user-centered paradigm (Norman, 1988, Verganti, 2009), designers are increasingly exploring the complexities that arise when acknowledging that design's spatial and temporal dimensions extend far beyond the human scale. This change in perspective serves as a catalyst for new enquiries, in which design ventures into the realm of the speculative, the unconventional, and the transformative. Can design's role extend beyond its established boundaries? Can we consider distant futures, parallel timelines, or alternate pasts? Can we embrace a more expansive design philosophy? These questions guided our thinking about the track.

As co-chairs (Karina Vissonova, Ivica Mitrović, Ákos Schneider), we concentrated on highlighting speculative approaches that address more-than-human (Wakkary, 2021) considerations, broadening design to encompass the interconnectedness of humans, non-humans, the biosphere, and the technosphere. In addition, we explored post-speculative efforts aimed at evolving the practice to better tackle real-world challenges and foster bottom-up changes. Our intention was not merely to present speculative design as a method for imagining future scenarios but to foster a space for reflections that surpass the dominant human- and user-centered context.

The potential topics ranged from critical speculative design to unconventional timescales, material complexities, and the creative hybridization of digital or biological agents, extending to questions of design ontology. We received 70 full paper abstracts, of which 20 were accepted, and ultimately 11 made it into the conference program. Additionally, 19 submissions for slide decks, posters, workshops, and Format X were received, with 10 being accepted. All submissions underwent a double-blind peer-review process, with the involvement of international reviewers.

The selected submissions were organized into four sections. The Design Futures section (chaired by Michael Smyth and Karina Vissonova) explored speculative design practices with a focus on technological futures, space exploration, video game storytelling and urban food systems. The More-than-human Liminalities: Decenterings section (chaired by Ivica Mitrović and Ákos Schneider) speculated on design beyond anthropocentrism, addressing non-human agency, planetary futures, and artistic explorations of dark matter. More-than-human Liminalities: Entanglements (chaired by Ákos Schneider and Zsolt Miklósvölgyi) featured presentations on multispecies engagement, ocean-object network relations, and prototypes for more-than-human coexistence. Finally, the Beyond Speculative Design (chaired by Bruce Tharp and Ivica Mitrović) section featured discussions on activism, political rhetoric, and marginalized local futures. Among the workshops, some aimed to ethically evaluate the provocative gestures of discursive design, others focused on the commodification of emotions, and some examined the post-humanist aspects of digital imagery.

Based on the presentations and discussions, we have formed the overall impression that contemporary design culture (Julier, 2006) is often perceived as being in a liminal phase, where traditional methods are breaking down, while new approaches are yet to fully take shape. This state of transition is marked by uncertainty and challenges to professional identity, making critical speculation a particularly relevant method. However, liminality also implies that any emerging practice may be met with skepticism.

The tools of critical speculative design are being applied across diverse regions and contexts, now clearly reaching beyond gallery settings and educational spheres. This growth suggests that the genre has matured over the past decade, establishing itself within the contemporary design field. Nevertheless, as speculative design becomes more mainstream, there is a concern that it might be absorbed by the very systems it seeks to critique, leading to provocative yet ultimately safe and streamlined visions.

At the same time, post-speculative approaches are increasingly merging with social design and participatory methods. While speculative design is typically associated with envisioning speculative futures or alternative presents (Auger, 2013), there is a growing recognition of the importance of grounding these visions in present-day actions. However, questions arise about whether speculative design retains its critical potency when applied to direct problem-solving. This dilemma fueled the most intense discussions by the conclusion of the conference.

Choosing “more-than-human” as a theme for the speculative tracks proved to be successful. Not only did it generate a significant number of submissions, but it also became the focal point for two out of the four sections. This reflects a growing interest in the convergence of speculative design and more-than-human perspectives, acknowledging that our environment is shaped by more than just human actors—incorporating non-human entities such as animals, plants, or digital algorithmic systems into the equations of design.

In the era of polycrisis, a critical question arises: can we shift our focus from immediate user needs, user experience and interaction to consider other temporal dimensions and material interconnections? Recognizing scales and relationships that extend far beyond the human is, in itself, a speculative endeavor. This may eventually require stepping away from fiction-oriented speculative design towards systems thinking, potentially adopting post-designer-centered, post-user-centered viewpoints. Amid radical ecological and technological transformations, embracing these decenterings and moving beyond the immediate here-and-now is crucial. In this context, critical speculative design may not represent an endpoint but rather a starting

point for departure and decentralization. The shape of a post-anthropocentric design culture remains uncertain; we find ourselves in an in-between state, compelled to speculate.

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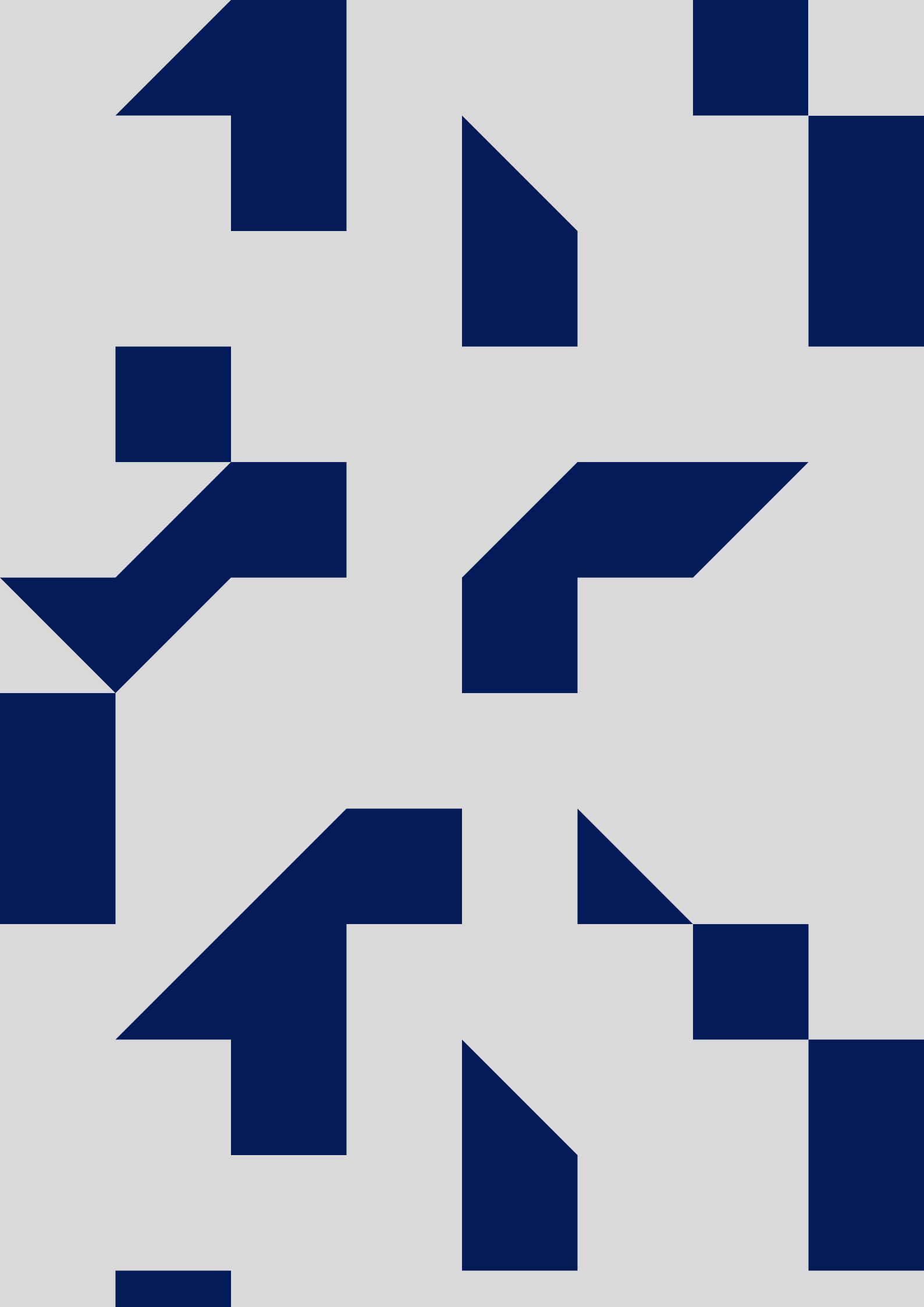
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P/REFERENCES OF DESIGN

SPECULATIVE PERSPECTIVES OF FASHION GAMIFICATION.

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DOI: 10.63442/FWAT6330

KEYWORDS | FASHION GAMIFICATION, SPECULATIVE DESIGN, FASHION EDUCATION, NUDGE THEORY

ABSTRACT | The paper delves into the concept of fashion gamification, which blends elements of fashion and game design, explored as a speculative tool capable of constructing narratives and proposing alternative worlds. These imaginative scenarios present fresh perspectives for the evolving field of fashion in its digital transition, offering an alternative to the current unsustainable model due to its environmental and societal impacts. Such speculative approaches, which question possible futures and promote ethical, responsible design through new languages, are conditioning fashion education. This shift is geared towards training fashion designers capable of dealing with the complex languages of contemporaneity. The very idea of fashion design is undergoing a transformation, moving beyond the design of physical clothes, to express fashion imagery through different channels, both physical and digital. Through the analysis of a series of case studies, including a teaching experience conducted in 2023 at the Università degli Studi di Firenze, the paper will reflect on how speculative approaches to game design can enable fashion to address critical issues, discuss and propose alternative future scenarios, in which today's design decisions can shape tomorrow's realities.

1. Introduction

In her book *Adorned in Dreams*, Elizabeth Wilson (1985) pointed out the continuous 'confusions between the real and the non-real' that characterised postmodern fashion. Since then, fashion has evolved into a dynamic and fast-changing environment, fragmented into a myriad of contents spread across fashion communities on platforms and social networks (Franzo and Vaccari, 2021). The mediatisation of fashion (Rocamora, 2017; 2023) fits into the ecosystems proposed by Digital Culture (Gere, 2009; Miller, 2020) and refers to the transformative power of media (Cottle, 2006; Lunt & Livingstone, 2015) on the practices and experiences of fashion that are increasingly moulded by and for digital media in production, consumption, distribution, and dissemination. Defining 'digital' as a 'culture' – as is done with 'cyberculture' by Lévy (2001), 'information culture' by Manovich (2001), 'Internet culture' by Castells (2002), or 'virtual culture in cybersociety' by Jones (1998) – it suggests a shared set of norms, values, practices, and expectations among a group. Media and digital technologies introduce not just new tools, but new ways of acting and interacting, absorbing all aspects of human relationships and activities, becoming key in shaping social reality.

In the realm of contemporary fashion, digitisation is changing the ways in which companies engage with consumers and the nature of products that, while retaining the intrinsic identity values that characterise them, become immaterial, digital, and interactive. Hence, contemporary fashion increasingly finds itself exploring new channels in which to present its products, construct or reinforce imaginaries, and arouse the public's desire for immaterial, experience-based design outcomes (Särmäkari, 2021). Gaming, in particular, has been an area of particular interest for the fashion system for some years now, due to its ability to materialise worlds and shape expanded realities (Mascio, 2012; Gill, 2020), as demonstrated by the exponential growth of the sector (Amed et al., 2023).

The paper fits into this scenario, exploring fashion gamification – understood as contamination between fashion and game design – not only as a new language adopted by global brands to open up to new generations of consumers but also as a speculative tool capable of constructing narratives and proposals of alternative worlds. These are alternative presents for an evolving discipline in the context of its digitisation, a response to the current model considered unsustainable due to its impacts on the environment and society (Fry, 2009). These speculative approaches, which question possible futures and stimulate ethical and responsible design through new languages, are also conditioning fashion education, which is increasingly aimed at training fashion designers capable of dealing with the complex languages of contemporaneity. The very idea of fashion design is being reconfigured, and it is understood that it can no longer be limited to the design of physical clothes, but leads to the expression of fashion imaginaries through different channels, both physical and digital (Bogost, 2008; Smitheram, 2015).

The paper will therefore analyse the emerging role of gaming in the fashion system: both as a process of constructing virtual worlds, which contribute to giving shape and reality to the imaginaries of global luxury brands and as the outcome of speculative approaches that incentivise a paradigm shift. These two perspectives will be defined through a review of existing literature and investigated through the analysis of some significant case studies, including the experience conducted in 2023 at the Università degli Studi di Firenze. Students were asked to design a game conceived as an expansion of the activity of a fashion brand or institution, with the aim of generating greater public awareness of the impacts of fashion and, through the playful experience, conveying a message and incentivising a paradigm shift. The methodologies of speculative design (Auger, 2013; Dunne & Raby, 2013; Malpass, 2013) were combined with those of nudge theory (Walcher & Zotz, 2016; Thaler & Sunstein, 2008), leading students to imagine and design figural systems in which players gain knowledge and improve their behaviour.

The aim of this paper is, therefore, to reflect on how speculative approaches to game design can enable fashion to address critical issues, and discuss and propose alternative future scenarios, in which today's design decisions can shape tomorrow's realities. In this way, game design in fashion takes shape not only as the creation of imaginative experiences but also as a powerful tool for reflection and change.

2. Playing Fashion

The contemporary landscape is characterised by an increasing trend towards virtualisation and the gamification of various aspects of life, including communication, collaboration, learning, consumption, and entertainment. Advances in gaming technology have sparked interest in the use of digital games beyond traditional gaming contexts, exploring their utility in non-game environments (Alexiou & Schippers, 2018). Numerous studies have focused on the positive impact of gaming and the act of playing on developing critical cognitive, emotional, and social skills (Caponnetto et al., 2014; Granic et al., 2014; Qian & Clark, 2016). Furthermore, gaming has been explored as a means to stimulate specific behaviours, such as encouraging sustainable fashion consumption (Waydel-Bendyk, 2020). This approach is often referred to as gamification, which Huotari & Hamari (2017: 25) define as 'a process of enhancing a service with affordances for gameful experiences in order to support users' overall value creation'. In the realm of fashion, brands are leveraging gamification and game experiences to engage customers actively and personally, maintaining high levels of attention and proving economic advantages (Amed et al., 2023).

Gaming is a domain that is inherently rooted in digital interaction and immersive storytelling. It facilitates engagement in unique ways, offering immersive experiences through the development of innovative and customised customer journeys, fostering a creative and interactive narrative around a brand and its legacy. Through gaming, fashion finds a novel conduit to these audiences, offering experiences that are not only visually compelling but also culturally resonant and emotionally engaging. It also highlights the increasing importance of virtual environments in shaping consumer experiences and cultural trends. Much of this shift can be attributed to the habits of younger generations, who are increasingly investing resources, both in terms of time and money, into shaping their digital lives (Bain 2021).

This trend is prompting fashion brands to seize the opportunity to remain culturally relevant and experiment within digital ecosystems. From social media to the metaverse, fashion brands are teaming up with game developers to enhance their visibility among younger consumers. Furthermore, in the digital realm, avatars are perceived as reflections, extensions, or simulations of the player's identity, as discussed by Jin (2012) and Mancini & Sibilla (2017). This concept aligns seamlessly with the notion of 'possible selves' (Markus & Nurius, 1986) as the imaginative projection of a person's future identity or who they might become. This connection establishes a direct link to the social dimension of fashion. Avatars, akin to fashion products, enable users to explore different identities and styles, reflecting 'the me I want you to see' (Wood & Szymanski 2020). Consequently, avatars transcend their role as mere tools for personal expression and become mediums for social and cultural reflection, influencing perceptions and trends in the physical world. This highlights the increasing importance of digital fashion in shaping identity and belonging, marking a significant shift in how fashion is perceived and experienced in the digital age.

Recent collaborations between fashion brands and game developers have opened new avenues for designers in both fields to explore and define the roles of garments in digital environments (Gibson, 2021; Makryniotis, 2018). Such collaborations at the intersection of fashion and gaming can be broadly classified into three distinct categories, as identified by Alice Noris, Nadzeya Sabatini, and Lorenzo Cantoni (2023): 'Gamification in Fashion', 'Fashion in Games', and 'Fashion Games'. While the latter refers to video games where fashion is the central theme, such as characters to be dressed up, and fashion-related work activities, the first two categories, 'Gamification in Fashion' and 'Fashion in Games', are where fashion brands have particularly focused their attention, leading to innovative experiments in recent years. In 'Gamification in Fashion', brands integrate gaming principles into non-gaming contexts, enhancing the consumer experience with elements commonly found in video games. This approach has seen fashion brands create interactive campaigns, virtual worlds, and digital experiences that go beyond traditional marketing, offering customers an engaging and immersive journey that aligns with the interactive nature of games. 'Fashion in Games' involves the integration of fashion into video games that are not primarily about fashion. This has led to innovative partnerships where fashion brands collaborate with game developers to incorporate their designs and products into game worlds.

The burgeoning interest of fashion brands in gamification is deeply rooted in gaming's ability to build and bridge brand images to younger generations and to effectively market both digital and physical collections (Kim et al. 2012, Lau & Ki 2021; Ryder 2022). Additionally, games serve as platforms for brand co-creation experiences, allowing consumers to engage directly with brands, thus adding a novel dimension to customer involvement (Nobre & Ferreira 2017), transforming the online retail experience by creating interactive and immersive environments (Insley & Nunan 2014) and becoming a powerful marketing tool to deliver captivating digital experiences and extend their reach (Milanesi et al. 2022).

However, for the objectives of this contribution, it is particularly noteworthy to expand the discussion on hybrid practices in fashion and game design. Exploring the role of gamification as a tool to foster systemic change within the realm of sustainable fashion is critical to further contextualising and addressing existing research gaps (Joy et al. 2022; Milanesi et al. 2022). This leads to the emphasis on systemic change, which can be effectively catalysed through speculative perspectives. Such perspectives challenge the existing status quo and open up possibilities for new paradigms: Both the fashion and gaming industries, in this context, do not just mirror the world as it currently is, but rather focus on envisioning the world as it could be.

The issue of sustainability in fashion is complex and multi-dimensional, necessitating a comprehensive systemic change to adequately address its array of challenges. The present state of the fashion industry requires a profound reassessment of its foundational practices and structures (Fletcher, 2010). In this regard, speculative perspectives can be instrumental in envisioning alternative futures and challenging established norms, thereby paving the way for transformative changes.

3. Game as a Speculative Approach

The previous section analysed how gamification is a process adopted in recent years by many fashion brands in order to expand and diversify their narrative modes, strengthen their imagery and involve new customers, especially the younger generations. Now fashion gamification will be analysed as an expression of speculative design. The contribution, in fact, argues that the playful approach can represent a way of imagining alternative and desirable futures, and possible changes in visions and practices, with the aim of redirecting the present, which is considered unsustainable.

The definition of experimental and speculative design encompasses a wide range of practices that lie at the crossroads of design, activism, visual culture, and sociology, and that utilise inventions, fantasies, and uchronic stories beyond the promotional aims and objectives of industrial production. As James Auger (2013, p. 11), a researcher at the Royal College of Art, points out, speculative design is an area that is intertwined with critical design, discursive design, design probes, and design fictions, developing projects away from the commercial approach, promoting research through models and prototypes, using fiction to present alternative products, systems or worlds. As he points out, alternative presents are design proposals that utilise contemporary technology but apply different ideologies or configurations.

Speculative practices thus live in close relation to the future, a time that takes on different characteristics in relation to the present. Starting from a critical theory approach to design, Anthony Dunne and Fiona Raby considered design as a tool for creating ideas, stimulating 'social dreaming' and speculating on possible futures. In their manifesto, they contrasted design 'in the service of industry' with design 'in the service of society'; design that has 'fictional functions' with design that has 'functional fictions'; design that 'changes the world to suit us' with design that 'changes us to suit the world' (Dunne & Raby, 2009). Shifting design from the logic of profit to the space of reflection, they developed a theorisation of the future – or, rather, futures – from the theories of futurologist Stuart Candy. Three typologies are identified: the probable future, in which most designers operate and which only an extreme event can prevent from occurring; the plausible future, which could actually happen; and the possible future, which derives from critical reflection on the present and the imagination of alternative scenarios (Dunne & Raby, 2013, pp. 3-4).

These approaches provide challenging exploratory devices, 'as they allow the exercise of design to be removed from contextual and production constraints' (Quinz, 2020). However, as for practice, the resulting design outputs turn out to be often artifact-totems (intentionally) distant from industrial reality, and, for this reason, they may activate potentially revolutionary conversations and provocations, while not triggering a concrete transition to alternative futures stemming from everyday life. If it is true that 'we are creating the world to be understood, not merely understanding the created world' (Holt, 2016), design for transition seems to inhabit two complementary times: on the one hand, a progressive present, in which design acts; on the other, a near-future towards which design directs its action.

Picking up on the reflections of Jonathan Lukens and Carl DiSalvo of the Georgia Institute of Technology, therefore, a speculative approach makes it possible to verify the current limits of design and go beyond them (Lukens & DiSalvo, 2011, p. 26). Underlying this perspective is the idea that it is no longer possible to wait for the user-consumer to change, but that it is necessary to propose a new vision, a different design from what exists, and to rethink creative and production dynamics. A central role is attributed here to the designer, who once again plays an active role in redirecting design practices with the aim of building a sustainable future. As Cameron Tonkinwise (2015) points out, what designers make becomes the future we inhabit. This is the 'futuring' approach described by Australian design theorist Tony Fry (2009; 2010). In this way, designers are tasked with contributing to the identification of possible political alternatives to the current productive, social, and cultural scenario, which Fry has openly criticised as inevitably defuturing. Design is thus the catalyst for change, due to its influence and relevance to the economy, industry, technology, ecology, culture, community, and territory. In order to be in dialogue with contemporaneity, it has the task of considering and promoting the concept of 'sustain-ability', which includes the actions and skills needed to sustain life, cultures, ideas, imaginaries, the environment and people. Underlying futuring are practices of redirection, capable of shifting paradigms, materialising ideologies, shaping interactions between people, and delineating new scenarios (Vaccari & Vanni, 2021). The disciplinary contamination of design with future studies is not recent, but it seems to emerge in times of crisis.

While speculative approaches have been theorised in the field of design for some years, there is still limited research on speculative fashion, to which fashion gamification can be traced according to the reading proposed by this contribution. Speculative fashion, in fact, refers to a fashion that does not yet exist, hypothetical, but which could give real indications as to what fashion could be or could become (Vaccari & Franzo, 2022). It also shares a certain sense of urgency and social and political engagement. On the one hand, it allows one to think about and imagine the future; on the other, it represents a critique of present and current practices. This is the 'What If?' perspective, theorised by Caroline Evans and Alessandra Vaccari (2020) in their reflection on uchronic time in fashion, understood as alternative history, which allows for the construction of fantastic scenarios from facts and characters that really existed, and as invented time, but with real repercussions that can be revisionist or experimental. Uchrony involves imagined and fictional times and, as such, allows for the development of innovative thoughts and narratives. It encompasses a variety of phenomena, including not only utopian legacies, when a fashion brand reinvents its history, and trendforecasting, when predictions of the future are commercially motivated, but also fashion gamification, made possible by digital fashion image-making.

The framework proposed by this contribution introduces an additional element that helps to understand and interpret the phenomenon of fashion gamification: the nudge theory, characterised by methodologies geared towards modifying people's behaviour through play and curiosity (Cai, 2019). As will be analysed in the following chapter, some examples of fashion gamification use the vector of play to improve user-consumer behaviour and bring about a better reality. In their bestselling book Nudge: Improving Decisions about Health, Wealth and Happiness (2008), economist Richard Thaler and legal scholar Cass Sunstein argue that simple 'nudge' techniques can help us break bad habits and make a range of choices in our own best interests (see also Sunstein, 2015; Thaler, 2015; Thaler and Sunstein, 2003a, 2003b, 2006). Thaler and Sunstein argue, however, that behavioural techniques have the potential to positively transform a wider range of societal problems, from racism, to suicide, to climate change (see also Halpern, 2015). These kinds of indirect prompts are much more effective in getting people to modify their habitual behaviour than more heavy-handed approaches.

4. Case Study Analysis

Some case studies will now be analysed to illustrate the two main trajectories characterising the relationship between fashion and game design. Together, these cases illustrate the diverse strategies fashion brands are employing to navigate the evolving landscape of digital engagement, showcasing the potential of gaming as a medium for innovative brand storytelling, audience expansion, and speculative design in fashion.

4.1 Louis Vuitton and League of Legends

In a pioneering instance of cross-industry collaboration, the year 2019 witnessed a landmark partnership between the luxury brand Louis Vuitton and Riot Games, the developer behind the esports phenomenon *League of Legends*. This collaboration signified a groundbreaking convergence between the world of high fashion and the realm of competitive esports, reflecting an innovative melding of distinct industry spheres. The collaboration encompassed multiple facets, beginning with the creation of a trophy case for the *League of Legends* World Championship. The finals of this esports event were held on November 10, 2020, in Paris, providing a global stage for this unique partnership, marking a significant cultural and commercial intersection, blending the traditional artisanship of a high-end fashion brand with the dynamic world of competitive gaming. The collaboration between Louis Vuitton and Riot Games reached a notable milestone with the unveiling of the *Louis Vuitton x League of Legends* capsule collection, designed by Nicolas Ghesquière in partnership with Riot Games. This collection, focused on womenswear and genderless garments, stands as a tribute to Qiyana, a female protagonist in League of Legends. Ghesquière had previously designed Prestige skins for Qiyana, featuring the signature aesthetics of Louis Vuitton, blending the world of high fashion with digital gaming culture.

This capsule collection represents a significant fusion of luxury fashion and virtual gaming iconography, demonstrating how a fashion house can effectively translate its design ethos into the realm of esports. By focusing on a female character from the game, the collection not only celebrates the influence of digital characters in contemporary culture but also showcases the potential of esports and gaming platforms as powerful channels for fashion expression and storytelling. The partnership between Ghesquière, Louis Vuitton, and Riot Games exemplifies a forward-thinking approach to design, where the boundaries between the virtual and the physical, the digital and the couture, are seamlessly blended.

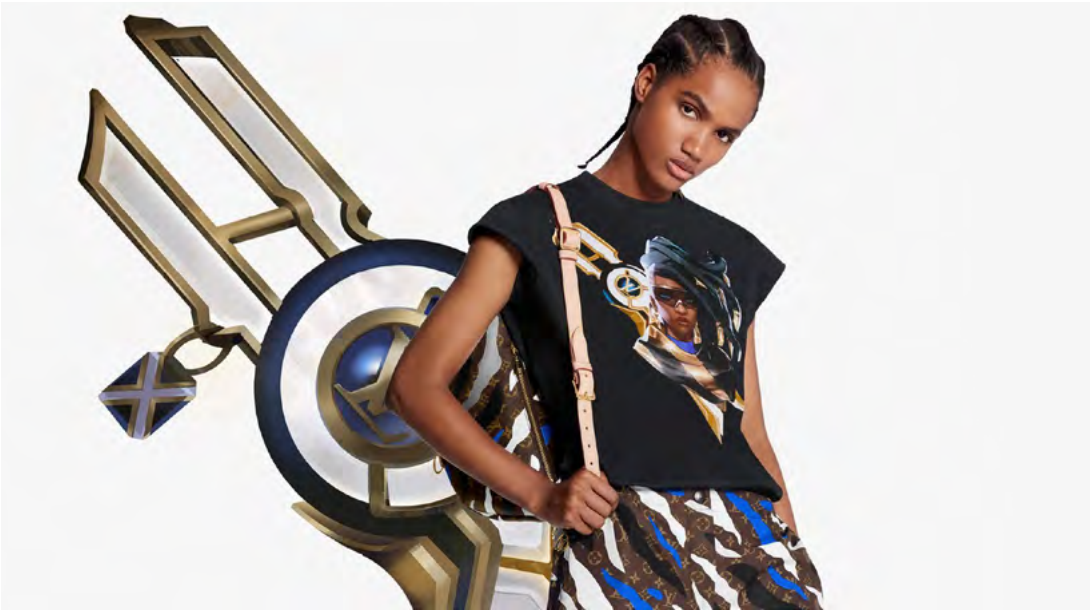


Figure 1. Louis Vuitton x League of Legends collection, 2019.

4.2 Balenciaga Afterworld

The Balenciaga *Afterworld* project represents a significant venture at the intersection of high fashion and digital gaming. In this initiative, Balenciaga extended its creative expression into the realm of digital gaming. Afterworld is an ambitious and immersive gaming experience that transcends the traditional bounds of fashion presentation. Set in a speculative future, *Afterworld* not only showcases Balenciaga's collection but also invites players into a narrative-driven journey through meticulously designed virtual environments. The game is set in the year 2031, offering a dystopian yet captivating vision of the future. Players navigate through various levels, each one of them specifically designed to reflect the thematic elements of Balenciaga's collection and the broader narrative of the game.

The integration of fashion into this gaming experience is seamless and intrinsic, with the game serving as a platform for showcasing Balenciaga's designs. The virtual avatars within the game are adorned with pieces from the collection, allowing players to interact with and experience the fashion in a dynamic, three-dimensional space. This approach to fashion presentation is groundbreaking, blending storytelling, gaming, and fashion design into a cohesive and immersive digital experience. *Afterworld* is not just a game; it's a visionary exploration of the possibilities of fashion in a digital context. It represents a paradigm shift in how fashion can be presented and experienced, moving beyond conventional runways and lookbooks to interactive and narrative-rich digital platforms. This project exemplifies how luxury fashion brands can leverage digital technology to create novel and engaging experiences that resonate with contemporary audiences, particularly those familiar with and immersed in digital gaming cultures.



Figure 2. Balenciaga Afterworld, 2021.

4.3 Max Mara Coat Adventures

This is a game within the Roblox platform, in which it is possible to witness the integration of immersive experiences and educational content in the realm of fashion gaming. This game, launched in 2023, proposes a virtual world, characterised by an imaginative landscape where traditional elements of fabric and textile manufacturing are reimagined: meadows transform into expanses of fabric and trees as colossal spools. Here, players navigate a rollercoaster carrying iconic 101801 coats, illustrating a creative interplay between fashion elements and gaming dynamics. *Max Mara Coats Adventure* is segmented into three primary zones: *Pattern Lab*, a virtual tailoring workshop; *Color Parkour,* a navigational challenge focused on collecting colour spheres that align with the brand's colour palette; and *WunderKammer*, a fantastical labyrinth co-created with the artistic collective Atelier dell'Errore from Reggio Emilia. In this section, participants can engage in the creative assembly of mythical creatures, known as 'daimons', which accompany the avatars of the players, adding a layer of personalisation to the user experience.

A relevant aspect of this gaming environment is its educational dimension. *Max Mara Coats Adventure* offers not only an engaging gaming experience but also educational insights, ranging from historical and cultural information about the textile industry to collaborative challenges that promote collective achievement within the game. This case study is a significant example of how fashion brands can expand their outreach into digital gaming platforms, effectively merging brand promotion with educational and community-building objectives. The game serves as an innovative model for how fashion can be recontextualised within digital environments, providing insights into the potential future trajectories of fashion branding and consumer engagement.

4.4 SUNNEI Canvas

SUNNEI Canvas, an initiative by the Italian fashion brand SUNNEI, combines traditional elements of design with cutting-edge digital technology. Launched in July 2020, the *SUNNEI Canvas* collection introduced a gender-neutral clothing line, presented through Computer-Generated Imagery (CGI) models. This approach was particularly resonant at a time when the world was adapting to life during the pandemic, with many people confined to their homes. On SUNNEI's digital platform, top retailers were given the opportunity to personalise their orders, allowing them to modify the design, shapes, and even the materials of each creation. This initiative marked a significant step towards reducing environmental impact, as it eliminated the need for physical samples. Moreover, it enhanced the direct relationship with buyers, allowing them a greater degree of involvement in the design process. This approach not only reflected Sunnei's commitment to sustainability but also its dedication to fostering stronger connections with its retail partners.

In further advancement of this concept, the *SUNNEI Canvas* collection went into the digital realm with the Fall/Winter 2021 presentation. SUNNEI elevated the digital aspects of its work by showcasing the collection within a video game environment. This platform featured 3D characters performing in a paradoxical, never-ending game, offering an avant-garde and limitless approach to fashion presentations. In this virtual setting, ten avatars were available for customisation with different outfits from the FW21 collection. Each avatar could transition through various looks, symbolising the continuous cycle of fashion trends.



Figure 3. SUNNEI Canvas, 2020.

4.5 Metamorphic Fashion Design

Metamorphic Fashion Design, conceived in 2020, is an educational project undertaken at the Università degli Studi di Firenze in collaboration with Fondazione Sistema Toscana – Manifatture Digitali Cinema. This initiative, born in the midst of the global pandemic, seeks to address the pressing issues of our time by

merging the worlds of fashion and gaming, particularly by using gaming as a tool to explore central themes in contemporary fashion. At the heart of *Metamorphic Fashion Design* is the exploration of protection as a concept, drawing inspiration from the natural world. The project delves into phenomena such as mutation, mimicry, symbiosis, and collaboration, mirroring these natural processes in a digital 'forest' setting. This environment serves as a backdrop for an array of unique characters, including grasshoppers, peacocks, bees, and aliens, which transcend traditional storytelling through metaphysical narratives and conceptual elements. The characters in this project are adorned in garments designed and adapted to the game context by students from the Università degli Studi di Firenze. The designs, which emphasise low environmental impact, no-gender principles, and multi-layered fashion, bring the narrative to life. They form a virtual collection that not only highlights sustainability and adaptability in fashion but also demonstrates the potential of digital technology in fashion design.

Metamorphic Fashion Design exemplifies the intersection of digital technology, environmental awareness, and cutting-edge fashion design within an educational framework. The project aims to redefine how fashion is presented and perceived, integrating contemporary themes and challenging conventional fashion paradigms. It showcases how digital platforms, used as an educational tool, can reorient the way fashion is taught, communicated, and experienced, making it a valuable case study for contemporary fashion education. This approach reflects the evolving needs of the fashion industry and the importance of integrating innovative methods like gaming into fashion education to address central themes in the contemporary fashion landscape.



Figure 4. Metamorphic Fashion Design, 2020.

4.6 Game Design Course

Concluded in January 2024, the Game Design course within the MA Degree Course in Fashion System Design at the Università degli Studi di Firenze was conceived as an educational journey, merging the worlds of digital gaming and fashion. In this course, students were challenged to design games as extensions of fashion brands or institutions, aiming to increase public awareness about the fashion industry's impacts. The course's approach combined playful experiences with educational content to convey meaningful messages and encourage behavioural changes, as well as a shift in perceptions of fashion among brands, institutions, or consumers. Throughout the course, students explored a speculative design approach to game design, allowing them to envision and create future scenarios, challenging the existing norms and practices of the fashion industry. In addition, the course incorporated nudge theory principles, to subtly

guide player behaviour within the game environments. This integration of nudge theory encouraged the development of games that not only inform but also influence player behaviour towards more responsible and sustainable fashion practices. The culmination of the course saw the creation of 'figural systems' – interactive and immersive game environments where knowledge acquisition and behaviour improvement were key objectives. These systems were designed to be both informative and engaging, offering players a platform to learn about the fashion industry's impact while enjoying a compelling gaming experience. The students' final projects demonstrated a deep understanding of how game design could be utilised as a powerful tool for communication and change within the fashion industry. Moreover, the course highlights the potential of integrating game design with fashion studies. It showcased how digital platforms could be effectively used to address critical issues in the fashion industry, offering a novel way to educate and engage both students and audiences about sustainability and responsible consumption.

4.7 Discussion

The collaboration between Louis Vuitton and *League of Legends* exemplifies the experimental efforts made by fashion brands to engage new audience types, such as esports players, showcasing how luxury fashion brands are reaching out to the gaming community. Meanwhile, *Max Mara Coat Adventures* represents a case of creating digital worlds that intersect brand communication with edutainment, reflecting an innovative approach to brand storytelling through in-game immersive digital experiences. Balenciaga's Afterworld project offers a profound insight into the interpretation of fashion gamification as an act of speculative design. This case highlights how fashion brands can use digital platforms not only for marketing but also for envisioning and presenting speculative futures. *SUNNEI Canvas* exemplifies a pioneering approach to fashion presentation and consumer engagement. By integrating digital technology and interactive gaming elements, SUNNEI has not only expanded the boundaries of fashion marketing but also illustrated the potential for digital platforms to revolutionise the way fashion is consumed and experienced.

Adding to this discussion of case studies, *Metamorphic Fashion Design* explores the use of gaming in fashion education as a tool to address key themes in contemporary fashion, such as environmental sustainability and adaptability. This project offers a fresh perspective on fashion communication and demonstrates the power of digital storytelling in fashion education. Furthermore, the Game Design Course underscores this educational approach, where students design games that extend the activities of fashion brands or institutions, aiming to increase awareness and encourage behavioural changes in the context of fashion's impact through speculative approaches.

These case studies collectively illustrate the evolving landscape of fashion in the digital era, underscoring the significant potential of gaming and digital platforms as influential tools for creative brand storytelling, broadening audience reach, and emphasising the importance of speculative approaches in fostering a shift towards sustainability in fashion. The array of strategies adopted by these fashion brands, along with the educational experiences conducted at the Università degli Studi di Firenze, marks a shift into a new form of Digital Game, where responsibility and social consciousness are proportional to the complexity of the virtual reality created.

This evolution represents a shift in the fashion industry's approach to engagement, moving beyond mere entertainment to embed deeper social and environmental messages within the gaming experience. The case studies demonstrate how fashion brands are effectively using digital platforms not just for marketing, but also for conveying contemporary relevant messages about sustainability and responsible consumption. The educational experiences at the Università degli Studi di Firenze, in particular, highlight how academic institutions can play a pivotal role in shaping the future of fashion by integrating gaming and digital technologies into their curricula.

5. Conclusions

In conclusion, this article aimed to capture the essence of how the fashion industry, through its engagement with digital and gaming platforms, is adopting speculative approaches to tackle complex, multifaceted challenges. As highlighted by Dunne and Raby (2013), this approach 'thrives on imagination and aims to open up new perspectives', creating spaces for discussion and debate about alternative ways of being. This is particularly evident in the ways fashion has embraced gamification and speculative design, moving beyond traditional paradigms to foster engagement, community building, and the strengthening of brand narratives.

The potential of gamification to motivate individuals to share knowledge, become part of a community, and reinforce the imagery of a product or brand has been increasingly recognised (Kwon et al., 2015; Swacha, 2015; Silic and Back, 2017). This recognition aligns with Bergonse's (2017) definition of a videogame as a mode of interaction within a meaningful fictional context, sustained by emotional attachment. This engagement transcends the mere consumption of fashion, involving players in a narrative that intertwines the virtual with the real. Hence, understanding fashion's attempts to engage with newer, younger audiences, such as gaming communities, requires exploring the mechanisms of fiction, blending the imaginary with reality, and creating narrative planes where fantasy, suggestion, and adventure intersect with real-life experiences.

The digital world, in its production of dematerialised identities, feeds on and contributes to new values and practices (Rocamora, 2023). The close link that is consolidated between physical and digital reality can be more easily grasped if we move away from understanding 'virtual' as a term exclusively referred to cyberspace (and thus as something illusory that differs radically from physical reality) to embrace the term in its original meaning, i.e. as something 'real without being actual, ideal without being abstract' (Proust as cited in Rob Shields, 2005) in other words as a 'plane of immanence', as a site of generative potentiality that is delineated through actualisations in daily life (Deleuze, 2005).

Thus, the cases studied here – from Louis Vuitton's collaboration with *League of Legends* to *Max Mara's Coat Adventures*, Balenciaga's *Afterworld*, *SUNNEI Canvas*, *Metamorphic Fashion Design*, and the Game Design Course at the Università degli Studi di Firenze – demonstrate a shift in fashion towards a more immersive, interactive, and imaginative realm. These initiatives highlight how fashion capacity in crafting narratives, and experiences, and engaging with contemporary societal issues, particularly sustainability. The integration of digital tools in higher education, as explored by Bain (2021), Bertola & Colombi (2021), Särmäkari (2021), Tepe & Koohnavard (2023), and Varra (2021), presents opportunities for creating alternative fashion-related experiences in digital and hybrid spaces. This approach prepares future digital fashion designers to break from traditional norms and develop practices and values unique to digital environments (Logaldo, 2016; Särmäkari & Vänskä, 2022; Thiel, 2017).

Ultimately, by embracing gaming and digital technologies, the fashion industry is not only expanding its reach and reshaping its narrative techniques but is also significantly contributing to broader cultural and social discourses. This transformative phase in the industry signifies fashion's evolution into a medium for storytelling, community engagement, and addressing global challenges, redefining its role in contemporary society.

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P/REFERENCES OF DESIGN

COUNTER-RHETORICAL DESIGN: USING POLITICAL RHETORIC AS A DESIGN FRAMEWORK.

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KEYWORDS | SPECULATIVE DESIGN, COUNTER-RHETORICAL DESIGN, MONETARY AND ECONOMIC VISIONS, COUNTERFACTUALS, SPECULATIVE AND CRITICAL DESIGN

ABSTRACT | Rhetorical discourse within the political sphere appears evermore meaningless and impotent to the complex challenges within contemporary society. This is partly due to the influence of social media, changing the dynamic of communication, and the limitations of traditional rhetorical devices to persuade and communicate new or original ideas. Through this research, we explore how speculative and critical design methods might be utilised within political discourse to communicate the unfamiliar by co-opting the familiar rhetoric from the past or present. We term this approach counter-rhetorical design, a subgroup of speculative design that utilises past failed rhetorical arguments as a framework to propose implementable solutions based on the original objectives represented by the rhetorical device. The results from this research project consist of two case studies created using the counter-rhetorical design approach. It concludes with an outline of future opportunities and further research which might enable new modes of political persuasion, or methods to bring specificity and content to the future political discourse.

1. Introduction

Traditional rhetoric in the political arena appears increasingly meaningless and ineffective in addressing the wicked problems that confront us globally. This aligns with the declining public trust in politicians, which Ipsos (2023) reports is at its lowest in four decades.

This paper proposes that social media's instant, omnipresent, and diverse feedback loops have negatively impacted how the public perceives political rhetoric. Digital media, as pointed out by Flanagin & Metzger (2017), makes it difficult for people to assess the credibility of the available sources due to their sheer number and the challenges of verifying their authors' intentions and expertise, reflecting a public credibility erosion in political speech. Moreover, Coe's (2015) concept of narrowcasting, where social media enables the possibility to target specific political messages to specific groups, not only alters the delivery of political messages but also fosters political division and scepticism towards political statements outside one's social media echo chamber. Despite its long-standing role in political engagement since ancient Greece, political rhetoric must be reconsidered and updated to suit our intricately connected modern society.

This paper aims to show how contemporary challenges associated with political rhetoric might be addressed by utilising speculative design methods and tools, thereby facilitating the development of concrete and impactful political propositions. Here, we introduce the concept of Counter-rhetorical design. This approach borrows from speculative design methods and uses counterfactual conditionals—hypothetical scenarios describing situations and their outcomes—to show what would have happened under different circumstances.

The counter-rhetorical design aims to unveil the fallacies within political rhetoric about ineffective, deceptive, or manipulative ideas, typically propagated by those in positions of power or influence, political figures, or movements, or by advertisements or campaigns. Borrowing from James Augers' notion of 'alternative presents' (Božanić, S., & Bertalanič, P. 2019), it seeks to envision how the world might look if these ideas had come to fruition. Counter-rhetorical design is not a futuring device but a fictional present generator. It challenges historical political rhetoric by illustrating its unfulfilled promises through speculative 'present-day' scenarios.

This paper presents two counter-rhetorical design project case studies: 'Trickle-Down' and 'Level Up.' Trickle-Down revisits the 1980s, proposing a new function of money that makes income tax redundant by directly redistributing wealth between people's banks or saving accounts. This system and its associated devices reflect the principles of classical liberalism and free-market capitalism advocated by Friedrich Hayek and popularised by the rhetoric of Margaret Thatcher and Ronald Reagan. Conversely, the 'Level Up' project introduces a variable geographical tax rate for a new central bank digital currency (CBDC pound), based on the 'Levelling Up' rhetoric used by Boris Johnson's government to gain power in the 2019 general election.

In summary, this study's practical design work and methodologies highlight the significance of critical thinking and design in lending tangibility and specificity to political discourse. This approach offers valuable insights and tools for future political endeavours aimed at exploring and trialling new ways of engaging with politics, formulating policies, and communicating ideas.

2. Broken Rhetoric – Contextualizing the Issue

This section outlines a brief history of the classic rhetorical tool and questions its effectiveness in our social media-dominated society. When rhetoric is free of restraint or review, is it time to rethink its use to frame our political choices?

Rhetoric is a tool for persuasion that has stood the test of time. Most scholars accept that rhetoric can be traced back roughly 2500 years to the sophists in Greece in the 5th Century BCE. (LEGGETT, 2012) However, it was Aristotle who helped formalise rhetoric.

> "…these three means of effecting persuasion. The man who is to be in command of them must, it is clear, be able (1) to reason logically, (2) to understand human character and goodness in their various forms, and (3) to understand the emotions-that is, to name them and describe them, to know their causes and the way in which they are excited." (Welldon, 1886, p.12)

According to Herrick (2017), opinions on rhetoric have been divided since its foundations. Philosophers such as John Locke, who qualified it as deceptive, or Friedrich Nietzsche, who coined it as a "gentle reproof", helped tarnish rhetoric's image. However, Herrick explains, we are at a cultural juncture where the study of rhetoric is gaining recognition for its contribution to human communication.

Good and bad rhetorical arguments have always existed. An example of a good and influential rhetoric would be Martin Luther King's 'I Have a Dream'. In his speech, aspects of Aristotle's principle of rhetoric were effectively met, using a wide variety of rhetorical tools and "rely[ing] heavily on "loaded" language geared towards engaging the emotions of his audience" Washington (1993). However, demagogues also propose bad rhetorical arguments that utilise people's desires or prejudices. This dichotomy shows how a "longstanding association with persuasion has been at the heart of the conflict over whether rhetoric is a neutral tool for bringing about agreements or an immoral activity that ends in manipulation"—Herrick (2017) p. 4.

The prevalence of good and bad actors in rhetoric might not have changed much over the centuries, but its methods of communication have. Traditional media (radio, television, or printing press) has often relied on verification and a consensus of experts to determine the truth of specific claims, often relying on journalistic standards, editorial processes, and fact-checking practices (at least in democracies). For example, the Code of Ethics of the Society of Professional Journalists set guidelines for "seeking truth and providing a fair and comprehensive account of events and issues", helping to reduce opportunities for demagogues to exploit.

With the advent of social media, all those brakes came off -the friction associated with editing a paper, commissioning a TV report, or travelling to deliver a live radio broadcast- is gone. The institutional control and self-regulating mechanisms from the media outlets and the broadcasting standards have been sidestepped, along with the expert's analysis and viewpoints that add perspective. The way social media works conduce to "low barriers to entry and reliance on user-generated content […] undermin[ing] the reputation mechanisms that serve to guard the quality of information of traditional media outlets" Zhurayskaya et al. (2020). Hence, facilitating and maximising the effect of unethical rhetoric practices.

In the light of social media and our highly connected society, rhetoric has exploded and arguably in doings so also become meaningless. Exemplifying this are a couple of tweets from Donald Trump's tweets during his tenure as U.S. president, during which he sent roughly 30 tweets per day. (Coles, 2020):

> I will be leaving the great Walter Reed Medical Center today at 6:30 P.M. Feeling really good! Don't be afraid of Covid. Don't let it dominate your life. We have developed, under the Trump Administration, some really great drugs & knowledge. I feel better than I did 20 years ago!
>
> 7:37 PM · Oct 5, 2020
>
> We are United in our effort to defeat the Invisible China Virus, and many people say that it is Patriotic to wear a face mask when you can't socially distance. There is nobody more Patriotic than me, your favorite President!
>
> 8:43 PM · Jul 20, 2020

> Obama's wind turbines kill “13-39 million birds and bats every year!” http://bit.ly/1jXRgk3 Save our bald eagles, symbol of our nation!
>
> 4:38 PM · May 23, 2014
>
> In addition to winning the Electoral College in a landslide, I won the popular vote if you deduct the millions of people who voted illegally
>
> 8:30 PM · Nov 27, 2016

2.1 Broken Rhetoric – The Act of Countering

In the previous section, we argued that traditional political rhetoric has become ineffective in the modern digital era, where social media's influence leads to decreased public trust in political communication. In this section, we introduce the notion of counter-rhetorical design, a design tool that can be employed to increase public trust in political messages.

As political discussions shift to social media platforms, rhetoric must evolve. It must become more concise and immediate, aiming to engage a diverse audience with clear, universally comprehensible language. Social media's intrinsic characteristics demand that rhetoric be handled as a form of direct communication between individuals (Dannagal et al., 2023).

On the other hand, the essence of political rhetoric must navigate within the boundaries of what is generally deemed acceptable by the public. Most politicians aim to secure election or re-election, so their rhetorical approaches must align with the **Overton window*** (Mackinac Center for Public Policy), ensuring their messages resonate within the permissible spectrum of public discourse.

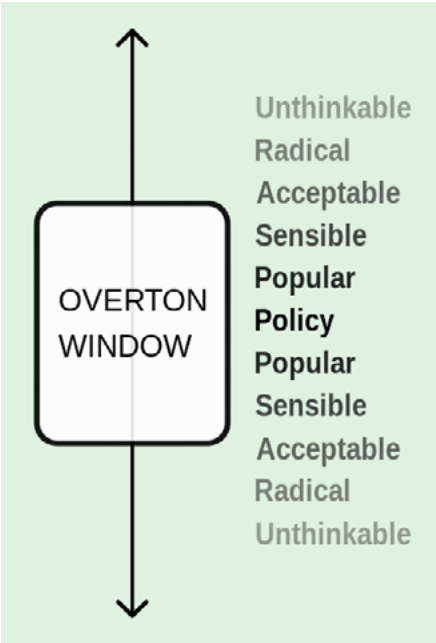


Figure 1. Diagram of Overton window, taken from Mackinac Center for Public Policy website.

In this context, it is easy to understand how political tropes become prevalent in social media political messaging. They simplify complex issues, evoke emotional responses, and reinforce ideologies or narratives. Examples of these increasingly pervading tropes in political public discussion in social media are 1980’s Thatcher’s retort*, “You can turn if you want to, the lady is not for turning”, or* 1996’s Blair’s “Education, education, education”, or 2018’s Theresa May’s “*There is no magic money tree”*.

This research introduces "counter-rhetoric" design as a novel method to critically address and challenge ineffective or misleading political rhetoric. By creating and analysing fictional scenarios occurring in the "present", this approach scrutinises the underlying meanings of political tropes and their potential impacts if realised, thereby offering a fresh perspective on evaluating political discourse.

Counter-rhetoric design is linked to critical design thinking and derives from counterfactual design practice, which "offers a narrative in which an event or situation has been changed in the past and a history is developed that establishes an alternative present and depicts an alternative trajectory of socio-technical development" Malpass (2017), and the Alternative Presents speculative practice identified by Auger (2013) p. 12 where "rather than focusing on asking 'what if' of historical events and imagining the effect on here and now, it shifts the emphasis onto artefacts".

Counter-rhetoric design counters failed rhetorical devices by unpacking their original intentions and designing an appropriate system and artefacts that evidence the results of its implementation within a believable scenario.

3. Case Study 1 – Trickle-Down

Thus far, we have outlined the challenges currently affecting rhetorical discourse in contemporary society and have proposed that design can play a role by adding specificity and palpability to political communications. In this section, we outline the first case study that employs a counter-rhetorical design method, focusing on the rhetoric of Trickle-Down economics.

3.1 Trickle-Down Rhetoric

The rhetorical aspect of Trickle-Down economics has a long and varied history. This rhetoric attempts to repackage a classical economic notion into a metaphor that appeals to all. Adam Smith proposed the economic notion in question:

> "[A tax] may obstruct the industry of the people and discourage them from applying to certain branches of business which might give maintenance and employment to great multitudes." (Smith, 1869, p 416)

This disincentivising nature of tax might be true in certain circumstances. However, Smith does not indicate as to the type of taxation. Also, the Industrial Revolution was in its infancy when Smith published his 'Wealth of Nations,' thus, the injustices faced by factory workers were not fully realised. Nor were the tensions between individual profit and taxation as a form of wealth redistribution. Only after the establishment of the wealth fair state in the 20th century did Trickle-Down economics appear in political discourse as a useful way to sell the idea of lower taxes for the higher earners to the public. During his 1981 address from the Oval Office, Ronald Raegan stated:

> "Our aim is to increase our national wealth so all will have more, not just redistribute what we already have which is just a sharing of scarcity. We can begin to reward hard work and risk-taking, by forcing this Government to live within its means." (Address to the Nation on the Economy - February 1981, n.d.)

Trickle-Down was a useful metaphor to justify how lower- or middle-income earners would benefit from low taxation of high earners. Yet the reality and impact of this policy didn't enable wealth distribution or even an increase in GDP; in their 2020 paper 'The Economic Consequences of Major Tax Cuts for the Rich,' London School of Economics senior fellow David Hope states:

> "We find that major tax cuts for the rich push up income inequality… Turning our attention to economic performance… real GDP per capita and the unemployment rate are unaffected by significant reductions in taxes on the rich in both the short and medium term." (Hope & Limberg, 2022)

In fact, the economist Heinz Arndt, in his 1983 paper 'The Trickle-Down Myth', suggests that the usage of the term Trickle-Down was never intended to be applied as a national redistribution tool. Arguing that the post-1945 development economists focused on inequality between countries rather than inequality within a country and assumed that an increase in gross domestic product (GDP) would broadly maintain the same wealth distributions (Arndt, 1983). In this regard, most economists do not take the notion of Trickle-Down economics as a serious economic proposal that enables wealth creation or distribution. Nevertheless, notions of Trickle-Down continue to exist within the political landscape as potent rhetoric. From Ronald Reagan and Margaret Thatcher to, more recently, Liz Truss**.** The notion of Trickle-Down constitutes a powerful political rhetoric but not the economic tool of wealth creation or redistribution that it was claimed to be.

Our project utilises a counter-rhetorical design approach, developing a functional object that enables the implementation of Trickle-Down rhetoric. This allows individuals to contemplate and reflect on the actual effects of applying its foundational ideas.

The project is a speculative design proposal set in 1980s Britain, where a researcher within White Hall proposes the Trickle-Down economic model and prototype devices that turn Trickle-Down from political rhetoric into a function of money.

3.2 Trickle-Down Monetary Design

Our counter-rhetorical fiction starts with Margaret Thatcher's 1983 Conservative conference speech in Blackpool, where she states:

> "One of the great debates of our time is about how much of your money should be spent by the State and how much you should keep to spend on your family. Let us never forget this fundamental truth: the State has no source of money other than money which people earn themselves. If the State wishes to spend more it can do so only by borrowing your savings or by taxing you more. It is no good thinking that someone else will pay—that "someone else" is you… there is only taxpayers' money." (Thatcher, 1983)

Thatcher's speech positioned the state as a taker of people's hard-earned money, but the distinction between rich and poor was not made; thus, the nuances of the arguments for wealth distribution were sidestepped with a straw man argument. However, when pushed during a 1977 interview with William Buckley, she states:

> "I think in societies where there are enormous differences between very great wealth and very great poverty, I would recoil from that… there is therefore something to be said for a certain amount of redistribution." ('What Have We Learned from the Failure of British Socialism?', 1977)

As Thatcher is not against redistribution, the challenge here is to enable some form of wealth distribution within a small state. The economist Friedrich Hayek, who heavily informed Thatcher's thinking, alludes to a potential approach:

> "…It is possible to bring about considerable redistribution under a system of proportional taxation. All that is necessary is to use a substantial part of the revenue to provide services which benefit mainly a particular class or to subsidise it directly." (Hayek, 2020)

'To subsidise it directly' is the key suggestion that informs the idea of placing Trickle-Down into a function of money, but what is a function of money? The 'functions of money' are often found within foundational economic texts, used to define money by its functions: "Money as a Medium of Exchange. Money's primary function is to facilitate trade" (Stiglitz, 2006), "a store of value is an item that people can use to transfer purchasing power from the present to the future" (Mankiw, 2012) and "a unit of account is the yardstick people use to post prices and record debts" (Mankiw, 2012).

Speculative design works have explored the idea of altering the functions of money, but rather than reducing these functions, this project explores the possibility of adding an additional function that bakes wealth distribution to its operation.

Historically, most aspects of money and its functions have evolved over thousands of years and have been largely limited to the characteristics of a given material (commodity currency like gold). Yet, within an electronic fiat currency system, the limitations associated with materials are not present, and money can be designed to incorporate new functions and characteristics. Our counter-rhetorical design proposal takes advantage of this design flexibility that electronic payment systems enable.

3.3 Crafting the Trickle-Down Devices

Thus far, we have outlined the rhetorical proposition that frames our design approach and the monetary theory that could be used to bring the rhetoric into reality. Now, we explore the generative design side of the work.

The speculative design approach used here is like the one outlined by James Auger in 'Crafting the Speculation'. (p.12): "A design speculation requires a bridge to exist between the audience's perception of their world and the fictional element of the concept." Bridging the fictional elements of this work requires reference points from popular culture and technology of the early 1980's. Hence, the industrial design aesthetic was informed by mainstream consumer electronic devices like the Panasonic KX-T1510 answering machine and the late 1970s CR1020 Receiver by Yamaha. Similarly, the technology the devices utilise is from the early 1980's; including the magnetic strip card and reader (IBM invented). And an early version of the early dial-up system 'USENET' created in 1997 by Tom Truscott and Jim Ellis at Duke University ("USENET~," n.d). These historical references act as the bridge to the fictional elements.
The main Trickle-Down device represents a consumer Trickle-Down monitor that a wealthy individual would own; it works by placing a magnetic striped bank card into the slot. When activated it links to their bank account via the phone line and displays the account total and the Trickle-Down rate. The rate of Trickle-Down can be changed depending on the amount held in the account. These rates are set centrally within the government and reflect the current economic priorities of the serving government.



Figure 2. A context shot of the Trickle-Down device.

The Trickle-Down device and system also encourage the natural ‘trickle’ of money through a buffer system, like claiming expenses against taxes within a business. The card owner can spend money in the local economy, which acts as a capacitor. For instance, if £2000 were spent locally, the constant Trickle-Down rate would come from the £2000 rather than the main bank account. This would encourage people to spend in the local economy. If the money is not spent in the economy, then the money will come from the main account.

As the state is reduced, the choice of the destination of the trickle lies with the account owners. They can select lower-level accounts where they want the trickle to fall or a-sign their trickle to any of the open Trickle-Down public receivers positioned by local charities to help those most vulnerable. To bring this aspect of the work into reality, the Trickle-Down public receiver of the money sits alongside the main device. In the context of a gallery space, the audience can experience the process of receiving a small amount of money via the Trickle-Down receiver.



Figure 3. A photo of the trickle-down project displayed at MoneyLab13, organised by NeMe in Cyprus.



Figure 4. A close up of the trickle-down receiver being fed from the consumer device on the right.

During the Moneylab13 conference and exhibition held at NeMe gallery in Cyprus, the audience could play with the cards and device to get a printout (from the smaller device) stipulating how much they had received from the wealthy individual. This brought a level of interaction to the proposal.

4. Case Study 2 – Levelling Up

This section outlines the second case study that employs the counter-rhetorical design method but shifts towards a much nearer time frame. We focus on political rhetoric based on a surprisingly old term: Levelling Up.

4.1 Levelling Up Rhetoric

'Levelling Up' is a term that many politicians today have used to reduce complex issues to a digestible term referencing popular culture. Although it initially sounds rather new concerning political discourse, as our popular imagination recognises it as a gaming term, this belies its long history. One of the first uses on record of 'Levelling Up' is within a political context during the 1860s, in a debate about the Anglican and Catholic churches. During this session, a Lord applied the term in a useful interjection by stating, 'You must arrive at equality either by levelling down or by Levelling Up'. Dr Jack Newman also notes that the phrase was used throughout the 20th century in relation to government spending, being adopted by various governments, including 'The New Labour and the first conservative government of the 21st century. (Newman, n.d.)

Although this longstanding rhetorical term has been utilised during a plethora of different political periods, this project is focused on the 2019 general election, where Boris Johnson won an outright majority on the promise of 'Levelling Up Britain.'

> "This Government is committed to Levelling Up all parts of the United Kingdom – and getting Brexit done will enable us to give new support to people in rural and coastal communities, and for our farming and fishing industries." (2019 Conservative Manifesto, n.d.)

As stated above, 'Levelling Up' was for 'all parts of the United Kingdom' to give 'new support to people.' A 2022 report from the IPPR (Institute for Public Policy Research) states, *"Levelling Up… evokes and reheats many previous agendas but remains less focussed (geographically and thematically) than its predecessors."(Webb, n.d.)* Another report from the Fabián Society comments on the 2 years of inaction

> "›Levelling Up‹ – a vague election slogan from 2019 that has only recently taken form in the government's White Paper and a Bill before parliament." (Raikes, 2022)

Since 2019, living standards have declined, aiding extensive political upheavals. Thus, Levelling Up during the 2019 election constituted a failed and ineffective rhetoric.

4.2 Levelling Up Taxation Design

To have a long-term impact, the aim of 'Levelling Up' an economy would require continuous economic incentives rather than limited or momentary 'funding pots'. Thus, to enable sustained and meaningful Levelling Up in all areas of the UK, systemic economic levers must be utilised to provide continual leverage. Not only this, but these levers need the ability to be fine-tuned between geographical locations and adjusted against a change over time in economic activity. In terms of which possible radical proposal might enable Levelling Up in this systemic way, an idea presented by payments expert David Birch suggests a possible way forward:

> "We should set ourselves up for a world in which there are hundreds, thousands, or even millions of kinds of money. Your phone will show you the price of your latte in London Loot but transfer money in California Cabbage, Apple Apples, and SF Parking Permits." (Birch, 2018)

Numerous currencies might also enable numerous fiscal and monetary policies. Perhaps then, areas with low economic activity would have a currency that would devalue and thus become attractive as an investment, driving growth. However, this market of money might not hold the central control needed to guarantee the Levelling Up agenda promised by the government.

Rather than enacting a dog-eat-dog scenario of currencies, might a dynamic taxation that enables varying tax levels between different areas of the country hold the possibility of encouraging investment in deprived areas? This type of dynamic taxation would only be possible using a digital pound. Could a central bank digital currency enable a more nuanced approach to taxation incentives and disincentives?

4.3 Crafting the Levelling Up Devices

Moving towards the generative side of the Levelling Up project, we employ another counterfactual approach. This scenario proposes a CDBC (central bank digital currency) system that embodies the Levelling Up notion by creating a digital British pound and a variable geographical VAT rate that increases within higher-wealth areas and reduces in lower-wealth areas.

We took a slightly different approach to bridging the gap between the audience and the fiction. Although considerations have been made regarding the aesthetic of the devices to resonate with the context of 10 Downing Street, the believability and communication come mainly from the interactive variable taxation map displayed on the Levelling Up device, which the audience can interact with to help understand the proposal.

The image below depicts the government's Levelling Up device, which enables changes in VAT rates between specific geographical places within the UK. In the scenario, the device is installed within number 10 Downing Street, enabling the government to set and rest the variable tax rates during every new budget.



Figure 5. A close up of the levelling-up device displayed at MoneyLab13, organised by NeMe in Cyprus.



Figure 6. An overview of the display, including the device, fictious address from Boris Johnson and the future wealth disparity maps.



Figure 7. A close-up shot of the wealth disparity map.

Alongside the Level Up device would hang a series of 3d printed wealth disparity maps. Areas of high deprivation are indicated as a peak and low deprivation as a trough. Within the context of this scenario, the 3d printed maps get updated every time the government introduces a new budget, usually once a year. The maps create a lasting and readable reminder of the progress the government policy is making within the UK. Enabling a palpable depiction of wealth distribution within the country over time.

5. Conclusion

This paper has presented the transformative potential of counter-rhetorical design in rethinking how persuasive political arguments are framed and communicated. By employing speculative and critical design methods, we have demonstrated that design can be used to enhance the specificity and tangibility of political discourse. The explorations within the 'Trickle-Down' and 'Level Up' case studies exemplify how such methodologies can critically assess and potentially rectify the fallacies and inefficacies within traditional political rhetoric. This approach fosters a broader conceptual bandwidth for political parties' communications, moving beyond the restrictive confines of Overton's window and engaging more deeply with political processes.

While counter-rhetorical design is a novel mode of political engagement, it faces limitations due to its speculative nature. The hypothetical scenarios it presents may not capture the full complexity of real-world political dynamics and may not be universally applicable or acceptable. The effectiveness of these design interventions in influencing political discourse and public policy remains largely untested and speculative.

Future research should concentrate on empirically testing and measuring the impact of counter-rhetorical design projects, assessing their influence on public opinion and political engagement. This would enhance the efficacy of counter-rhetorical design, consolidating its status as an effective design method for enriching political discourse and democratic engagement.

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P/REFERENCES OF DESIGN

(DE)COLONIZING OUTER SPACE: SPECULATIVE FRONTIERS OF OUTER SPACE EXPLORATION IN VIDEO GAMES.

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KEYWORDS | VIDEO GAMES, SPECULATIVE DESIGN, OUTER SPACE EXPLORATION, SCIENCE FICTION, INTERACTIVE MEDIA

ABSTRACT | The narratives around the new frontiers of space exploration promise a future in which humans could become a multi-planetary species that will benefit from the exploitation of extraplanetary resources. Economic opportunities are driving large private investments in the space industry, assuming the role that once was of public institutions in the development of technologies for space exploration and raising concern around legal, ethical and sustainability issues. In this paper video games are interpreted as speculative media that can blend boundaries between the fictional and the actual. Science fiction video games are analyzed as media artifacts that are both representative of neoliberal and colonialist approaches to outer space exploration but, in virtue of their speculative potential, can also promote critical and alternative perspectives. The concepts that allow us to situate games, game worlds, and game mechanics in the context of anticipatory and critical design practices are discussed. It is argued that the acknowledgement and adoption of concepts, ideas, methodologies, approaches, and practices that can resonate both in design and game cultures addresses the need to confront the complexity of contemporary challenges, of which space exploration is a paradigmatic example, from multiple perspectives.

1. Introduction: Trajectories and Narratives of the Space Economy

On February 6, 2018, at 15.45 EST, the Falcon Heavy FH-001 was launched from Launch Complex 29A at Kennedy Space Center in Florida (Uri, 2023). The launch, like the other SpaceX missions, is live streamed, offering the audience an informative yet entertaining overview of all the salient characteristics of the new rocket being tested. In fact, the Falcon Heavy is one of the most powerful super heavy-lift launch vehicles ever built, capable of delivering nearly 64 metric tons to low Earth orbit (SpaceX, 2021). SpaceX's Falcon Heavy and the Starship, which is currently under development, address the growing market demand for reliable and cost-effective launchers capable of carrying materials, satellites, and humans to orbit. It has been estimated that the satellite payload market size will reach 24.51 billion USD by 2029 (Satellite Payload Market Size Report, 2024), demonstrating private interest in the commercial opportunities of the space economy. During the streaming, every stage of the startup sequence that is successfully completed is cheered by the crowd of SpaceX engineers attending the launch from the mission control room. The broadcasting conveys the excitement and the tension of the moment. During the minutes leading to the launch, the mission profile is presented in detail by representatives of the company's departments. Finally, when the countdown reaches zero, the Falcon Heavy rocket successfully lifts off from the launch pad with a deep, powerful roar. The crowd cheers and shouts loudly with joy. Cameras alternate views from the ground and from the rocket itself, offering dramatic perspectives of the rocket lifting from Earth. After reaching an altitude of 60 km, 2 minutes, and 38 seconds into the flight, the side busters shut down and separated from the main rocket. They will successfully perform a choreographic synchronous vertical landing on Landing Zone 1 and 2 in the famous Cape Canaveral Space Force Station. A few seconds later, the central core engine is turned off and dethatched from the upper stage of the rocket that contains the payload. Cheers of celebration. The onboard camera shows the upper stage's engine glowing while the Earth profile moves in the background. After 3 minutes and 45 seconds of flight, the crowd's cheering and the mission control audio is suddenly drowned out by the sound of an electric guitar and by the lyrics of David Bowie's song *Life of Mars*. The camera is now framing Starman, an astronaut mannequin comfortably and boldly sitting at the wheel of Elon Musk's own red Tesla Roadster mounted on a support system inside of the upper stage fairing, the protective shell that contains the material to be shipped to orbit. The fairing is finally deployed, revealing a spectacular view of Starman riding his supercar into the universe with the Earth in the background.

In the described mission, Musk's Tesla has been used as a dummy payload, a nonfunctional mass that simulates the loading capacity of a spacecraft during test launches. Dummy payloads are used to evaluate the spacecraft's behavior when loaded with material's, equipment's, and crew's weight. Dummy payloads are generally used during test flights since the high chance of failures. Although any object with comparable size and weight would have effectively served as a dummy payload, using a Tesla Roadster offered an unprecedented marketing opportunity for both Elon Musk's companies, SpaceX and Tesla.

The new frontiers of space exploration promise a future in which humans could become a multi-planetary species that will benefit from exploiting extraplanetary resources. This vision and the economic opportunities it prospects are driving large private capital investments in the space industry, assuming the role that once was of national institutions in the development of technologies for space exploration. The growth of private capital flows in such a strategic industry is raising concerns around legal, ethical, and sustainability issues (Iliopoulos & Esteban, 2020). The dramatization of outer space operations offers a spectacle of private companies' technological achievements underplaying the complex issues of power and control that derive from the private ownership of such technologies. Moreover, such a spectacle contributes to the construction of the contemporary narrative about human space endeavor that shows to gather impulse from neo-colonialism modes of approaching space exploration (Mitchell et al., 2020). A narrative that exposes the utilitarian and neoliberal perspective of private interest in developing human access to outer space.

Together with the cinematic commercials of private companies, contemporary media artifacts concur to the construction of the space culture narrative, both dramatizing the real events of past and contemporary

space exploration and using fiction to project the future speculative frontiers of space travel. Considering works of fiction, in fact, the conquest of space colonies, the visions of space tourism, and the story of intergalactic wars for resources and territory control are widely depicted in numerous sci-fi novels, movies, and video games. Science fiction novels have largely contributed to inspire scientists and engineers in the development of new technologies. The influence of science fiction novels on real-world space artifacts has been discussed in the analysis of the design for future space habitats (Ceylan, 2018, 2022), new technologies and interfaces (Figueiredo et al., 2015; Kendrick, 2002), and new forms of outer space commercial travels (Ceuterick & Johnson, 2019).

In this context, however, alternative and diverse ways of approaching space exploration are being discussed to challenge the dominant spaceflight culture and narrative to acknowledge diverse and underrepresented perspectives (Schwartz et al., 2023). Fictional representations of space exploration, and science fiction in particular, play a significant role in the diffusion of space culture and shaping people's opinions on emerging technologies. Isaac Asimov, considered one of the seminal authors of the genre, considers science fiction novels a form of response to the transformations happening in technology and society (Asimov, 1982). From a critical design point of view, the analysis of future-oriented narrative artifacts offers the opportunity to reflect on emerging attitudes toward technological and cultural transformations. In particular, examining contemporary science fiction media, it can be observed which political and economic values are emerging as drivers that motivate the future human presence outside Earth's boundaries. This paper discusses how video games, and science fiction video games in particular, can be understood as interactive forms of design fiction that speculate on the future of outer space exploration. It is argued that, despite the dominance of a neo-colonialist and exploitative rhetoric, video games can advocate for a critical perspective on the future of human space presence in outer space that is driven by values alternative to that of neoliberal capitalism. Play is a form of expression of ideas and values, a creative form of production, and not a mere form of consumption (Sicart, 2014). A critical perspective towards future scenarios can be developed through the experience of play, and video games solicit such an attitude through the distinctive qualities of the medium that will be discussed in the next paragraphs.

1.1 Methodology

The introduction of this paper reports a specific SpaceX's mission streaming as a representative example of the current dominant narrative on human endeavor for outer space exploration. Being a highly experimental field, it requires powerful and evocative depictions to drive investors' interest to the space economy. Such representations not only serve this purpose but also shape the dominant narrative on space exploration in Western countries. This paper aims to analyze science fiction video games as media artifacts that are both representative of neoliberal and colonialist approaches to outer space exploration but, in virtue of their speculative potential, can also promote critical and alternative perspectives. For doing so, literature on games and play has been reviewed to bring out the concepts that allows to situate games, game worlds, and game mechanics in the context of anticipatory and critical design practices. The identified defining ideas of speculative design are confronted with related concepts specific to the medium of video games. The discussion is presented in paragraph 2. It constitutes the theoretical premise that allows to observe science fiction video games as materialization of actual and future perspectives on outer space exploration, which is discussed in paragraph 3. Paragraph 4 uses two case studies to exemplify the ways video game can address science fiction scenarios without adopting narrative and visual clichés. The two games have been chosen as case studies to exemplify how both commercial and non-commercial games can offer alternative perspectives on the discussed topic of outer space exploration. Moreover, unlike the other games mentioned which are products developed by established game companies, the selected games are representative of two bottom-up design processes: a workshop activity and a thesis project that developed in a successful commercial product.

2. Video Games as Speculative Media

In contemporary technocultural society, the specificities of video games bear an "aesthetic potential which allows for speculation over the very structure of knowledge and contemporary technology" (Luersen & Paula, 2023). In this paper, video games are interpreted as speculative media that can blend boundaries between the fictional and the actual. Several scholars have addressed the multiple connections between video games and speculative practices, discussing how worldbuilding and diegetic elements intertwine with the mechanics of play themselves and the effect on player experience and critical reaction.

Games have reflected the cultural and ideological values of society since ancient times. Video games represent the interaction and the conflicts of social and technological transformations. They are both cultural objects (Dovey & Kennedy, 2006; Schrank, 2014), materialization of the commodity from (Celaschi, 2000) in the contemporary market exchange system (Jagoda, 2020), and products of a complex industrial system (Dyer-Witheford & De Peuter, 2009; Woodcock, 2019). Through the practice of appropriation and re-functionalization, ludic artifacts can suggest and invite critical reflections on social, ethical, and political issues. The manipulation of the game structures and affordances in avant-garde games (Schrank, 2014), the adoption of "radical" (Flanagan, 2009/2013) and critical (Grace, 2014) approaches to game design, and the appropriation and re-functionalization of the medium, such as in the case of machinima and game mods (Joseph DeLappe, 2018), are some of the methodologies and practices that have been adopted to address political and social issues through games.

As a medium, it can be argued that video games can be considered an interactive form of design fiction. Despite being commercial products (whereas design fiction and speculative artifacts generally are not), games are inherently speculative. The in-game decisions players are continuously faced with and the layering of slight interactions that add up during the gaming experience force a constant speculation on the possible outcomes of one's decision (Kunzelman, 2022). With a particular focus on science fiction games, Kunzelman describes the "mechanics of speculation" as the "ways that games specifically ask us to engage in speculative practices while playing them" (Kunzelman, 2022, p. 22). As presented by Kunzelman, those mechanics are specific to the medium and can produce several effects on the players, from Brechtian estrangement to the stage of the differences between the actual and the fictional world, between one ideology or the other. In design fiction, the narrative is functional to the representation, in the form of prototypes, of the transformed or alternate world (Sterling, 2013). In game worlds, mechanics can be considered narrative devices that produce real-time events and responses to player action (Dubbelman, 2016). Game mechanics determine the limits of the action and the type of affordances accessible in the game world but also activate mechanics of speculation within it.

Compared to linear media, games are defined by rules within a system in which players engage (Salen & Zimmerman, 2004). Such a system constitutes a possibility space that is discovered and interpreted by players through their performance (Squire, 2008). The frame of rules and objectives that regulates the game world combine with the possibility and the indeterminacy of play, characterizing video games as experimental artifacts (Jagoda, 2020). As argued by Jagoda, games are experimental both in formalist terms for their capability to model alternative forms of reality and for offering players a possibility space (Squire, 2008) where the uncertainty of play can encourage the emergence of difference and unpredicted outcomes. Games offer a space for experiencing an alternative vision of the world and exploring the dynamics of alternative control and power structures. In their book on fictional games, Gualeni and Fassone (2022) explore the role of fictional ludic artifacts that only exist in narrative worlds. Fictional games lack complete game rules or can function only through technological or magical elements that make them impossible to play in the real world. It can be argued that fictional games act as forms of diegetic prototypes (Kirby, 2010), that are contextualized as real functioning (playable) artifacts within the narrative. They emerge as the materialization of social and cultural values or, by contrast, as ludic forms of reaction to the established dominant powers. In fact, fictional games can act as transformative tools, questioning the socio-political environment depicted in the fictional world and becoming utopian tools. They can transform, through the indeterminacy of game dynamics, dystopian narratives into acts of

critique (Gualeni, 2021). Even within the grim and undesirable characters of a dystopian narrative, critical dystopias open a space of contestation and propose the hope of a positive alternative, if not within the narrative itself, at least outside of it (Baccolini & Moylan, 2003).

Besides its capability to address social conflicts and issues through the materiality of design, design fiction is a design practice that can be adapted to support the development of new real-world technologies. The diegetic prototypes of design fiction conceptualize and enable reasoning about the impact and possible applications of new technologies (Bleecker, 2009). The artifacts of science fiction prototyping (Johnson, 2011) represent the design concept of the things that one day will be possible to build. Games artifacts materialize such prototypes situating them both as functional and interactive means, and as technocultural expression of the fictional world.

Effective speculative design needs to build "perceptual bridges" between the observer's reality and the speculative future (Auger, 2013). Auger suggests that such perceptual bridges can be inspired by different fields, such as psychology and comedy, that offer insights into the way the human mind works. In games, these perceptual bridges are constantly built through the complex combination of aesthetic, kinesthetic, and sensorial experiences of game feel (Swink, 2009). The sensation deriving from the feeling of directly and precisely controlling the avatar, from the physical interaction with the simulated world, and from the effects that polish and enhance the interactions, act on players' nonconscious cognition as affective experiences (Jagoda, 2020, p. 116), and constitute the medium-specific perceptual bridges to the speculation.

The concepts that have been briefly discussed in this paragraph constitute a reference framework that situates games as a form of speculative media. The next paragraph introduces science fiction games as a genre that is particularly representative of the speculative qualities of video games and problematizes the dominance of colonialist themes that, it is argued, are representative of contemporary space endeavors.

3. Speculative Scenario of Outer Space Exploration in Sci-Fi Video Games

Science fiction and games have been sharing themes and visual iconography since the origin of the video game medium. From *Spacewar!* (Russell, 1962) and *Space Invaders* (Taito, 1978), to the *Halo* series (343 Industries et al., 2001-2021) and the recently published *Starfield* (Bethesda Game Studios, 2023), games have represented science fiction and space exploration narratives with increasing visual accuracy and technical sophistication. Science fiction games have developed in a wide variety of subgenres, among which space simulators are one the most representative because of the game mechanics it has introduced. Space simulations can be subdivided into two main categories of space combat simulation and space exploration simulations (Tringham, 2013, p. 413). As reported by Tringham, *Star Raiders* (Atari, 1979) can be considered one of the first examples of the space combat form that introduced the fundamental features, such as the presence of strategic mechanics and resource management systems, that characterize the genre still today. Regarding exploration games, *Elite* (Barben & Bell, 1984) is considered the first prototypical example of space exploration simulation presented as an open-ended large real-time 3D explorable universe where to collect, trade and fight for resources. The idea of procedurally generated game words introduced by *Elite* has developed in numerous game genres. A recent example of a science fiction game that largely uses procedural generation is *No Man's Sky* (Hello Games,2016) whose explorable universe is constituted of 18 quintillion planets, each characterized by a unique geology, flora, and fauna.

The peculiarity of science fiction video games, compared to other game genres and other mediums, has been observed in their capability to "convey a more active sense of futurity" (Frelik, 2014, p. 230). Moreover, as a medium, games reach a vast and diverse audience, making the ideas and concepts of science fiction more accessible. Frelik identifies four intersections between the medium of video games and the mode of science fiction. Video games "as narratives of space […]", "as integral elements of distributed narratives spanning multiple media and forms", "as instanced of visual science fictions invested in the pictorial portrayal of futurity", "as performative simulation, conveying a sense of malleability of the future" (Frelik, 2014, p. 230).

In discussing the argument of this paper, the spatiality of science fiction video games is particularly relevant. As suggested by Frelik, in science fiction games, spatiality emerges in two specific aspects. The first one is worldbuilding. Through the construction of coherent and complex fictional scenarios, players are confronted with visions of alien planets, extraterrestrial settlements, and advanced technologies. Compared to movies, which also provide strong and descriptive visual cues, games enable players to freely navigate such fictional universes, providing an "affective experience of the genre's sense of alterity" (Frelik, 2014, p. 231). Speculative practices heavily rely on worldbuilding and environmental narratives. Speculative cinematic narratives, such as *Planet City* (Young, 2021), guide observers through the architecture, the rituals, the technologies, and the identities of fictional future scenarios in which humanity addresses the environmental crisis in a radical way. In *Plane City* speculation, humanity gathers in a hyper-densely populated city, leaving the rest of the planet to nature. The project, in addition to a cinematic representation, uses essays and costumes to explore the technical, environmental, social, and cultural implications of such a scenario. The video game series *Mass Effects* (BioWare, 2007, 2010, 2012) offers a parallel to a similar speculation. In the game, the *Citadel* is a hyper-dense galactic settlement where humans and alien species coexist under the government of the *Citadel Council*. The massive galactic infrastructure resembles that of an O'Niell Cylinder, a conceptual outer space infrastructure proposed by Gerard K. O'Neill in the 1970s (O'Neill, 1977/2000) that generates artificial gravity through centrifugal acceleration. Compared to O'Niell design, the lateral surface structure of the *Citadel* is not continuous, but it is constituted by five 43.6 kilometers of arms (the Wards) that extend from a central pentagram-shaped ring with a diameter of 7.2 kilometers. The *Citadel* portrays the organizational structure of the social system that relies upon advanced technology. In the same way, *Plane City* suggests a critical reflection of how the political and social structure could operate in combination with technological infrastructures in a complex superorganism. The spatiality of games allows the exploration of such natural and artificial speculative environments, soliciting players to explore the architecture, the technologies, and the affordances offered by such artifacts and the dynamics of different social structures.

Another spatial-related mode, Frelik suggests, is represented by the narratives of conquer and exploitation of extraterrestrial worlds and living beings. Such trait, as already discussed, is recursive in both fictional media, but also suggested by the commercial narratives of the space industry. With few exceptions, most science fiction video games propose imperialistic narratives and forms of exploitation and control (Frelik, 2014). The main themes revolve around spaceship flight and combat, military strategy, survival of dangerous and dreadful extraplanetary environments, and new worlds colonization (Majsova, 2014). Such narratives have been present in science fiction video games since the origin of the medium, which roughly coincides with the years of the Space Race and the Cold War between the United States of America and the Soviet Union. The competition between the two blocks drove large investments in technological innovation for developing military and defense applications. During this period, the emerging video game industry offered a space to programmers where to develop game technologies without military implications (Izushi & Aoyama, 2006). Although the entertainment, technical, and artistic value of this production is acknowledged, it is argued that the abundance of such themes is representative of the utilitarian, exploitative, and neo-colonialist attitudes that have animated, and still animate, past and contemporary perspectives on outer space exploration. If during the Space Race period, science fiction video games' themes reflected the political and military tension between nations, today's neoliberal values that nurture private companies' efforts to access outer space are mirrored in the science fiction game mechanics of resource accumulation, management, and crafting. For Roberts, understanding something as science fiction depends on the moment and the context of reception (Kunzelman, 2022, p. 6; Roberts, 2005/2016). As an example, *Blade Runner* (Scott, 1982) movie portrays climate crisis as an energetic, continuous anthropogenic process driven by capitalist interests that destroy the environment and voraciously consume resources. In *Blade Runner 2049 (Villeneuve, 2017),* the world's resources have ended and the world has been consumed. It can be argued that today, in light of a different perception of climate issues influenced both by the ecological debate and by the witnessing of the effects of climate change, *2049* climate dystopia resonates more with contemporary concerns about climate crisis compared to 1982's movie. In this sense, today's science fiction video games solicit a strong connection with the future of outer space exploration prospected by contemporary narratives of private companies.

4. Escaping Science Fiction Speculation Cliché's Orbit

It has been argued that the adoption of strong dystopian visual clichés in movies (and games) may represent a limit of the medium's capability to invite a critical reflection from the viewers, since they can passively rely on the genre's canonic categories to shape their interpretation (Dunne & Raby, 2013, p. 75). The effort that is required for the reader of science fiction novels is to visualize the story in a process that moves from one word to the other. The subjunctive level of science fiction, being the possibility that certain events could or could not happen, requires a progressive correction process of the visualization that happens in the readers' mind that is coherent with their understanding of the physically explainable universe (Delany, 2009). In visual media, viewers don't need to make a visualization effort. Yet, the critical understanding of the artifacts within the fictional world and their relations with the speculative environment are still there to be made. Visual clichés narrow down the speculation process toward beaten tracks. Hence, when considering science fiction video games as speculative media, original critical and speculative enquires can arise from game worlds that propose alternative narratives and different perspectives that avoid recurring genre clichés. Games can evade stereotypes and clichés by radicalizing the boundaries of the speculation. Still maintaining the "perceptual bridges" with the player's world, visual references can be metaphorized by the worldbuilding and articulate speculation on a more abstract but fundamental level. In science fiction narratives, readers, viewers, and players are constantly invited to make parallels with their own reality. Both scenarist and narrative cliché weaken the speculative potential of science fiction since not much effort is required to situate one's own values within the alternate reality of the fictional world.

Two examples have been chosen to discuss how extreme or radical speculative scenarios can be vehicles to bring different values into the space exploration discourse and, therefore, to broaden the boundaries of inclusion. *He Ao Hou: A New World*[1] (Na Anae Mahiki Collective, 2017) is a game developed during the 2017 SKINS 5.0 workshop as part of the activities promoted by the *Initiative for Indigenous Futures*[2]. During the three-week workshop, Hawaiian indigenous people were given tools and knowledge to develop a video game on the topic of indigenous narratives in a setting of indigenous futurism (Dillon, 2012). As discussed by one of the workshop coordinators Rilla Khaled (Kahled, 2022), the game addresses questions related to the decolonialization of space exploration. The developed game is a point-and-click adventure game in which players explore different worlds inspired by *Mo'olelo*, the traditional Native Hawaiian stories. The progress in the game is achieved through the knowledge of *Mo'olelo* and through the *Aloha 'Āina*, the ecological principle of spiritual, cultural, and social Native Hawaiian identity. In the game, the kukui nut, a symbol of knowledge for Hawaiian Indigenous people, is used as an artifact that allows interactions with the world. The game developed from a radical perspective in which economic or political reasons do not foster space exploration but is a discovery and growth process in accord with the foundational values of the indigenous population. Despite not speculating on practical technologies and solutions to align the contemporary attitudes of space economy to the game proposed values, it points out how underrepresented and unacknowledged such perspectives are. In this act of re-actualization, designers intervein as mediators of knowledge and sensibilities in a co-design process of materialization of these values in game environments, mechanics, and narratives. Moreover, this project stands out as a form of reaction against the Western politics of settler colonialism that are inherent to Indigenous territory occupation for the construction of space research facilities (Sammler & Lynch, 2021; Smiles, 2020). Mauna Kea is a quiescent volcano in the Hawaiian archipelago and, in virtue of the characteristics of the site, is the location of a dozen observatories. Since 2014, local communities have started protests and legal battles against the construction of the Thirty Meter Telescope (TMT) since Mount Kae is the most sacred mountain to Hawaiian people. With the growing interest of private companies in the space economy, there is a growing risk for underrepresented and indigenous communities to undergo exploitative politics. From this case study, it emerges the importance to include marginalized perspectives in the design of speculative artifacts in order to disrupt the hegemonic perspectives that are often represented in the mainstream visions of the future.

[1] The game is freely accessible at: https://skins.abtec.org/skins5.0/?page_id=1689.

[2] https://indigenousfutures.net.

Another game that can considered an example of science fiction that avoids visual clichés is *Outer Wilds* (Mobius Digital, 2019). *Outer Wilds* is a successful commercial video game that proposes an exploration adventure of a fantastic solar system. The game, developed from Alex Beachum's Master Thesis project at USC Interactive Media & Games Division (Beachum, 2013), combines elements of science fiction and fictional archaeology. The gameplay is based on a 22-minute loop that recursively brings the players to their planet of origin. The game progression is not based on the usual mechanics of skills' acquisition or mission achievements. The element that drives progression in the game is the acquisition of information that players need to elaborate to understand the events happening the game universe and how to proceed in the exploration. It has been argued that in *Outer Wilds* "the experience of learning and knowing proceeds from an obstinate tension toward the unknown" that constitutes a game mechanic that "values curiosity and exploration over achievements" (Luersen & Paula, 2023, p. 17). As well as the previous example, the artifacts players can use are probes to investigate the world and gather clues that contribute to form speculation about the game universe. These artifacts do not propose self-reflective speculation on technology but depict technology as a means to access information and develop knowledge. As discussed by Luersen and Paula, in *Outer Wilds,* the devices players can use to explore the solar system (such as the signal scope that detects acoustic signals, the probe that allows the survey of inaccessible areas, and the translation tool that translates the inscriptions of the extinct alien civilization) establish with the data they produce and the player a meaningful relationship that drives the experience of discovery (Luersen & Paula, 2023). Reflecting such critical observation on our actual reality, the instruments that have been sent to orbit over the years have produced knowledge about the universe and the Earth. Military technologies and services based on space infrastructure have become accessible to a greater number of people. However, contemporary conflicts, social and climate challenges make orbital infrastructures and satellite data a strategic and critical asset. In this context, the contribution of critical design is to balance the economic value of space operations with the social one adopting speculative artifact as means of representation, analysis, and critique. Critical design needs to advocate for a just and responsible distribution of the positive impacts of the space endeavor, broadening the discussion and reflecting on the ways designers can contribute to this process.

If the dominant narratives of the majority of science fiction video game impose a top-down perspective of the futures, countergaming (Galloway, 2006/2022) practices propose alternative ways of engaging with such scenarios, turning them into platforms for divergent speculation. For Galloways, countergaming is a form of critical engagement with the game medium that questions the hegemonic practices of the game industry. Game mods are a form of countergaming. Modifying the game code to alter the gameplay mechanics, the control system, and the visual representation of the 3D environment, is a form of appropriation and re-functionalization that establishes a negotiation between the imposed narrative of the game world and the players' sensibilities. Another way to open up and subvert confined game narratives is through the making of machinima (Berkeley, 2006). Machinima can be seen as another form of countergaming. Machinima are linear media such as short movies, video essays or feature-length films that are produced within the game environment and recorded through the game rendering engine. Authors of machinima often remediate the game system into a tool for telling stories unrelated with the original game narrative. Some machinima authors even intervein on the game code to introduce new 3D models, custom visual effects, or additional camera viewpoints. Although games propose their own representation of fictional and speculative futures through worldbuilding, narrative and gameplay, an approach that leverages critical engagement and countergaming practices suggests that video games can be adopted as speculative platforms in anticipatory design practices.

5. Conclusions

In this paper, it has been argued that video games, and science fiction video games in particular, can be understood as speculative artifacts that can propose alternative perspectives on outer space exploration, which is currently dominated by neoliberal and neocolonialist ideals. It has been discussed how both private companies' self-narration and science fiction media concur to represent future scenarios in which human presence in outer space is primary driven by exploitative interests and implemented through forms

of neocolonialism. However, it is argued that both commercial and non-commercial games can become platforms for developing critical reflections and promoting forms of reaction to the values and means that drive contemporary outer space exploration. Such critical artifacts, rather than suggesting technical solutions or practical approaches, fictionalize novel perspectives emerging from the alternative ideals that aim to nurture the space endeavor. It emerges the need to involve marginalized and underrepresented communities in the co-design of speculative artifacts, which come to be empowering tools that challenge the hegemonic perspectives on future technologies and their use. For their capability to reach and engage with a vast audience, video games can be adopted as speculative platforms that contribute to including more people, a wider range of sensibilities and more diverse identities in the public discourse on space exploration politics. The commercial narratives proposed by private space operators, based on the exploitative premises of the space economy, restrict the boundaries of inclusion towards those who don't share such a vision. Understanding video games as speculative media enables designers to adopt game design approaches to explore new methods for speculative enquiries and to engage with games as critical artifacts that can reflect and develop in design practice. The acknowledgment of concepts, ideas, methodologies, approaches, and practices that can resonate both in design and game cultures addresses the need to confront the complexity of contemporaneity from multiple perspectives. The adoption of video games as tools and methods for broadening the discussion on such relevant topics is synergic with other co-design practices. In fact, the inclusion of underrepresented communities in the co-design of speculative games, as the *He Ao Hou* case study demonstrates, allows to escape science-fiction clichés promoting the development of divergent speculative scenarios. Forms of countergaming, re-mediation, re-functionalization, and appropriation allow designers and non-designer to critically engage with the game worlds, promoting bottom-up critical and creative processes. Future development of the arguments presented in this paper will investigate how design can act as a mediator in developing a promising research field at the intersection between game design and cultures, playful design, speculative and anticipatory design practices, and critical theory.

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P/REFERENCES OF DESIGN

ANTHROPOGENIC NARRATIVES: COMMUNICATING AND EXPERIENCING NON-HUMAN PERSPECTIVES.

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KEYWORDS | SPECULATIVE DESIGN, COMMUNICATION DESIGN, CLIMATE CHANGE, PROTOTYPING, EDUCATION

ABSTRACT | The paper explores the implementation of an anti-disciplinary approach within a Communication Design Studio at Politecnico di Milano, focusing on teaching visual identity and experience design through a speculative design framework. Students are encouraged to engage in problem-seeking and problem-finding practices, fostering the development of concepts and scenarios without predetermined functions.

The studio's main outputs are communication design ecosystems manifested through visual identities, experiences, and Communicative Machines prototypes. These artefacts were showcased in an open event/exhibition, inviting external feedback. Anthropogenic Narratives, starting from the assumption of proposing non-human perspectives (e.g., the ones of rocks, sun, moon, or ice), aim to provoke and activate reflections on the relationship between humans and nature. Each subject is treated as a fictional organisation, which communicates through all the necessary elements of a fictional brand and related touchpoints, unfolding futuristic scenarios while involving the human/user in interactive experiences essential to understanding the narratives. The results come from an experimental educational path based on the risk of trying new solutions and techniques and verifying them on a real scale. Design speculations that are not meant to give answers and certainties aim to imagine new questions and reflect on contemporary and future times. A learning path that intends to go beyond the centrality of téchne to encourage the wielding of knowledge.

1. Introduction: Climate Change, the Role of Design and Critical Stances

The relationship between humans and nature needs to be changed, mainly due to the upheavals triggered by human activities within the last three centuries. The topic of climate change causes discussions and debates. However, most public opinion appears to stand still in front of such modifications rather than becoming aware of their role. Discussing these issues, especially in the context of education, is crucial.

Humanity is facing the most complex challenge it has ever experienced. If our Earth has passed through extreme events, such as the Ice Ages, the crisis the world has faced in recent years, although equally severe and urgent, is very different. In this case, it is possible to identify who is at fault, the ones responsible for the dangerous conditions that human beings and all the other ecosystems are experiencing. Earth is over 4,5 billion years old, while humanity has existed for just 200.000 years. Less than 0.04% of Earth's existence was enough to radically change the environment on which all species depend. The Earth has always experienced change, but the peculiarity of this crisis is the increasing rhythm at which these changes are happening. Indeed, climate change is getting worse year after year, and though there is awareness and discussion on the topic, nothing seems enough to provoke serious action.

Though the data related to the possible risks is clear and easily accessible, the changes in people's daily lives are still not enough. According to a report published by the Pew Research Center (Funk & Kennedy, 2016), although most Americans express to care about the environment, only a much smaller percentage declare to "always try to live in a way that helps the environment." Three-quarters declare themselves as particularly concerned with helping the environment in their daily lives. Nevertheless, only two in ten (20%) describe themselves as people who strive to live "sustainably always." These are cases of cognitive dissonance, a psychological phenomenon that occurs when a person holds contradictory values or attitudes and their actions conflict with their beliefs. It often leads to rationalising people's behaviour by minimising the importance of actions or blaming others for the problem (Jonas et al., 2014). Another bias is the so-called diffusion of responsibility, a process underlying the bystander effect that refers to the fact that as the number of people participating in the problem increases, the personal responsibility that an individual feels decreases (Blagg, 2023).

As Mitrović (2018) highlights, "Design, as the driver of modernism, also had its role in the establishment of the so-called 'Anthropocene' (or 'Capitalocene'), which more than ever in human history opens possibilities for extreme catastrophic scenarios that are about to take place shortly." The term 'Anthropocene' refers to the impact of collective human activity on biological, physical, and chemical processes at and around the Earth's surface ("Anthropocene", 2023). Design has always been a driver for innovation. However, the kind of solutions that have been developed were, most of the time, new tools and products, a race to go beyond the old and substitute with something brand new. When humans understood the consequences of this massive production, they started to shift the design processes to the methodology. Mitrović adds:

> "The idea that design thinking as a method could be used for resolving problems in business or everyday life has conquered the neo-liberal world. Through concepts and business models offering methods and tools for 'designing one's own life' [...], this business philosophy tends to transform into a worldview." (Mitrović, 2018)

It is clear indeed that design has played an uncritical supporting role to industry (Auger, 2023, pp. 65–76), determining the situation we are living in nowadays. "Most of the time, without reflecting on the implications of […] [his] actions" (Mitrović, 2023, p. 31).

As affirmed by Auger (2016), “contemporary design is a fundamental part of a postmodern socioeconomic system, inextricably linked to entrenched notions of progress, the manipulation of desire and conspicuous consumption.” Following and contributing to the dogma of progress as a way to achieve a better life, design has paradoxically been left behind by its modernist promises and principles (Colomina & Wigley, 2016), showing the limits of its deterministic spirit. In this condition, it becomes necessary to re-think new roles for design itself (Dunne & Raby, 2013, p. 12).

The rise of user-centred or human-centred approaches testifies to how the anthropocentric perspective has dominated all the aspects of research and production in the design fields (Sznel, 2020; Borthwick et al., 2022).

Norman (2023), the father of user experience design, in his recent book, “Design for a Better World”, states that designers should embrace the need to transition from human-centred design to an eco-systemic approach to humanity. This diverse mindset could help them to have a more comprehensive understanding of their responsibility to the people they design for.
The underlying belief to all these problems, as we already affirmed above, is anthropocentrism, the conviction that a particular species, Homo Sapiens, has some kind of privileged relationship with objects in the world (Caffo, 2017). It is a metaphysical system that considers all other beings as tools to serve humans’ interests (Rao, 2021).

These premises were the starting point from which the 2022/2023 edition of the Final Synthesis Communication Design Studio (Section C1), third year, Bachelor in Communication Design at Politecnico di Milano, took place. The belief is that sustainability-related changes and our connection with the planet require profound critical reflections and a significant shift in perspective, moving away from a purely human-centred view. It is a shift that entails expanding our outlook to consider the perspectives of all creatures involved in our ecosystems, even those typically overlooked, and granting them a voice in the discussion. As a field of practice, design disciplines have “the potential to detect, mediate and generate new relations and to encourage radical imagination” (Mitrović, 2023, p. 35).

Speculative design revealed itself as the perfect framework to do so. It offers the opportunity for an anti-disciplinary approach, using traditional and established design tools and methods to face “wicked problems” (Dunne & Raby, 2013, p. 2): challenges regarding the existence of no immediate or easy resolution, opening discussion in a disruptive way.

2. The Design Studio: Designing Speculations

Through imagination and a radical approach, speculative practice inspires thinking, raises awareness, examines, provokes actions, opens discussions, and provides alternatives needed in today’s world (Mitrović, 2019). With critical thinking, the design of objects generating a story or through the stories embodied in artefacts, speculative design attempts to anticipate the future and, at the same time, helps us re-think the world of today. In that sense, the practices related to Speculative Design reveal this potential and how successful it is as “an experimental environment to test different hypotheses about our lives in the future” (Mitrović, 2023, p. 35).

The statements mentioned above consistently convey the idea that design, specifically communication design, far from being a mere problem-solving framework and a commercial-oriented practice, can also be a tool for exploration and questioning to investigate and face the uncertainty of our contemporaneity. These insights form a fitting foundation for undergraduate teaching, which we will describe and discuss in the following paragraphs. This level of education seeks to equip students with technical skills and a spectrum of soft skills essential for professional practice. But with a robust critical consciousness.
The education path’s main goal, integrating research into and through learning, was to imagine and design possible, if not probable (excluding the preferable) futures, conducting and stimulating intentionally critical reflections on the present.

The main outputs to develop were communication design ecosystems within an anti-disciplinary approach, adopting a speculative design framework. Some developed main elements are visual identities, experiences, and prototypes (called Communicative Machines and at a 1:1 scale) to verify with an external audience.

Another goal of the Communication Design Studio, in terms of critical stances, was to make designers question their ethical role. To link the needs of a world in crisis, asking for action, awareness, and responsibility, to the one of education, the perfect place to stimulate these processes, experimenting with traditional methods and approaches to face severe and unresolvable problems.

In an educational context, adopting such an approach (e.g. Speculative Design, Critical Design, or Design Fiction) offers educators a means to help students develop practical design skills and critical thinking abilities (Helgason, 2020). As an educational tool, it broadens students' perspectives, encouraging them to "think more creatively and critically about the role of design in our shared futures" (Auger, Hanna & Mitrović, 2021, p. 21) and apply design principles across diverse contexts and project types. Most design education programs still adhere to "the modernist rational and functional understanding of design as a problem-solving discipline" (Grakalić, 2020). However, it is increasingly essential for designers to cultivate a capacity for "reflective practice" and learn to function as "researchers within the practice context" (Schön, 1983, p. 68), moving beyond mere problem-solving. It wasn't just a technique or a methodology taught to the students, but the development of a different attitude, the desire for more awareness, that gave birth to projects that demonstrated understanding and judgmental criticism towards something so delicate yet fundamental as the subject of climate change is.

The brief, starting from the assumption of proposing non-human perspectives (e.g., rocks, moon, sun, ice), aimed to provoke and activate reflections on the relationship between humans and nature. As affirmed by Rao (2021), speculative design allows expanding thinking to consider the perspectives and viewpoints of the "other" that lies beyond human experience and perception. All objects, living and non-living entities, have the same degree of being in the world. Through this reversal, the invitation expressed by the brief was precisely to imagine, discuss and speculate how nature could experience climate change.

Each subject was treated as a fictional organisation, which communicates through all the necessary elements of a fictional brand and related touchpoints, unfolding futuristic scenarios while involving the human/user in interactive experiences essential to understanding the narratives. Possible futures, dystopic narratives, and alternative realities are used to change the present (Inayatullah, 2020).

In this educational path, Communication Design is used to validate speculation: the speculative process is correct when design artefacts can effectively convey it, and vice versa. Design should not be considered a mere self-reflective practice but a powerful communication tool to promote speculation, critical if not political positions (Mehl & Höfler, pp. 13–14).

Students are organised into small teams and taught to traverse disciplinary boundaries and embrace a critical stance towards an apparently fixed discipline, such as Communication Design. It is a matter of fact that Communication Design, usually intended as the area concerning the design of communicative artefacts and specifically of visual kind (Bucchetti, 2020, p. 117-118; Lussu, 2010), has nowadays expanded its boundaries, becoming more of an open context with blurred borders (Grimaldi, 2009).

The applied iterative process views experimentation as a pathway to finding solutions, even in domains where teachers, professionals, or students may lack complete mastery (Triggs, 2003, pp. 7-17). During the prototyping phase (from initial development to final stages), students adopt a 'learning by doing' approach, embodying something akin to the concept of "thinkering" (Antonelli, 2011), whereby a conclusive outcome is achieved through successive collective refinements. Berglund & Grimheden (2011, p. 737) affirm that experimentation and prototyping entail iterations of "trial and error", a pivotal aspect across various stages of response development, from design conception to ultimate implementation. The prototyping phase is crucial, and students are introduced to using Arduino and some coding

environments to promote technological fluency (Lukens & DiSalvo, 2012). In this educational setting, the goal is not to specialise but to become literate, as Reas (in Cangiano, 2016) explains. That means understanding which tools best bring concepts to life. Students are not restricted to using specific mediums; they are encouraged to explore different technologies to find the best fit for their project, whether print, three-dimensional space, or code.

The educational design process is grounded in an anti-disciplinary (Ito, 2016) and evolutionary concept, rejecting a rigidly fixed design methodology. Characterising the teaching approach as anti-disciplinary implies transcending mere multidisciplinarity, avoiding narrow specialisation within Communication Design education (Childress, 2016). Embracing an anti-disciplinary stance entails drawing from diverse sources to envision novel possibilities rather than confining oneself to a single domain (Brin, 2016). This pedagogical strategy, underscored by a critical perspective, prioritises unconventional problem-solving paradigms, encompassing problem-seeking initiatives and problem-posing inquiries (Blauvelt & Davis, 1997, p. 80).

The proposed methodology and educational objectives must acknowledge that the Final Synthesis Communication Design Studio in the third year represents the culmination of undergraduate students' academic careers. It serves as a platform for integrating the knowledge and skills acquired in preceding semesters, with coding and prototyping augmenting those associated with communication design and visual systems. Overall, the final project allows students to deal with a hybrid, transversal dimension of Communication Design, not necessarily closed in a specific area. In these terms, as Bernstein (2011) commented, "fluency with technology often draws on knowledge, skills, and approaches that cross traditional disciplinary boundaries."

By embracing a speculative design approach, students gain exposure to diverse media and tools that transcend traditional design domains and methodologies. This approach enables them to experiment with various methods, tools, techniques, and instruments and draw insights from other practices and disciplines. However, another pertinent consideration is the notion, as mentioned above, of technological fluency, which entails navigating between different domains and perceiving the boundaries separating inquiry areas as permeable (Crow, 2008). Lukens & DiSalvo (2012) affirm that speculative design and technological fluency are inherently cross-disciplinary and integrative.

In conclusion, Speculative Design offers a versatile approach that transcends disciplinary boundaries, fostering creativity, critical thinking, and technological fluency essential for questioning contemporary problems and addressing future challenges.

3. Anthropogenic Narratives: Case Studies and Exhibition

The learning process of the Communication Design Studio can be summarised in five main parts, as shown by the Speculative Overlapping Double Diamond model (Fig. 1) (Isidori, 2023): Exploration, Speculation, Communication, Interaction and Making. The overlap of the various phases, defined as Synthesis, is effectively the moment of transformation into key intermediate project outputs.

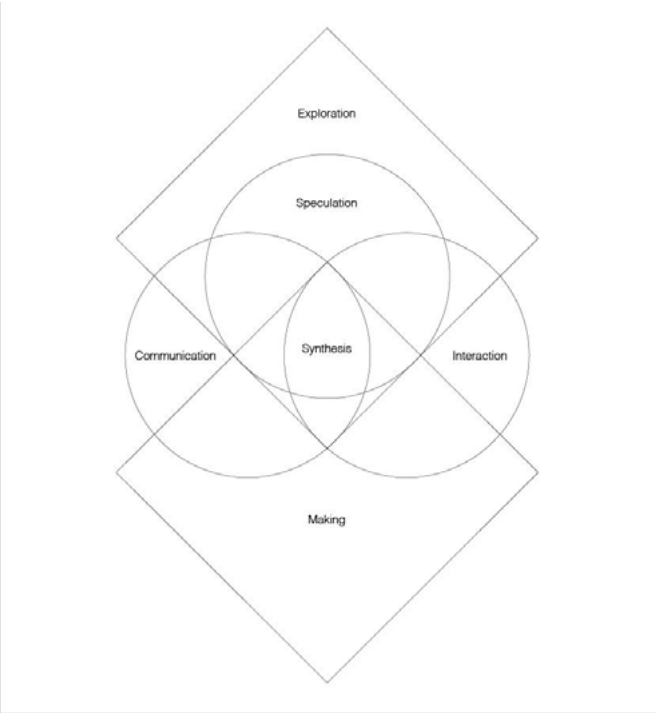


Figure 1. Speculative Overlapping Double Diamond Model (Isidori, 2023).

Students undergo diverse stages of the design process in each phase as they progress towards their final project. However, as emphasised by Frascara & Winkler (2008, p. 7), this process is not merely "reduced to a mechanistic set of steps", as "method without imagination contributes very little to the design profession and the solution of complex design projects." They collaborate in groups of 4 up to 6 individuals. Upon receiving the overarching theme (climate change), each group must delineate a specific perspective on the assigned subject (e.g., rocks, moon, sun or ice) and a corresponding scenario to address. Thus, they are tasked with identifying and dissecting a problem through analysis and research, operating within the realms of Exploration and Speculation. Leveraging human superstructures and organisations as valuable subjects, they employ fictional branding to "represent" their narrative, drawing upon competencies and skills acquired during the Bachelor's initial two years (4 semesters).

Subsequently, the focus shifts towards defining a concept and communication strategy and its multidimensional and multichannel execution (utilising touchpoints and selected media). Additionally, the students delineate the main functions, meanings, and contents of the Communicative Machine. Aligned with their concept and strategy, they devise a visual identity that ensures consistent communication across two- and three-dimensional outputs. They gain confidence in designing complex systems and transitioning into Communication and Interaction, where they begin synthesising the project.

A relevant phase is the prototyping one (Making), which encompasses both digital and analog realms. Students are encouraged to independently acquire any lacking skills, particularly in digital design, coding, and prototyping, while receiving guidance from instructors to refine their projects. Each member assumes a specific role within the group based on their interests and skills. Central to this critical pedagogy is the acknowledgement, rather than dismissal, of students' social experiences and cultural affiliations, which serve as lenses through which they perceive the world and mirror the audiences they aim to engage (Blauvelt & Davis, 1997, p. 80).

The primary outputs, the so-called Communicative Machines, are objects, installations, or interactive devices realised as prototypes for testing and verification. These objects are at the centre of narratives and intended to be like 'deus ex-machina', allowing the users outside the narrative to interpret the provocation and jump into the narrative. Other communication artefacts support this narrative; all the designed touchpoints ultimately enable the user to comprehend the world proposed (the story). All these objects, or

artefacts, produce the story's context appropriately and plausibly (Appadurai, 2013, pp. 355–364). Considering the given main subject (climate change), it was obvious to look for other kinds of stories and new worldviews to establish value and behavioural coordinates suitable for current and future conditions. The communication ecosystems (touchpoints, artefacts, interactive devices) are the narrative systems.

The premises that define each result are real: true data and actual risks humanity faces or will have to face because of climate change, conduct the scenario building and the concept development. This information is filtered through the judgment of an outsider spectator, who could be either victim, cause, or completely excluded from the phenomenon. It is preferable to consider different potential visions of the future as part of a participative journey toward centring a shared vision. When involving multiple stakeholder groups, it is important to acknowledge that each group may be concerned about a different set of issues and hold a different and conflicting set of values that could influence their choice. The intention was to promote an informed debate on a set of visioning scenarios and not to choose one in particular as 'the way forward' (Meadows & Kouw, 2016).

In the next paragraphs, we will briefly describe four case studies of the eleven projects produced in the 2022/2023 Communication Design Studio. The description considers the elements (moon, ice, rocks, sun) and their perspective on climate change. At the end of each case study, there is a link to a full description, images, and videos useful for complete comprehension.

If we consider, for example, the rising sea level, two completely different approaches and scenarios have been developed depending on the different positions and the involvement of the natural elements in consideration.

3.1 Moondo

The moon is an outsider participant in the climate change crisis. However, it contributes to the damages provoked by its effects. Its perspective is neither worried nor angry; on the contrary, with great irony, it takes advantage of the situation to make some profit, extending its influence and power.

The narration begins in 2030, and sea levels, triggered by global warming and moon activity, caused the flooding of several coasts and the abandonment of many cities. Moondo (Fig. 2) is a travel agency that takes advantage of the new environmental conditions and turns the submerged cities into perfect tourist destinations. The company offers numerous activities in each city, such as kayaking, paddle surfing, snorkelling on the surface, and scuba diving in the deep. Moondo transforms what would have been abandoned cities into the most fascinating places to visit. An interactive device, through the selection of geographical area, moon phase, and year of interest, allows the users to have a complete forecast of the floods that will occur within the next 120 years and find out the next available destinations and activities. The prototype has the shape of a computer, with a sloping top for the screen and a horizontal bottom for the controls. The structure was made of wood, then sanded, treated, and enamelled, with some elements in plastic and plexiglass. Arduino UNO Base connects the hardware with JavaScript, HTML, CSS software, and certain libraries and APIs. The libraries used were P5js, Jquery, and OpenLayers, which allowed the generation and interaction with the maps displayed during the interaction and made them available through a real-time data request service to Maptiler.

The final part of the Moondo experience consists of a video that, based on the user's choices, shows what activities they can do in a particular year, on a specific coast and in a certain phase of the moon.

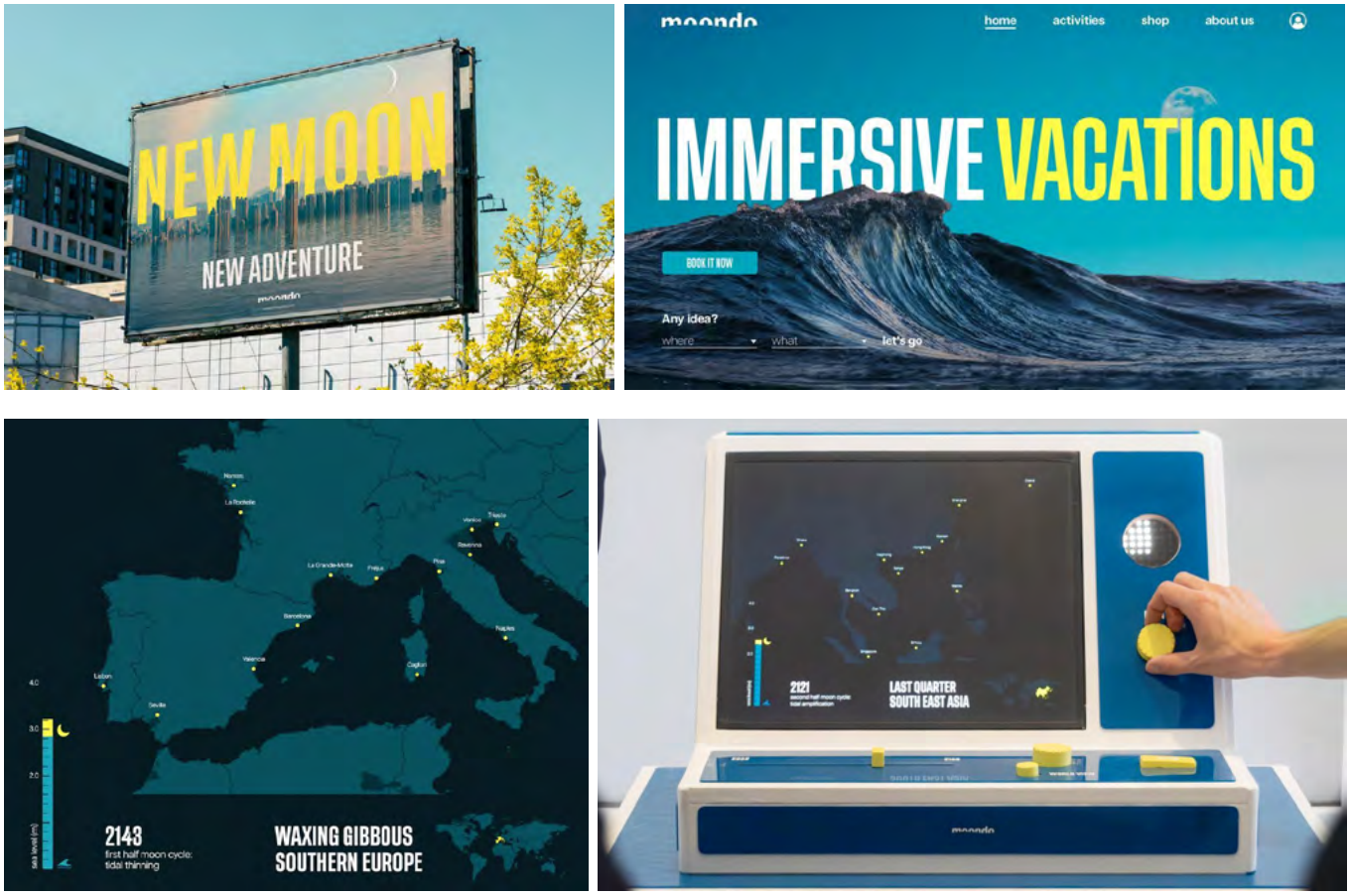


Figure 2. Moondo: advertisement, website landing page, the Communicative Machine, a screenshot of the selection process. Authors: Guglielmo Basile, Matteo Dell'Agostino, Arianna Marenghi, Marta Piatti, Chiara Provana, Ilaria Urgesi, Davide Vitrano. Source: https://anthropogenicnarratives.labsintesi-c1.info/projects/10_MOONDO.html.

3.2 I.C.E.

Ice's perspective is very different from the previous one though the project also reflects on the problem of the rising sea level. This element is indeed greatly affected by climate change. Humanity, blinded by its hunger for power, has made it weaker and weaker, dangerously close to extinction. Ice melting is probably one of the oldest and most known consequences of global warming. The persecution of actions that provoked such a problem has continued for years and years, fomenting a rage and a resentment that is now ready to come out.

I.C.E. (Insurge, Commit, Extinguish) (Fig. 3) is a terrorist organisation whose goal is to put to an end the harmful being that humiliates and destroys nature: humans. I.C.E. bombs are everywhere. Their timer lasts a few minutes and accelerates if anyone tries to get close. The only way to stop them is to stay still: place a hand on the icy surface of the device and stop doing anything that would make the crisis worse. As soon as contact ends, however, the time runs out again. The bomb explodes, triggering an environmental catastrophe at a specific point on earth, causing terror and destruction.

The bomb body, which hosts all the electronics, was modelled and printed in 3D. Once assembled, the cube was then covered with a black shrink sleeve. The final part, the ice in which the bomb was embedded, was made in epoxy resin. The device's functionality depends on a proximity sensor linked to a timer that triggers the bomb to 'explode'. When touched, a peltier cell makes the device appear cold, evoking the element of ice from which the message comes.

In addition to the bomb, the Communicative Machine consists of an old hackered television set.
The two elements communicate through an Arduino and a Raspberry PI. When the timer expires, the

Arduino contained in the bomb sends a signal to the Raspberry PI in the TV that broadcasts environmental disasters, interrupting the white noise signal displayed till then. The video and audio signals stored in the Raspberry PI were converted from an HDMI output to a SCART input to be displayed on the TV screen. The project is situated in a non-specific moment, taking reference from different periods and contexts to create a surreal world through a rich scenario that could be either in 20 years or tomorrow.



Figure 3. I.C.E.: urban graffiti, a newspaper headline announcing the possibility of stopping the countdown, the website landing page, the bomb and the television set (the Communicative Machine). Authors: Ginevra Bernasconi, Giulia Bonalumi, Jacopo Domenichini, Agostino Sanna, Andrea Vitali. Source: https://anthropogenicnarratives.labsintesi-c1.info/projects/01_ICE.html.

3.3 Litia

As in the previous case, the project's scenario presenting the rock's perspective is situated in an undefined time context. Rocks are not affected by climate change. They have witnessed countless shifts in the environment, and this crisis is nothing more than one of the many that Earth has and will always experience. Human beings, however, have developed a feeling of anxiety towards this problem. To cure this disease, eco-anxiety, a company for self-care named Litia (Fig. 4), has created Specta, a device that looks at

climate change as the geological phenomenon of rock stratification. Climate change is not a problem if we look at it from a rock's perspective.

Thanks to Specta, eco-anxiogenic events are visualised as relaxing layers that expand the user's perception into a space of dialogue with the rocks. The device consists of a manipulable object that resembles a real rock in shape and size. By lifting and slowly rotating the device, the user can transform the vision of catastrophic events into rock stratifications. The visual effect that deforms the image was created using shaders, a special programming language that allows the same instructions to be executed simultaneously for every pixel on the screen.

The prototype's core is the controller board, specifically the QtPy ESP32-S2 model Adafruit7, which contains the data from the gyroscope and sends it to the base via an Arduino MKR WiFi 10109 board. A light sensor controls the transmission of information so that Specta only sends data when it is actually in use, not when it is on the base.

Specta was modelled and printed in 3D. Its aesthetic resembled that of a rock despite its clean and smooth surfaces, slightly smooth edges, and flat colours, which are very unnatural.

The experience is completed by tracking the amount of content the user has been protected from through an app that provides all the statistics on the device's benefits.

The real problem isn't climate change, an inevitable evolution of life on Earth. It's the way humanity looks at it that must change.



Figure 4. Litia: the device named Specta and a sequence of the eco-anxiety silencer. Authors: Francesco Bonetti, Federico Gajo, Emiliano Garibaldi, Enrico Isidori, Cecilia Pizzagalli, Camilla Tosi. Source: http://anthropogenicnarratives.labsintesi-c1.info/projects/08_LITIA.html.

3.4 Illumia

The project brings a similar message but in a completely different narrative system. Illumia (Fig. 5) is a machine designed to store data on the relationship between atmospheric composition and the colour of sunsets. It embodies the Sun's perspective, generating past and future sunsets from the star's birth to its supposed end. The story is set in a fictional 1984, in the Atmospherical Research Institute of America (ARIA), also a fictitious reality that gives truthfulness to the research at the base of the project. The narrative is set in a context that mixes historical events with imaginative ones, recalling elements from an actual past to build an alternative present and future.

The Communicative Machine consisted of a fictional digital archive whose shape and interface evoked the aesthetics of early computers. It was modelled and printed in 3D, divided into two parts due to its size. Its main components were a Raspberry Pi, serving as a server for a tablet, which also acted as a display, a mechanical keyboard for user inputs, an on/off button, and an LED.

After turning the computer on, the user can select a city from a predefined list and any year in Sun's past and future history. These coordinates are combined with the CO2, temperature, and humidity values identified for each year. These parameters represent the atmospheric components most sensitive to climate change and significantly influential on the colour of the sky. Once the user selects the preferred parameters, the screen displays the generated sunset and three graphs showing the different values of the three parameters over time. At the end of the experience, the user can also obtain a printed output version. The printout includes all the data displayed on the final screen with a message from the Sun itself.

The project aimed to help humanity reconsider the scale and impact of climate change from a broader perspective. The Sun has existed for 4.5 billion years, witnessing seven great extinctions and experiencing temperatures and conditions that humanity can't even imagine. From its point of view, the current climate crisis is an insignificant variation of the ongoing and perpetual change that the climate is constantly undergoing.

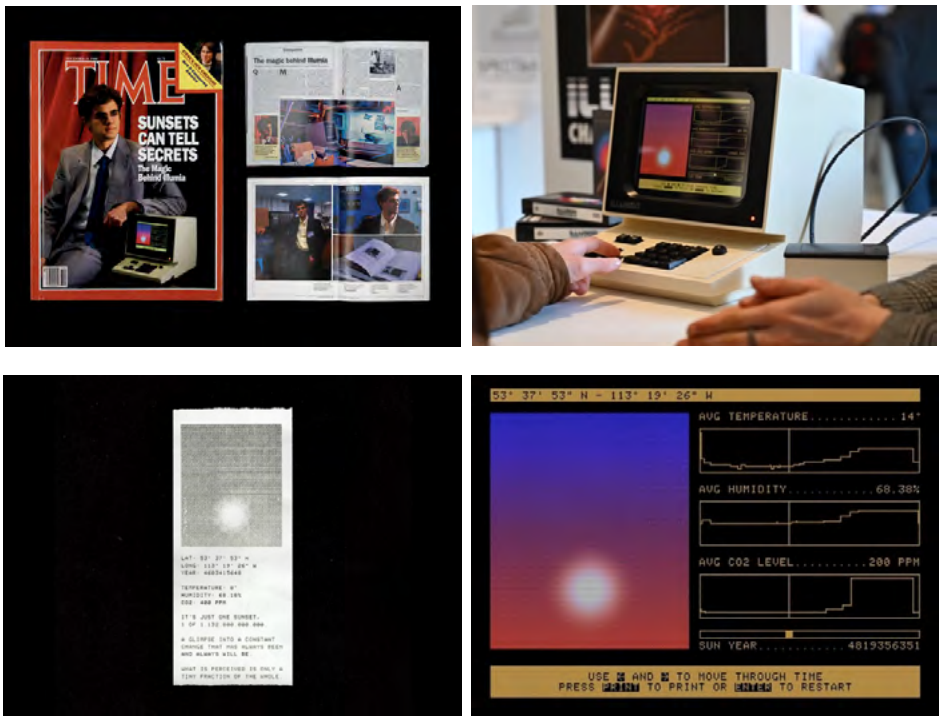


Figure 5. Illumia: cover and inner pages of a magazine setting the scenario, the Communicative Machine Illumia, the receipt with data and the message from the Sun, a screenshot of the interface. Authors: Andrea Borsato, Camilla Brusadin, Martina Esposito, Chiara Mazzeo, Anita Maria Ruggiu, Marco Ernesto Taino. Source: https://anthropogenicnarratives.labsintesi-c1.info/projects/07_ILLUMIA.html.

3.5 The Exhibition and Some Considerations

Even if only as a fiction exercise, the possibilities offered by the projects stimulated a real dialogue toward unheard dimensions. Embodying a non-human perspective, each group showed how the different natural elements send signals and messages worth grasping as they can enrich our vision and awareness and guide us to restorative action.

Among the eleven, these four projects were conceived during the first semester's Communication Design Studio and then showcased in a one-day exhibition at Triennale Milano. The exhibition was emphatically entitled "Anthropogenic Narratives. Communicating and Experiencing Non-Human Perspectives" to summarise both the brief that conducted the learning process and the output. "Anthropogenic" refers to environmental change originating in human activity. The term "Narratives" refers then to the stories behind each project. The word "experiencing" referred not only to the design of experiences. The intention was to invite people to have a direct experience of these perspectives through the communication design ecosystems produced by the groups of students.

The exhibition/event lasted 9 hours and saw the participation of over 700 people who engaged in discussions with the groups about the projects, tested the prototypes, and provided feedback. In some cases, the scenarios were presented so convincingly in terms of communication and narrative that visitors thought they were real products or services.

The four shortly discussed projects developed using the presented pedagogy process generated responses in the meaning of Frascara (Frascara & Winkler, 2008, p. 11): design reduces problems and should always involve research. These designs were conceptualised from diverse perspectives, exploring varied scenarios and employing a range of technologies and media, encompassing both analog and digital formats. Consequently, each design necessitates theoretical discussion and practical validation through prototyping. Students were encouraged to experiment with visual communication, user interface design, and tangible interactions across two and three dimensions, inevitably involving the fourth, the one of time. This approach facilitated the exploration of unconventional methodologies and alternative design paradigms, fostering a critical examination of design values, forms, and representations (Johannessen, 2017; Bardzell & Bardzell, 2013).

Speculation and critical stances were translated actively using Communication Design but approaching design solutions as a hybrid discipline, which means it "allows to break out of traditional typologies, to experiment with hybridisations of formats, structures, and modes of expression" (Quaggiotto & Galasso, 2023, p. 220). By adopting this approach, students are led to assume a critical attitude towards their position as designers, reflecting their practice's social and political implications. Moreover, they also get used to managing their professional field as an open context, not necessarily closed by disciplinary boundaries but evolutionary by nature. Design speculations are not meant to give answers and certainties; they aim to imagine new questions and reflect on contemporary and future times.

The prototyping phase is significant since, beyond the reasons already explained, it generates organisational capabilities such as flexibility and requisite variety, becoming integral to products and processes. It also operates as an antidote against core rigidities through updates of new knowledge and new methods for solving problems (Leonard-Barton, 1995; Berglund & Grimheden, 2011). According to Berglund & Grimheden (2011), the learning model allows students to add benefits to teamwork, utilising each other experiences and perspectives, integration and synthesis, and socialising.

The material and/or digital prototype artefacts are essential in introducing students to a Research through Design (RtD) attitude (Zimmerman, Forlizzi, & Evenson, 2007). According to some of Giaccardi's (2019) statements, they play intriguing and essential roles in demonstrating possibilities, provoking and speculating on alternative presents or futures, evaluating design outcomes, and empirically testing hypotheses. Certainly, reducing the projects' development to a single objective is impossible.

4. Conclusions

Speculative Design is one of several disciplines that can help us to take action, anticipate the future, and explore what's possible. The future is not a passive destination but rather a continuous process influenced by our thoughts and actions in the present. Changing the probabilities of future outcomes and shifting towards preferable tomorrows requires connecting past actions to present behaviours. Imagination and the choices in people's everyday lives are the tools that make it happen.

As affirmed by Anagnostou, Karvinen and Vasko (2020), the concrete actions useful to create different futures don't need to be "grandiose intervention, they can also be gentle gestures". Despite its ironic and disruptive methods, the impact of speculative design is subtle and light. It quietly and discreetly touches the hearts of the people who participate in the project and find themselves indelibly changed by the experience. Stories are not vague; they have strong, real implications. As stated by Harari (2015), it is a fact that humans use their language not merely to describe reality but also to create new, fictional realities. Fiction is a powerful tool to create stories to believe in and to redefine the relationships between the elements of the world as it is. It turns out that the world as we perceive it is partly the product of human imagination.

> "We humans control the world because we live in a dual reality. All other animals live in an objective reality. We humans also live in an objective reality, but over the centuries, we have constructed on top of this objective reality a second layer of fictional reality, a reality made of fictional entities, like nations, like gods, like money, like corporations. What is amazing is that as history unfolded, this fictional reality became more and more powerful, so today, these fictional entities are the most powerful forces in the world. Today, the survival of rivers and trees and lions and elephants depends on the decisions and wishes of fictional entities that exist only in our own imagination." (Harari, 2015)

A meaningful event, as the exhibition entitled "Anthropogenic Narratives", enriched the memory with new information and redefined the relationships between already-known patterns so that these concepts can no longer be emptied of this newly attributed meaning. The change of perspective made it impossible to forget the point of view once it had been considered.

Each fiction created during the Communication Design Studio has had a concrete and powerful impact on the lives of those who participated in the project: students, professors, and visitors to the final exhibition held at the Triennale. Storytelling is a powerful tool for understanding the future and motivating the discussion related to a delicate and severe topic, such as climate change. Through participation, they had multiple benefits (Ackoff, 1993). They have a valuable learning opportunity and their commitment to action increases.

Reflecting on the project's impact within the educational context, what is the most interesting is the critical judgement that was stimulated in the students about their profession. These young designers became more than just capable operators: aware of the power their work has on people, they transformed into informed professionals, conscious of the ethical implications of their actions.

The feedback collected over the years from students and the audience in enhancement and presentation occasions (e.g., exhibitions, websites, social networks) confirms the effectiveness of the learning process and educational experimentation to create working prototypes. Students appreciate the anti-disciplinary approach in acquiring new knowledge and skills, directly verifying communication design's hybrid nature. At the same time, they learn to learn, accepting the challenge of a constantly evolving discipline and practice. In the comments to the various editions of the Communication Design Studio, they define the design approach as "extremely innovative" and "useful to learn by doing, work more independently, and deal with technologies never used before." Furthermore, the assignment of issues to develop through a speculative approach is interpreted as "stimulating" and "a challenge", which allows them to "find unconventional design solutions."

Conversely, a recurring comment concerns technical skills. Due to time constraints, many notions and knowledge are not provided during the course through frontal lessons, but their deepening is left to practice and individual initiative. This is particularly true regarding aspects related to coding or prototyping. Specifying that these comments were collected before the exam and the final exhibition is essential. Subsequently, following individual or small group interviews, these comments fade away. The completion of the experience and field verification make the educational model more evident to the students.

The practical verification, made with an external audience, finally allowed the students to verify the design hypotheses through the prototype. Its role is crucial to understanding the narrative through direct and personal experience. For students, this phase can be critical for questioning the design hypothesis. However, it also becomes the moment for self-criticism, for reflection on what has been achieved.

We firmly believe that an anti-disciplinary approach to design applied to a topic such as climate change can be effective in the teaching context. Thanks to a speculative framework, which allows, by definition (Dunne & Raby, 2013, p. VII), to create "Parallel worlds" or to make "The 'unreal' real", students could experience a perspective that traditional design wouldn't consider. By using the proper tools of Communication Design in an unconventional way, they could translate messages sent by natural elements to broaden a discussion that would otherwise be impossible.

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P/REFERENCES OF DESIGN

TOWARDS INTERMEDIATE ZONES: ARTEFACTS OF THE UMWELT DESIGN APPROACH.

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ABSTRACT | This paper begins by recognising our environment as a more-than-human community that is temporally and spatially situated. Within this community, all living beings are acknowledged as unique individuals encountering a reality that is shaped by their predecessors. As humans, we are part of this community, and we can choose to insert ourselves in a caring manner – or not. Acknowledging contemporary spatial practices' shortcomings, the study introduces a design approach inspired by Uexküll's concept of Umwelt to engage with the more-than-human reality. The first aspect of the approach emphasizes that each individual forms their own reality and that engaging with the subjectiveness of that reality is a participatory act towards the more-than-human community. The second aspect introduces the concept of 'intermediate zones', speculative spaces of interaction and mutual influence between Umwelten. These 'intermediate zones' seek to decenter human-centred thinking and foreground the entangled nature of our shared reality. By extending Umwelt's concept, the approach fosters a framework for exercises that explore these ideas, tested through Living Labs. In the Living Labs, an increase in the participants' sensitivity towards the more-than-human community was observed. The constellation of exercises centred around Umwelt has underscored the design process as a journey of engaging-with, rather than adhering to the conventional approach of problem-solving. We believe that the designer's role undergoes a subtle yet significant evolution: transitioning from a problem solver to a curator of ritualistic practices that incorporate and propagate more-than-human perspectives.

1. A Temporally and Spatially Situated Community

In every now-moment (Bird Rose, 2012), we humans are embedded in a whole set of more-than-human relations without which we could not live. Our lives are constantly entangled and supported by a network of animals (Van Dooren, 2010; Meijer, 2019), plants (Gagliano et al., 2017), bacteria (Margulis, 1998), fungi (Tsing, 2015), viruses, and soils, by the weather (Ingold, 2007) – but also by machines, buildings, computers and other forms of technology (Wakkary, 2021). The environment we live in is a communal effort of all these individuals whose entangled activities form the currents that push the continuous unfolding of the world forward – the worlding of the world is always a becoming-with (Margulis, Sagan, 1986; Haraway, 2016; Tsing, 2015; Disalvo, Lukens, 2011).

This network does not just lie waiting to be used by us – it is not a resource instrumental to human progress. This entire network has its own influence and formative power – and it shapes us not only in an idealistic sense but also in a material sense. For example, as Donna Haraway points out, consider that only 10% of all cells in our body contain our own DNA. The other 90% of cells contain the DNA of bacteria, fungi, and protists with which we share our environment but have thus also become part of our existence in a literal, material sense.

In focusing on two types of relationships, sequential and synchronous, anthropologist Bird Rose (Bird Rose, 2012) understands this multispecies network as a real community, in the complete sense of the word, a community that has its own history, existing of a group of multispecies individuals interacting in the now-moment. For what forms us all, our customs, our institutions, our way of life, is precisely the convergence and interlocking of all these elements. And, of course, in this network, the human is today a dominant weaving force, but he does not do that, in a Heideggerian sense, 'from the outside'. Although we often fail to notice, humankind is fundamentally shaped by the more-than-human network in which it is entwined.

From such a point of view, another-than-human being, such as a crow, is actively building towards the future of its surroundings. By living his life, that crow is helping to shape the framework within which all other beings, including humans, will shape their lives now and in the future. The crow always does this as an individual – situated and shaped by a unique spatial and temporally situated more-than-human community. That crow, after all, inherits (van Dooren, 2014) at birth a reality that is already structured by his crow predecessors but equally by past generations of rats and humans, and his life depends on his ability to insert himself as well as possible and thus contribute to shaping the fabric in which he is always embedded. This is a historical, temporal and located task, not an eternal return of the now, as our cyclical understanding of nature might suggest. It is a task in which this specific crow must demonstrate his own responsiveness and creativity.

When we, therefore, engage a specific location – professionally or otherwise – we are thus always interacting with the location's existing multispecies community. Relational networks are constantly being built on and around a site and in interaction with the site. Even by being present, we become active participants within these processes, integrating ourselves into the existing fabric, accounting for shaping a future more-than-human community. We can choose to do this in a caring manner or not – not because we are unique beings with a choice, but just because we are, at this moment, the most dominant species.

2. How to Engage?

In contemporary design approaches, however, there is little attention or respect for the existing more-than-human community. Such a lack of attention usually does not necessarily stem from ill will, practical objections, or time pressure but from the failure to see our surroundings as the multispecies spatially and temporally situated community that it is. In his book Ways of Being Alive (Morizot, 2022), Morizot points to a sensitivity crisis as the result of an impoverishment of what we can feel, perceive, and understand. This crisis of sensitivity stems from various factors, including technological advancements, urbanisation, and

predominantly Western cultural attitudes that prioritise human-centric perspectives over ecological interconnectedness. In short, we have created a condition in which we no longer need to be attentive to other-than-human life to thrive and are stimulated to turn inwards. The sensitivities of our human perceptual apparatus are shifting from a physical and multispecies world towards a digital one. We must relearn the 'art of attentiveness' if we aim to preserve and redefine what relationships we are able to develop with other living beings.

Our ability to form connections is hindered not only by a lack of attentiveness but also by the distance we have created between ourselves and all other living beings. It is a consequence of the humanist tradition embodied by Descartes' Bête Machine and Cartesianism (Stengers, 2007; Debaise, 2017; Driessen, 2020), constructing a bifurcation between humankind and all other life that is still deeply embedded within Western culture. For example, the notorious German philosopher Heidegger (Heidegger, 1995) reaffirms this bifurcation in a lecture series (1930) by claiming the other-than-human world is 'poor-in-world' while man is 'world-building'. We, humans, are believed to be the only ones with a history and the ability to creatively engage that history to construct a future. All other living beings are claimed to lack history and openness towards the future as they are unable to surpass their genetically determined path. In other words, we have constructed our Western reality on the belief that hard boundaries exist between us and other species while "our strong sense of difference from any other life-form, our sense of species superiority is a delusion of grandeur" (Margulis, 1998). When questioning these boundaries, it predominantly happens from our human-centred perspective, often resulting in affirming what is questioned (de Waal, 2016; Bridle, 2022). Although posthumanist studies of the last 30 years have increasingly countered this bifurcation, we simply forgot how we could relate, or in Ingold's words, correspond, with life surrounding us. In our day-to-day lives, we fail to notice how both we and they go along together in the current time (Ingold, 2017). In his book 'Being a Beast', Foster explores how he relates to the fox in his London neighbourhood, a badger family in his beloved Wales and three other earthly companions by immersing himself in the lifeworld of these individuals. "I share much more with a fox than with a fundamentalist [from Alabama]. I've lived and I live with the fox in an embodied, sensual world of wood and earth and bone and semen and cold. We met and meet in a real place" (Foster, 2016). Foster's attempt to become those animals, live or feed like them, is an immersive act of his whole bodily and sensory self. It is a radical and impossible attempt, but in its seriousness, it beautifully foregrounds the understanding of the broader phenomenological tradition that our sensory engagement is a participatory act. A focus on one's own bodily and sensory reality simultaneously broadens one's awareness by reimmersing one in a more-than-human community. "Far from restricting my access to things and the world, the body is my very means of entering into relation with all things." (Abram, 1997)

A third challenge hindering us from seeing and approaching our surroundings as a more-than-human community is the complexity and uncertainty it brings and our inability to deal with that. Being attentive and open to an existing community implies letting go of certainty. We have to come to terms with the fact that we will never fully understand the vastness of relationships that form a specific community, nor will we ever truly be able to predict how our actions will affect it. To solve this ignorance, we instinctively exert as much control as possible over the future, using assessment guidelines, nature conservation principles and norms or masterplans to form as complete a picture as possible of the ideal community we want to realise. We constantly readjust reality to match these understandings and visions and hence fail to be attentive and listen. According to Tănăsescu, the only way forward is to accept ignorance not as something to solve but as constitutive and structural. "The centrality of ignorance amounts to a perpetual commitment to observation and study, to finding out exactly what the nature of our community is. Given, indeed, both chance and change, this is a never-ending task." (Tănăsescu, 2022). Response-ability (Haraway, 2016) is never-ending. Constitutive ignorance and vulnerability are wedded, and accepting ignorance foregrounds the vulnerability we must exert when truly engaged in being part of a more-than-human community (Puig de la Bellacasa, 2021). It is a matter of openness to change, to relationships and the fluctuating nature of these relationships, and an openness to the future while being responsive to the past. It is a commitment to making choices in our engagement with the more-than-human community. This is inevitably associated with a degree of failure and force: making choices means not making other choices, and certain things will be excluded from the future community. We must be aware of this necessary force (Ginn et al., 2014). Just

because it is necessary does not mean it is unproblematic. This realisation should prompt us to exercise a certain care: don't let your choices be too burdened by a desired ideal image, but work uninhibitedly with what is now presenting itself. It is a commitment to "take on the fraught work—never finished, never innocent—of weaving new stories out of this multiplicity: stories within stories that bring together the diversity of voices necessary to inhabit responsibly the rich patterns of interwoven inheritance that constitute our world". (Van Dooren, 2014)

3. From Umwelt to Subjective and Intermediate Realities

To address the challenges above, we have conducted multiple experiments over several years, together with art and design students, to develop an open design approach based on two distinctive ways of creatively and speculatively engaging with Jakob von Uexküll's concept of Umwelt (von Uexküll, 1934). This approach aims to generate artefacts that transcend an all-too-human representation of our shared, more-than-human environment and help us, in the process of the making, to engage our struggles in relation to the more-than-human community.

In the book 'A Stroll Through the Worlds of Animals and Men', biologist von Uexküll takes a "stroll into unfamiliar worlds" by imagining a bubble around a creature that "represents its own world, filled with perceptions it alone knows." (von Uexküll, 1934) From this perspective, we see the world as it appears to the creature, and within this world, coined by Uexküll as the animal's Umwelt, we are only interested in what is relevant to that specific animal. Uexküll uses the sea urchin as an example to map out its relation to the world. Sea urchins are sensitive to light and perceive a darkening of their environment as an incoming threat and respond by moving their spines to the perceived threat. However, the sea urchin would react similarly to any sudden darkening of their horizon – be it a ship sailing above it or a cloud temporarily blocking out the sun. Uexküll illustrates this example by juxtaposing two illustrations. The first image illustrates an underwater scene as we would perceive it: we recognise a boat, a fish and a cloud. To underscore that for a sea urchin, these differentiations do not matter but are merely experiences of moments of sudden darkness, the second image pictures the same underwater scene with blobs taking place of the (for humans) recognisable elements. This illustrates that whilst we share the same environment, we all perceive and thus interact differently. As concluded by Lee: "The perceptual apparatus of an organism is directly related to its agency within the perceptual world it inhabits." (Lee, 2018). In understanding the intimate connection between an individual's perceptual apparatus, its agency and its surroundings, we come to understand that each individual inhabits, engages and actively forms their own reality. (de Roo, Ganzevles, 2023)

We distil two key notions from Uexkull's concept of Umwelt that shape our design approach. We expand upon the concept of Umwelt, extending its application beyond its original scope with a degree of flexibility. We intentionally avoid the distinctions between plants and animals in light of ongoing discussions in plant phenomenology (Brenner et al., 2006; Struik et al., 2008) and the evolution of our anthropocentric views on sentience and intelligence (Bridle, 2022). We also believe it can be beneficial to dissolve the distinctions between the living and non-living altogether, adopting an animistic approach to our environment, as David Abram propagates and spiritual ecology. While we recognise that abiotic elements such as the wind do not possess an Umwelt, deliberately exploring such fabula can aid us in the pursuit to counter anthropocentric thinking and decenter our ways of seeing.

The first key notion is the construction of a highly personal world through a sensory engagement with what surrounds an individual. We advocate an experimental approach rooted in the inherent subjectiveness of any individual to be-in-the-world, to highlight and explore this. For this reason, we developed a set of exercises inspired by radical observation methodologies specifically focused on our own Umwelt and subjectivity. These exercises range from listening sessions to observational walks or palette collecting. By focusing on our own subjective experiences, bodily reality and sensoriality, we acknowledge the existence of our Umwelt and its relativity towards the multitude of other Umwelts. As our individual activities form areas of greater and lesser sensitivity, this focus redefines the sensitivities within our own Umwelt beyond

what we usually use. In retraining our senses to be attentive to the more-than-human world, we counter the 'sensitivity crisis' as identified by Morizot and relearn how observation is always a participatory act. (Ratcliffe, 2008)

We devised these exercises so they lead to the production of artefacts using graphical, textual and audio-visual means or other artistic expressions. These artefacts are intended to translate the qualities and reality of engaging a more-than-human world – surfacing the producer's perspective and creative reaction to their surroundings, the synaesthetic reality of a place and the impossibility of completely grasping or understanding it. As such, they communicate the visceral reality of engaging a place and its inhabitants, stimulating a response-able engagement with the more-than-human community within the broader group of stakeholders of the general design process.

A second key notion is the visual intermingling of Umwelts. The drawings in Uexküll's book, exemplifying the Umwelt of a sea urchin or a mollusc, are interpretations of the perceptual worlds of these animals, projected over how we would perceive that environment. These drawings do not aim to show reality but highlight different relevant perceptual cues within the environment for that other-than-human, transposed on how we perceive the environment. In creating these visual overlays, Uexküll unintentionally provides an intriguing pathway to explore as part of a more-than-human design approach (de Roo, Ganzevles, 2023), as there is an inherent quality in these in-between realities. We, therefore, developed a guide to develop these transpositions and leverage their qualities. Starting with an analysis of the other-than-human individual and a reading of the landscape from the individual's perspective, we work towards developing a speculated reality in between our subjective reality and the subjective reality of another-than-human individual. We call these in-betweens 'intermediate zones'. These 'intermediate zones' can take various forms, from written documents to graphical or audio-visual interpretations to site-specific interventions, provided that they encompass what makes tangible the perspective of another and immerse us in their Umwelt through our own. Following Shores' expansion of the Umwelt towards becoming-animal of Deleuze & Guattari, we propose that these 'intermediate zones' can also be realised in actually transforming our bodily reality towards the bodily reality of the other-than-human. Instead of taking on the identity of another creature, becoming-animal rather involves trying to draw near enough to it so that one enters into a "shared zone of proximity". (Shores, 2017)

The artistic quality and the speculative act of creating these 'intermediate zones, knowing full well that they will not – and can not – be a complete transposition or transformation, foreground structural ignorance and speculation as a tool to engage the more-than-human world. It is exactly this speculative character that brings out, in Forlano's words, the "imaginative and rigorous ability to defy the constraints of a typical design brief". (Forlano, 2016)

4. Living Lab

To empirically investigate the effects of our approach, we established two Living Labs over one academic year. Living labs refer to collaborative sessions built on a process of design research. The consequences of various design scenarios are actively discussed and evaluated (Lupp et al., 2021). These sessions aim to unlock knowledge, dialogue and co-creation processes, allowing iterative feedback loops. A derelict industrial marshalling yard was selected for testing as the contrast between the sites' harsh urbanised characteristic and the unintended non-human use foregrounds the existence of a more-than-human community in which we are no active participants.

Each Living Lab was a six-credit interdisciplinary course taught on-site once a week in 4-hours blocks. The second- and final-year bachelor students participating came from various academic backgrounds, ranging from art to design disciplines. The overall goal of the Living Labs was to test the developed exercises around the concept of Umwelt based on the students' retention of key concepts and realisation of a shift in sensitivities as designers towards multispecies communities through ongoing and end-of-course evaluations with an invited jury.

Students were asked to fill out a questionnaire to establish a baseline of their knowledge. Students were asked to use a notebook to document their thoughts, ideas and experiments throughout the course. We emphasised the production of artefacts through various exercises to move the research forward. The exercises forming the design approach aim to stimulate students' sensitivity towards the more-than-human community, encourage them to integrate themselves within that community, and propose design interventions exemplifying and communicating their relationship with the more-than-human community. A selection of exercises is detailed below.

The first two weeks introduced key concepts in posthumanist discourse and let students get acquainted with the site. We invited species experts to uncover traces left behind by other-than-human actors and to expand students' knowledge of the site. Under their guidance, students first-handedly experienced the impoverishment of their sensory sensitivities compared to the abilities of our experts to, for instance, detect the smell of a fox.

By introducing exercises in the form of non-human persona cards (Tomitsch et al., 2021) and species passports (Weisser, 2019), students were stimulated to expand their knowledge of the actors on the site.

In the subsequent four weeks, students were given exercises to explore the site and attune to it from the perspective of their own Umwelt – referencing the first key quality we identified in von Uexküll's theory. These exercises consisted of observation exercises (Bodily Observations, EX1) in various forms, focussing on our senses as well as the site. They help students discover the subjectivity and sensitivity of their senses and introduce observation as a participatory act. Senses enable interaction, bind the individual to material reality, and help to stay with the trouble. As such, cultivating our senses becomes an ethical act of more-than-human acknowledgement.

Through the exercise of palette collecting (Palette Collecting, EX2), students were challenged to collect objects or observations on site. Collecting, following an intuited pattern, frees us from our expectations and enables us to form new subjective perspectives and understandings. Moreover, ideating patterns in the collections activate long-term memory as our personal history informs the patterns we see and develop. Rearranging the found elements gives them meaning. This stone is no longer just a stone; it's a stone that stands in relation to other elements because, by collecting it, you introduce these relations. It is a way to acquire and express identity together with a location, eventually strengthening your situatedness in the physical world. Collecting is a creative engagement weaving your story through the landscape, resulting in a landscape that is fully alive and active.

A third exercise meant to develop a sensitivity towards the derelict marshalling yard was observing one specific actor (One Actor Observation, EX3). Daily, we encounter other-than-humans but often rely on our preconceived notions to 'classify' and move on. For instance, we roughly know how a feral pigeon looks and how it acts and are therefore less attentive to that specific pigeon in that environment. The observant transforms from an alien and accidental observer to an immersed individual, transforming the relationship we have with the environment to which that individual belongs.
In the next four-week period, we introduced other exercises that relate to the idea of 'intermediate zones' that we drew from the second key quality we described in von Uexküll's conceptualisation of Umwelt.

An introductory exercise was Multispecies Storyboarding (Multispecies Storyboarding, EX4). Drawing from the practice of storyboarding in HCI and design (Truong et al. 2006), this exercise revolves around understanding how actors interact with a spatial object. The goal of this tool is to acquire a better understanding of the importance and appearance of the object within different Umwelten by retelling a narrative from different perspectives. Where humans approach an object from their perspective, experiences and viewpoint of utility, other-than-human actors can dedicate a completely different meaning or utility to that same object. For instance, where humans might view a shed primarily as a storage space, other-than-humans, such as crows, see the structure as a safe place to land and observe their surroundings. By identifying the role of the object for multispecies interactions, a layered understanding is built around this object, where various Umwelten overlap – informing the creation of 'intermediate zones'.

In this exercise, it is possible to understand how abiotic elements interact with the object, for example, how the course of wind changes due to the shed, leading to ripples into other Umwelten. These insights can then inform speculations about potential acts of care that could influence existing relationships or pinpoint moments in each individual's timeline that hold promise for connection.

In 'Appropriating Non-Human Form' (Appropriating Non-Human Form, EX5), we speculatively explore becoming another-than-human being as a creative and liberating way to bind the bodily self to the bodily reality of the other-than-human individual, eventually resulting in an 'intermediate zone' in which possible entanglements can be ideated. "The ways in which, inevitably, I perceive and describe a badger's scent world involve things that have no representative at all in the badger's own world. They are purely human artifice (...) I can't know what the immediate burst of a dog's mercury scent does in a badger's brain, but does it really matter?" (Foster, 2016) A gap between you and the other will always exist, but by taking on other-than-human forms, we inch closer to each other by creating an 'intermediate zone'. In changing our morphology and sensory capacities through the use and development of sensory-shifting tools and prosthetics, we are able to perceive the world more like other-than-human beings. In focusing on the meanings these perceptions have and the effects they generate in us and the other-than-human individual, we can give meaning to that 'intermediate zone'. In these attempts, we do not aim to replicate an experience or become that being altogether; we strive to creatively extrapolate that experience into a mediation, a space for new meaning and relationships to emerge.

We can employ technological tools that extend our senses to aid these exercises. Incorporating existing and emerging technologies allows us to decenter our human perspective temporarily. For instance, we understand our site differently by using night vision cameras and thermal optics. Using LiDAR technology, we can inch closer to understanding how a bat might perceive the environment. Furthermore, the emerging field of generative AI opens up a vast array of possibilities for sensing, decoding and visualising these intermediate zones.

The final exercise provided to the students was to explore entangling Umwelten (Entangling Umwelten, EX6). Building on desk research captured in the species passports and non-human personas and by comparing the sensitivities inherent in our senses with those of other-than-human actors, infused with the learnings from the previous exercises EX4-5, we can speculate on the different perceptions of a specific context. These speculations should not only account for the primary functions of the senses (i.e. locating food, finding kin) but should also consider how the anatomical structure of the individual might influence the possible sensitivities of the senses.

This speculative exploration requires rendering intermediate zones visually as the designer has to mediate between representing their own Umwelt and questioning how to represent the Umwelts of their chosen actors. This speculated entanglement provokes opportunities to consider "numerous overlapping worlds in which many kinds of things and many ways of seeing and being are possible" (Bridle, 2022). This comparative analysis aims to illuminate potential conflicts and opportunities within our co-existing effect-worlds, offering a deeper understanding of our shared environment from multiple perspectives.

5. Reflections

By incorporating the concept of Umwelt into our exercises, we have anchored our design approach in Art Science – a hybrid practice where artistic production and methodologies are fused with scientific research and principles. This hybridity is crucial as speculative 'intermediate zones' can only effectively contribute to decentering the design discourse when deeply rooted in biological realities. This grounding ensures that these speculative environments are not only imaginative but also resonate with current scientific understandings of the more-than-human world, thereby enriching the exploration in this field. This groundedness is achieved by drafting lifecycles or species passports and collaborating with biologists, trackers or nature conservationists. At the same time, this approach ensures ecological professionals' involvement and remaining interest, evidenced in both Living Labs. Concurrently, the development of

‘intermediate zones’ for decentering the human crucially hinges on the experiential component, as underscored by DiSalvo and Lukens (DiSalvo, Lukens, 2011). This aspect is vital in ensuring that these zones not only conceptually but also tangibly shift perspectives away from a human-centric view, fostering a more immersive and engaging experience that resonates with and challenges the audience.

While the group of exercises strikes a balance between speculation and grounded research, individual exercises often lean more heavily toward one specific aspect. Allowing participants the freedom to choose their path through the exercises opens up opportunities for exploration and personal engagement with the material. However, we noticed the students tended to gloss over the science/research-oriented exercises and relied on preconceived ideas and simple anthropomorphisms to tackle the speculative parts of the design approach. This was more pronounced in the projects of art students. This could be correlated to art studies, generally having a less focused scientific groundedness. One project focused on feral pigeons and, following detailed observations developed a headmount for humans to see the world as a pigeon. In this case, the project did not dive deep enough into the different senses of a feral pigeon in relation to its life cycle and day-to-day survival to realise an ‘intermediate zone’. Another student created an Instagram page to share insights on the speculated emotional condition of the wind, yet overlooked researching fundamental meteorological phenomena driving local wind patterns, like thermal shifts from differences in paving materials. Therefore, this exploration felt flat as it couldn’t be effectively linked to the site’s materiality and was disregarded further in the process.

While we support tailoring the design approach to an individual’s project – with room to introduce or exclude exercises as seen fit – the aforementioned observations highlight the importance of engaging with exercises that significantly differ from one’s own expertise. Neglecting this leads to an unbalanced approach that hinders the exploration of ‘intermediate zones’. Following other design approaches, we strongly advocate for an iterative process, as the knowledge developed in each step can strengthen or steer preceding exercises in new directions.

During the two Living Labs, the students started to pose critical questions as they developed an increasing sense of curiosity and wonder. “Why do we attribute so little value to what already exists?” “Why has the publicly accessible part of the site been cleared of spontaneous scrub vegetation?” Many students were emotionally shaken when a bulldozer came and eradicated most of the existing life to establish a temporary parking lot. This common practice does not normally elicit the same strong emotional response or feelings of grief. The zones on the site, still awaiting ‘clearing’, slowly drew the students’ attention, as these zones felt like the more-than-human community could still further develop – that there is a starting point to build relationships.

Considering the short time frame of the Living Labs as well as the beyond-human scale of the site, students could never become experts of the site and its more-than-human community. Despite that, students did manage to develop a sensitivity towards the existing community. In one project, a student connected his family history to the researched history of the Italian poplar trees on site. As a landscape architect, he abstained from drafting an architectural plan for the end-of-course evaluation. Instead, he developed several proposals, some of which consolidated his bond to the poplar trees, aimed at fostering the flourishing of the trees, notwithstanding the substantial and forthcoming transformations of the site.

Students indicated several reasons as to why their sensitivity grew throughout the Living Lab. Some referred to specific exercises as pivotal moments, and other students highlighted the encounters these exercises triggered. Others simply referred to immersing themselves in the more-than-human community by spending 30+ hours on-site thinking about that topic. Throughout the 10 weeks, the concept of a more-than-human community took root in the students' minds, leading us to argue that the design approach laid the foundations to become a reponse-able actor within that community.

The growing sensitivity to the topic made some students question conceptualising physical interventions on-site for the end-of-course evaluations. They posed that it contradicted the ideological objective of the assignment, where inscribing ourselves in the more-than-human community meant not yet again to

produce something. “We already make too much; can’t we just not make anything?” Following this enquiry, some students focused on the observational exercises - developing artefacts that foregrounded their personal encounters with the site. This led to interesting discussions, linking the critique with the idea that humans are somehow always an ecologically destructive species (Tănăsescu, 2022), that human actions are somehow unnatural (Vogel, 2011), or the perception that the thriving of a more-than-human community does not involve some sort of violence.

> “Flourishing always involves a constitutive violence; flourishing does not imply an ‘anything goes’ free-for-all but requires that some collectives prosper at the expense of others. This perspective requires us to see non-humans not always as victims nor humans as perpetrators. Rather, flourishing involves many species knotted together, often imbricated in human landscapes or economy, working with and against other multispecies assemblies.” (Ginn et al., 2014)

These debates led us to question the design process in the context of response-able engaging a more-than-human community. Do we keep understanding design as a process working towards some sort of pivotal interventionist moment to solve a problem, or should we understand the moment we enter the site as the start of the intervention? How can we even speak about a pre-intervention stage in this post-anthropocentric world? The learning process to engage a more-than-human community becomes the intervention to “increase the affordance of the built environment to life and to expanded forms of cohabitation”. (Leveratto, 2024)

The accumulation of artefacts gathered in the provided notebooks was crucial for initiating and conveying this transformation, as it reflected the students' efforts to interact with and respond to the existing affordance of other-than-human individuals. Our understanding of the artefacts developed further during the Living Labs, particularly as some students engaged in performative acts, dug holes or cultivated plants from cuttings. Others pursued more expected creative endeavours ranging from drawings and sketches to audiovisual works. Expanding on our notion of artefacts, we regarded all these pursuits as results of the process of engaging with the more-than-human. Thus, we experienced how design in the more-than-human reality mirrors the practice of gardening (Cléments, 2015), slowly attuning the self and the community to each other through incremental acts. Each act is an opening up to that community, to remain attentive and to acknowledge we are learning to find our place precisely because we will always be unable to know exactly what that means.

Through interactions with the more-than-human community, the role of the designer transitions from external entity with a defined objective to an active participant within that community, and ideally, its advocate—capable of voicing concerns beyond human-centric ones and navigating the intricacies of the multispecies interactions amid spatial transformations.

6. Conclusion

This paper begins by recognising our environment as a more-than-human, temporally and spatially situated community. Within this community, all living beings are acknowledged as unique individuals encountering a reality shaped by their predecessors. The ability of an individual to survive and thrive within that community depends on their ability to insert themselves and shape the fabric in which one is found. This is a responsive and creative act. As humans, we are part of this community, and we can choose to insert ourselves in a caring manner – or not. Contemporary spatial practices indicate our struggle: we often fail to recognise our place within this community, to see ourselves as equals within this community, or struggle to engage with the structural ignorance that comes with this.

To address these challenges, we developed a design approach based on two distinctive ways of creatively and speculatively engaging with Uexküll’s concept of Umwelt. The first aspect of our approach emphasises that each individual forms their own reality and that engaging with the subjectiveness of that reality is a

participatory act towards the more-than-human community. The second aspect introduces the concept of 'intermediate zones', speculative spaces of interaction and mutual influence between Umwelten. These 'intermediate zones' seek to decenter human-centred thinking and foreground the entangled nature of our shared reality. Through these lenses, we interpret the concept of Umwelt beyond its original scope, offering a framework for exercises that directly or indirectly relate to these key features. The effectiveness of this approach has been tested through Living Labs, providing insights on the exercises and the overarching shift in sensitivity towards the more-than-human world.

In the Living Labs, we observed an increase in the participants' sensitivity towards the more-than-human community. Not only in acknowledging the existence of that community but also in recognising our non-central or relative position within it. While it is premature to conclude that this heightened sensitivity translates into a lasting, productive force in the subsequent design attitude (given the limited scope of the living labs), our use of Umwelt as a red thread throughout the various exercises has contributed to an increased awareness of the 'intermediate zones' where designers operate.

Moreover, the constellation of exercises centred around Umwelt has underscored the design process as a journey of engaging-with, resembling the nurturing practices seen in gardening, rather than adhering to the conventional problem-solving approach. In this context, we believe that the designer's role undergoes a subtle yet significant evolution: transitioning from a problem solver to a curator of ritualistic practices that incorporate and propagate more-than-human perspectives.

Further research is required to evaluate the implications of this evolving role of the designer on concrete design proposals and to understand its applicability in a context where other challenges and limitations are at play. However, our findings suggest a promising avenue for redefining the designer's role in an entangled, multispecies reality. This role emphasises the importance of continuous, sensitive engagement with our environment, in which design is seen as a collaborative and caring act that accounts for the innumerable voices of the more-than-human world.

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P/REFERENCES OF DESIGN

INSECTURE: INTERSPECIES-INTERACTION (IX) DESIGN.

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ABSTRACT | Using insects as the primary subject, this paper presents a speculative, biology focused model of performance and design-based thought and creativity. It is supported by the expansion of the Goethean method of biological analysis and defines a new discipline of interspecies-interaction (IX) design. This is best represented by the following works: Mao Moth Laos, the documentary films by Tokuro Oka and Mao Kobayashi (2019), and Insect Viewing Apparatus (IVA), a tool by Christopher Mark Kaltenbach (2016).

This discipline is juxtaposed with the problem of how to understand and creatively use insects in ways that generate pro-environmental advocacy from an external audience and considers how the concepts of empathy, consciousness, and ethics, as they apply to insects, aid in that advocacy work. This provides a steppingstone to move beyond the confines of those who solely advocate on behalf of insects in favor of an idiosyncratic exploration and celebration of insect form and behavior that in turn manifests a unique behavioral model between human and insect.

Furthermore, this research clarifies and expands upon the insect-based design and research strategy discussed in Kaltenbach's dissertation. It is situated within his definition of Design Applied Environmental Entomology: "…aesthetic approaches of framing and interaction with these animals. Set against three commercial industries of bioengineering, food manufacturing and pet breeding…[implying] another approach to sustainability" Ultimately, this model demonstrates "enthusiasm, care, and value" for these animals and provides new ways to contemplate their beauty and mystery.

1. Introduction

The title of this paper Insecture is a neologism first coined in Christopher Mark Kaltenbach's PhD dissertation under the same title (Kaltenbach, 2019, p.3). The addition of the "-ure" suffix to an animal name that defines any class of arthropod was made to capture a conceptual idea about a broad set of design engagements ("act, process, being") (Merriam-Webster, n.d.) with and for insects. It is an aesthetic contribution, enhancement, and promotion of these animals and the underlying common good they bring to the planet's ecologies and societies. As a verb and noun, in this paper, it is a broad umbrella from which to introduce a specialization of creative works that use performative strategies such as dance and product design to envision new behavioral realities between humans and insects. This design specialization is described here as interspecies–interaction (IX) design.

The two creative and biology-based works put forward as representations of IX design are: the documentary films Mao Moth Laos by Tokuro Oka and Mao Kobayashi, and a tool called Insect Viewing Apparatus (IVA) by Christopher Mark Kaltenbach. The uniqueness of these performative works propelled the definition of this design discipline, which is enhanced and aided by a variety of mediums and devices, such as light, video footage, tool and/or spatial envelope. The objective in both is to create a new appreciation, inspire empathy and wonder from the interplay of viewer/participant/performer and insect. Ultimately, the key question is, can these types of invented, artificial interactions with insects— performance- and design-based works— motivate pro-environmental action in the public?

One does not have to look far to find a similar model that researchers have identified as generating public appeal for conservation efforts (another form of pro-environmental advocacy) for the zoo. Here specific characteristics of the contemporary zoo have been identified to foster a positive appeal for individuals. Beyond these animal enclosures, circuses, marine mammal parks and aquaria are also spaces for interacting with "wild", un- or semi-domesticated animals. Contentious as these venues may be, these likewise provide important models for future analysis.

Within the fields of art and design, much has been written on the subject of animal integration into art and design work (Brady, 2010; Aloi, 2015; Mitchell, 2016). Little, however, has been published on insects in creative disciplines (Barrett and Tierney, 2022), especially as it pertains to their interactive, performative potential. The discipline of IX design described in this paper, is currently unable to assert if the work presented offers the same opportunities to invoke pro-environmental or conservation messages as those found in a zoological model. With that said, recent research in insect consciousness is providing another pathway for garnering a better appreciation for these animals, which may aid in messaging to the public the importance of these animals, and hence the need to advocate on their behalf.

The expectations of purpose that govern Mao Moth Laos and IVA are speculative, because the immediacy of the performative activity, the result of presenting these impromptu interactions between human and insect is neither fully known or complete. Their speculative nature can also be understood as instructional devices for the dancer or designer in order to create future works, or to have the potential to motivate the viewer or participant in some positive action, ideally advocating for the preservation of their natural habitat. Ultimately, what these works present are models of action within a process of becoming. This type of creative work comes closest to resembling the performance art-based strategies popularized in the 1990s, as described in Nicolas Bourriaud's book, Relational Aesthetics (Bourriaud, 2009).

Speculative approaches in the field of design have a rich history dating back to the drawings of the late 18th-century French architect Étienne-Louis Boullée, which the Australian art critic Robert Hughes aptly described as "paper architecture" (Hughes, 1980). As well as the more recent practice of British designers Anthony Dunne and Fiona Raby, whose "supernatural, future fiction" (Kaltenbach, 2017, p.42) projects and collaborative teaching with students, which spans more than twenty years (Dunne and Raby, 2013), introduced a type of design that blurred its intentions with contemporary art strategies. In general, speculative design can also be defined as work that is waiting to or is not intended to be made (remaining

as a 2-D rendering) or mass produced (remaining as a one-off object); it also has the potential to imagine alternative societal norms, conditions and/or issues. Today, this mode of art- or design-based work continues to evolve.

Furthermore, it must be acknowledged that these projects function as contemporary, urban mediators between individual and insect. The interpretations of these animals and the decisions of how one should interact with them is a by-product of the human-made environment and its social milieu, including influences from Asian cultures. This perspective can best be understood using Steven Vogel's concept of a "social construction of nature." (Vogel, 2016, p.33) It establishes that the "way in which nature is experienced changes over time and is closely related to changes in social structure and worldview, this does not mean that nature itself, the thing that is experienced in different ways by different societies, changes." (Vogel, 2016, p.35) Similarly, the works by Oka, Kobayashi and Kaltenbach are also social constructions, fabricated interpretations of these animals, separated by the actual lived experience of the insect itself. Whether or not their perspectives on insects represent broader social structures or worldviews will be left to future analysis.

2. Insect Empathy + Ethics + Consciousness = Pro-Environmental Activism?

When it comes to placing animals at the center of pro-environmental activism, often their plight and the larger environmental issues they come to represent become mired in debates between political, agricultural, industrial food animal production constituents, to name a few, and those who seek to promote their autonomy. The long-held beliefs that animals, like many of the earth's resources, are meant to serve and sustain human life, become irreconcilable against those who hold animal existence and their interconnectedness within the earth's ecologies as a priority over commerce-based mandates that either benefit from their eradication or use as a commodity.

Environmentalists, conservationists, and vegetarians or vegans have largely depended on empathy and the promotion of an ever-evolving field of animal ethics as tools for advocating for the welfare of animals. Insects have recently found these advocates calling for the ethical treatment of them, especially as it pertains to food production. As subjectivity forms our understanding of animals, it is necessary to recognize which insects are perceived useful. For example, the bee has higher standing than the locust in areas of North American agriculture production due to the bee's function as a pollinator. A utilitarian function that aids the productivity of humans is one area of valuation in an otherwise socially constructed value system. Insects, like the idea of nature, "boils down to nothing more than what our culture makes it out to be" (Kahn and Kellert, 2002, p.153). (Kaltenbach, 2019, p.72)

Circuses, zoos and marine parks provide immediate and intimate encounters with undomesticated animals. In a 2019 study, researchers found that repeat visitation to a zoo leads to an accepting attitude towards animal conservation efforts (Andrea and Eduardo, 2002, p.10). Even more telling was when zoo staff interacted with the public in an educational manner, the zoo experience was greatly improved; they "found that public animal training and public animal training with interpretation produced more positive zoo experience and perceptions of exhibit size than passive exhibit viewing or interpretation-only sessions" (Andrea and Eduardo, 2002, p.10). This is an important observation, as it demonstrates that in some instances the observed interaction between an animal caretaker and the animal itself can generate stronger feelings of empathy for the animal than if the animal was left alone in an enclosure.

Outside the interactive experiences found in the zoo environment, where insect exhibits are rarely included, what opportunities does the public have to be informed by these small, often tiny animals in a controlled space? There are natural science museums that showcase dead specimens, or sometimes a lepidopterarium with live butterflies. In Japan, there is a type of pop-up beetle petting zoo that periodically opens in a department store's vacant floor. These provide the public, especially children, valuable hands-on exposure to these animals (Kaltenbach, 2019, p.228-229). Beyond these examples, the insect in most instances is stigmatized, making the possibility to change people's opinions in an educationally interactive public experience challenging.

Perception and Proximity: the Difficulties with Insect Empathy

Most animals have the capacity to allow people to feel some level of personal empathy toward them, and some more than others, such as a family pet. There are two important aspects for this relationship to be established. The eyes of the animal are one and the other is feeding an animal. Most animals can indicate recognition with one another through eye contact. The eyes of warm- and cold-blooded animals are relatively the same in that there is an eyeball with a pupil inset in an iris and sclera (often the two are the same color). This eye can move, and the pupil can change in size and shape. However, when it comes to the entire face of the insect, it is difficult for humans to discern. The components of its face provide no clues to establish if the animal is aware of another's presence. This is due to the abstractness of the insect's facial features, which makes the eyes and mouth difficult to identify. The single continuous color of the insect eye never provides a visible change. As the mouth opening of an animal is usually formed by a defined edge, like lips or a beak, the insect provides no clear demarcation. Also, since a mouth is typically used for some level of defense, it can be difficult to know which end of the insect to stay clear of.

When the mouth of an animal has been established and one finds themselves in a situation to feed it directly (which is usually the case at a zoo, petting zoo or even a koi pond), the exchange can be thrilling, especially when the tug of the animal is felt, its will being transferred through a leafy branch to the hand; there is an unmistakable feeling of momentary connection. There are few insects that provide that visceral immediacy in this food exchange. For these reasons it can be argued that it is difficult to feel empathy for or from the insect, hence the difficulty in developing a relationship with it. These observations provide part of the critical rationale to justify the need for design to reframe the insect.

In addition, we typically do not allow animals to initiate physical contact. We make the first advances by petting dogs, horses, rabbits and when at the zoo, the handler controls the animal and the situation by directing us where and when to stroke the animal. Insects on the other hand, find us, without us realizing it. They land on our shoulder, crawl up our pant leg or cling to our clothing when brushing up against an object. Typically, it is only when we feel the uninvited tickling of the tiny legs or the proboscis of the mosquito piercing the skin that we shudder and cringe. The feelings of fear, pain and annoyance are generally the first to come over us. However, when a person approaches an insect and initiates physical contact, the experience can be very different, even enjoyable. (Kaltenbach, 2019, p.72)

Insect Consciousness: Scientific Analysis vs. Social Construct

Can insects be considered sentient beings? Scientists have found it difficult to establish what kind of subjective experience insects have. Researchers have argued that for insects to feel pain they would need nociceptors (pain receptors), which they do not have. However, they do respond to heat, cold, and mechanical stimuli. Also known as nociception behavior, Zeder reports, "It was found that a single class of neuron (class IV multidendritic neuron) is sufficient and necessary to cause this nociception behavior." (Zeder, 2015, p.3191). The insect is "genetically programmed" with the behavior and is not actually thinking about the pain or recognizing that it is feeling pain. Nociception is not pain, it requires an emotional response, which insects are unable to convey (Hwang et al., 2007).

A paper published in 2016 by researchers Barron and Klien suggest that there be an "alternative approach to studying the capacity for subjective experience in invertebrates" (Barren and Klein, 2016, p.4901). They

proposed “arguing about what subjective experience is, and what is capable of it, is most productive when appealing to empirical neuroscience” (Barren and Klein, 2016, p.4906). Using various methods, they determined different levels of subjective experience and that “there are many classifications, but each posits a basic form of consciousness that consists of a direct awareness of the world without further reflection upon that awareness” (Barren and Klein, 2016, p.4901). Furthermore, “the insect brain resolves action and target selection, processes sensory information, and clearly executes a command function over the behavioral system” (Barren and Klein, 2016, p.4903).

The research work of neuroscientist Andrew Barron has also identified fine neural structures in the brains of honeybees. From his decade-long research, he believes that brain structures in this insect match the way the human midbrain processes spatial information (Anderson, 2019). Additionally, researchers concluded that “honeybees can learn and apply the concepts of greater than and less than to interpret a blank stimulus as representing the conceptual number of zero and place zero in relation to other numerical values. Bees thus perform at a level consistent with that of non-human primates by understanding that zero is lower than one” (Barren and Klein, 2016, p.4905) (Kaltenbach, 2019, p.72).

So, what level of insect consciousness can guide us in understanding how we can relate to them (Howard et al., 2018)? Is there a correlation between a higher knowledge of their subjective selves and a rise in empathy for them? These questions begin to help us define what is required to understand insects in order to promote change in our behavior towards them. We now know that when an insect is identified as a key agent in a system that benefits the welfare of humans, a great deal of public momentum is created to motivate government legislators to act, demonstrated five years ago when France banned several pesticides, some which were identified in bee colony collapses (Samuel, 2018).

Can domestication play a role in providing empathy for insects? Clues to this question can be found in Japanese historical texts that provide a highly imaginative, Animistic/Shinto and Buddhist perspective on their lived experience and value to humans (Hearn, 2015). These texts provide an aestheticized appreciation for these animals as it relates to their ability to conjure and amplify ambient conditions such as auditory mnemonics and ancestral worship. Two books provide insight into that history, Lafcadio Hearn’s 1921 book Insect Literature and Kanoh Yasutsugu’s 2011 book Singing Insect Cultural History: Known Places of Singing Insects and Insect Sellers.

Both Hearn and Kano describe the consumer market of singing insects in Japan from the 18th through the early 20th century. Hearn provides a chapter dedicated to discussing the history of selling a variety of chirping insects as musical pets (Hearn, 2015, p.129-156). His historical accounts were based on records available to him in Japan at that time, which allowed him to create detailed descriptions of the vendors and how their lives centered on selling and enjoying these insects. The wealth of information Hearn provides creates a framework for understanding how the cultural value of these animals was commercially shaped and measured at that time. Hearn’s description brings to life the beauty and magic of the role singing insects had in the lives of people in Japan (Kaltenbach, 2019, p.65). Having his account of the organized commercial activity of selling insects for no other reason than the auditory aesthetic value provides important historical legitimacy to the work of Oka, Kobayashi and Kaltenbach.

The usefulness of the products that bees, crickets, and silkworms produce has provided empathy for these animals during different periods in time (Kaltenbach, 2019, p.65). However, what happens when insects themselves become the commodity, as seen in the rise of entomophagy, insect as food? As an important alternative to industrial food animal production, do vegans consider them worthy of advocacy?

Cautionary Tale on Ethics: Insect Protein vs. Vegan Strategy

What standard of ethics should be applied to the use of insects? Since the 2013 United Nations report (van Huis, 2013) on the value of edible insects as an environmentally sustainable alternative to other livestock sources, a range of claims have been made on the relatively small footprint of resources required to produce this food source, especially as it pertains to greenhouse gas emissions, agricultural land,

and freshwater use. With mounting concerns over the future of global food stability and access to drinkable water, one might think this would be a welcome alternative; however, for those who are vegans, their socio-environmental stance is driven by an unwavering "morality of consumers to eat what is ethical," (Emel and Neo, 2015, p.237) applied to all animals, including insects.

Anecdotal evidence of the sternness of this moral position, was recently collected at a sustainability product exhibition/trade show in Tokyo. In December 2019, Kaltenbach exhibited a section of a prototype insect terrarium wall system. This installation proposed the raising and harvesting of crickets for use in food production within small terrariums nested in the cavities of a specially designed brick he had designed.



Figure 1. (left) Christopher Mark Kaltenbach explaining the Acheta Socket Brick + Terrarium wall system at the JIDA (Japan Industrial Design Association) Next Eco Design exhibition at Tokyo Big Sight, in Tokyo. December 5th to 7th, 2019. (right) Acheta Socket Brick + Terrarium wall system design by Christopher Mark Kaltenbach. photos: Miki Chishaki.

At some point during the event, an older gentleman approached him and questioned his use of insects as a food source. The gentleman accused Kaltenbach of demonstrating a complete disregard for these animals. While trying to explain the environmental benefits of raising this rich protein source over that of other industrialized food sources, he admonished him, declaring that no animal should be subjected to industrialized methods. Kaltenbach continued by pointing out the Japanese had had a long history, up until the early 20th century, of eating insects. Regardless of this historical precedent, the vegan advocate believed it to be a moral crime to breed crickets for human use and consumption. There appeared to be no environmental argument that could be offered as a defense that would change this individual's mind. In his eyes, the gravity of Kaltenbach's offense was tantamount to a mortal sin.

This tense encounter represented a vegan strategy of advocacy, where no level of litigation could penetrate the singularity of reasoning, "to abolish animal food production altogether and to cease consumption of animals" (Mcelwain, 2009, p.292). Kaltenbach's approach in presenting an ecological alternative was a desire for a "gradual reform in animal food production methods" (Mcelwain, 2009, p.292) away from beef, pork, poultry, and fish via the promotion of insect consumption. The display of the decorative terrarium wall system, as an expression of this philanthropic overture, was not environmentally progressive enough for the vegan. Proving the adage that forms a cautionary reminder to those who attempt to solve a societal problem with design, whether it be at an individual, community, civic, national, or global scale, "it should be remembered that one person's problem is another's home or fight for freedom or means of transport" (Davies and Parrinder, 2010, p.17). In the case of this cautionary tale, the need to promote an environmentally sustainable food source alternative was another person's moral offense.

Should this unwavering empathy displayed by the vegan advocate be championed? Should this ethical position be extended to other types of animal use, such as wildlife management" (Lunney, 2012) or the veterinary profession (Sandøe et al., 2003)? What about the use of insects in commercial industries beyond food manufacturing, such as in bioengineering and pet breeding? If insects can be promoted for use of their molecules or natural compounds such as amino acids, iridoids, or chitin, which help to wean society off the dependency on petro-chemicals or the overuse of soil and water, by its very nature, isn't this positive, pro-environmental activism?

In this section, three approaches to understanding and appreciating insects, at a deeper level, has been presented: the concepts of empathy, consciousness, and ethics, as it pertains to these animals. The pathway to a deeper value of insects, either through empathy felt towards them, or a scientific grasp of their level of consciousness, or applying a moral principle, all provide a way to construct a personalized belief system on how best to use and conceive of them. But do these concepts describe how to treat them humanely? What standards are applied? Does publicly treating insects humanely automatically equate to motivating pro-environmental advocacy? How does one ensure that an audience can be appeased? Currently, it is difficult to assess where exactly the moral high ground is when using these animals. For a dancer or designer to include and engage with insects in the public realm, it must be acknowledged that no matter what the best intentions are, misunderstanding and misperception are bound to arise.

3. Observational and Experiential Processes: An Emergent Behavioral-Model

> "[S]hifts in perception and positioning that can be provoked when we commit to more expansive ways of being in and of the world. That means looking more closely and listening more deeply, noticing fine details and attuning to processes, and at the same time adopting a wider, more holistic view that situates our experiences with larger webs of relationships, spaces and times." (Almarcegui et al., 2021, p.15)

Since Aristotle's *History of Animals*, it has been known that the pathway to understanding the natural world has been through reflective observation, be it the naturalist or the artist. The concentrated, documentable focus on the behavior, physical characteristics, and growth of animals and plants during extended periods of time and across seasons, defines the approach to fieldwork in the life sciences, and in creating scientific illustrations. This engagement with biological models became the basis for taxonomical, morphological, and ornamental motif studies, which today are important parallel lineages to the empirical and phenomenological studies found in design across several disciplines.

Beyond the Goethean Method: The Phenomenology of Insect Life

When it comes to understanding the techniques of observing natural phenomena and then translating this into an artistic response, the Goethean method is often cited (Verma, S.K., Punekar, R.M., 2019; Rowland, 2000). In basic terms, it is a four-step process: use, understand, become and channel. First, use all of one's senses to directly observe the phenomena in an objective manner; second, understand the phenomena over time; third, to become open to a new understanding and locate a suitable medium from which to express this; fourth is to channel that knowledge into an appropriate form to express those biological phenomena. We can see the graphic transference of an eye-mind-hand-tool activity that Johann Wolfgang Goethe (1749-1832) intimated in his writings and depicted in the antiquated scientific illustrations from the period. Today, designers have a canon of twentieth century urban observation work by which to be inspired. Annotated sketches, diagrams, and photographs as seen in Wajiro Kon's Modernology, and Terunobu Fujimori's The Street Observation Society or the détoumement (diversion) and dérive (drift) of Guy Debord's Situationist International (McLaughlin and Fry, 2001), all provide analysis tool kits for eye-witnessing the world in the most urban manner, if at times, a caterpillar's pace.

The usefulness of reflective observation for a designer is to activate the imagination towards an act of creative inspiration. However, when it comes to directing the designer's focus on a biological entity this can be bewildering, due to an expertise in people-centered analysis. Here, the references and cues are of another dimension and scale. For this activity, insects are especially appropriate biological subjects because of their small size, unfamiliarity, and the general bewilderment they can generate due to their foreign, non-mammalian characteristics.

When considering the work of Oka, Kobayashi and Kaltenbach, Goethe's method appears to be broadening with a necessity to add an additional step. In a way, it is a return to the first step; however, moving past simple empiricism into a subjective realm of sensorial interaction with the specimen. These works make the process-of-discovery mode of investigation itself the framed experiential work in a duration of intervening. However stylized—partially preconceived and/or aided with an object/environment—the form that is expressed is the human behavior set in motion to counter, join or contemplate the actions of the animal. This is an important distinction; in that it describes an intervention with the specimen from which to gain an experience that in turn coaxes a new behavior from the person. It is through this behavior that then a new understanding of themselves in relation to the insect is gained — an experiential subjectivity that generates a sense of empathy for the animal. The ability to observe this in another person or to be placed in a situation from which to gain this first-hand experience is the emergence of a biology-inspired performance process and the apprehension of a behavioral-model.

Catching Crickets

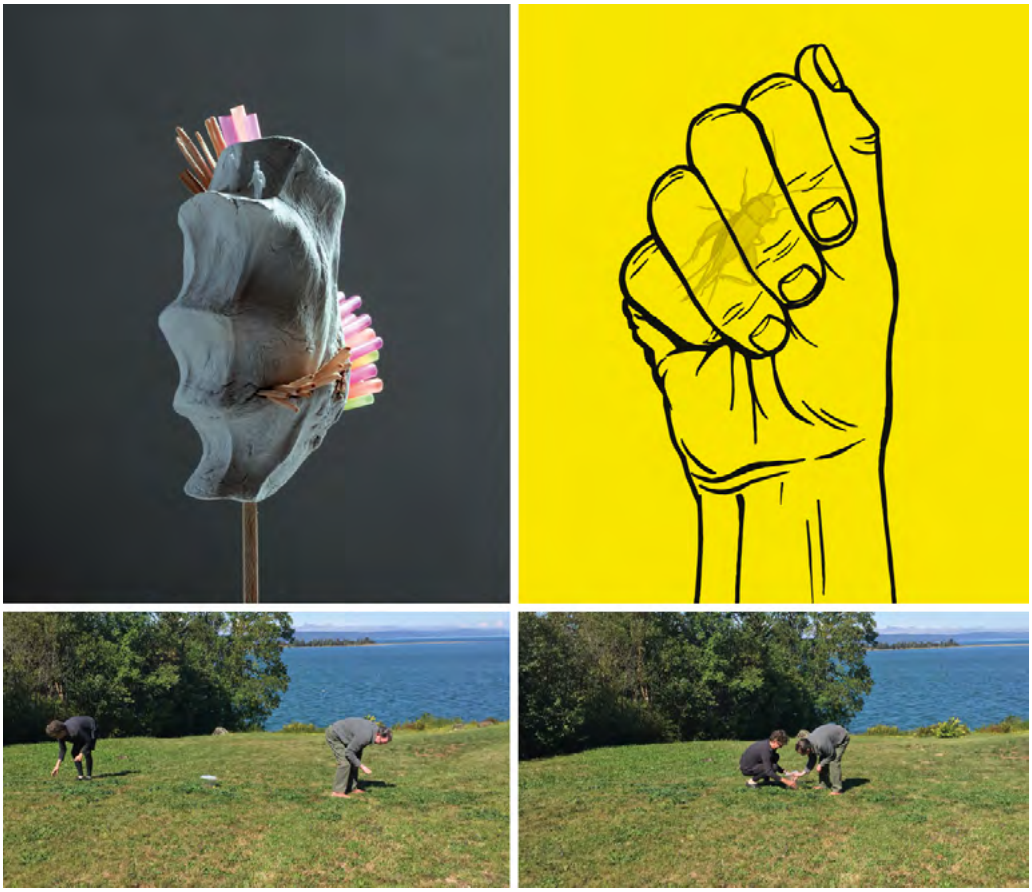


Figure 2. (top left) A small sculpture by Christopher Mark Kaltenbach representing the enclosed space of the hand occupied by a cricket, photo: Christopher Mark Kaltenbach; (top right) An illustration by Christopher Mark Kaltenbach depicting the cricket contained in the hand; (bottom left, right) Catching crickets, Christopher Mark Kaltenbach with architectural historian Dr. Christopher Mead in Smiths Cove, Nova Scotia, Canada. August, 2017. photos: Michele Penhall.

In Kaltenbach's PhD dissertation, he discusses coming upon a new appreciation of the minutiae of personal experience that insects provide. Like Goethe he learns that this requires a different mode of curiosity for which to become attuned to a distinct sensibility and that every encounter is an opportunity of possible discovery, even if not recognized at that instant.

An example of this shift in perceiving an insect in a new way is recounted by Kaltenbach, in an episode that took place in late summer of 2017. While assisting a colleague with excavation work, he noticed that in certain patches of the ground, black crickets were in abundance, at almost infestation levels. As he was preparing to teach a new design course on the theme of the insect order Orthoptera, to which crickets belong, he planned to provide students with their own crickets to care for, purchased from a local pet store. At that moment he recognized that caught crickets would be a good alternative, so he set out to catch them.

Using only his hand, he developed a technique for catching and holding the insect while transferring it to a terrarium. The technique is the forming of a perfectly enclosed pocket in the interior space of the hand—four drawn back fingers, curled against the base of the thumb and hand, and capped with the tip of the thumb.

Despite a few insects killed or maimed in the process, he eventually mastered this technique. The enthusiasm of this new-found activity even motivated a colleague to try the technique and join in the hunt, as he too had never caught crickets; the novelty of the activity was contagious.

After being swept up in the challenge of catching these insects and trying to form the perfectly enclosed pocket in his hand, he recognized something extraordinary. In the process of handling the crickets, he became aware of a new perception of the animal, an intimate connection that had nothing to do with what it looked like or what it could be used for. The insect was inhabiting his body and mind. He could feel the insect in the cavity of his clasped hand, the slight tickling of its legs on his skin created a mental world of a thing that was both real and imaginary. In the process of transporting it to a container, he also had found a new empathy and concern for its care. He had become attuned to the insect and with this engagement, a different persona was brought forth.

What had seemed at the time as a natural, pragmatic response to the necessity to catch crickets revealed itself as a theatrical activity; it had entertained those who watched the entire cricket-catching episode unfold. It was here that his interest in the performative possibilities of design was reinforced. The insect had created an invented engagement that no commercial application or historical precedent could have prepared him to anticipate. (Kaltenbach, 2019, p.74-75)

The observational and experiential processes of understanding an insect in this section of the paper demonstrate avenues for interpreting and feeling insect-empathy, -ethics, and -consciousness.
While these empirical activities of acquiring insect knowledge are understandable and replicable, how to reflect on these processes and the specimens themselves so it can manifest into creative work, such as a dance or product design, is beyond the scope of this paper. While the two speculative works described in the next section of this paper are void of clarifying what actual processes were used to determine their generation —serving primarily to provide examples of IX design—the proposed expansion of Goethe's method and description of Kaltenbach's technique for holding insects in one's hand has provided an opportunity to consider, through reverse engineering, their possible processes of ideation.

4. Interspecies–Interaction (IX) Design: A New Discipline

The neologism interspecies-interaction (IX) design borrows from the widely-used term user-experience design, also known as UX design. This term has gained popularity in the last twenty-five years due largely to the 2006 book Designing Interactions by Bill Moggridge, which chronicled the development of the personal computer, its software and user interfaces, as well as Moggridge's own career evolution from British product designer to a Silicon Valley, screen-based interface proselytizer. It is within the history of the birth and development of this consumer-electronic tool that a range of invented, pragmatic, engineer-based

development processes concerned with user testing were described, such as guided fantasy, participatory design, and blank screen experiment. Thanks to the proliferation of the smartphone app design industry, spawned by Apple's 2006 iPhone, user-experience design has come to signify those who work in app, website, display and/or service design, and more recently, even taking on an ethical dimension for those who wish to signal a populous, lowbrow affinity.

User experience has played key roles in architecture, product, print, package and wayfinding design for decades prior to the advent of the personal computer or smartphone — the Remington No. 1, 1876 (first mechanical typewriter), Open Air School (Amsterdam, Netherlands), 1927 by Jan Duiker, Animal car park pictograms for the 1967 Montreal World Expo by Burton Kramer, and Enzo Mari's 1974 Autoprogettazione line of furniture, just to name a handful. With the inane insistence to classify something so historically ubiquitous into a narrow field of digital application, it serves to reason that a case can be made for a similar narrow classification for designing, that which takes place between humans and animals, interspecies-interaction (IX) design. As mentioned before, the following two prototypes, both created within the last ten years, represent IX design as it pertains to insects, the documentary films titled Mao Moth Laos by Tokuro Oka and Mao Kobayashi, and the tool called Insect Viewing Apparatus (IVA) by Christopher Mark Kaltenbach.

Mao Moth Laos



Figure 3. One of the two documentary films by Tokura Oka, "Mao Moth Laos, Mao Kobayashi." Film projection at the "Insects: Models for Design" exhibition at 21_21 Design Sight, Tokyo, Japan, in 2019. photo: C.M. Kaltenbach.

Oka's films focus on evenings with the break-dancer, choreographer and amateur entomologist Mao Kobayashi. The presentation of the two films were in the exhibition *Insects: Models for Design*, curated by Japanese designer Taku Satoh for the Tokyo venue 21_21 Design Sight, in 2019. Kobayashi who at the time lived in the village Pukun, about an eight-hour drive from the Laos' capital Vientiane, was conducting field research on live *Lepidoptera* specimens and developing new breakdancing choreography. These activities were captured by the camera work of Tokuro Oka, a filmmaker, documentarian and cinematographer based in Japan.

Filmed with a stationary camera, we are witness to two narratives with views of nocturnal scenes of flying moths; at times outside on a porch or in an empty room with a single bulb and swarming moths; the other film with Kobayashi in the act of impromptu choreography within the vortex of moths circling a bare incandescent lightbulb. This documentary footage was projected on two walls in an intimate gallery space within the large gallery complex of the Tadao Ando designed, subterranean building. The two films were like facing pages in a book spread: verso, a record of the moths themselves; recto, Kobayashi in their midst.



Figure 4. (left) Exhibition poster "Insects: Models for Design," designed by Tomohiro Okazaki. The exhibition was held at 21_21 Design Sight, Tokyo, Japan, in 2019. (right) Japanese designer, Taku Satoh being interviewed by Christopher Mark Kaltenbach, July 26, 2019, at Satoh's office, Ginza, Tokyo.

Oka captures the spiral torrent of winged insects circling the bulb at various heights as if contained in an imperceptible cylinder extending down from the ceiling. These rare views, taken within rustic domestic interiors and void of most furniture, allow the single figure of Kobayashi, clothed and barefoot, to be centrally composed in the whirling, feathery, aggregate-permeated-dervish of hemolymph propulsion. As a break-dancer, he flails his body in spiral movements, no longer an isolated mass of self-expression, he becomes a symbiotic instrument, improvisationally responding, merging, and physically commenting on these animals' frantic flights.

Kobayashi employs a wide range of acrobatic moves: "the windmill, coffee grinder, kick slide step, three step, knee drop, kick out," (Hec 2023), at times appearing to be inspired by martial arts. The angular velocity and momentum control he maintains within the stylistic sequences of moves, interplays with the swirling moths, providing moments in which one does not know if the dancer is propelling the animals or vice versa.

The natural behavioral phenomena found in these insects does not have a singular explanation. It is reported that the cause of this "flight-to-light behavior" in moths appears to have several theories, one being the *light-compass theory*, it "postulates that moths navigate by flying at a constant angle to a distant light source such as the moon. When near a lamp, they mistake the lamp for the distant light source and fly at a constant angle to it. This directs them along flight paths that spiral in toward the lamp or circle around it (Baker and Sadovy, 1978)." Another theory is the *mach band*, which "postulates that artificial light produces visual artifacts of apparent darkness next to the light source. The moth flies toward the apparent darkness, which directs it into a path around the light (Hsiao 1972)." (Rich and Longcore, 2006, p.308) Ultimately, Oka's films provide glimpses into an impromptu, practice dance session by Kobayashi. This is a type of prototype performance in which his breakdancing moves are attempted. While the opportunity to peer into the process of choreography is in itself unusual, the true uniqueness of this footage lies in the incandescent summoning of a wide range of insects. It is within that moment and the overall spontaneity of the insects' interactions with the bulb and in turn Kobayashi's interaction with the insects, that we are provided a chance encounter that inspires awe in us.

Insect Viewing Apparatus

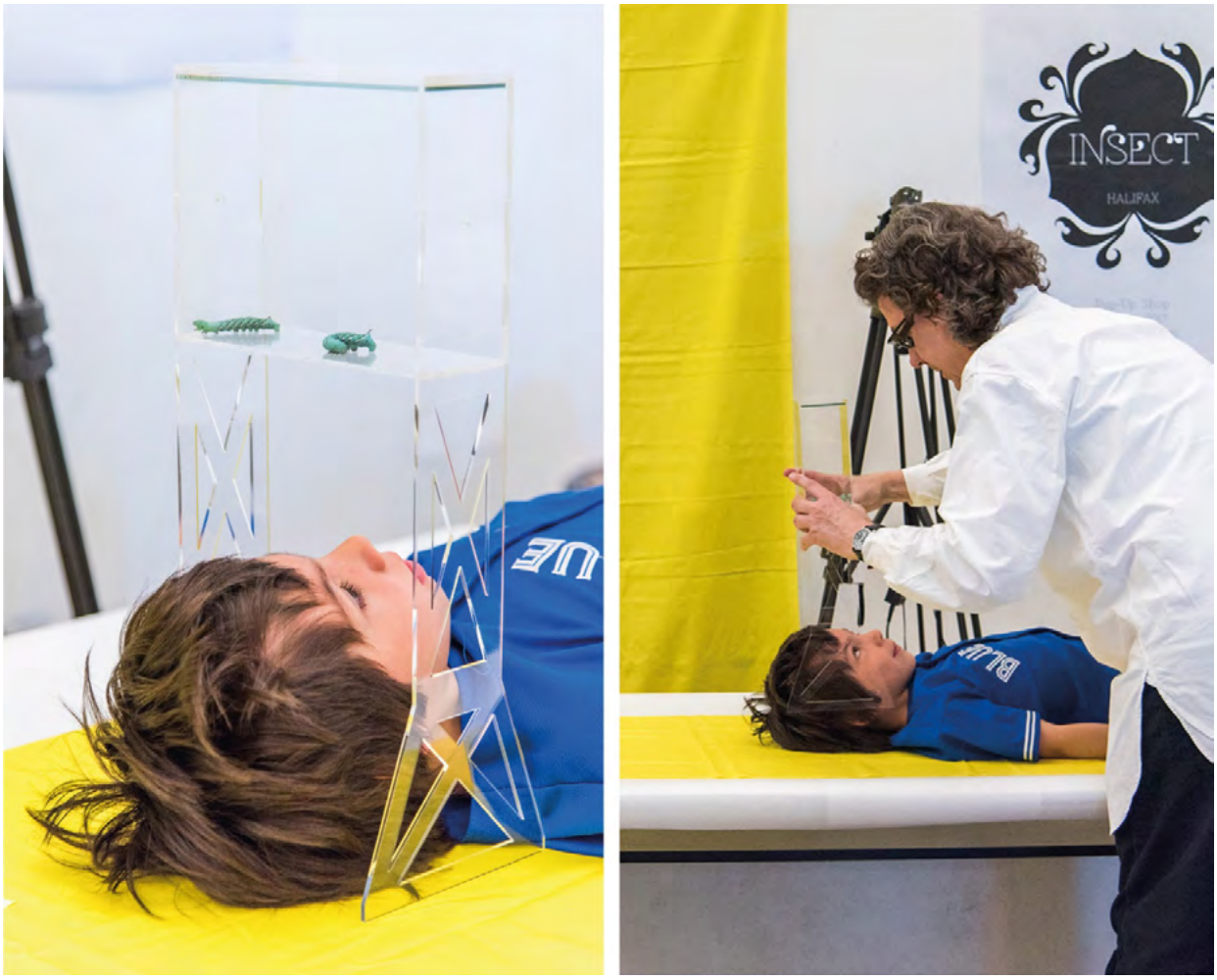


Figure 5. (left) Insect Viewing Apparatus (IVA) with Manduca sexta, blue hornworm by Christopher Mark Kaltenbach; (right) The IVA being placed over the head of a young participant in the Halifax Insect Pop-Up Shop by Christopher Mark Kaltenbach, May 13, 2017. The Shop was in NSCAD University's Port Campus, in Halifax, Nova Scotia, Canada during a community event. photos: Katherine Nakaska.

The Insect Viewing Apparatus (IVA) is a prototype tool for viewing insects created in 2016 by Kaltenbach. In the same year, it was showcased in two pop-up shops that he had also created. These shops, the first launched in Tokyo, Japan and the other in Halifax, Canada, focused on publicizing the commercial applications of insects. The IVA was created to explore how to change the power dynamic of the human-

insect relationship. In this design provocation, the objective was to reverse that relationship while keeping both the person and insect safe. Rather than looking down and examining insects, as is typically done, the device provides a view from underneath the insect. Within the two pop-up shops, a broad cultural and age visitor demographic were introduced to this apparatus.

This unprecedented view of an insect offered by this tool is constructed entirely of a transparent acrylic, the design being a basic box-carriage connected to two legs, with a mirror fixed underneath the carriage's lid. This important feature provides the participants with three simultaneous views: a view of the underside of an insect, a view of the top of the insect, and a view of the participant's own eyes juxtaposed with the entire insect. With the presentation of these three views into a single scene, the device sought to awaken the user to a different understanding of the insect.

Furthermore, the tool was situated within a type of scripted performance repeated for each participant, which dictated a specific mode of engaging the public and delivering the apparatus and insect to the visitor of the shop. Framed by an insect operator persona that Kaltenbach invented and performed himself, a formal manner of care for both the participant and the insect, positively elevated the experiential impact on the visitor. This created a kind of clinical atmosphere from which the public became compliant with the directions given to them in this physically vulnerable situation (Kaltenbach, 2019, p.118-141).

Here Kaltenbach describes the operation procedure of the IVA:

> "The activity began by offering to the visitor a choice of insect to be viewed. Once the insect was chosen, the visitor was asked to remove any excess clothing, guided to the edge of the table, and invited to sit down. If the participant was a child, they were asked if they would like to be picked up. While it was not necessary for the participant to take off their shoes, they were encouraged to if they felt inclined. Once seated, they were told to slowly lean back. The operator continued to try to put the participant at ease, usually placing his hand on their back to gently guide them back onto the table, moving his hand to the back of the head right before it touched the surface. Their legs remained dangling over the edge of the table. Asked if comfortable, they were requested to remain patient while an insect was placed in the apparatus. Once the insect was carefully positioned, the apparatus was then carried to the waiting participant and slowly lowered over the face, aligning the bottom of the insect carriage with the visitor's eyes. They were asked again if they were comfortable and reminded them not to touch the apparatus. Every 20 to 30 seconds, they were checked if they would like to stop the activity. Once they affirmed they would like to stop, the apparatus was removed, and they were told to wait until the operator returned to assist them off the table. The apparatus was then placed back on the adjacent table where other insects were kept. The participant was assisted off the table, and the insect was then removed from the apparatus and returned to its terrarium." (Kaltenbach, 2019, p.144)

In both shops, a therapeutic resonance in the apparatus-shop environment was inferred based on the reactions of the participants. The requirement of the participant to lie down and relax their body on the surface of a table, then to focus on both the insect and themselves in the apparatus enhanced a perceptual and psychological immersion into the insect experience (Kaltenbach, 2019, p.147).

Like Kobayashi's prototype dance performance, individuals are placed in their own unrehearsed engagement with insects where the spontaneity of the moment reveals something new about the animal, and more importantly about how that individual reacts.

5. Conclusion: Expanding the Definition of Design Applied Environmental Entomology

In this paper, a new mode of speculative, biology-based making and thinking has been defined, interspecies-interaction (IX) design, as well as introducing observational and experiential processes that expand the Goethean method. This research provides choreographers and designers examples of how living biological entities can be integrated into performative works. While the paper is solely focused on two disciplines and the use of insects, it can be expected that this design discipline provides opportunities for cultural producers working in any medium to create meaningful and aesthetically enriching interactions with a wide range of animals.

The broad domain of research being carried out on the empathy, ethics, and consciousness of animals, provides important and necessary avenues for gathering scientific facts and subjective interpretations of the inner life of an insect. However, these often support contemporary social structures and worldview trends that direct readers on how one should think and feel about these animals, rather than offering paths to explore and interact with them in ways that are meaningful and informative to that individual.

The necessity for public demonstrations of enthusiasm, care, and value for insects aims to increase both the desire for empathy and greater knowledge about them, which is also the central mandate for a zoos' menagerie. One may ask, what then is the choreographer and designer's broader conservation or pro-environmental objectives? And shouldn't those be made explicit? This is where a deviation from the zoological model is found, in that these works are created by individuals and not private, non-profit organizations, and therefore the scope of their mandate is modest. In addition, the nature of performance and design work aspires to be inspirational to some segment of society. Unlike the business of operating a zoo, which must have broad public appeal through the presentation of and education about the animals under their care, these IX design works wish to elevate the insects by enhancing or augmenting them. It is the hope that the experience of the work itself, conceived of by the choreographer or designer, will be the motivation for self-actuation towards pro-environmental action.

Furthermore, these works also represent an expansion and reevaluation of Christopher Mark Kaltenbach's dissertation and the insect-based design work contained in it, which he defined as Design Applied Environmental Entomology. While the Insect Viewing Apparatus (IVA) was originally developed under that objective, its application stood outside of the three commercial industries of insect bioengineering (Kaltenbach, 2015), food manufacturing, and pet breeding, which the dissertation identified as its scope of application (Kaltenbach, 2019, p.52-57). IX design is not concerned with the need to foreground insects' utilitarian function for the betterment of humankind, as a mode of deriving empathy for them and hence the need to protect them vis à vis pro-environmental activism. These works argue for an appreciation of these animals as they are, allowing for the insect's behavior to direct and in some instances co-create the aestheticized experience and presentation of them. Ultimately, the strength of Mao Moth Laos and IVA is in the use of what these animals naturally do: fly around a light bulb and crawl on surfaces, that we are left to reinterpret them, as they are, and to see them as if for the first time (thanks in part to being framed in artificial and highly aestheticized settings), and to find the wonder and joy in their simple, yet amazing physical expression.

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P/REFERENCES OF DESIGN

DE-ANTHROPOCENTRISING OCEAN OBJECT RELATIONS.

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ABSTRACT | The ocean can be seen as a hard-to-reach place for human empathy and tangible connection for inspiring behaviour changes to reduce climate change impacts. A healthy ocean is crucial for essential human activities ranging from transport, food, oxygen, CO2 absorption, recreation, and tourism. For a long time, designers have been engaged with designing for the ocean primarily through recreational and industrial equipment for fishing, tourism, transportation, and leisure. A new climate critical role for design is emerging which requires a strategic systems-based approach combined with more traditional design solutioning methods. We conducted a design research experiment using an AI sensor package installed on a ship to geolocate and identify objects across the Atlantic Ocean on a 6,070 nautical mile voyage between Kangerlussuaq in the Arctic Circle in Greenland and Poole in Dorset, UK. The motivation was to conduct a broad cross-sectional object identification scan using 4k cameras to capture 'everything that isn't the ocean' to begin connecting the intangible ocean for co-designing solutions. The focus of this research is to identify theories and concepts of object-network relations that go beyond anthropocentric concerns to include more diverse stakeholders and multi-species representation and communication in future design work. We draw on a range of theories from Actor Network Theory, Boundary Objects, Suffixscapes and Object Oriented Ontology to compare pre- and post-theorising with applied fieldwork to draw conclusions around liberating conceptual models. We conclude by discussing how we can enhance inclusive representation of 'others' into climate sensitive research and design driven decision-making processes.

1. Introduction

Designers often tackle ocean issues after encountering a problem via personal experience or reviewing secondary material. While this has many benefits it also risks diverting crucial effort away from the most critical areas. Tangible issues like ocean plastics impact are serious but they are also tangible, encouraging design solutions. Even more significant challenges like a 2^0C warming of the seas or the resilience challenge posed by cascading regime shifts (tipping points) (Rocha et al, 2018; McKay et al, 2022; OECD, 2022; Dietz, Rising, Stoerk, Wagner, 2012) impacting ocean systems, which are some of the most sensitive to change, are far more difficult to address. A new global role for design is emerging which requires a strategic systems-based approach combined with the more traditional design innovation solution methods. This opens the possibility of exploring the potential for behaviour change to support coastal communities to shift from vulnerabilities to enhanced adaptive capacity to cope with widely anticipated future coastal change. At the heart of this role shift lies a need to connect ocean science and data with communities who need to use evidence of how the ocean is changing to adapt to new practices and relations. In other words, there is a need to bridge the quantitative and qualitative data gap between evidence and action.

The [Redacted for review] is a long-term project awarded a UNESCO Ocean Decade (IOC,2021) implementing partnership status from 2023-2030. The core concept is to support developing new economic models for the ocean recognising that sustainability and regeneration have complex human and environmental connections. We decided to conduct an initial experimental survey that would go beyond 'design issue selection' and focus instead on data gathering. Our aims were to:

- Develop a design research experiment that could traverse the quantitative-qualitative data gap;
- Open the possibility of new ocean issues and new understandings to emerge;
- Use data visualisation techniques to make the ocean and its objects more tangible;
- Support a long-term strategic prioritisation of design effort;
- Focus on a broad definition of objects as potentially designable outcomes.

The experiment involved a broad cross-sectional object identification scan using four 4k AI cameras and a sensor package (Fig. 1 right) mounted on the monkey island of the St Helena ship (Fig. 1 left) to capture 'everything that isn't ocean' between Kangerlussuaq in the Arctic Circle in Greenland and Poole in Dorset UK via the Azores, Gibraltar, and Sardinia in Italy. The unusual voyage was away from shipping lanes, and once the AI sensor package and cameras were installed, data and recordings were made continuously throughout with the research team swapping drives in Sardinia (further details of the technology packages, quantitative data analysis and qualitative co-design work are reported in separate forthcoming publications).



Figure 1. The St Helena showing camera survey angles, the sensor package located in the radio room and camera shrouds located port and starboard on the monkey island handrail approx. 30m above the ocean.

Our methodology involved an initial critical review of potential object-network theories followed by a comparison and an exploration of combinations of models. We then conducted a pre-and post-engagement analysis to reflect on how the theories might influence our understanding and shaping of ocean-object network relations on the transatlantic identification voyage. The influences could apply to a range of areas from participants' engagement planning and emergent methodology progression to technology selection and integration through to meta level approaches that inform more subtle types of decision making. We also speculated how our current understanding can enhance inclusion and representation of other xeno-species (Schmeer, 2019) into climate sensitive research and decision-making processes.

2. Ocean Object Network Relations

The aim of concentrating on objects is to consider how follow-on co-design interventions can be focussed on tangibility and how coastal communities can relate to these artifacts in terms of everyday lives, routines, and rituals, and how these objects can elicit narratives and physical, cultural, and psychological connections. One of the key challenges in this work is how to develop an understanding of the relations not only between humans and objects but also allow possibilities for other actors beyond the human sphere. These can range from objects, events, and living ecosystem animals, plants, and ocean life. The challenge was to find a conceptual model that supports us to make decisions on tools, methods, methodologies, and analysis processes that maintain a potential for the inclusion of the ‘other’ at future stages of the research. We also felt the need to question traditional design anthropocentric preferences in terms of what could be considered an object and move beyond objects as products and linked service and experience solutions to liberate new creative opportunities.

We developed an expanded notion of objects going beyond those made by humans and nature, and used a shorthand description of things that could be perceived as ‘moving against the background’ to provide more co-researching narrative power allowing co-design processes to move beyond more traditional object orientated problem solving. Apart from the human tangibility of objects there also exists the potential of intra-object relations. These were important considerations to drive decision making and visualisation design in a 3-dimension geolocation platform that we could use with participants.

While there exists design literature exploring what might be broadly termed as ‘de-anthropocentrisation’ there remain few examples testing or comparing theories in practice beyond speculative works and even fewer that test out large-scale explorative data gathering away from land-based environments. We use the slightly awkward term de-anthropocentrisation here to deliberately indicate the desire to shift away from human-centred decision making in complex systems (climate change) as opposed to the broader interests of post-humanism which has wider concerns. Earlier work by the Authors (2021) has highlighted the need to de-anthropocentrise healthcare environments and the need to invert the position of human-centred design in the value pyramid (Authors, 2021, p.5). In the context of this research a powerful need emerged to review several theories that could underpin our experiments and provide opportunity and capacity for future work aiming to reduce anthropogenic privileges. The space between de-anthropocentrising theories and the practices of design contain confusions and contentions and it is not our intention to solve these, only to illuminate where possible our experiences of them.

3. De-Anthropocentrising Theory

We considered a range of object-network theories. There are no methodologies we have found that prescribe which theories should be considered or in which combination and we have therefore used a variety, some of which the researchers have experience of using in previous fieldwork and others only on a theoretical level. Some of the theories we have selected are clearly part of much larger philosophical movements while others are more discrete in scale. This is important as we recognise that the terms theory, concepts, and philosophy have varied usage across the sources we have reviewed.

A prime candidate for consideration is Actor Network Theory (ANT), a material semiotic theory originally developed by Bruno Latour (2005), Callon, Law and others to remove human-centred priorities in network relations to allow new types of power structures to emerge from elements that have traditionally been excluded or marginalised. Non-human actors can drive change and gain power in social scenarios. Actors (or actants) are anything that has the power to apply change communicated by a mediator to other actors. The power is derived from how new power (politics) emerges from the network. However, there are several contentions with ANT. The definition of what is an actor, and an intermediary (mediator) is inconsistent following research by Toenneson et al (2006) who reviewed material from seventeen ANT journals finding differences in "material," and the attribution of authorship and responsibility. The impartiality of actor networks has been questioned by Mutch (2002), and Collins and Yearley (1992) highlighting one of the key limitations of non-human liberation governed by human networking efforts. Latour and others have resisted turning ANT into a technology-driven networking effort although many examples have since been created including healthcare technology (Cresswell, Worth and Sheikh, 2010), online community participation (Rivera and Cox, 2016), and development informatics (Faik, Thompson, Walsham, 2013). Revisiting ANT Latour has claimed that it is "a powerful tool to destroy spheres and domains… Yet it is an extremely bad tool for differentiating associations" (Latour, 1996, p.380).

The issues of differentiating between actors and mediators can have significant impacts on where power relations lie but even more significantly in a design context can mean very different things can become visualised as 'objects' (actors) versus mediators and affect design issues emergence and follow on action.

Boundary objects (BO) are an extension of ANT developed by Star and Grisemer based on the study of Berkeley's Museum of Vertebrate Zoology collections. They set up the building blocks differentiating away from ANT with an opposite view of emergent boundary objects concentrating on conceptual variance with rich and thick descriptions. Star and Grisemer identify a series of 4 inter-related boundary objects including: repositories, ideal types, coincident boundaries, and standardised forms. The institutional value of boundary objects is further confirmed by Caccamo, Pittino and Tell (2023) who conducted a literature review of 87 sources finding that they are a multifaceted construct, integral to organisational life. The organising role can be a competitive advantage leading to organisation improvement uncovering how boundary objects are a fundamental part of the innovation process. Scoles (2018) in researching messy objects describes how boundary objects can strengthen the pursuit of ANT studies in continuing education. In studying the overlaps, Scoles recommends delimiting linear mediators and following the actors to find emergence. Boundary objects have emerged from a diverse range of contexts including contracts. Franco-Torresa, Rogers and Ugarellic, (2020) study the agency role of a city sustainability department and how it changed the urban concept of water flows. They explore water flows in city emergency events and identify some useful sub-concepts including pluralistic tolerance, selection pressure, social worlds (worldview) and objects as shared aims. The city's flood plan is identified as the boundary object and its impact on the collaboration of several agencies is reported. Closer to design research Comi and Vaara (2021) study political dynamics in knowledge work with a special focus on visual artifacts dealing with pragmatic boundaries. In the context of architectural practice, they conclude that visual artifacts can manipulate the boundaries of organisations with political impact.

In design research, Balint and Pangaro (2017) stretch the concept of boundary objects from the role of emergence in social sciences to a provocative probe in a design context. The use is inverted from a slowly emerging realisation to an object that transgresses boundaries and links to Scoles' use of the term messy objects. We therefore see potential for boundary objects as either emergent opportunities in networks to unleash new creative potential via divergent issue descriptions or via the Balint Pangaro approach of creating boundary objects with the specific purpose of probing new opportunities. Limitations for our purposes emerge from the higher degree of anthropogenic focus, particularly if traditional thick and rich descriptions are used and more emphasis is placed on actors as opposed to mediators due to the focus on an emergent common. This may have the effect of offering less xeno (different in origin, non-human) opportunity in the future unless a particular focus is applied.

Suffixscapes (Appadurai, 1990) derive from the field of global cultural anthropology with an aim to identify and explore disjunctions, or unequal flows of power across a series of thematic landscapes. Conversations and communication take place across a global series of landscapes or 'scapes' including the: Ideoscape (disseminating ideas), Ethnoscape (cultural movement of people), Technoscape (how machines facilitate impact), Mediascape (presenting and shaping of information and opinion) and the Financescape (rapid economic movement of money). Disjunctions provide pivotal points of focus showing how power is leveraged over different groups both within and across suffixscapes, national borders and continental boundaries. The aim is to bring forth new voices and make cases for reducing exploitative structures and institutions. The concept in hindsight can now be seen in the context of decolonisation and remains an under-utilised idea in this field. Modifications to suffixscapes include Bello's Goodscapes with a focus on objects (Bello, 2010), and examples of this theory exist in practice-based design research including translocated design by the Authors (2013; 2017) and Rassouli (2024) in the context of decolonising resource constrained innovation. Although unsurprisingly not mentioned in the literature (1990), suffixscapes focus entirely on human-centred concerns in power relations. This does not however preclude its use more widely to identify disjunctions between 'other' species, human and object relations in the context of climate issues. For example, the CETI initiative (2024) is devoting considerable resource to decoding whale speech to develop inter-species communication affording the future opportunity to bring other species into suffixscapes communications. In the case of whales, identifying disjunctions in human-ecosystem impact could prove very revealing. In Appadurai's later work we can gain significant value from the following statement that:

> "The primary problem with images of object agency, network and the device is not just that they tend to lose the soul of objects, in spite of their intentions to reanimate the object, but that they have no real grip on the deepest problem of objects, which is their capacity to generate contexts. The problem of contexts is one of the black holes of current social science, and this black hole opens new possibilities for thinking about design processes from a social and cultural point of view." (Appadurai, 2013, p.258)

The black hole highlights a major issue in the social sciences that is not dealt with in boundary objects, that objects emerge from context as human-driven interaction but tell us very little about the reverse, how objects make contexts. This is addressed in part by ANT and semiotic relationality "a network whose elements define and shape one another" (Law, 2007, p.7). The questions around objects and contexts reinforces our decision to focus on objects and how they can be significant creators of place, meaning and most importantly the capacity for difference and change.

In design terms capturing disjunctions through co-research and co-design processes could focus effort in more strategically valuable places with a thematic link to scapes highlighting design opportunities. While suffixscapes is conceptually weak in dealing directly with objects, work by Authors (2013; 2017) and Rassouli (2024) have shown that there is no issue with object inclusion as a research focus.

Object-orientated ontology (OOO pronounce triple 'O') emerged from the analytical branch of western philosophy sitting within speculative realism. It reacts against the history of human-centric ontology in philosophy and instead proposes an object orientated approach that flattens human value pyramids and creates places and spaces for emergence. It shares an affinity with some aspects of ANT and boundary objects but rejects the networking of ANT and the actor human-centred focus of boundary objects. Graham Harman (2018), Ian Bogost (2012), Levi R. Bryant and Timothy Morton (2013) amongst others have developed aspects of the philosophy which centres around a number of concepts including that all objects are created equally but some are more equal than others (Harman, 2018; Bogost, 2012), real objects and sensual objects that animate relations between real objects, and unit operations and carpentry (Bogost, 2012) referring to properties for intra-object relations and practices. Harman expends considerable effort in rejecting 'theories of everything' from physics criticising smallism (assuming that studying particles can explain all bigger structures and phenomena) causing undermining and overmining (claiming that emergence and large-scale observations are driving forces). The combined duomining integrates critical approaches that attack object-centred philosophies from both below and above. Criticism of physics

'theories of everything' can be summarised as theories of everything that physics is interested in, but not everything is interested in physics. An example used is religion and spirituality which string theory (the main contender as a science theory of everything (Becker, Becker and Schwartz, 2007)) is unable to explain (Harman, 2018). Religion and spirituality account for major parts of many peoples' lives and often drive huge geopolitical events yet is discounted as a subject for the theory of everything in physics. Harman, Bogost and others go to great lengths in exploring the nature of objects with Harman giving a useful example of the Dutch East India Company VOC as an object (Harman, 2016). The VOC has many properties of an object, but when we come to assess its components we find the ships, employees, offices, and practices are highly dispersed around the globe and cannot be seen as a traditional object in the Liebnitzian sense. Morton describes these as hyperobjects (2013). Wilde (2020) focusses on relationship issues in OOO arguing that there cannot be a hierarchy between objects and relations. This is particularly important following the OOO argument that an object cannot be summarised as the total of its external values. Furthermore, an argument is made that an object cannot be separated from where it is, aligning with Appadurai's claim that objects make contexts and the inability of current social science theory to explain how this takes place (the black hole). In a review of post-humanist theory including OOO, ANT, non-representational theory, feminist new materialism, and transhumanism Forlani (2017) argues that in the context of design research decolonial and critical race theory show that limitations of inclusion and empowerment can continue to exist in post-colonial theory. Attention is paid to OOO's flat ontology and the refusal to prioritise special interests.

In applied design research Linley, Akmal and Colton (2020) report on a design research laboratory project developing IoT interactions. They focus on how advanced technologies such as AI and IoT challenge traditional concepts of reality and find that design research and philosophy (OOO) can develop partial answers and 'proxies for the unknowable' (Lindley, Colton, Akmal, 2018). The subject of their research provides scope for OOO to provide generative ideation and experimentation although these appear to be experiences of the researchers as opposed to participants. OOO has much to offer design research both in applicable designerly concepts such as real and sensual objects alongside practices such as carpentry. Its conceptual base in aesthetics engages well with both tangible and theoretical design practices and can have value in helping us understand the visualisation of objects and diverse relations.

We are primarily interested in the conceptual power of these theories rather than their specific practices, for example rich and thick descriptions of boundary objects or highly complex network analysis of ANT, ethnography, or OOO.

4. Pre-Work Analysis

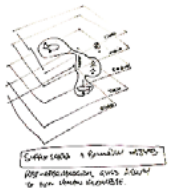
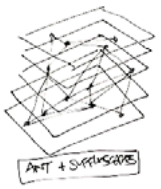
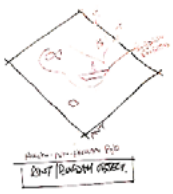
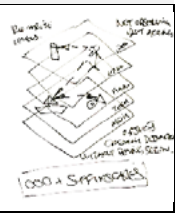
Based on the theories selected and reviewed in section 3, table 1 summarises the value of each of these across the criteria of research interest, project potential and assumed limitations to develop a foundation from which to gauge value. Our methodology in this respect is highly emergent (Gaver et al, 2022) and we place value on uncertainty (Gaver, Boucher and Pennington, 2005) in a constructivist epistemological position.

Table 1. Pre-data Gathering and Fieldwork Theory Analysis.

Theory	Research Interest	Project Potential	Assumed Limitations
Actor Network Theory (Latour)	Ability to trace relations and de-anthropocentrise emergence of new observations and flows.	Use visualisation applications to make actor networks between ocean and human activities and natural and human-produced objects.	Linearity of relations, punctuating the network, defining mediators and intermediaries, space for multi-stakeholder layered narratives?
Boundary Objects (Star & Grisemer)	Emergence of boundary objects in a hard-to-reach challenging environment with complex actor relations and diverse power relations.	Potential for descriptions of conceptual variance, delimiting design assumptions around designable or physical objects.	Sophistication and richness of network interactions at scale. Ability of design research to transgress BO criteria. Human centredness.
Object Orientated Ontology (Harman)	Landscape where human agency and visibility of objects ebbs and flows allowing new realisations with potential for ocean stakeholders to find unexpected relations.	Conceptual inspiration supporting practices and allowing space for de-anthopocentrised relations through to comparing carpentry etc. to design research practices.	Lack of applied design research and in particular OOO's relationship to network and concrete relations, actions and impacts across different human and non-humans.
Suffixscapes (Appadurai)	Layered landscapes allowing conversations on disjunctions in information flows with potential to support identifying ocean issues.	Possibility to add new novel 'Bioscape' layer to de-anthropocentrise suffixscapes and allow more direct spaces for non-human agency.	Networkability of the concept. Anthropocentric model based on human layers. Object focus for design actions?

Going beyond the conceptual value of the theories we have reviewed is an opportunity to consider combinations of theories and their geometric relationships. Table 2 captures combinations of OOO, ANT, Boundary Objects and Suffixscapes across 6 combination criteria. It explores potential relational spaces for design visualisation and conceptual richness. Note that orange highlights indicate potential issues with combinations.

Table 2. Geometric Ocean Object Network Combinations.

	Theory Combinations					
	Boundary Object + Suffixscapes	Boundary Object + OOO	ANT + Suffixscapes	ANT + Boundary Objects	OOO + ANT	OOO + Suffixscapes
Geometries						
Criteria						
1. Relationship between humans & nature via objects	Human and non-human object relations can be mapped, scope for networking?	Potential for OOO and BO to exist and connect outside of human view to nature.	Networking and scapes can combine via disjunctions.	Close bounded relationship with nature accessible.	Networking power and flat OOO allow nature links.	Through OOO clear links, scapes less so but possible.
2. Power to de-anthropocentrise	BO and scapes least powerful de-anthro combination.	OOO strong potential though some BO limitations.	Good via ANT though less when combined with scapes.	ANT good potential though less with BO actor focus.	Strong with both though conceptually different in aims.	Partially with OOO however, scapes less tested.
3. Connects quantitative to qualitative transfer	No limitation to quant/qual in scapes or BO literature.	Potential though not highlighted as a possibility.	Quant can be actors and scapes both quant/qual.	ANT via mediators, BO through thick and rich descript.	Via ANT good potential OOO less obvious.	Potential but may need additional methods.
4. Inclusive with future 'others' and stakeholders	Descriptively rich though less in other mediums.	Strong via OOO flatness BO good engagement.	Strong ANT less with scapes but has potential.	ANT good and qual depth of scapes supports.	OOO and ANT stakeholder linking potential.	OOO strong and scapes depth and disjunctions.
5. Tests de-anthropocentrised theories in practice	Scapes and BO's more anthro focused in practice.	OOO good potential but BO more human centred.	ANT good potential, scapes not intended for this.	ANT good potential and BO can provide qual depth.	Strong double potential but also opposites in some intentions.	OOO flat ontology designed for this but not scapes.
6. Participatory understanding of 'hard to reach' environments	Clear spatial relationships with scapes and BO practices.	BO and OOO both point towards this capacity.	ANT and scapes both have potential to connect.	BO and ANT have potential to deliver this aim well.	OOO applied concepts and ANT networking reach.	Scapes likely lead on this capacity to understand via practices.

Previous work by the Authors (2) found value in combining suffixscapes and ANT to discover how design process agency acted in a translocated making process across geographically distinct socio-spatial groups (Fig.2). We decided based on the object network geometrical analysis to consider OOO and Boundary Objects as our preferred conceptual candidates while leaving opportunity for Suffixscapes and ANT to play a role. OOO and BO provide a powerful combination of deanthropocentrising power with the boundary object depth, human and potentially inclusion of 'others' into design perspectives. OOO's special and expanded focus on objects is intriguing with potential to open up new co-design possibilities.

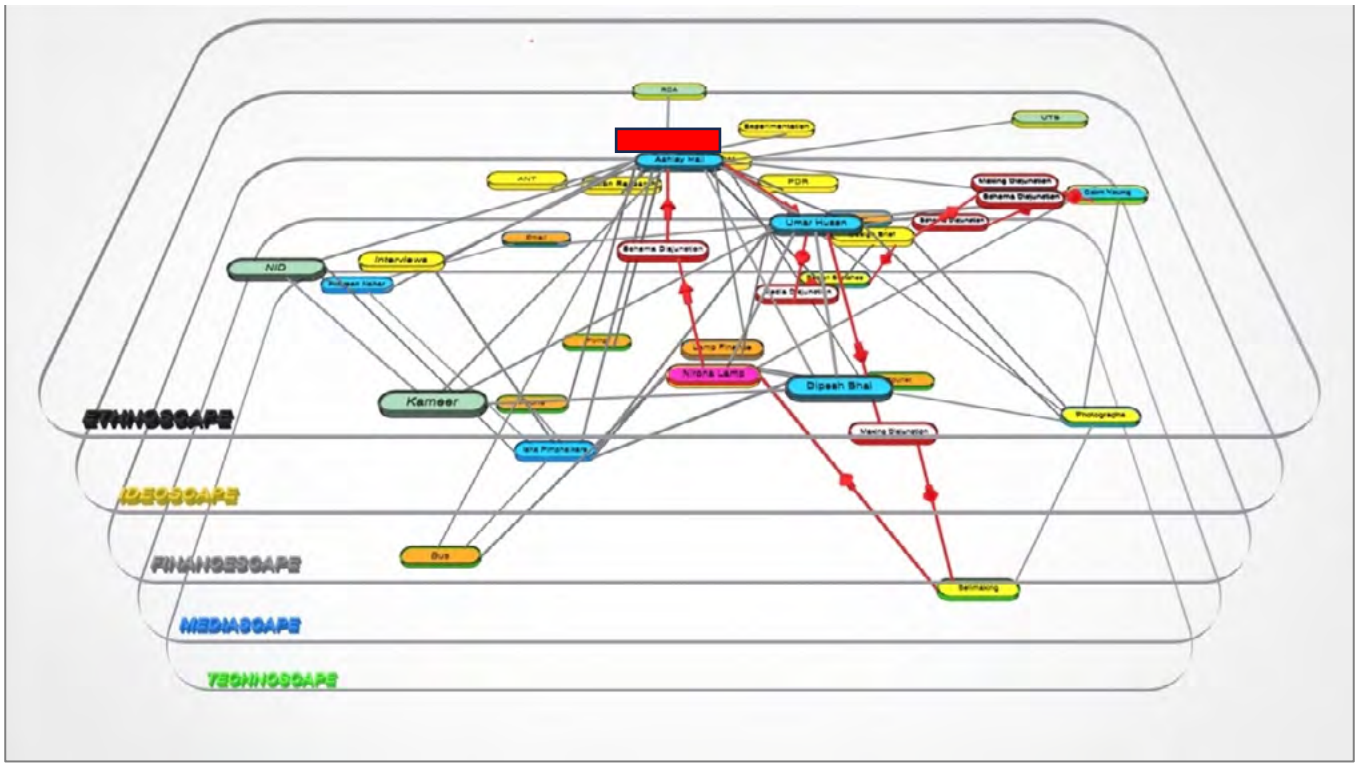


Figure 2. Combination of Suffixscapes and actor network showing role of design process in driving agency across geographies Authors (2017).

5. Post-Engagement Reflection

Data analysis via AI and a human observer using pomodoro technique (Cirillo, 2007) of the 12,140 nautical miles of 4k footage from the two wide-angle camera's on port and starboard identified 3,605 objects. We decided on different spatial categorisations of above, on, and below the ocean and human and naturally made objects.

An immediate issue was the definition of what is an object. Figure 3 shows a sample of the diversity of objects observed with some obvious examples including a seal (bottom right), dolphins (bottom centre), ships (centre and centre right), garbage (middle left), and then less certain objects. The top left shows a powerful tidal effect where the outgoing mineral-rich glacial till turning the water a strong light blue-green colour which moves quickly up the Kangerlussuaq fjord past the ship. We can also see in Figure 4 unexpectedly small objects on the left which are water and ice crystals forming on the camera lens at night and even more surprisingly on the right we see the tail end of the 500-mile-wide hurricane Larry – the largest storm in the north Atlantic for 10 years – which the ship sailed through. Our surprise with hurricane Larry was that the AI object identification (design for land-based use) was almost constantly on for several days indicated by a purple stripe on the right side of the footage (Fig. 5). It was only after thinking this through that we realised the complex sea state produced by the hurricane was interpreted by the AI as an object, one that was so big in fact that the ship sailed through the edge of it for several days. The hurricane was visible to the human observer as weather, but to our AI it was in effect a continuous object. We had not anticipated encountering any object at this scale let alone to sail through one. The glacial till tidal flow and hurricane may be conventionally recorded as effects rather than objects.

However, we wanted to ensure that all objects were treated equally as our research was experimentally emergent and we wanted to give future collaborators and participants equal access to all types of objects. This led us to realise that we had begun to apply OOO's more diverse arguments for what constituted an object, possibly even hyperobjects as described by Morton (2012). Hurricane Larry needed satellites, a ship, cameras, an AI sensor package, an internet connection, algorithms, visualisation software and human

observers to perceive its presence. In some ways this could be compared to Harman's (2016) description of the Dutch VOC having such diverse evidence of its objectness. We also recorded other effects ranging from pools of oxygenated water, sunsets, mirages, unexplainable shadows, and various slicks. Each of these was given equal status via its description, GPS location, image icon and short MP4 clip. Combining effects into objects also addresses Manuel De Landa's criticism of OOO (Harman, 2018, p.41) not being able to address effects. Our experience also agrees with Harman's definition of "OOO means 'object' in an unusually wide sense: an object is anything that cannot be entirely reduced either to the components of which it is made or to the effects it has on other things" (Harman, 2018, p.43).

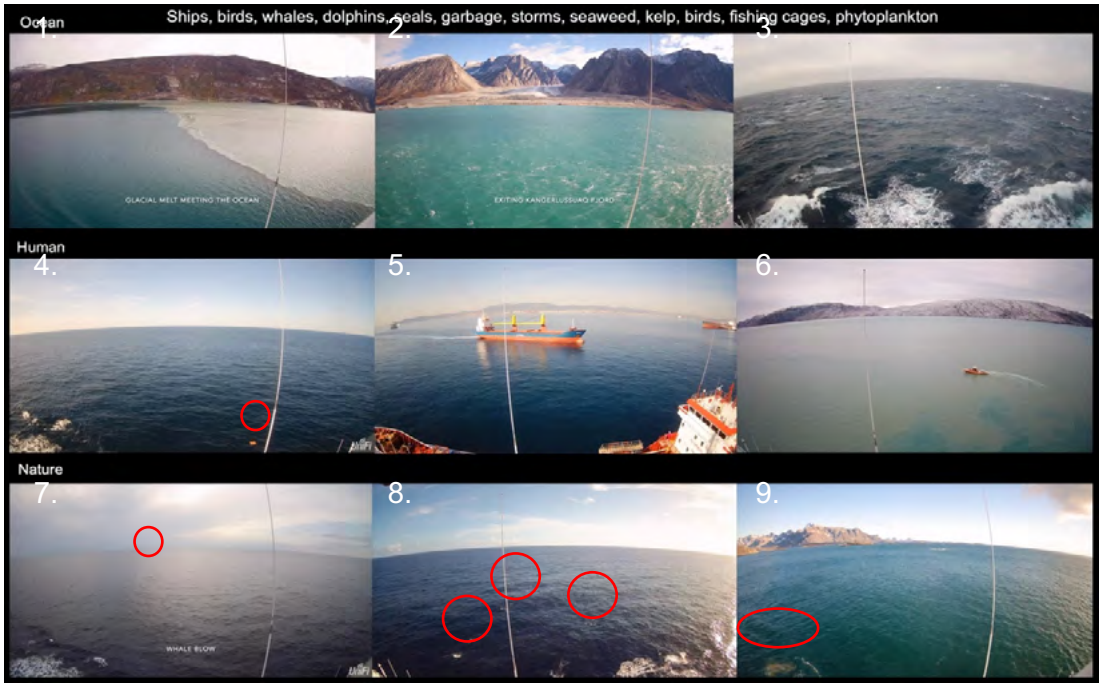


Figure 3. Diversity of ocean 'objects' identified by the sensor package from ocean effects on the boundaries of an object (1,2) through to natural; megafauna (whale, dolphins, seal; 7,8,9) to human made (5,6); waste (4), ships and aeroplanes.

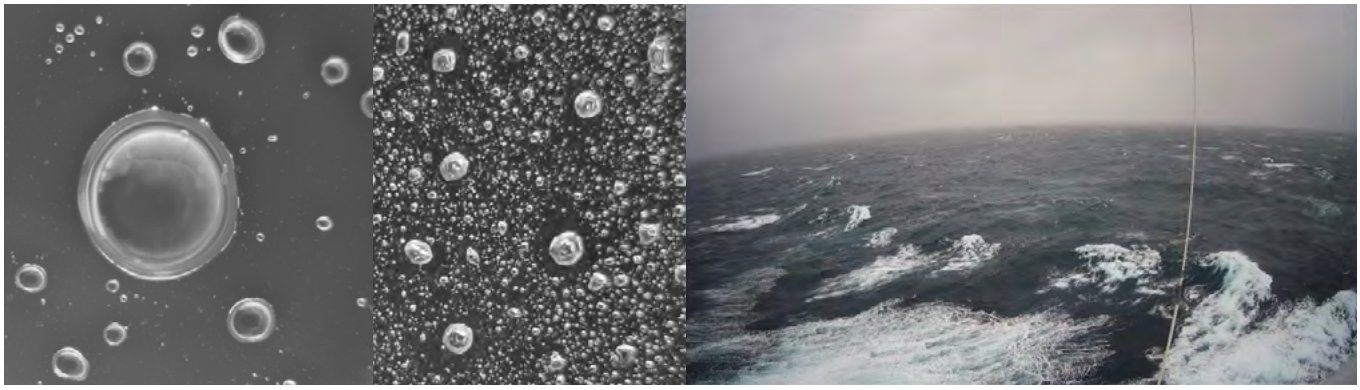


Figure 4. Objects observed vary in scale from water droplets and ice crystals 1-2mm (L) (note seascape inversion lens effect) directly on the camera lens up to the tail end of hurricane Larry around 500 miles wide that the ship sailed through (R).

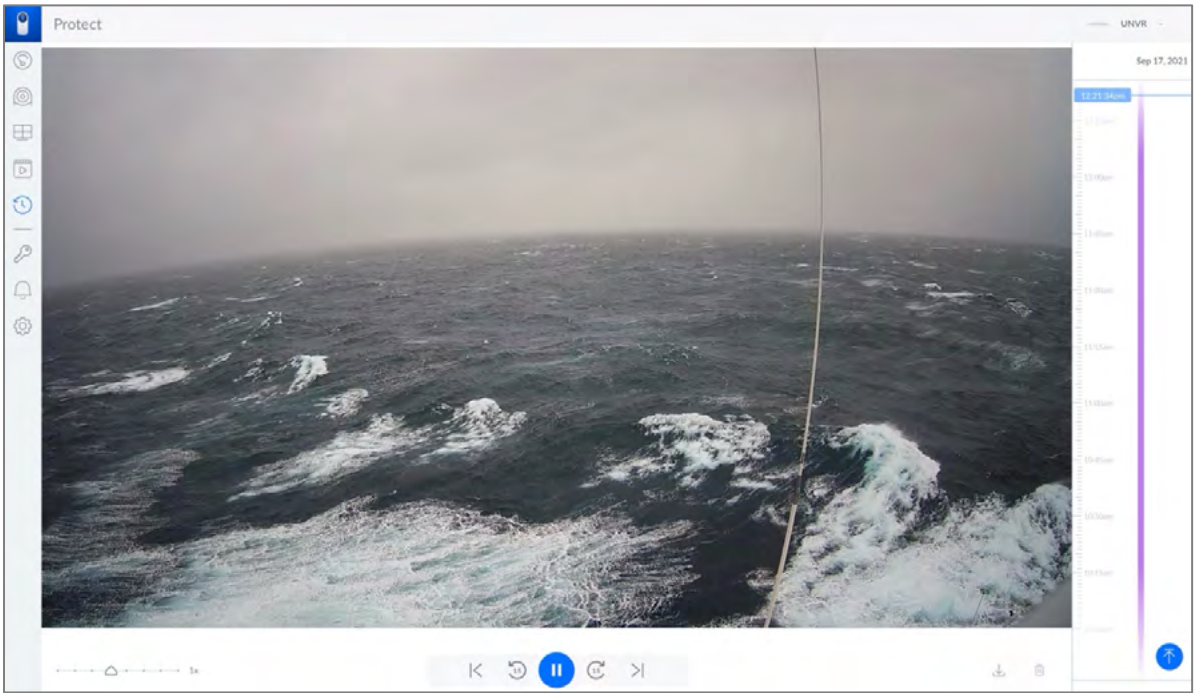


Figure 5. Evidence of Hurricane Larry as an AI 'object' (purple stripe right) on UniFi network video recorder (NVR).

Once our data had been reviewed and tested, we used Cesium Ion (2024), an open-source, three-dimensional, global GIS based geospatial visualisation platform to input our objects in their GPS positions along with icons identifying spatial separation and creator type (Fig. 6). Cesium uses a timeline which allows objects to emerge as they are recorded by our camera's allowing flythrough and time-based investigations via different use cases. A pop-up panel triggered by floating over a sighting allowed basic information on type, location, and a link to our Unifi (2024) cloud-based AI drives that provided short videos of each object. We started considering boundary objects experientially without rich and thick descriptions and found that Cesium was a good candidate in a similar way to how contracts have emerged as central connectors with agency in organisations (Franco-Torresa, Rogers and Ugarellic, 2020). Cesium delivered an ability to handle time, multiple scales from local individual to global, coordinate connections across several software platforms (Cesium Ion 3d geo-spatial platform (2024), Google Sheets, UniFi AI Security (2024), Fleetmon GPS tracking (2024)) and different team members with different disciplines and skills ranging from engineering to computer science, data visualization and co-design. In terms of OOO we see Cesium as a sensual object with capacity to make new connections not only between real objects but across time, space, and diverse actors. It has scope for conceptually aestheticising these relationships providing material for considering both unit operations and carpentry (Bogost, 2012; Linley, Akmal and Colton, 2020). For future work, this may allow data visualisation techniques to facilitate novel object-to-object observations not visible in real-world scenarios, e.g., migration routes, salinity, ocean currents, dissimilar object densities, spatialisation etc.



Figure 6. Cesium Ion GIS trace from Kangerlussuaq in Greenland to Poole in the UK via the Azores, Gibraltar, and Sardinia. Note icons differentiating object types including events (cloud-sun) and spatial separations. RNLI flags (top right) denote a number of applied ocean design projects conducted around the UK influenced by the ocean data (to be reported separately).

We found less direct evidence for the conceptual power of suffixscapes at this stage of the research, but we anticipate the concept of disjunctions could prove powerful when mapped across institutions and geographies to identify imbalances that can be addressed through design action. Actor Network Theory was interesting in the sense that while we were aware of complex networks of actors with the power to leverage significant change and that non-human potential was significant, the resources and complexity of making transoceanic networks with an object-orientated focus is conceptually and technically challenging at this stage. We feel it may be something that has potential in a future evolution of the research or can be prototyped in a more discrete way.

Table 3 shows a summary of our analytical framework comprising of presence, emergence, distance, and value have been used to summarise how we experienced and noted the impact of each of the theories.

Table 3. Post-fieldwork Theory Analysis.

	Presence	**Emergence**	**Distance**	**Value**
Criteria **Theory**	If/where and when we saw evidence of this concept	How this concept came into being into the research	How close, integrated this became in our practices - philosophical to applied	Value gained and type (E.G. theory, data gathering, methods, analysis)
ANT	No clear evidence at this stage of the research, future potential noted.	Considered and retrospectively can be of future value.	No directly applied or considerations changing approach or decisions.	None directly at this stage of the research.
Boundary Objects	Yes, via Cesium Ion as a boundary object media mediator of objects and relations.	Perceiving connections across software stakeholders, objects and hyperobjects.	We became aware of this later into the visualisation and reflection stage of the research.	Useful for understanding role of Cesium beyond data visualisation and how it has centralised ideas.
OOO	Slowly becoming stronger throughout the applied research and directly in reflection stage.	Clear value gained from a new perspective on objects improving their inclusion and actionability in design and beyond human.	This was an active conversation relating to what is/not an object from early stages of the research.	Direct value in identifying new types of objects and considering how they can be additional interests to design and co-design.
Suffixscapes	No obvious direct use, more future potential.	Considered, but yet to play a major role.	Not directly applied at this stage.	None directly at this stage of the research.

As a final speculative deviation, we go back to consider Harman's critique of scientific 'theories of everything' (2018, pp. 25-38) by considering new developments in science. With the recent discovery of ambient quantum superposition (the ability of a particle to be in many places at the same time) in photosynthesis (Lloyd, 2011; Higgins et al, 2021) and Penrose and Hameroff's ground-breaking work on consciousness in Orchestrated Objective Reality (Orch OR) (Hameroff and Penrose, 2014) leading to claims that microtubules in the brain's perceptual boundary are capable of a quantum superposition (Hameroff, 2012), we speculate that from an OOO perspective, an object's ability to 'see' other objects, unit operations and sensuality may not be so far from the leading neuroscience theories of consciousness and physics theories of everything. Now that we know the human brain has quantum superposition potential, we wonder if future visualisation technologies can change the way that waves become particles, losing all information apart from the final reality. This could indicate that we can influence vastly complex and difficult to empathise environments in a new way. OOO from philosophy and string theory (Becker, Becker and Schwartz, 2007) from physics may end up being two sides of the same coin, rather than diametrical opposites. Data visualisation may interfere in the process of Orch OR by creating new objective routes to reduce highly numerous possibilities. Could there be connections between designing experimental spatial data visualisations and the conscious triggering or realisation of quantum biological superposition embodying object-orientated ontology?

6. Conclusions

With the quantitative data gathered and visualised along with some initial stakeholder engagements, we have been able to reflect and speculate on the value of the ANT, OOO, Boundary Objects and Suffixscapes going beyond our initial expectations of providing conceptual stimulation for methods and tools selection. We have found strong affinities between our expanding object definition needs and OOO's real and sensual objects, carpentry, and boundary objects. We have learnt that having several theories circulating in our research has allowed us conceptual breadth, inspiration, and broad scope for genuine emergence of conceptual value to support an emergent methodology. Many smaller decisions were supported or triggered by the theoretical breadth, and this also gave confidence in going beyond traditional design relations between people, objects, events, spaces, and scales.

Our work so far has informed our emergent methodology evolution and promises to provide more support and confidence from theory to reach out into new spaces for engaging broader consideration of who, what and others to include. The significance of this is to find direct value from concepts in OOO including real and sensual objects, unit operations, carpentry and boundary objects that directly influenced our methodology, practices and mental models concerning the research. Furthermore, we have been able to begin grounding several concepts from OOO and boundary objects directly into practice-based design research.

The speculative convergence of OOO in philosophy and quantum physics superpositions in nature is significant. We do not make a claim to connect it here, only to note there are enhanced thoughtful possibilities and converging properties worth exploring through immersive design visualisations. We may come to realise that when we say that we have a strong affinity with the ocean, it may be more than emotional.

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P/REFERENCES OF DESIGN

MULTISPECIES ENGAGEMENT AND SPECULATIVE ECOLOGIES: TOWARDS MULTISPECIES WAYS OF KNOWING FOR ECO-SOCIAL SPECULATIONS.

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KEYWORDS | MULTISPECIES DESIGN, MORE THAN HUMAN DESIGN, SPECULATIVE DESIGN, CLIMATE ACTION, SPECULATIVE ECOLOGIES

ABSTRACT | This paper introduces the concept of “Multispecies Engagement” as a framework to bridge speculative design practices with emerging multispecies and interspecies approaches that challenge the traditional human-centred focus within the design discipline. It emphasizes the necessity of incorporating non-human stakeholders into speculative design processes to address climate-related challenges, such as biodiversity loss, environmental conservation, and energy transitions, among others, thereby fostering social and ecological innovations. This study underscores the critical role of speculative design in tackling these issues and traces its evolution toward multispecies approaches, drawing from interdisciplinary fields like anthropology, amidst emerging socio-ecological challenges, transcending purely technological implications. The discussion is grounded in a mapping of Multispecies tendencies and potentials within design. This mapping identifies fields of action, roles, skills, and responsibilities of speculative designers, prompting further discourse. The goal is to provide guidance on navigating these diverse approaches and delineating the actions required from speculative and future-making designers concerning the potentials and limitations of embracing a multispecies perspective.

1. Climate Change as a Multispecies Design Challenge

Speculative Design Practices (SDP) play a pivotal role in envisioning alternative futures, and making substantial contributions to transdisciplinary and societal transformation processes. Traditionally, their focus has centred on critically examining the social impact and aesthetics of emerging technologies through fictional "What if" narratives and storytelling objects. However, as the climate crisis intensifies, a new frontier emerges, necessitating a shift beyond the technology- and human-centred roots of Speculative Design Practices. To meet this challenge, it becomes imperative to engage non-human stakeholders, such as plants, microbes, insects, and undiscovered and almost extinct species, in shaping solutions for today's complex socio-ecological issues.

This necessity becomes evident when putting human life in perspective: the estimated total number of species on Earth varies widely, with the vast majority believed to be microbial and still undiscovered. When considering only known and described species, humans represent a minimal percentage, estimated at less than 0.01% of the total. Even though this number is a rough estimate, it underscores the importance of envisioning futures that serve purposes beyond human-centric needs. Against this background, this study aims at sharing observations of an ongoing *multispecies turn* within Speculative Design Practices and questions new roles, responsibilities, and research questions that are emerging for the design discipline. Furthermore, this study invites framing climate related and ecological challenges as a *multispecies design challenge*, that requires modes of engagement and knowledge-production with other-than-human beings.

1.1 Interdisciplinary Playgrounds for Speculative Design Practices

The transformative potentials of Speculative Design Practices extend beyond the confines of design discipline. For instance, within the realm of research agendas, such as Responsible Research and Innovation (RRI) (von Schomburg, 2013) methodological approaches of Speculative Design Practices are valued, to include different perspectives from research, policymaking, economy, and society at an early stage of the innovation process, by extrapolating possible developments of emerging technologies with uncertain impacts, such as biotechnologies (Harles & Heidingsfelder, 2021). By embodying these outcomes through fictional narratives, they open debating grounds to discuss societal needs and to include perspectives of everyday life experts. However, against the backdrop of socio-ecological challenges, such as biodiversity loss, new design challenges emerge, that extend beyond technology-centered agenda settings and human needs. But the challenge lies in articulating those needs which interconnections are not always apparent in everyday life.

Furthermore, the potentials of Speculative Design Practices are increasingly recognized within the realm of public sector innovation, policymaking, and democracy. But here as well, the necessity to include non-human agents becomes evident, as the notion of granting legal rights to non-human beings gains traction at governmental levels, exemplified by initiatives like the "Sumac Kawsay" in Ecuador or the "Te Awa Tupua Act" in New Zealand (Kauffmann & Martin, 2018).

Against this backdrop, this study delves into how Speculative Design Practices can effectively respond to the growing demands for inclusivity on societal, political, and environmental levels that go beyond human-centric perspectives.

In the first section, the study emphasizes the impact of interdisciplinary *Multispecies Studies* and *Multispecies Design approaches* that challenge anthropocentric and Western-centric perceptions within the realm of socio-ecological challenges. This is followed by a short overview of the entanglements between design and nature, ranging from "Nature-inspired Design" to an ontological turn.

The main part of this study scrutinizes the evolution of SDP, tracing their roots from *Radical Design*. It showcases significant influences from interdisciplinary touchpoints and maps an emerging multispecies turn. The study culminates in a reflection on the requirements, challenges, and limits of a Multispecies approach in design, illustrated by a prototypical concept of "Multispecies Engagement."

2. A Multispecies Turn: Moving Beyond Human-Centered Ways of Knowing

2.1 Multispecies Ways of Knowing: Theoretical Common Grounds

This paragraph provides a brief overview of the theoretical foundations of *Multispecies Studies* at the intersection of interdisciplinary disciplines of humanities, social sciences and natural sciences. These contributions emphasize the interconnectedness of all living beings, including humans, animals, plants, and microorganisms. By moving beyond anthropocentric and western-centred understandings of nature, Multispecies Studies also challenge new modes of academic knowledge production. Therefore, this emerging field develops new methodologies for studying the agency and perspectives of other-than-human entities, contributing to social and environmental justice. As part of this study's investigation on Multispecies Approaches within the Design discipline, an overview of existing theoretical concepts is crucial. This overview proposes three theoretical pillars, each of them defined by influential concepts and pioneers from different backgrounds:

1. **Sociology & Posthumanism**
   Relevant and influential contributions to understanding multispecies are grounded in sociological and post-humanist concepts—primarily represented by Donna Haraway and Bruno Latour. Haraway's concept of "nature cultures," "companion species," or the "Chthulucene" challenges the traditional divide between nature and culture, emphasizing the complex and mutual entanglements between humans, animals, and the environment. Latour's actor-network theory highlights the agency of non-human actors in social networks (Latour, 2007), and his concept of "parliaments of things" proposes a new way of thinking about the relationship between humans and non-humans by emphasizing the need to understand the complex networks of actors and their interactions (Latour, 1993).

2. **Anthropology and Environmental Histories**
   Building on the foundations laid by Haraway and Latour, key concepts have emerged at the intersection of anthropological sciences and environmental history, specifically that of *Multispecies Ethnography* (Kirksey & Helmreich, 2010*), Multispecies* Assemblages (Aisher & Damodaran, 2016)*, Multispecies* histories (Loewenhaupt-Tsing et al., 2019) describing an *ontological and non-human turn (Grusin, 2015)*. These approaches have, in common, that they recognize the interconnectedness and inseparability of humans and other life forms from an anthropological perspective. They are emphasizing the agency of other-than-human species, highlighting the environmental, political and economic dimensions of human-nonhuman relations. The intersection of anthropological and environmental research, a contributing with valuable interdisciplinary methodologies for studying complex human-nonhuman relations.

3. **A Symbiotic View Of Life from a Natural Sciences Perspective**
   Recent findings in natural sciences challenge the perception of life forms as individual, independent entities. Gilbert's work on "A Symbiotic View of Life: We Have Never Been Individuals" advocates for re-evaluating the concept of the "biological individual" (Gilbert et al., 2012). Furthermore, the introduction of the "holobiont" discussed in natural science recognizes the multispecies assemblages comprising the multicellular eukaryote and its

persistent symbionts. This shift, influenced by Lynn Margulis, emphasizes the significance of symbiosis and cooperation in biological systems. Horizontal gene transfer further elucidates symbiotic evolutionary developments. These scientific foundations underpin multispecies ethnography, exploring the interconnectedness of human societies with the non-human world. Incorporating developments in environmental, conservation, and evolutionary biology into multispecies approaches enables interdisciplinary exploration of relationships between humans, non-human beings, and their microbial symbionts. This approach sheds light on how these relationships shape culture, society, and health.

These developments are paving the way towards new ways of knowledge production in academia that can lead to a fundamental culture change in Western-centric research institutions.

3. Human and Non-Human Entanglements Through Design

The entanglements of the human and non-human worlds within design practices are vast, forming a significant part of design history that is shaped by scientific and technological developments. To comprehend the mutual benefits between Multispecies Studies and the design discipline, this paragraph explores the roots of interconnected relationships between humans and their natural world within the design process, by proposing three concepts:

1. **Nature-Inspired Design: Nature as a Source of Inspiration**
   Nature has influenced various design domains, including product design, material design, architecture, and technology. Learning from nature, by adopting principles or mimicking movements, material qualities, and functionalities, has resulted in nature-inspired prototypes and concepts such as Biomimicry Design or Biodesign (Sachs, 2016). By engaging with nature as source of knowledge, other-than-human beings inform the design process. Here, designers are drawing inspiration from nature and seek nature-based knowledge, rather than opposing it. However, caution is essential to ensure that the design outputs benefit both human and non-human entities, considering ecological sustainability and ethical production.

2. **Transition Design, Eco-Social Design & Pluriversal Design: Designing for Eco-Social Transitions**
   Further developments that can be observed within the design discipline are approaches that consider the entanglements of social, political and ecological impacts of design. Its roots can be traced back to influential concepts evolving in the 1970s, such as Viktor Papanek's "Design for the World," or Buckminster Fuller's works on the "Operating Manual for Spaceship Earth." They are emphasizing the need for functional, sustainable, and accessible designs that address the needs of all people, marginalized groups, and the environment. In contrast to nature-inspired design, the role extends beyond generating tangible design outputs. It is elevated to a systemic level that connects societal, political, and ecological perspectives.
   The systemic role of design is negotiated against the backdrop of current socio-ecological challenges and is expanded through approaches such as Transition Design (Irwin, 2015), Eco-Social Design (Krois, 2020) or Pluriversal Design (Escobar, 2017). These approaches distinguish themselves by not aiming to develop final solutions, but by using design to raise ecological, political and socially relevant questions. They are democratizing the design process, enabling co-creative, participative, interdisciplinary design processes that involve pluriversal perspectives from communities, society, politics, science, and economy. This requires common grounds for societal debates and desirable visions of the

convivial futures. The importance of Speculative Design approaches, which often open space for alternative realities and imaginaries of the future, is particularly evident here, as illustrated in the next paragraph.

3. **More-than-Human Design**
   In response to escalating environmental concerns and ethical considerations of novel technologies, such as Artificial Intelligence, the design discipline undergoes a paradigm shift from a human-centred to more-than-human approaches (Gatto & McCardle, 2019; Hook, 2019; Mancini & Lehtonen, 2018; Metcalfe, 2015). Multispecies and interspecies approaches, often inspired by the three theoretical pillars outlined above, advocate for the active involvement of other-than-human agents as clients of design. These methodologies can be observed at the intersection of urban planning, material design, and human-machine interaction.
   More-than-human Design is not only narrowed to other living species, such as animals or bacteria. Its scope encompasses every entity on this planet, from the technosphere, biosphere or geosphere. These considerations lay the groundwork for exploring the potentials of Multispecies Studies and Speculative Design, establishing a necessary framing for further inquiry.

A retrospective of the entanglements between nature and design within the past decades is relevant to explore the evolution of a Multispecies Turn in Speculative Design Practices outlined in the next paragraph.

4. A Multispecies Turn in Speculative design?

4.1 From Radical Design to Speculative Ecologies

In this exploration, Speculative Design Practices encompass a collective category of design approaches whose origins trace back to the 1960s with movements like *Radical Design* and *Critical Design*. Over the past two decades, a diverse array of SDP methodologies has emerged, including Speculative Design (Dunne & Raby, 2013), Design Fiction (Bleecker, 2009; Bleecker et al., 2022), Adversarial Design (DiSalvo, 2012), Associative Design (Malpass, 2013), Discursive Design (Tharp & Tharp, 2018), Critical Artifact Methodology (Bowen, 2009), and Speculative Enactments (Elsden et al., 2017).

These approaches share a common objective: to detach design from market-oriented utility and the creation of ready-made consumer goods. Instead, they use design to interrogate societal, technological, economic, and ecological developments and their interconnections. Rather than simply describing how things are, these practices generate fictional narratives and storytelling prototypes of alternative futures and sooner-nows to stimulate societal discourse. The designed outputs are considered as research artefacts (Matthews, 2014), “diegetic prototypes” (Kirby, 2010), "provotypes" (Boer & Donovan, 2012), or “boundary objects” (Heidingsfelder et al., 2019) embodying the intricate interweaving of societal and technological developments. Unlike design prototypes for consumer goods, these artefacts do not describe functionality; instead, they aim to pose questions and foster collaborative inquiries on how things could be. In this way, these artefacts break down the complexity of future impacts, translating technological and scientific feasibilities into everyday scenarios, while creating a space for collaborative exploration of how we want to co-exist with new-to-everyday life artefacts.

Speculative Design Practices are increasingly recognized beyond the confines of the discipline, particularly for engaging the public in scientific and technological innovations. This recognition allows for early-stage assessments of acceptance of novel technologies in both the public and private sectors. However, there is a risk of a technocratic misunderstanding of these approaches, which consider potential developments through a solely human-centric lens, seeking to address complex challenges primarily through readily

applicable technological solutions, while overlooking broader societal and political implications. This limited perspective, often rooted in Western, and capitalist world views, frequently disregards environmental consequences and fails to acknowledge the wealth of cultural knowledge and diverse perceptions of the world (Tunstall, 2013). Therefore, it is crucial to consider the ethical responsibilities of SDP in the context of socio-ecological challenges before expanding these approaches towards Multispecies Studies (Harles & Heidingsfelder, 2021). There is a need for an ontological turn, that considers societal developments that call for decolonized, pluriversal and inclusive futures that expand the realm of SDP through new approaches, such as Afro-Futurism or Indigenous Futurism (Harrington et al., 2022).
Against this background, the reconsideration of Multispecies Studies within SDP means to integrate a multiplicity of perspectives and speculative ecologies (Armstrong, 2021), that are considering the complex relationships between humans, cultures, non-humans, and the environment.

4.2 Evolutionary Roots of Speculative Design Practices

The following paragraph provides a brief overview of the development of Speculative Design Practices (SDP) over the past 30 years, highlighting its inherently close connections to human history and technological advancements.

The roots of SDP can be traced back to Radical Design, a design movement that emerged primarily in Italy during the 1960s and 1970s. It arose in response to the social, cultural, and political upheavals of the time, forming part of a broader countercultural movement that aimed to challenge established norms and question the role of design in society. Radical Design sought to break away from traditional design conventions, exploring new ideas, materials, and forms.
In the 1990s, Dunne and Raby developed the concept of speculative design to challenge the conventional view of design as a problem-solving activity. They aimed to explore the potential of design as a tool for thinking and speculation about the future, influenced by societal, political and technological developments. This marked a shift from strategic future thinking prevalent during the Cold War, characterized by scenario planning and predictive approaches. In contrast to this strategic understanding, Speculative Design argued for viewing future scenarios not as final goals but as mediums to enable collaborative debates and “social dreaming” of many possible futures.

Simultaneously, the affordability and widespread use of electronic devices, especially computers, began to impact various aspects of our lives. This raised questions about the usability, aesthetics, and future roles of electronic products in society, laying the conceptual foundations for what Dunne and Raby defined as Critical Design. Critical Design proposes the use of design as a tool for questioning and critiquing the role of products and technology in society, encouraging debate and speculation about possible futures. Since the 2000s, SDP has witnessed a rich biodiversity of approaches building upon these conceptual foundations, that go beyond the scope of this paper. However, three fundamental concepts, that lead to relevant evolutionary developments within SDP, will be highlighted in the following.

4.3 The Mundane Turn: Sooner-Nows and Speculative Enactments:

Despite being rooted in future-making methodologies, Speculative Design outputs do not exist in a “futurist vacuum.” The conceptual roots of SDP connect present challenges and developments with potential future outcomes. To ensure public engagement within speculative practices, future scenarios must be understandable to a broad audience. There has been a call from a design anthropological perspective to align Critical and Speculative Design Practices with everyday life situations, creating “mundane” futures rather than opening fictional narratives beyond our expected lifetime (Auger, 2013; Kjærsgaard & Boer, 2015).

By linking speculative scenarios to everyday realities that describe the impact and frictions of emergent technologies in mundane situations, it establishes a direct connection to the audience. Given the societal relevance, there has been a questioning of access to SDP outputs, often presented as passive objects in museum contexts. The focus is not only on situating these scenarios in everyday application contexts but also on the experiential aspect through immersive scenarios or so-called Speculative Enactments (Elsden et al., 2017). Additionally, the role of SDP artefacts has been scrutinized, with designers not only crafting artefacts but also involving the audience and non-designers in the process. This participatory approach allows different personal perspectives to be considered, enabling societal groups to articulate needs and desires for future scenarios (Heidingsfelder et al., 2019).

This shift, termed by the author of this paper as the “Mundane Turn” in Speculative Design Practices, aims to argue for a more profound and responsible understanding of SDP, particularly in addressing urgent environmental challenges that demand immediate action and prevent problems from being deferred into an intangible future.

4.4 The Biotechnological Turn

In addition to a paradigm shift in temporal aspects within SDP, there is also a thematically driven transformation to consider, which will be explained in the following paragraph.

Significant technological developments that have rapidly gained momentum in the past 20 years, turning our understanding of nature upside down and challenging the boundaries between human-made and nature-made, are the field of Modern Biotechnology and Synthetic Biology. Through them, humans have not only learned to decipher the code of life but also to rewrite or redesign it entirely, and at increasingly affordable costs and time investment. This technology brings forth fundamental ethical questions and tremendously complex impacts on society, the economy, politics, and the environment. Its significance is underscored as it is declared as a key technology at political levels within a short period, prompting inquiries into global ethical standards.

This technological development does not go unnoticed in SDP and forms the basis for an expanded line of questioning that not only incorporates humans and technology but actively includes nature as a stakeholder in the speculation, thus re-examining the boundaries of SDP (Dunne & Raby, 2013). The engagement with biotechnological implications on society through interventionist speculative design methods is referred by the author of this paper to as the "Biological Turn." This turn is exemplified by numerous contributions, as illustrated in the following through exemplary use cases.

- Emilia Tikka's work "ÆON" envisions a future where the biological clock can be reversed by genetic reprogramming. The project is embodied as a device for daily use and narrated as a fictional story of a couple who made opposite choices about using the rejuvenating technology 60 years ago and now must face the consequences of their decision. The project aims to question the human desires and dreams driving current biotechnological innovations, and societal dimensions of the idea of prolonged lifespan, raising philosophical questions about human life, death, and the afterlife.

- The Pink Chicken Project by the Nonhuman-Nonsense Collective proposes using a “Gene Drive” to change the colour of the entire species of chickens to pink. This is in response to the impact of human-made materials on marine life, with the bones of 60 billion chickens killed every year leaving a distinct trace in the rock strata. The project aims to change the future fossil record by modifying the genetic makeup of chickens, turning them pink, and using the recently invented Gene Drive technique to spread this gene on a global scale. Raising questions about the impact and power of synthetic biology and gene drives, and invites the public to reflect about the incentives and impacts. However, it highlights the need for an ecological discourse that includes

issues of social justice and the radical restructuring of society needed to break the death grip of the sixth extinction.

- An interdisciplinary example of Speculative Design at the intersection of biotechnology is the work of Dr. Pinar Yoldas, who combines design, synthetic biology, and cultural criticism to coin *Speculative Biology*. This field involves the design of tissues, organs, organisms, biological systems, ecotypes, and ecosystems to catalyse creative critical thinking about the ethical and cultural implications of biotechnology. In her project "Ecosystem of Excess" features a series of speculative organisms that live in an ocean of plastic waste, highlighting the impact of human-made materials on marine life. The project uses synthetic biology to design organisms that can survive in this extreme environment, such as a jellyfish that feeds on plastic particles and a shark that has evolved to swim through plastic waste.

- Another prominent example is the work of Daisy Ginsberg, who uses design to explore the potential implications of synthetic biology. Her project “Synthetic Kingdom” imagines a world where synthetic organisms have been designed to perform various functions, such as cleaning up oil spills or generating energy. The project emphasizes the need to consider the ethical and societal implications of creating new life forms. Furthermore, her project "Designing for the Sixth Extinction," which explores the use of synthetic biology to save endangered species. The project uses SDP to spark a dialogue between the conservation and synthetic biology communities about the ethical implications of using biotechnology to save existing, “natural” organisms.



Figure 1. ÆON by Emilia Tikka| Photograph by Zuzanna Kaluzna.



Figure 2. Pink Chicken Project by Nonhuman-Nonsense.

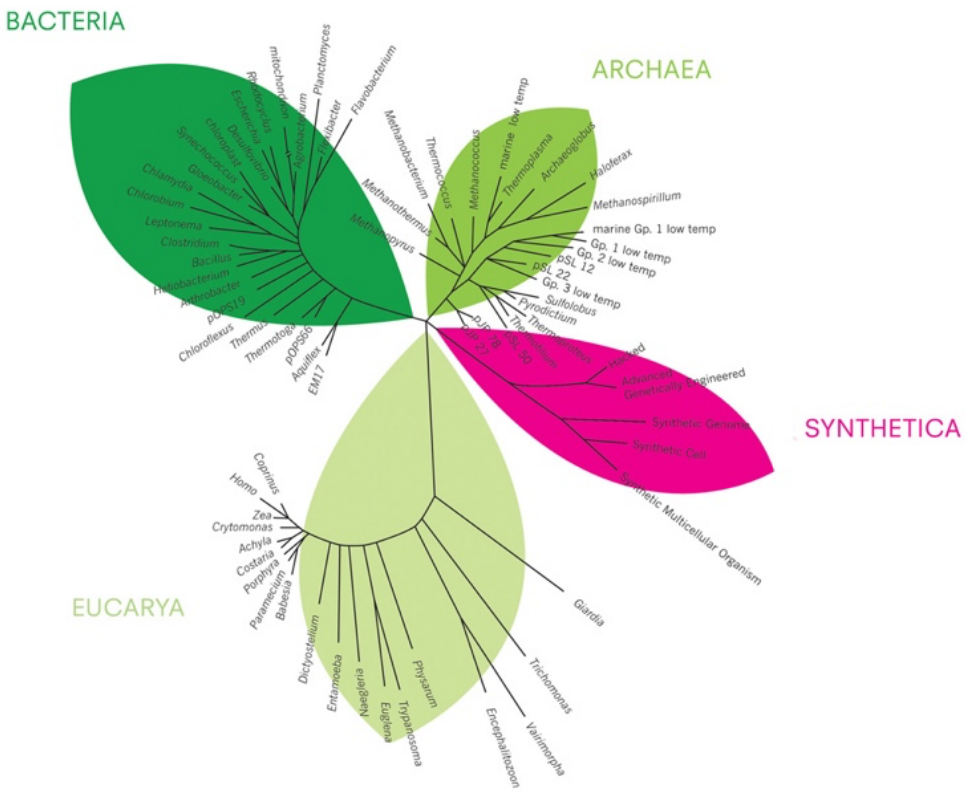


Figure 3. Synthetic Kingdom by Alexandra Daisy Ginsberg.

These use-cases exemplify the application of Speculative Design Practices to explore the boundaries between nature, humanity, and technology, concurrently prompting critical inquiries into the ethical and cultural implications of such advancements. The advent of the Biological Turn significantly contributes to the evolution and potential of SDP, particularly in addressing socio-ecological challenges. This shift places non-human protagonists and speculative living artifacts at the centre of Speculative Design Approaches.

Despite the intended focus of these projects on highlighting current environmental issues and posing essential questions, it is imperative to note that the primary emphasis lies on technological feasibilities and human impacts, rather than intercultural and non-human implications. The biotechnological outcomes, such as genetic modifications to non-human entities or extending human lifespan, are predominantly contemplated from a human-centred perspective, lacking consideration for the perspectives of surrounding ecosystems and non-western cultures.

In summary, the Biological Turn illustrates how SDP can facilitate holistic storytelling for collaborative inquiry into environmental issues, positioning non-human entities as central protagonists. However, there exists a potential risk of perceiving these non-human agents merely as artificially implemented living technological interfaces in natural habitats, serving human-centric benefits. Consequently, there is a pressing need for a more radical inclusion, which will be expounded upon in the subsequent paragraph.

4.5 The Multispecies Turn

Expanding on the reflections discussed above, it becomes apparent that there is a compelling necessity for the continued evolution of Speculative Design Practices in addressing intricate socio-ecological challenges, such as biodiversity loss, rising temperatures, and sea levels. A spectrum of experimental use-cases and practice-based design research projects has already emerged, positioning themselves at the intersection of these challenges and multispecies studies. These projects can be recognized as pioneers, navigating the boundaries and challenges inherent in adopting multispecies approaches within speculative design practice.

These initiatives traverse various fields of action intimately connected with everyday life, encompassing environmental conservation and multispecies in urban habitats (Roudavski, 2021; Sheikh et al., 2023), prototypes for enhancing coastal regions (Metcalfe, 2015), explorations of human-plant interactions (Gatto, 2019), and efforts focused on fostering empathy for non-human entities through Animal-Computer Interaction (Hook, 2019). Employing speculative and immersive methodologies, these projects ponder how socio-ecological challenges can be envisioned from a more-than-human perspective.
Moreover, these endeavours are generating pertinent research questions that explore methodological frontiers and interdisciplinary playgrounds at the crossroads of multispecies ethnographies, conservation strategies, and biological impact assessments. Going beyond mere speculation, they actively seek collaborations with scientific experts, non-governmental organisations, local communities, and stakeholders. By building bridges and facilitating knowledge transfer, they strive to cultivate meaningful collaborations extending beyond public debates, translating into tangible actions for socio-ecological betterment. In doing so, they contribute to a more nuanced and actionable approach in the evolving landscape of speculative design, integrating theory and practice to address urgent socio-ecological challenges.

5.A Multispecies Engagement Framework

5.1 Engaging Other-Than-Human Agents Through Speculative Design

In light of the preceding discussion, this study introduces the concept of a "Multispecies Engagement Framework," proposing a paradigm shift in speculative design interactions with non-human entities in socio-ecological transitions that aim to take climate action. In this study, the term is inspired by *Public Engagement with Science (PE)* (Schäfer, 2019*)* which delineates a participatory approach to science communication fostering a mutual dialogue between science and society. Public Engagement and participatory practices are evolving as strategic pillars within research institutions, aiming to involve the public in their research agendas to create impactful outcomes aligned with societal needs.

Speculative Design Practices have demonstrated their potential to involve societal stakeholders in Public Engagement formats through design-based methodologies, using speculative future scenarios as a collaborative platform of exchange and inquiry (Heidingsfelder et al., 2019).

In the context of pressing ecological challenges, this study posits the hypothesis that SDP, aiming to engage communities within ecological transitions, needs to take the ontological turn into account. It renegotiates the influential concept of PE, primarily focusing on incorporating human needs into scientific research. There is a risk that PE keeps perpetuating a human-centred (and Western) bias into research agendas, excluding cultural perspectives and ecological impacts, particularly concerning overarching societal issues at the intersection of sustainability and conservation. As communities and environments are impacted by ecological challenges in very different ways, there is a need to expand the modes of engagements. Against this backdrop, the concept of Multispecies Engagement expands the notion of “the public” beyond the human scope. So, what and who constitutes a “Multispecies Public”?

The proposed concept “Multispecies Engagement” advocates for establishing a mode of engagement that includes other-than-human beings within research and innovation processes, aiming to create transformative change within the scope of socio-ecological challenges. This concept serves as a bridge between design, society, nature, science, and pluriversal perspectives and drives ecological, environmental and multispecies justice through a *multispecies way of knowing*.

5.2 Methodological Approach and Use-Cases

The multispecies framework builds upon the developments in Speculative Design Practices (SDP) discussed earlier, focusing on collaborative inquiries for socio-ecological imaginaries of the future by translating complexity into everyday scenarios, and engaging diverse cultures, modes of knowledge, and interdisciplinary expertise.

This framework is constructed through a methodological mapping of practice-based design literature centred around multispecies, interspecies, and more-than-human design interventions, aiming to address socio-ecological challenges in collaboration with or for other-than-human entities. Given that this field is still in its nascent stages, the framework also incorporates use-cases that may not explicitly align with Speculative Design Practices. However, they share the same values and aspirations. Their ambition to engage other-than-human beings within their design process and exploration of interspecies methodological approaches makes them a relevant source of knowledge. Some investigated use-cases are highlighted below to provide an overview of what can be defined as multispecies design practice.

- Daniel Metcalfe's dissertation “Multispecies Design” (2015) introduces a design approach recognizing animals as clients of design, human-animal interactions as designed experiences, and man-made systems as extensions of ecological systems. The research addresses designing for biodiversity in human-dominated habitats, emphasizing the physical and socio-cultural requirements. The developed *Principles and Tools for Multispecies Design* aim to shift practices towards more sustainable and biodiverse human habitats.

- Alan Hook's paper on "Exploring Speculative Methods" (2019) proposes using speculative design to understand nonhuman animals and foster interspecies understanding. The Equine Eyes prototypes explore human-horse interactions, challenging anthropomorphizing nonhuman animals. The paper argues for creating experiential artifacts in speculative design and highlights the role of design in suggesting arguments about the world.

- The paper "Reparative futures of smart urban governance: A speculative design approach for multispecies justice" by Hira Sheikh, Peta Mitchell, and Marcus Foth (2021) explores the potential of speculative design to create more just urban environments for both humans and non-human species. The authors suggest a framework considering the needs and perspectives of all urban inhabitants, using speculative design to investigate the potential of urban governance for environmental justice and species equality.

The methodological mapping analyses these and other projects, identifying approaches, similarities, and blind spots to refine the understanding of how multispecies frameworks and speculative design can be effectively employed.

5.3 Aspects of a Multispecies Engagement Framework

The following paragraph highlights seven main principles that build the conceptual foundation of the Multispecies Engagement Framework to engage other-than-human stakeholders within SDP.

1. **Anticipating Otherness**
   Speculative design critically examines anthropocentrism, challenging the prevailing human-centric worldview. It seeks a more profound understanding of the non-human sensorium, encompassing the sensory experiences and perceptions of non-human beings. This raises the question of who has not yet been considered, requiring an initial comprehensive understanding of protagonists, dependencies, and frictions in

ecosystems. To achieve this, we must first overcome our human empathy biases towards significantly different mammals and dissolve classifications between domesticated, wild, and utilitarian animals.
Furthermore, other-than-human beings include not only animals and other species that are visible to human eyes, with which we already have a connection. It is crucial to consider microorganisms, bacteria, fungi, and ecological agents, such as soil, air, and water as well that present different modes of otherness than that of mammals, birds, or fish. Above all, it is essential to understand that all beings are part of an ecosystem, indirectly affected regardless of their dependency relationships. So multispecies world building is a complex entanglement of different modes of otherness, that needs to be anticipated.

2. **Levels of Engagement: From Co-Producers to Clients of Design**
Speculative design approaches, depending on their goals and processes, offer various possibilities for involving non-designers. This results in different roles, such as that of the informant or consultant, providing expertise to the designer. Participants, representing the affected target groups, are engaged through speculative artifacts, ranging from informants shedding light on challenges from their perspective to co-designers actively involved in shaping artifacts. These levels of engagement must also be questioned in multispecies approaches. In addition to considering whom the designer includes, there is the question of how other-than-humans can be involved—ranging from co-production, such as material development, to "clients of design" like the intertidal species in Daniel Metcalfe's project, to "informants" highlighting challenges from their perspective.

3. **Fields of Action and Interdisciplinary Playgrounds**
The application realms of Multispecies Engagement within Speculative Design Practice are as varied as the challenges it addresses. Key themes revolve around participatory processes in urban habitats, converging design, architecture, urban planning, and environmental sciences. These initiatives explore how urban spaces can be designed for both humans and non-humans, recognizing cities as crucial habitats and "urban arks" for various species. This perspective shifts urban structures from "Anthropocene objects" to new to nature ecosystems, optimizing them as protected habitats through strategies like Rewilding, Assisted Migration, or Grey Greening.
These applications extend beyond urban spaces to rural areas. For instance, Metcalfe's exploration of optimizing a Coastal Pipeline as a shared habitat involves approaches from Multispecies Ethnography (Kirksey & Helmreich, 2010), Reconciliation Ecology (Rosenzweig, 2003), Cross-Species Engagement (Hinchliffe et al., 2005), and embodied design interventions (e.g., prototypes of tiles).
Rasa Weber takes it further by introducing concepts of Interspecies Architecture in critical maritime zones like coral reefs, coining the term *Sympoïetic Design* (Weber, 2022). Inspired by Lynn Margulis's theories, this approach combines materials research with behavioural biology and Living Architecture to create artificial reefs tailored for non-human marine environments.
Approaches at the intersection of material research and food production, such as Emma Sicher's work, bridge design, anthropology, and molecular biology. Sicher explores human-plant-microbe interactions, envisioning "Multispecies Matter" as an adaptable open design model promoting regenerative practices and resilience in diverse contexts (Sicher et al., 2023).
Projects like the *Interspecies Designstudio*, led by Jannis Kempken, engage non-human as co-designers to produce colours or decay materials. Other mentionable speculative

endeavours at the intersection of Environmental and Multispecies Justice consider other-than-human beings as eligible actors in democratic processes (Sheikh et al., 2023). Furthermore, projects situated at the intersection in Animal Aided Design and Animal Computer Interaction aim to make species' sensorium accessible to humans, promoting empathy through design (Hook, 2019).
Their focus is on opening negotiation spaces and perspectives through interdisciplinary, research-based practice, rather than developing final market-ready products. Despite lacking a specific timeframe, these projects address various environments, from cities to underwater realms and research laboratories.

4. **Engaging Multiplicity Modes of Knowledge-Production**
Engaging communities within speculative design processes requires empathy with communities and an understanding about everyday life realities. Expanding these requirements to a non-human perspective, traditional human-centred design approaches, such as interviews and cultural probes, reach their limits.
Here it becomes crucial to engage with scientists, communities, and local knowledge holders, that have a certain knowledge about other-than-human beings through research, observation or co-existence, while incorporating their perspectives into the design process. Therefore, Multispecies Engagement in SDP necessitates interdisciplinary knowledge development, including scientific, local, or indigenous knowledge. It is important to be aware and embrace various forms of knowledge production beyond academia. Overcoming interspecies barriers may also engage spokespersons for certain species, primarily with scientists, local communities, environmentalists (Metcalfe, 2015). Another crucial step is that designers need to immerse themselves in the environment, spending time observing or embodying movements through somatic practices or technological enhancements to adopt non-human perspectives. This approach entails assessing specific knowledge about how other-than-humans might be affected by socio-ecological challenges. Additionally, designers need skills to navigate through environments that may not be natural habitats for humans (ocean), spanning activities from diving and snorkelling to working in biolabs. Multispecies Engagement challenges designers to step out of their comfort zones within design studios.

5. **Mundane Futures and Non-Human Time Scales**
This principle involves considering time, a central aspect in Speculative Design Practices. Whether exploring alternative presents, mundane futures, or distant scenarios, time frames the speculative design process, providing perspective and orientation for reflection.
Understanding the timescales in which other-than-human entities can adapt to ecological challenges, such as forest dieback or migrating insect species, is crucial. Non-human beings operate on different timescales than humans, influencing their interactions with the designed environment. This understanding, incorporating short lifespans of flies (a few days) or the long lifespan of trees (up to more than 1000 years), should inform the design process. Respecting non-human time scales is essential in creating sustainable, resilient, and just designs with long-term impacts on diverse species and ecosystems.
This principle signifies a shift from anthropocentric to eco-centric design practices, prioritizing the diverse needs and perspectives of non-human beings. By integrating an understanding of non-human time scales into the design process, designers can foster coexistence, collaboration, and mutual flourishing between humans and non-humans.

6. **Non-Human Sensory Toolkit**
   This principle highlights the necessity to think outside our human sensory realms and language-based communication. Humans are not able to grasp the manifold ways in which natures communicates, such as sounds, colours or molecular messages that cannot be perceived by our bodies and nervous systems. This multisensory biodiversity opens new question for practice-based research on how designers can include non-human communication channels within SDP.
   Furthermore, we need to anticipate this kind of otherness, without anthropomorphizing or romanticizing other-than-human beings, as this can risk to misleading the debate.

7. **Measuring Impact and Transfer**
   To ensure the practical application and sustained impact of speculative design beyond debates, a transfer within and outside the design discipline is necessary. Alternative methods of impact measurement, such as ecological indicators, should be employed to assess the effects of design interventions on non-human beings and ecosystems, highlighting the socio-cultural, ecological, and ethical dimensions of speculative design.

6. Conclusion

Over the past decades, Speculative Design Practices responded to social and technological developments with transformative potentials and challenges. Against the backdrop of pressing ecological issues, SDP are confronted with new challenges and developments, such as the multispecies turn. This calls for a shift from human-centred to multispecies ways of knowing, that engages other-than-human beings in the co-creative and discursive approaches of SDP. Thus, it will become crucial to push the disciplinary boundaries of the design field once more and draw together a multiplicity of knowledge, that extends beyond human, western and scientific understandings of nature.

Despite the promising potentials that SDP has to offer to create new ways of multispecies ways of knowing, it is important to critically reflect boundaries and expectations of interspecies collaborations, as every multispecies intervention is ultimately initiated by humans. This initiation always follows the motivation that our efforts serve the purpose of ensuring our survival. Humans are likely the only species aware that they will die and that are aware that they are currently depriving the basis for life themselves. Human bias cannot be avoided, but this is not a reason to not pursue further investigations into the possibilities of Multispecies approaches through design.

The real potential lies not in fostering interspecies collaborations but, above all, in breaking through thought patterns of thought that have shaped our society and academic research for centuries. It is a shift away from unlimited technological progress, especially a shift in the Western-centric and repressive understanding of nature, influenced by Western concepts and views through the spread of natural history museums.

Multispecies Engagement is a path to multispecies ways of knowing or “tentacular thinking” as Donna Haraway aptly puts it, breaking with the human-centred tradition of design. It frees design from the shackles of one-dimensional perspectives and the economic benefits that have tried to domesticate it through terms like Design Thinking. To summarize, Multispecies Engagement is an invitation to raise awareness, switch perspectives and to building bridges between design, politics, science, and society and non-human realities. What is known is worth protecting.

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P/REFERENCES OF DESIGN

TECHNOLOGICAL FUTURES AND RECURRING DREAMS: THINKING ABOUT EMERGING TECHNOLOGIES THROUGH SPECULATIVE DESIGN.

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ABSTRACT | This paper examines how an emerging technology can transition from the habitat of the laboratory to everyday life, with a particular focus on the different roles design can play throughout this process. Design is intrinsically linked to notions of the future, through the arrangement of elements to accomplish predetermined goals. More familiar is design's near-future role – the arrangement of existing elements to create useful, marketable objects. However, design also has an important role in longer-term planning through the arranging of potential elements to create hypothetical objects and related future imaginaries – visions of how the future could be, should that technology reach maturity. First, we trace the typical journey of a technology through three distinct phases: from its 'genesis' in a scientific laboratory, through the 'imaginary' phase where the emerging technology's potential is transformed into a vision of how the future could be, to the development of an actual product or service for use in everyday life. Next, we present a list of reasons why dreams of the future have stagnated, with an emphasis on how design is implicated in this process. Finally, we present three speculative design projects by PhD students, each working in a different phase of the tripartite process: placing the designer in the laboratory to upstream prototype and infuse scientific research with social responsibility and/or domestic sensibilities; revisiting stagnant technological dreams and updating through the counterfactual history approach; and downstream 'super testing' using speculative methods to better understand the implications of technologies in everyday life.

1. Introduction

The practice of design is intrinsically linked to notions of the future, both near (months and years) and relatively near (years to tens of years), through the arrangement of elements to accomplish predetermined goals (Eames, 1972). More familiar is design's near-term role – arranging existing elements to create useful and desirable objects that can be sold on the market. However, design also has an important role to play in longer-term planning through the arranging of *potential* elements (for example, emerging technologies) to create hypothetical objects and related dreams and visions of how the future *could* be should that technology reach maturity.

In the second section of this paper, starting from a diagram, we trace the typical journey of a technology through three distinct phases: from 1) its 'genesis' in a scientific laboratory, through 2) the 'dream' phase where the emerging technology's potential is transformed into visions of possible futures (both utopian and dystopian), to 3) the development of an actual product or service for use in everyday life. During the 20th century, the middle 'dream' phase became increasingly important in shaping the technological future. Such dreams take on a variety of forms, exist for a plurality of reasons, and inform futures in complex ways. We will focus predominantly on socio-technical imaginaries (STIs) described by Jasanoff & Kim (2009) as 'collectively held, institutionally stabilised, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology'. STIs are particularly helpful because they encode not only the visions of what developments in science and technology might bring but also an entrenched notion of a society's shared value system – the invisible forces that inform and define pathways into the future.

To illustrate the journey of a technology, we will present two case studies that represent the dominant 20th-century Western (US) imaginary, with a focus on the role of design. The belief systems at the core of this imaginary continue to influence contemporary visions of the future and what is seen as the 'good life' despite the mounting evidence against its ideals and methods. The third section offers a list of five reasons why future visions have stagnated or are simply inappropriate for the 'polycrisis'-ridden world of today.

We are in desperate need of new imaginaries. In the short term, we must develop better ways of challenging and exposing the limitations of the existing model. As a starting point towards more appropriate approaches, in the fourth section we present three ongoing speculative design projects by PhD students. Each project acts in a different phase of the tripartite process described above, and presents new design methods and approaches that address the limitations and flaws of the dominant socio-technical imaginary and design's role in shaping it.

2. The Journey of Technology

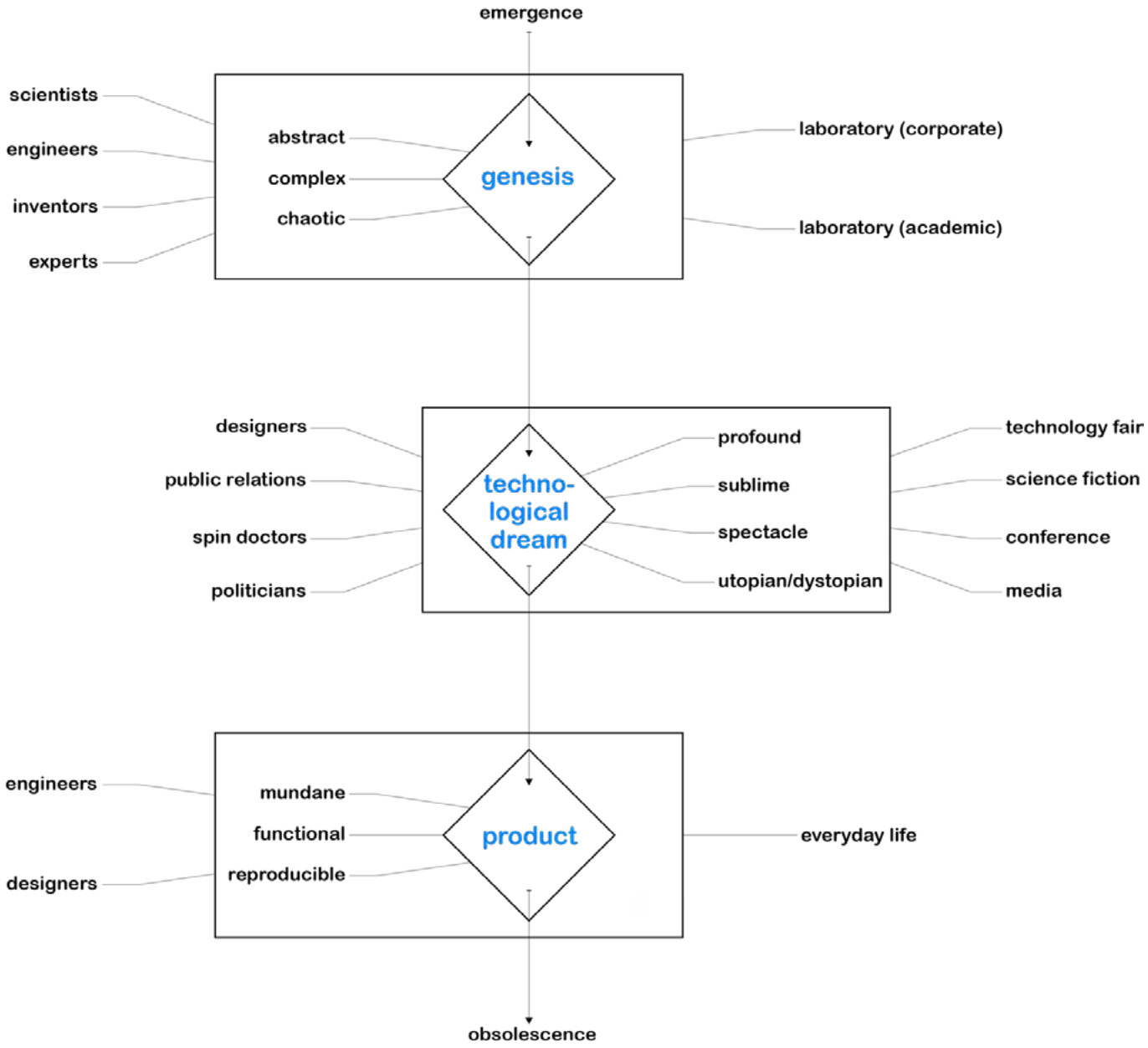


Figure 1. The journey of a technology: The diagram describes the (fairly typical) journey a technology makes from its genesis as an emerging technology in a laboratory, through the technological dream phase before transitioning into real products that exist in the context of everyday life. Finally, the technology descends into obsolescence as it is replaced by more advanced iterations. On the left are the actors involved at each stage and on the right are the contexts.

The diagram in Figure 1 describes, in general terms, the typical journey a technology makes, starting from its genesis in the laboratory through to its ultimate obsolescence. At its genesis the technology is abstract and complex, its behaviour and potential are only properly understood by the scientists responsible for its development.

Next is the technological dream phase. Here the *potential* of the emerging technology is translated into (typically) techno-utopian visions of the future. According to Basalla (1988):

> "Technological dreams are the machines, proposals, and visions generated by the technical community, whether in the Renaissance or the present time. They epitomise the technologists' propensity to go beyond what is technically feasible. Fanciful creations of this kind provide an entry into the richness of the imagination and into the sources of the novelty that is at the heart of Western technology."

Technological dreams take on a variety of forms, exist for a plurality of reasons, and inform futures in complex ways. In this paper we focus predominantly on socio-technical imaginaries (Jasanoff & Kim, 2009). During the last century this *imaginary* phase became increasingly important in cementing the fundamental belief in technological progress and the consequent shaping of the technological future.

The last phase of the journey is the translation of aspects of the dream into the products of everyday life. The iterative nature of technological evolution (Heilbroner, 1967) typically results in the new technology simply being applied to existing product lines. This has become the industry standard model of product development and facilitates generational iterative advances, typified by items such as the iPhone. As the (once) emerging tech reaches everyday life, it is usually quite conservative and familiar – just enough of an advance to make the new product slightly more desirable than its predecessor. Finally, the product descends into obsolescence as it is replaced by more advanced iterations. In certain cases, the dream gets recycled or regurgitated; for example, the recurring dreams of domestic robots, flying or driverless cars, or space tourism.

As discussed above, this process largely emerged in the early 20th century. We will now look more closely at two particular case studies: first, the internal combustion engine and the petroleum-based socio-technical imaginaries that were built around it, and how these evolved during the course of the century before finally become obsolescent; second, the rise of so-called 'smart' technologies, which are based on identical value systems and represent an almost seamless transition towards post-petroleum imaginaries.

2.1 Case Study 1: Petroleum and the Internal Combustion Engine

The new machines of the late 19th and early 20th century, such as the internal combustion engine or the coal-powered steam generator, revealed for the first time the true potential of fossil fuels. Petroleum, for example, is a naturally occurring liquid that stores a fragment of the solar energy that reached Earth during the Jurassic and Cretaceous periods (typically via algae and woody plants). While the first recorded use of petroleum can be found 4,000 years ago when natural asphalt was used in the walls and towers of Babylon, it was not until the early 20th century that the potential of petrol as a useful form of energy began to exert its influence on so many diverse aspects of human life.

The aeroplanes, automobiles and ships that were built around these engines became the symbols of the new machine age, as extrapolations of the *potential* of the internal combustion engine fed the utopian imaginaries of the near future. For a country emerging out of the despair of the Great Depression, *Streamline Moderne* (as it became known) represented the American dream of freedom and escape. Designers were for the first time beginning to play an instrumental role in linking technological progress to the notion of a better future, all in the service of American corporate capitalism. According to the design curator David A. Hanks, American Art Deco and Streamline Moderne differed from the European functionalism of the Bauhaus in that, while the former 'arose from an artistic vanguard', streamlining was 'aimed at the widest possible public and was based on an admiration for industry and speed' (Hanks & Hoy, 2005).



Figure 2. Buick LeSabre. By James Vaughan, 2010, Flickr.
Source: https://www.flickr.com/photos/x-ray_delta_one/4453386674/in/photostream/

The movement inspired the design of a new wave of domestic products, from toasters and kettles to radios and televisions to children's toys, that would give consumers a sense of buying into – and thus belonging to – the utopian American dream, the 'World of Tomorrow'.

Nothing exemplifies this period of techno-optimism better than *To New Horizons*, the promotional film of designer Norman Bel Geddes' *Futurama* exhibit in General Motors' 'Highways and Horizons' pavilion at the 1939 New York World's Fair. The film begins by invoking 'the mystery and the promise of distant horizons [that] always have called men forward' with the promise of a brighter future; a future driven by technological progress, but one which paradoxically never quite arrives. The imagery accompanying the voiceover is the settlers' view of America, complete with covered wagons and frontier forts: moving West to conquer and colonise new territory as well as the indigenous inhabitants, finding new ways to subjugate nature and apply the logic of extractive capitalism, always enabled by the advent of new technologies. In the film the frontier becomes a network of futuristic highways 'for men to go places', symbolising American freedom and dominance. The film represents perhaps the perfect sociotechnical imaginary, a means to 'engage directly with the ways in which people's hopes and desires for the future – their sense of self and their passion for how things ought to be – get bound up with the hard stuff of past achievements' (Jasanoff, 2015, p.32).

The core message of *To New Horizons* is that this new world is in a constant state of flux, 'opening before us at an ever-accelerating rate of progress' with the related imaginary representing 'a greater world, a better world, a world which always will grow forward.' As the (piston or intermittent) internal combustion engine transitioned to the final 'product' stage of the diagram, new dreams were necessary. In the 1950s the invention of the jet engine (Continuous combustion) allowed for supersonic flight, in turn expanding the horizons and moving the technological dream upwards and into the 'final frontier' of space (note again the colonising terminology).



Figure 3. Bell X-1 46-062, nicknamed *Glamorous Glennis*. NASA.
Source: https://commons.wikimedia.org/w/index.php?curid=22975326.

This provided the impetus for countless new visions including the Moon mission and related Cold War imaginaries (Barbrook, 2007). It also represented the final extrapolation of the petroleum dream, in the sense that within a few years these utopian dreams would be exhausted, deflated. As the novelist J. G. Ballard (1979) observed in an interview titled 'The Space Age Is Over':

> "The world of 'Outer Space', which had hitherto been assumed to be limitless, was being revealed as essentially limited, a vast concourse of essentially similar stars and planets whose exploration was likely to be not only extremely difficult, but also perhaps intrinsically disappointing … The number of astronauts who have gone into orbit after the expenditure of this great ocean of rocket fuel is small to the point of being ludicrous. And that sums it all up. You can't have a real space age from which 99.999 percent of the human race is excluded."

Elsewhere at the same expo in 1964, however, a new genesis was being revealed which introduced a refreshingly new direction for technological futures. The IBM Pavilion, with exhibition design and a film presentation by Charles and Ray Eames and architecture by Eero Saarinen, introduced visitors to the computer and its place in mainstream contemporary life. Again, quoting Ballard (1979), this time on the promise and allure of the Information Age:

> "The ability to pass information around from one point in the globe to another in vast quantities and at stupendous speeds, the ability to process information by fantastically powerful computers, the intrusion of electronic data processing in whatever form into all our lives is far, far more significant than all the rocket launches, all the planetary probes, every footprint or tyre mark on the lunar surface."

2.2 Case Study 2: Smart Futures

Ballard's prophetic observation segues neatly into the second case study: the dream of 'smart'. The term has relatively ancient roots, predating the emergence of computer technology, robotics, and notions of artificial intelligence. In the 19th century, the word 'smart' was used as an adjective to describe someone quick-witted, refined, or elegant. Davin Heckman (2008), in his book on the evolution of the smart home, cites the advertising campaign for the Oldsmobile Futuramic to illustrate the semantic evolution of the term:

> "In the truly modern home or the truly modern car, it's functional design that counts. Smart styling is styling with a purpose, as seen in this 1948 'Futuramic' Oldsmobile. Luxuriously appointed inside and out, the Futuramic Oldsmobile brings truly modern post-war design to the automotive field. There's utility as well as beauty in every smart detail, there's the safety of greater visibility, there's automatic shifting too and no clutch pushing thanks to GM Hydramatic drive. The smart way to go is the Automatic way, in a Futuramic Oldsmobile."

The connection between smart and automation evolved into one of the key STIs of the 20th century. The logic is relatively simple: automation builds on the early promise of modernism, where advances in technology lead to domestic products that reduce the need for human labour and increase notions of comfort and leisure in everyday life. The emerging technology behind these new imaginaries was the computer – the important advances made during WWII, in particular at Bletchley Park on encryption, had highlighted the vast potential of this technology, and research continued post-war with new impetus. In 1948, Norbert Wiener published *Cybernetics or Control and Communication in the Animal and the Machine*, which described how the function of machines and living organisms were governed by the same laws (feedback loops). What emerged from this scientific research was the notion of self-regulating thinking machines that would soon be used to generate, plan and control environments. Whilst research in the military domain continued in the background, in the foreground new imaginaries were flourishing, especially in the fields of transportation and the domestic – here with a strong focus on the kitchen.

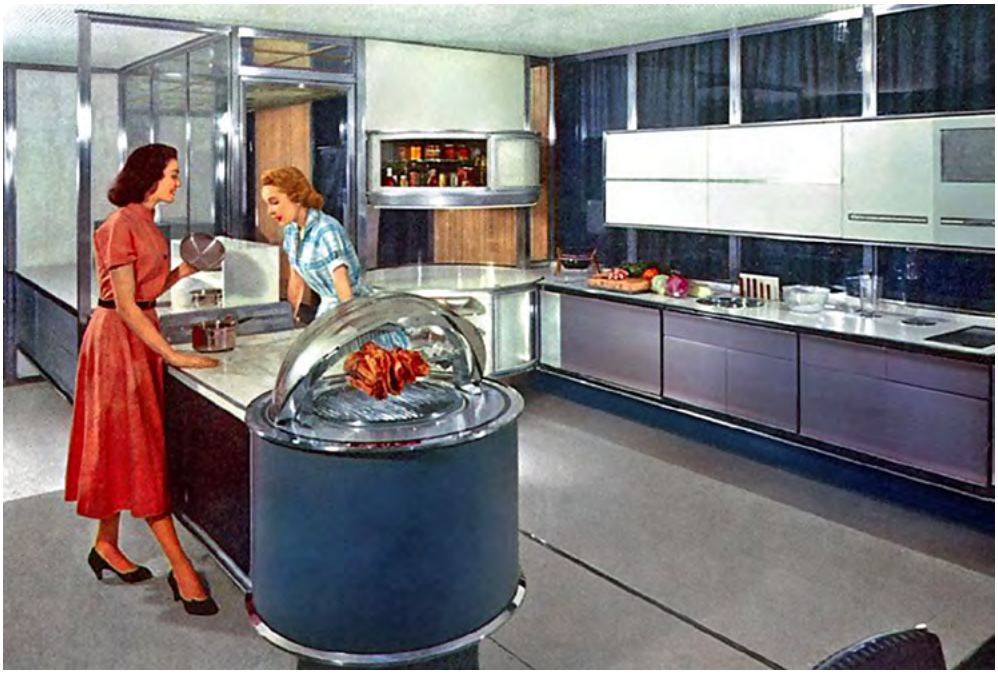


Figure 4. Frigidaire prototype kitchen (1957). By James Vaughan, 2009, Flickr. Source: https://www.flickr.com/photos/x-ray_delta_one/4189652500/in/photostream/. CC BY-NC-SA 2.0 DEED.

1950s *kitchens of the future* were not yet classified as 'smart', yet they represent the evolution of the dream that continues to this day. For example, RCA and Whirlpool's 'Miracle Kitchen' began travelling around the world in 1956 and made an appearance at the American National Exhibition in Moscow in 1959. It was meant to showcase a future where everything was controlled with the push of a button, so that 'the things

women don't like to do are done automatically', according to a promotional video for the concept kitchen. As Anya Smirnova, curatorial assistant at the London Design Museum, explains: 'the features of the kitchen, like the autonomous vacuum cleaner, anticipated today's domestic robots and smart home devices. As a pre-history of the contemporary smart home, the RCA-Whirlpool Miracle Kitchen provides important historical context' (Whirlpool, 2018).

As in the case of petroleum dreams, the imaginary continued to evolve, informed by the latest developments in computer technology. In the 1980s, for example, the American entertainment industry began to adopt a global approach to technological planning, best exemplified by Walt Disney's Experimental Prototype Community of Tomorrow (EPCOT). More than just a theme park, EPCOT was described as:

> "A community of tomorrow that will never be completed but will always be introducing and testing and demonstrating new materials and new systems. And EPCOT will always be a showcase to the world for the ingenuity and imagination of American free enterprise." (Beard, 1982)

As a highly planned, controlled and automated 'living blueprint', EPCOT is a vision that heralded and contributed to the future global spread of automated systems in everyday life – described in a language that could have been taken almost directly from *To New Horizons.*

In the late 20th century, the computer completed the shift from the fields of research, military, and business to the homes and domestic lives of many people. However, whereas the normalisation of the motorcar led to the end of petroleum dreams, computer-related dreams continue to flourish, fed by various concepts such as Ubiquitous Computing (Weiser, 1991), Augmented Reality (Caudell & Mizell, 1992), the Internet of Things (Ashton, 1999 / 2009) and Artificial Intelligence (Turing, 1950)[1], and through marketing and branding exercises such as LG's 'HomeChat' (2014) and the Ericsson 'Social Web of Things' (2012). The fundamental challenge with future smartness relates to the ever-diminishing number of acts left to be automated. Bill McKibben in his aptly titled book *Enough* (2004) provides the following examples of how the industry was thinking in the early 2000s:

> "Eventually, says Mary Walker, of IBM's home automation division, 'smart ID' chips will be implanted inside you. Then 'your body temperature might give your stereo system cues as to your mood and it would select appropriate music'; the chip could also 'compute how much of your body weight is fat, and offer suggestions for diet recipes to the refrigerator'." (McKibben, 2004, p.121)

In the early twentieth century Sigmund Freud wrote about the pleasure principle (id) versus the reality principle (ego), the latter involving the delayed gratification that comes with adulthood. As science fiction has played on numerous times in recent decades (think of Disney's own *WALL-E*), 'smart' technologies – higher level automation combined with late capitalism – often invite us to override our adult selves, exchanging self-control and responsibility for the childish expectation of instant gratification in all aspects of daily life.

3. Five Insights: Why Visions of the Future Have Stagnated

In our present century, the future has become highly complex and contested. While Silicon Valley continues to present aggrandised versions of 20th-century techno-utopias[2], some observers have begun to

[1] AI could be described as a recuring dream having passed through numerous iterations since its genesis in the 1940s

[2] See, for example, Elon Musk's recent announcements for his Neuralink – the longer-term goal for this research is human / AI symbiosis.

'comprehend that we live in a world that is taking away futures for ourselves and non-human others' (Fry, 2020). Berardi (2011) described the 'slow cancellation of the future' as a consequence of diminishing trust in the scientists and policy-makers who once exercised the kind of powers that made the Moon programme possible (exemplified by John F. Kennedy's speech at Rice University in 1962). Speculative designers have also been guilty of focusing too much on the technological future, albeit for more responsible ends. As Matt Ward points out: 'By focusing on futures … many believe that SCD [speculative and critical design] neglects the near and direct urgency of now' (Mitrović et al., 2021, p.185).

To reflect more broadly on the implications of the two case studies outlined above, we present five key observations on why visions of the future have stagnated or are simply not appropriate for the world of the 21st century, and why they are ripe to be revaluated and reappropriated using new design approaches.

1. **Those responsible for the creation of future visions are guilty of being overly optimistic, never acknowledging the possible negative implications of their dreams.**
   The constraint of positivity – what we might call 'progress dogma' – blinds future-makers and future-shapers (scientists, technologists, politicians, designers) from the potential negative implications of their proposals. Technology is good, the story of progress goes, and the future, as long as technology takes the lead, will be better than the present. This blind optimism and faith in technology is not limited to mere visions, either: it extends to designed artefacts such as the Amazon Echo, which bring with them into peoples' homes a host of unintended consequences.

2. **Those responsible for the creation of future visions are guilty of being overly simplistic – perfect worlds, perfect people, interacting perfectly – thus negating the complex and messy reality of human lives.**
   In advertisements for smart homes and smart products, the generic user is overwhelmingly young, able-bodied, and wealthy. He is often male, usually white, and heterosexual, a bachelor in a perfect luxury apartment of glass and steel. Advertisements for the LG 'HomeChat' (2014) or the Ericsson 'Social Web of Things' (2012) are two examples. Strengers (2014) has called one version of this idealised user 'Resource Man': 'a rational, individual, and masculine image of the energy consumer'. In contrast, what would a smart home for a multi-generation family look like – unharmonious, not necessarily wealthy, and full of complicated interactions? Or a smart home that favours connections to natural systems over technical systems?

3. **The reduction of technological dreams into singular experiences has resulted in the dislocation of means from ends – the systems (means) that facilitate the function of future artefacts (ends) are inherently complicated and restrictive.**
   Take, for example, the automated vehicle. Whilst the dream of a car that drives itself is relatively easy to imagine, its realisation is constrained by (amongst other things) the complexity of engineering and computation, legacy infrastructure, insurance laws, and road legislation. The dream is simple, reality is complex. Dreams represent a jump to another reality; socio-technical change is iterative for a reason. Dreams, in this sense, can provide future goals to aim for – but short-term time-frames constrain the political and corporate actors who have the power to act upon the social and the technical (for example through the need for near-future shareholder satisfaction or fixed-term democratic government). How then can dreams lead to systemic change in the context of everyday life?

4. **The reduction of visions into objects of desire leads to an increased instrumentalisation of operation and banal iterative development.**
   The motorcar again: travel has become instrumentalised as we focus on the object, rather than the act. Since the beginning of the 20th century, the car has iterated in small steps made possible by technological advances. Why is this a problem? Because it constrains designers to design only what the product could conceivably evolve into – narrowing the scope of future possibilities. Smart products, such as the automated vehicle, are simply existing products updated with sensors and computation. How can we step outside of the constraints of this sort of lineage to design more radical and appropriate solutions – not influenced by history?

5. **Many of the metrics through which we evaluate future imaginaries remain the same as those from the machine age – faster, more efficient, more automated – and as such are wholly inadequate for addressing the complex problems we face today.**
   In the first point of his influential 'ten principles', German designer Dieter Rams (n.d.) states simply that 'Good design is innovative', elaborating that 'Technological development is always offering new opportunities for innovative design.' But while 'new opportunities' are still being offered by emerging technologies, the straightforward exploitation of these opportunities has become complicated in our own time by a growing awareness of the impact we are having on the planet. The faith in technological enhancement expressed in Apple's early (1990) slogan – 'The power to be your best' – is no longer sufficient to meet humanity's complex needs. Rams' list does include the advice to keep 'physical and visual pollution' to a minimum, but it fails to acknowledge the larger extent to which design is implicated in or even responsible for catastrophes such as global warming.

4. New Dreams: The Promise of Speculative Design

'How, Taylor asks in the opening pages of *Modern Social Imaginaries*' – as Jasanoff (2015) writes – 'did modernity come about, with its distinctive complex of new practices and institutions, new ways of living, and new forms of malaise? His explanation can be summed up in two words: imaginaries changed.' At the turn of the last century modernism brought about a fundamental change in the socio-technical imaginary, facilitating an unchecked approach to the future driven by a fundamental belief in the positive progress of technology.

How then, can we develop approaches that change the current imaginary? And more importantly, what roles could designers play in this process? As a starting point, we present three ongoing speculative design projects by PhD students. Speculative design in this case denotes a type of experimental design practice that explores imaginary futures or alternative presents through the use of 'objects and images': for example, 'how domestic spaces change with the evolution of new communication technologies; how relationships shift under surveillance capitalism; … how work will be reconstituted through automation', and so on (Mitrović et al., 2021, p.168). More specifically, each of these three projects acts in a different phase of the tripartite process described in the 'journey' diagram (Figure 1): first, placing the designer in the laboratory to upstream prototype and infuse scientific research with social responsibility and/or domestic sensibilities; second, revisiting stagnant technological dreams and updating through the counterfactual history approach (Auger & Hanna, 2023); and third, downstream 'super testing' using speculative methods to better understand the implications of technologies in everyday life.

1. Placing the designer in the laboratory to upstream prototype and infuse scientific research with social responsibility and/or domestic sensibilities.

The transition towards a post-petroleum society is one of the main challenges addressed by a wide range of actors (activists, researchers, industrialists, designers, politicians, and consumers). Each vantage point or knowledge-base creates and feeds a different imaginary – a dream that is social, economic, or scientific in character. (This links to insight 4 above: interrogating and rethinking notions of materiality at the inception of the design, de-objectified and free from the outset.)

One effect of a post-petroleum shift that exerts a strong impact on industrial design, and on industries more widely, is the inability to create new petrochemical-sourced plastics. Time has shown that the discourse around sustainability and ecological thinking has not led to a substantial reduction in the production of plastics. This reluctance to slow or reverse consumption highlights the techno-solutionist position of industry – waiting for a scientific revolution that will lead to a new material paradigm.



Figure 5. Images from the project *Flower*: Long natural flax fibers are broken into shorter ones to be integrated as matrix inside a composite material.

Historically, such a rapid and drastic paradigm shift in industrial materials already occurred when plastics became the new standard. First used to replace animal-based material such as horn and ivory, plastics developed rapidly after WWII aided by military research and funding. Unlike any other material, its 'plastic' qualities were so extensive that it gave designers previously unimaginable freedom in terms of shape, colour, and performance. In this sense, plastic was a new horizon of infinite possibility, matching the desire of the post-war period for a bright and colourful future. Plastic was a 'superlative material' whose praises were sung even by poets like Raymond Queneau in *Le Chant du Styrène* (1958), a short documentary directed by Alain Resnais for the industrial giant Pechiney.

Today the view of plastics is far less optimistic. Plastic has become a major threat because of the pollution created during its production, its lack of effective recycling, and its degradation into microplastics that poison living organisms. The pressure of public opinion, taxes, and legislation on manufacturers has not made them change their practices so much as forced them to invest and transfer this pressure into the research field, waiting for a miraculous technological solution. We may be again at the dawn of a new materials paradigm shift, but this time it is a more complex and globalised world deeply rooted in consumption. To question the role of design in this transitory moment and speculate on the evolution of industrial objects, Axelos has chosen to focus on material research, working together with scientists at the Institut national de la recherche agronomique (INRAE).

At the beginning of this expected shift, materials are still quite weak in terms of performance, plasticity, and the shaping process. Low-tech experiments are already ongoing, especially in independent design studios, along with more technical materials and process-related experiments currently in development in laboratories. As designers, we can only speculate on new 'potential materials'. This immateriality and potentiality of future matter radically alter the design process, which is normally involved in the late stages of technical projects. Traditionally, designers can experiment with industrial materials if they are stable enough, with a fully developed manufacturing process already available. This exploration process shapes

the materiality of those designed objects. But how can designers experience the materiality of a material that has not yet been created? 'Potential matter' forces designers to rethink their position in the project timeline, to adapt and develop new methodologies and approaches regarding material-centred design, and to create new interactions with those involved in this early stage of development, especially researchers. By collaborating with active researchers and placing the designer in the laboratory, this practice-based PhD will offer the opportunity to experiment with new methodologies and document impacts on both design and research practices.

2. Revisiting stagnant technological dreams and updating through the counterfactual history approach (Auger & Hanna, 2023).

Valentin Graillat's project *Archaic Smartness* uses the counterfactual history approach to question and update stagnant smart home visions of the future. (This links to insights 2 and 3 above: reimagining 'smart' as something that goes beyond an instrumentalist focus on 'solving' human problems with technology to acknowledge complex ecosystems; the home is not simply the end, but a system of means and ends functioning in harmony with the local environment.) The project began by tracing the actual history of the smart home to identify the key moments[3] (political, cultural, technological, corporate, etc.) that led to the contemporary situation. The genesis of the smart home was traced to the *Houses of Tomorrow*, conceived in the United States during the Cold War by the hegemonic corporations of the time (Disney, Monsanto, General Electric). These seductive and spectacular future visions conditioned long-term expectations in the West by positioning as desirable a technology-driven lifestyle centred on consumption, disengagement, and entertainment. The legacy of yesterday's *Houses of Tomorrow* is the crystallisation of the desire for market-friendly technological futures constructed through a value system based on the application of smart technologies (as discussed above). The counterfactual approach acts to challenge this dominant and entrenched model through the generation of alternative narratives and imaginaries that bypass the constraints of historical lineages.

After tracing a timeline of the smart home concept, Graillat identified key historical events where a different outcome could have led to an *alternative present* more in line with current concerns for the environment and sustainable lifestyles. The project's counterfactual moment came in 1973 when the United States was violently shaken by the oil crisis. President Nixon signed the Independence Project and intended to initiate a strategic policy to develop domestic energy production. The counterfactual history postulates a radical alternative research group, similar to the Farallones Institute in Berkeley, receiving substantial government support facilitating the rise of an alternative path in which the term 'smart' bifurcates from a market-friendly automated culture towards one more symbiotically aligned with natural systems and habitats.

The practice-based element of the project speculates on various research outputs of a fictitious scientific institute based in California, presented through a variety of *historical evidence*, including blueprints, books, and models that would have been displayed at trade fairs and public exhibitions. These combine to present historical visions of an alternative future which acts as a manifesto – the term 'smart' no longer refers to house *automation* but instead to the *adaptation* of the home to its local living environment (such as approaches to materials and the production of bio-energy). The first concept imagines a radical form of cohabitation with local organisms through the development of vast termite colonies alongside the human home – this symbiotic relationship provides security for the termites and biogas for the human inhabitants.

[3] The Farallones Institute was a non-profit, educational organisation dedicated to the research, development, demonstration, and application of potentially appropriate community technologies. All their programs and projects placed an emphasis on the integrated nature of renewable sources of energy, land and resource planning, water and waste, recovery systems, and food production within the context of cultural and social acceptability, and local community self-reliance.

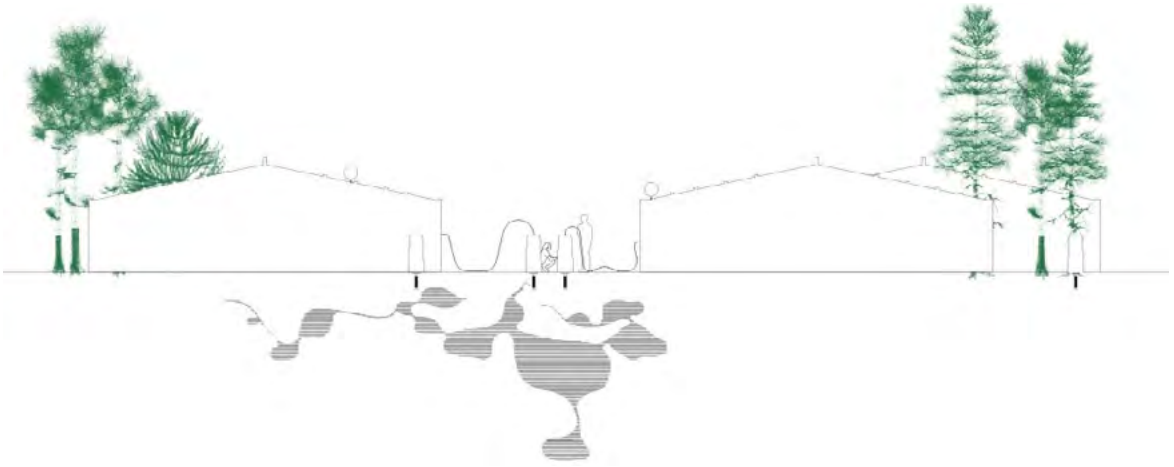


Figure 6. Habitat-scale domestication of termites to produce small quantities of biogas for food and lighting.

The counterfactual approach provides the designer with the opportunity to continue the evolution of the alternative timeline which becomes increasingly diverse as more time passes, offering the designer a 'rich narrative potential for reimagining and critiquing technological developments and contemporary products' (Auger, 2012).

3. Downstream 'super testing' using speculative methods to better understand the implications of technologies in everyday life.

The super-testing method operates as a crash test of future visions, public policies, services, and products enabled through speculative design methods. As practised by Estelle Hary, investigating the ramifications of AI and machine learning in public services, super-testing prompts the involved publics to identify and assess potential implications and externalities that may arise from the proposed speculative artefacts. (This links to insight 1 above: casting a cold eye on 'progress dogma' to explore possible consequences, negative as well as positive, when research enters the real world and takes shape as concrete products and policies.)

Super-testing aims to challenge dominant socio-technical imaginaries by changing the lens through which a particular issue is considered. It highlights issues that are often overlooked due to prioritisation of economic values such as efficiency and productivity – for example with the deployment of AI systems in public services. Indeed, as Hary identified through her research, a well-known narrative, conveyed through various institutional means (reports, public funding programs), underlies the deployment of AI in French public services: the technology is thought to be impartial and effective. It can handle vast amounts of information quickly and might potentially lead to automated decision-making, speeding up administrative processes. This would free up time for public servants to undertake more valuable tasks. The promise goes even further by suggesting a vision where public services would be customised to individuals' needs. In essence, AI systems are presented as a cost-effective magic wand, capable of solving the State's biggest (political) challenges while improving the quality of public services.

As with many such promises, however, blind spots and preconceived ideas are widespread. Promises based on AI systems do not take into account the body of literature on political, environmental, and social justice issues that come with their use. They also rely on the assumption that the economic, political, social, and material conditions of society are immutable. For example, projects to deploy AI in public services are conceived as if future societies will benefit from the same material conditions as today when the energy and raw materials needed to maintain the infrastructure required for AI systems to run are still relatively abundant. But what happens when such material conditions can no longer be met, while all public services

have been digitised, 'algorithmised', and 'AI-ified'? This possibility has been explored through the Fail-Soft[4] mode in a degraded world scenario where several design artefacts suggest the intermittent availability of public services based on energy resources. A billboard at a bus stop displays the weather forecast of digital public services. Some of them are suspended, others are running normally, while still others run on a backup based on citizen mobilisation. To face the new material conditions of this scenario, the government has created the National Authority for Administrative Transparency, in charge of reviewing new projects aiming to deploy algorithms in public services based on environmental criteria.

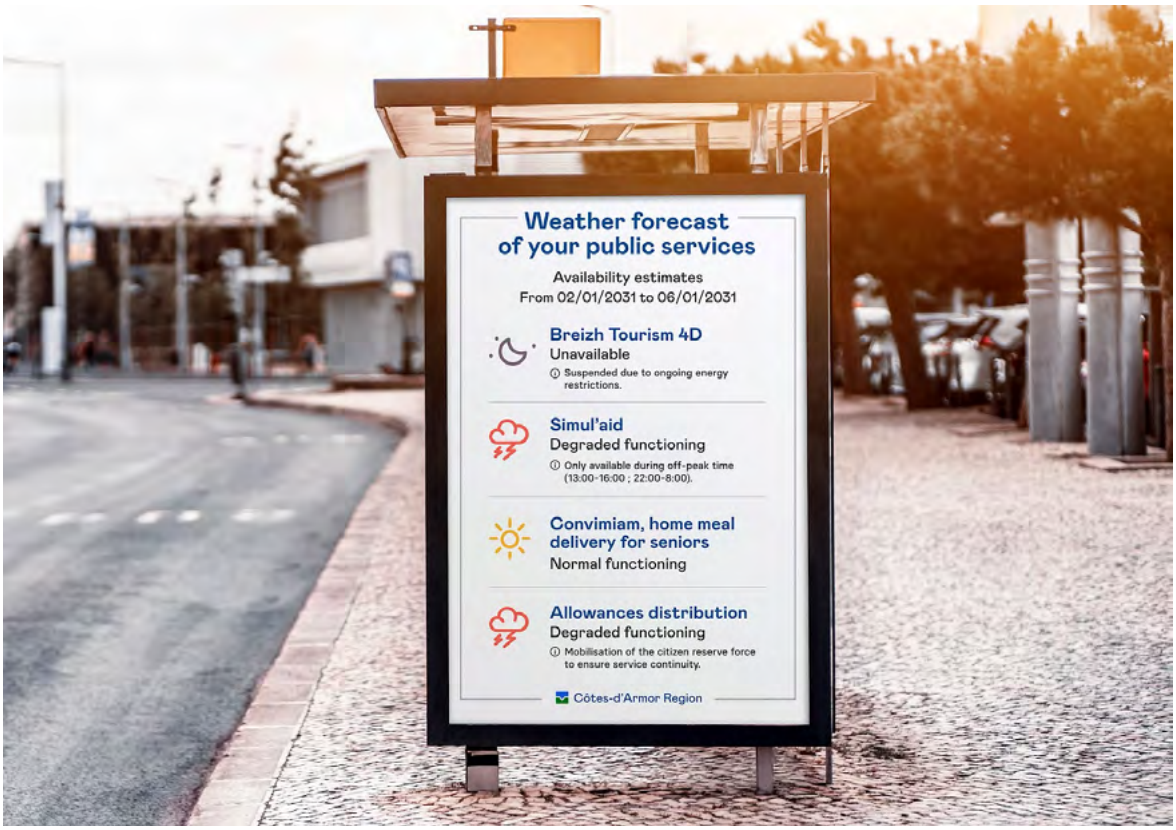


Figure 7. Speculative government information services at bus stops providing updates on the state of public services.

These artefacts raise many questions. How was the priority given to each public service decided, and who took part in this decision? Who reviews the applications for new algorithms and learning systems to be implemented? How was the criteria grid built? Why are such projects still supported when the world does not seem able to sustain them? Super-testing does not stop at the creation of speculative design artefacts that raise provocative questions about the shortcomings of technological promises. For the 'test' to happen, the design artefacts need to be confronted with the stakeholder publics: policymakers, public servants, citizens, civil society, unions. The design of the 'debate space' is in that regard also part of the super-testing method, where supporting the diversity of people taking part in the debate is critical to express a plurality of views coming from everyone's personal experiences. It enables a rich, detailed, and diversified mapping of the positive and negative externalities around a technological dream whose analysis might allow for an update of our collective vision of our future society. This in turn might lead to the adaptation, bifurcation, or even cancellation of public policies around AI and other smart systems.

[4] A Fail Soft System is one that shuts down non-essential functions when something goes wrong allowing the system to function at a basic level. The term can be applied to machines, vehicles, computer systems, other systems, and many types of equipment.

5. Conclusions

Following the SpeculativeEdu project conclusions, we aim to contribute to the dialogue on speculative design by contemplating 'a plurality of futures beyond the techno-heroic' and more importantly, 'reclaim[ing] the present' through 'speculat[ing] on different versions of today' (Mitrović et al., 2021, p.211). Design needs a revolution in order to keep pace and adapt to the rapidly shifting demands (social, political, ecological) of the 21st century. (This links to insight 5: the need for new metrics to reflect complex new 21st-century realities.) As Papanek (2019) suggests, we must learn from disaster. This revolution must begin in design education, and one way to bring it about is to create new approaches that are both speculative and pragmatic, linking alternative visions to urgently needed actions in the real world. Speculative design must abandon the simplistic and slavish game of extrapolating futures based largely on emerging technologies, and instead examine existing (and historical) conditions in order to imagine alternative presents, more appropriate futures - other ways of being.

At the beginning of this paper we traced the journey of a technology through a tripartite process, from the laboratory to the dream phase to the products and services of daily life, and examined the role design plays in this process. To illustrate this journey, focusing in particular on the dream or imaginary phase, we presented two case studies: petroleum and the internal combustion engine, and 'smart' technologies. In the next part we presented five insights to explain some of the reasons why visions of the future have stagnated. Then in the last part we presented the ongoing work of three PhD students, each of whom is focusing on a different stage of the journey – the designer upstream in the lab; the designer revisiting stagnant technological dreams; the designer 'super-testing' downstream in everyday life – and the different role design could play in each stage as a means of creating new visions and approaches that are better suited to the huge challenges we face in the 21st century.

We have tried to raise questions and introduce new possibilities to provoke changes in design education. What is the role of dreaming in design? How conscious are we of the dreams that shape our futures? What happens when technological dreams become repetitive and stale? How do our dreams relate to our waking lives, to practical necessities and urgent responsibilities? Should we stop dreaming about far-off futures and magic solutions, and wake up to the realities of our present? How can we dream differently, and actively, so that our dreams help us imagine and shape better realities? There are still many questions to investigate – many alternatives to imagine – and urgently. In the words of Ursula K. Le Guin (1979), 'it is above all by the imagination that we achieve perception, compassion, and hope' (p.53).

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P/REFERENCES OF DESIGN

REDEFINING DESIGN PRACTICE: POST SPECULATIVE & CRITICAL DESIGN AND CRITICAL JUGAAD IN DETROIT'S ABOLITIONIST WORKSHOP.

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ABSTRACT | Detroit is at a pivotal moment, facing a transformation that could redefine its identity. Historically known as the powerhouse of American industry, the city has endured economic challenges, demographic shifts, and changing urban dynamics. Recently, a narrative of rebirth through tech innovation and urban redevelopment has gained traction, promising modernization but risking the displacement of established communities and marginalization of their voices. Parallel to this narrative, grassroots movements, local organizations, and individuals envision a Detroit prioritizing equity, resilience, and communal well-being. They advocate for inclusive growth that respects and incorporates Detroit's diverse communities rather than erasing them. However, there's a noticeable absence of young voices in these crucial conversations about the city's future, a gap that needs bridging to ensure Detroit reflects its youth's aspirations and identities. The workshop aims to fill that gap, providing a space for collaborative dreaming and participatory planning. It challenges existing power structures by fostering alternative visions for Detroit. This article delves into the innovative intersection of post-speculative & critical design (POST-SCD) and the critical jugaad paradigm through the lens of the transformative workshop in Detroit. The methodology provides the much-needed inclusive and democratizing approach to design methods that encourages participants, especially the youth, to actively shape their city's future, leveraging their insights and dreams to forge new paths.

1. Introduction

This article delves into the innovative intersection of post-speculative & critical design, also used here as post-SCD and the critical jugaad paradigm through the lens of a transformative workshop in Detroit. As the city grapples with narratives rooted in technology-driven progress and community gentrification, the workshop emerged as a catalyst for change, empowering Detroit's younger generation to shape their city's future narratives actively.

The workshop, firmly grounded in abolition principles, introduced participants to the critical jugaad framework, where jugaad represents the art of resourceful problem-solving and creative improvisation. The amalgamation of these two paradigms allowed participants to reframe the dismantling of oppressive systems as an opportunity for constructing just and equitable alternatives—a notion at the core of critical jugaad thinking. A pivotal aspect of the workshop was its emphasis on moving beyond critique and into constructive action. Participants explored applying critical jugaad principles to address systemic inequalities and transform their city. Through the participatory speculation process, attendees actively co-created alternative futures for Detroit, positioning themselves as proactive agents of change and reflecting on how they could apply critical jugaad principles to address systemic inequalities and transform their city.

This article also explores the post-speculative design and the critical jugaad paradigm to propose diverse ways of envisaging and forming equitable futures in urban development and community empowerment. These structures seek to break the norm, not just by mere speculation or critique, but rather by proposing a move to be more action-oriented through this inclusive methodology. The post speculative & critical design or post-SCD looks up to traditional design thinking. It underscores the necessity of actual interventions and applications in the real world, not just mere speculation or deconstructive criticism. It does not dismiss the fact that imagining and speculating are vital in imagining alternative futures but rather insists that these should be rooted in practical, implementable strategies. Another derivation is the critical jugaad paradigm from the Indian term “jugaad,” which is said to apply frugal innovations, usually with modest resources but of flexible and intuitive ingenuity. Unlike the traditional jugaad, which has the characteristic of application under the existing constraints and without an inquiry into more systemic or deep-rooted problems, this critical jugaad paradigm becomes critical on its own. This means it encourages creative problem-solving and serves as a stimulant toward deep analysis of social, economic, and political systems that perpetuate inequity. The addition of critical analysis to the principles of jugaad makes it a creative way for communities to address systemic injustice while continuing to advocate for resourcefulness.

The workshop's unique perspective on the "politics of imagining futures," as inspired by Gerber's work (2018), was enriched by the critical jugaad paradigm (Butoliya, 2016). It showcases how the workshop created a dynamic environment where participants could harness their resourcefulness to shape Detroit's future narratives with a focus on equity, resilience, and community-driven solutions.

The article underscores the significance of incorporating grassroots organizations, local insights, and the voices of Detroit's youth throughout the research process, demonstrating how critical jugaad principles enhanced the workshop's problem-solving capacity and encouraged innovative, adaptive solutions. As an outcome of this workshop, the article offers insights into the methodologies and tools used to empower participants through the fusion of post-speculative & critical design (post-SCD) and the critical jugaad paradigm. It illustrates the critical role of research that integrates these paradigms in advancing the cause of abolition, particularly in addressing the complex challenges of urban transformation. It exemplifies how synthesizing critical jugaad principles and grassroots participation can drive innovative, socially just, and equitable futures for Detroit and beyond.

2. Theoretical Framework

2.1 Post Speculative & Critical Design

Many design schools worldwide have incorporated speculative and critical design or SCD practice into their curricula. Students sometimes engage with speculative design projects to enhance their portfolios. However, with this new phase of SCD, no significant change has been noticed yet in its practice or pedagogy. Students and designers have produced and imitated similar artifacts and projects from other contexts, and the counter-critiques are not reflected in their works. The new academic programs in SCD follow similar paths and continue reinforcing the prevalent dichotomy and hegemony of Western influence on this practice in most cases. There is a need for design practice in response to the mainstream SCD practice that will promote the debates essential to the public reception of such design practice and support pluralistic visions.

There is an imperative to address the underlying issues and to generate and explore a renewed framework for speculative and critical design practice. This raises many questions, the most prominent being: what is post-critical in design? The term post-critical (sometimes used as postcritical) was first used by Michael Polanyi in his seminal work Tacit Knowledge: Towards a Personal Philosophy (1998), which meant a shift away from objective scientific thinking or critical thinking to thinking that considers personal tacit knowledge (Polanyi, 1998). Post-critical design emerges as a response to critiques of the critical design practice, which has been influential in highlighting design work's social, political, and ethical dimensions. Critical design, as discussed by authors like Malpass (2017) and Bardzell & Bardzell (2013), operates as an interrogative and discursive practice, using design as a medium to question and challenge norms, values, and assumptions embedded in contemporary culture and technology.

The post-speculative design could be seen as an evolution or a critique of speculative design practice. While there is no hard definition or a set of practices that define post-speculative design universally, it probably builds off or responds to the methodologies and aims of speculative design. The speculative design itself produces imaginative projections of alternate presents and possible futures through design representations and design objects.

> "It sometimes gets serious, sometimes playful; it provides a way to think about futures and critique current practices through designed artefacts that involve the spectators in the scenarios of futures." (Auger, 2013)

An instance of such projects is works such as "Speculative Everything" by Dunne and Raby, where design is considered as a tool to imagine how things might be and propose a kind of design that creates ideas rather than objects, opening debate about the kinds of futures people want (Dunne & Raby, 2013). The overview of speculative design pedagogy and practice has been well researched and documented by the Speculativeedu project and documented in the resulting manuscript Beyond Speculative Design: Past Present Future (Mitrović et al.,2021). This gives a deep understanding of how post-speculative design could be understood.

Post-speculative & critical design evolves beyond speculative and critical design (SCD) by critically examining its principles and extending its outcomes. It questions SCD’s approaches and explores new methods and results that engage more directly with current issues and prospects. It integrates marginalized voices to foster equitable futures by focusing on actionable, inclusive outcomes and addressing socio-political concerns. Unlike speculative design, which imagines future possibilities and critiques present practices through artifacts and scenarios, post-speculative & critical design advances into actionable, participatory, and interventionist approaches. It emphasizes stakeholder co-creation, confronts societal and environmental challenges, and tests future speculations in real-world settings. The post-speculative & critical design merges speculation and critique with practical implementation, aiming to actively shape future realities.

2.2 Critical Jugaad

To acknowledge the wide range of making practices that emerge from conditions of scarcity, a recent study explores the concept of "jugaad" – a term from the Hindi language that encapsulates making do and surviving despite limited resources. While often viewed simplistically as a make-do solution involving found objects, this practice transcends limitations in its native context. Jugaad represents a mindset, a form of critical yet collective thinking that serves as an informal yet legitimate way of life in societies where resources are scarce, particularly for marginalized groups. Despite its innovative approach, this form of creativity has historically been overlooked as a designerly practice, primarily because it challenges the Western colonial foundations of design. The study posits an urgent need to disrupt Eurocentric design narratives by embracing pluriversal perspectives that value diverse cultural viewpoints.

The research introduces the term “critical jugaad” (Butoliya, 2016;2017) as a method to decolonize design through various modes of representation, discourse, and practice, particularly at the intersection of Global South perspectives and critical design. Critical design, a field known for questioning social and cultural norms through artifact creation, has been critiqued for its Eurocentric and privileged stance. The author argues for a shift beyond the Western logic of criticality in design, advocating for a “critical jugaad” approach that reflects the complex social, cultural, political, and economic realities of marginalized communities in the Global South.

Global South extends beyond geographical boundaries, representing communities historically marginalized by colonization, globalization, and capitalism. Detroit, Michigan, serves as a notable example within the United States, a country typically associated with Western privilege. Historically overlooked by the design community, Detroit's designation as a UNESCO City of Design challenges this narrative, emphasizing the need for diversity, equity, and inclusion by studying and establishing locally rooted design and making practices. These practices highlight an inclusive future for such communities and contribute to achieving racial justice by design.

Jugaad is creativity born out of the dire necessity of a society where resources are scarce. It has been a practice deep-rooted within the common people of the Global South and the other marginalized communities, which it carries along with the spirit of resilience and resistance. Critical jugaad, on the other hand, does not relate to making do in the spirit of something ad hoc but, in fact, to redefining the rules set by an environment of severe resource constraint. It is based on local knowledge and takes the form of an improvisation that is sustainable, accessible, subversive, and relevant in its context. Our research in jugaad practices in the context of marginalized communities in Detroit has found that critical jugaad is a vehicle for building community resilience.

The critical synergy in this regard—of abolitionist thinking and critical jugaad in design for social justice—thus lies in the forces of empowerment and equity evoked through systemic change that both efforts are bound to. When the thinking of abolitionist commitment to undoing oppressive systems is combined with the innovative and resourceful tendencies of jugaad in design, the designer's solutions will have served two.

2.3 Synergies between Post-Speculative & Critical Design and Abolitionist Futures

Abolitionist futures envision a society free from prisons, policing, and traditional punitive justice, inspired by past movements seeking to end slavery. This vision focuses on tackling the root issues that lead to harm by empowering communities to create their solutions, utilizing restorative methods, and boosting social support instead of relying on imprisonment. It promotes widespread changes that involve reducing prison populations, championing economic and social rights, and adopting transformative ways of dealing with conflict that mend and strengthen community bonds. The aim is to shift the concept of safety from one grounded in monitoring and discipline to one built on community support, economic possibilities, and collective well-being. Policy changes are necessary to make abolitionist futures a reality, along with growing public understanding, empowering local communities, and collaborating across different societal

sectors. This is all in pursuit of a societal transformation that embraces fairer, more inclusive, and more effective approaches to fostering safety and justice.

Abolition in design seeks to understand how design may play towards visioning and making conditions for the abolition democracy in designing abolitionist futures. DelSesto writes.

> "Abolitionist perspectives have important contributions to make to this emerging work in design, especially in terms of how design thinking and acting might be oriented towards systemic transformation and a renewed social imagination." (DelSesto, 2023, p.257)

The approach at the intersection of abolitionism and design draws a reflection pathway about the existing design practices that might perpetuate or challenge current dominant power structures and bring the design outcomes toward more just and equitable directions.

This workshop delved into various facets of post-speculative design, exploring its potential to foster inclusive, equitable, and radical systemic changes. This critical approach highlights the urgent need to utilize speculative design as a tool to confront and dismantle racial and class-based disparities. By prioritizing the Black experience, these projects critique existing inequities and propose abolitionist futures where such disparities are eradicated. The work underscores the transformative potential of post-speculative design in reimagining societal norms and structures, advocating for an equitable and just future for all, particularly marginalized communities.

Afrofuturism's role within speculative design is pivotal, offering a framework that decentralizes traditional power structures and promotes design as a community-centric endeavor. This perspective is vital for marginalized groups, as it validates and centers black and brown lived experiences within the design process, aiming for inherently equity-driven outcomes (Bray & Harrington, 2021). By foregrounding the experiences and aspirations of these communities, Afrofuturism within speculative design acts as a catalyst for envisioning and crafting futures that are inclusive, equitable, and reflective of diverse societal needs and desires. The application of speculative design in participatory approaches to reimagining community safety exemplifies its potential to instigate profound societal change. By involving community members in envisioning alternatives to traditional policing, speculative design merges with participatory processes to challenge and rethink oppressive systems. This approach provokes thought and encourages collective imagination towards radical systemic reforms, demonstrating speculative design's capacity to empower communities to shape their futures (Gerber, 2018).

2.4 Speculative Co-Design with Marginalized Groups

Engaging marginalized groups in speculative co-design processes is crucial for ensuring that future visions are inclusive and relevant. This approach allows these communities to express their unique perspectives and desires, encompassing utopian aspirations and recognizing ongoing dystopian realities. Through speculative co-design, marginalized voices are not only heard but are integral to the conceptualization and design of future technologies and ideas, ensuring that the outcomes are genuinely inclusive and responsive to the needs of all community members (Harrington & Dillahunt, 2021).

By integrating abolitionist ideas and engaging marginalized groups in co-design processes, speculative and critical design holds the potential to critique the present and constructively shape the future. As we continue to explore and expand the boundaries of SCD, it remains imperative to center the experiences and aspirations of those who have been historically marginalized, ensuring that the futures we envision are truly reflective of a diverse and equitable society.

3. The Detroit Workshop: A Case Study

3.1 Introduction

The workshop titled “Making Just Futures for Detroit (2021)” focuses on imagining futures for Detroit as a city and as a community through the vision of Detroit's youth and the lens of Abolitionist principles. This workshop served as an experimental ground for merging the critical jugaad paradigm with abolitionist design principles, aiming to address the city's long-standing issues of inequality and disenfranchisement. Organized as a collaborative initiative, the workshop brought together local youths, designers, activists, and academics to reimagine Detroit's urban future through participatory future envisioning sessions. Participants were introduced to various design methodologies and speculative tools and encouraged to draw upon their experiences and community knowledge. The workshop facilitated a space where creative problem-solving was not just about addressing immediate needs but envisioning long-term, sustainable changes to the urban fabric of Detroit. Projects developed during the workshop ranged from community gardens that served as social gatherings and education hubs to digital platforms designed to enhance local economies and foster skill-sharing among residents. The case study section will provide a detailed analysis of these projects, exploring how they reflect the integration of critical jugaad and abolitionist principles. It will examine the impact of these projects on participants and the wider community, including challenges faced in their implementation and the potential for scalability.

The workshop was integrated into ongoing research for a studio inquiry of a master of the design program at a research-oriented public university in the United States. The MDES students of the 2020-2022 cohort were the design student participants, with one male and four female students of diverse backgrounds in terms of geographic locations of their hometowns and ethnicities. The community participants were one founder and four youth members of the Afrofuture Youth Detroit, which describes itself as Afrofuture Youth is a Detroit-based, black, youth-led organization using Black Futurist and healing-centered frameworks to co-create equitable and pleasurable futures where all aspects of black life can thrive and exist as they are.

The Afrofuture Youth Detroit is a non-profit organization that helps youth learn and practice organizing through learning and action. The participants were mostly in the age group 16-19 and were native to Detroit. The participants had diverse gender identities while being all native black Detroiters (a term they used to describe themselves). The author served as a facilitator and organizer of the workshop, and another faculty member observed for a partial duration.

3.2 Workshop Description

To expand on the workshop grounded in abolition principles and the critical jugaad framework, it's essential to focus on the transformative role of youth participants, particularly those from Afrofuture Youth Detroit, a grassroots organization dedicated to empowering black and queer youth through education and political awareness. This segment aims to detail the significance of their involvement, their unique challenges, and how the workshop serves as a pivotal platform for reimagining futures free from systemic oppression.

At the beginning of the workshop, we introduced ourselves in a very informal setting over lunch. During this time, the youth participants from Afrofuture Youth Detroit (AFYD) shared their experiences, interests, and ambitions. This allowed the design students and the youth to understand each other and get a glimpse of perspectives. Some youth shared their experiences of being queer and black in Detroit which was foundational in establishing trust in the communities. This was followed by an orientation presentation where we introduced speculative and critical design concepts, the need to establish a post-speculative and post-critical approach, and the methods of creating futures rooted in design education and practice. (See Figure 1) The students were foregrounded to the concept of critical jugaad and its role in our present and shared futures.

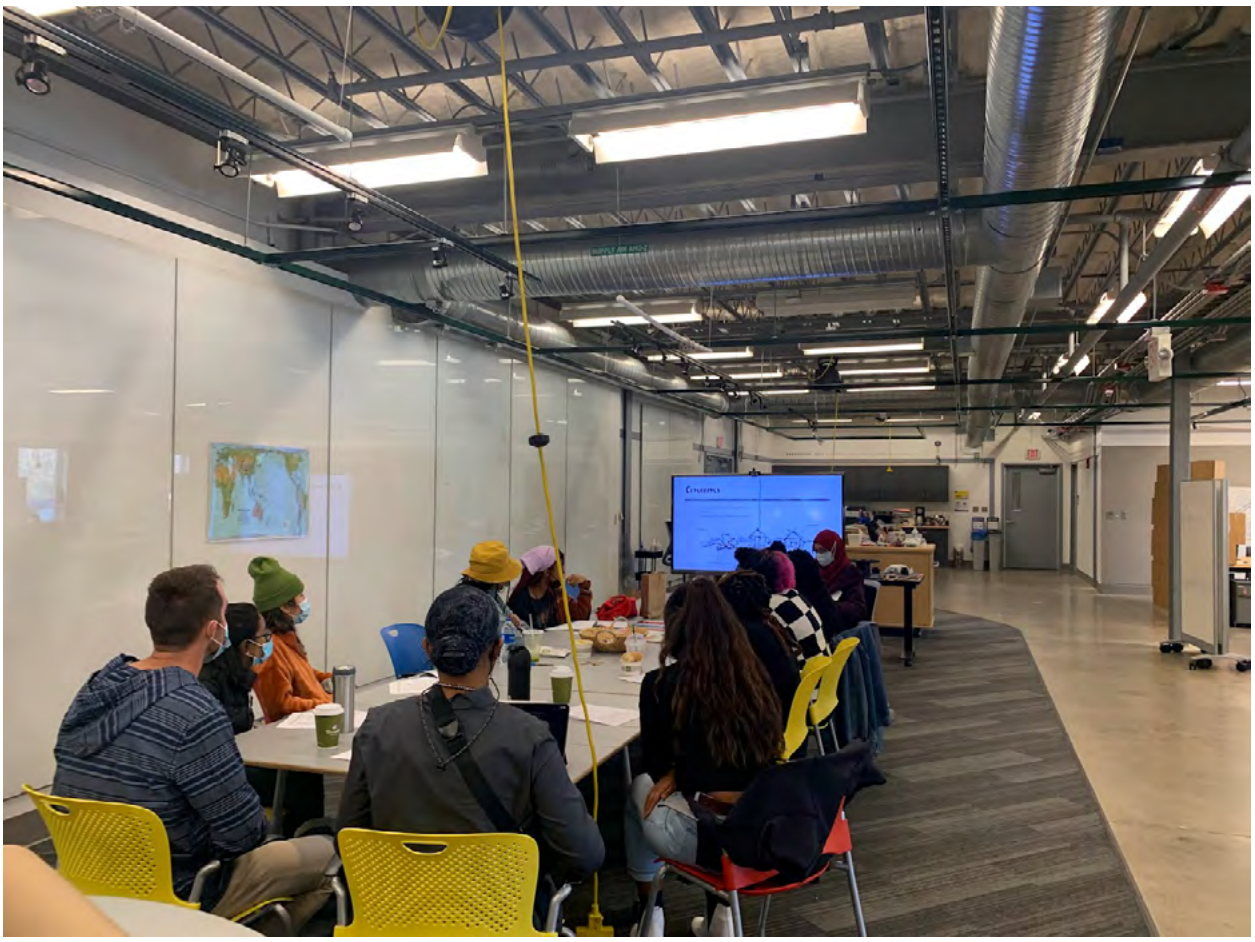


Figure 1. The workshop participants are oriented with the theories and concepts during a formal orientation session in a design studio at Stamps School of Art and Design, Ann Arbor, Michigan.

The tools used for the workshop were:

1. STEEP cards from IVTO.org;
2. Crit Kit toolkit (author, 2015).

STEEP cards are a set of foresight cards developed by IVTO- a research and education company in the Netherlands. STEEP is an acronym for social, technological, economic, environmental, and political. As mentioned on their website, STEEP is a structure used for scanning developments in the external macro environments. The STEEP set contains 134 cards, with 125 cards depicting external driving forces.

The other toolkit used here is the Critical Toolkit, developed by the author for critiquing critical and speculative design projects to make critique accessible to all and help individuals design their speculative and critical design projects. This toolkit consists of carefully considered question cards to self-evaluate the projects and a set of stickers with critical comments that could be posted on each other's projects during critique. (See Figure 2). The test cards playfully challenge participants on their bases and assumptions, making critical inquiry part of the imagination. The critical kit also contains a set of stickers that participants can use to critique each other's ideas. This playful activity helped participants ease the tension while reflecting on the challenges in their visions.



Figure 2. STEEP foresight cards, Critical Toolkit test cards, and stickers used during part one of the workshop.

The workshop was divided into two parts. The first part involved introductions amongst participants and facilitators and a description of theoretical frameworks followed by forming teams, with each team having youth participants and design students. The teams were then asked to choose one card from each category of the STEEP cards randomly. Using STEEP cards, the teams were asked to imagine scenarios for alternative futures for topics/situations like Urban Gardens or Public Schools, Energy infrastructure, etc. Youth participants and design student teams were prompted to visualize futures through discussions and imagination. They were given an option to draw or write their future imaginaries. Each team was asked to present to the whole group after 30 minutes of brainstorming.

In the second part of the workshop, participants were asked to use the critical toolkit to question those future visions to tease out the details and enable critical thinking using stickers or test cards. The next step was to return to the teams and reimagine what the future could be now with critical thinking and a mindset generated because of the critique of the future imaginaries created in the first part.

For the second phase of the workshop, the participant teams of both design students and the youth were asked to create their future scenarios or artifacts from the kludging of reusable materials procured from the scrap materials store and some from surrounding recycle bins. The teams were also provided basic assembly tools such as scissors, glue, x-acto blades, tape, etc. This workshop phase was met with much enthusiasm, and the teams were competing for unique objects to make their final prototypes/installations.

Materials for the workshop were obtained from a unique local store selling donated art and craft scraps, recycled materials, and items at a very low cost (see Figure 4). These materials would be usually discarded, but these items are sold in this store to find a renewed purpose and meaning. The materials obtained were unique and essential to the ethos of critical jugaad as we constructed visualizations for futures from found objects of our surroundings. Having an outlet where one could purchase things such as printer rolls, old

piano keys, bicycle handles, and much more served two purposes: One, it was an accessible resource for creating artifacts that didn't need much expertise and were non-intimidating to the youth who didn't have extensive art or design training. Secondly, such materiality simulated the realities of marginalized communities worldwide, where such items make the material for creative improvisation for survival and resilience (see Figure 5).

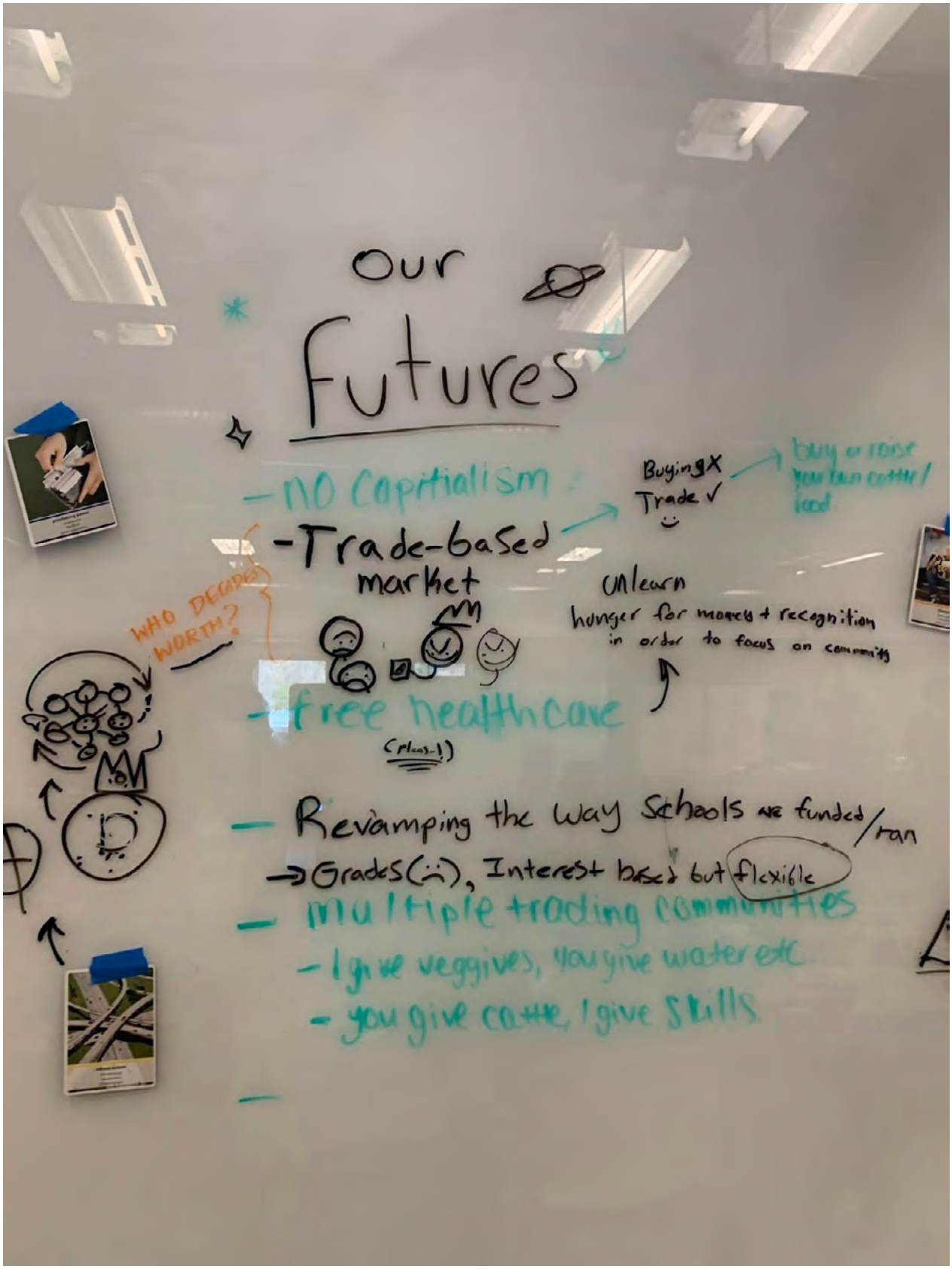


Figure 3. A whiteboard image of brainstorming done by one of the teams during the initial exploration sessions.



Figure 4. Scrap store in the Metro Detroit area where materials for the workshop were purchased.

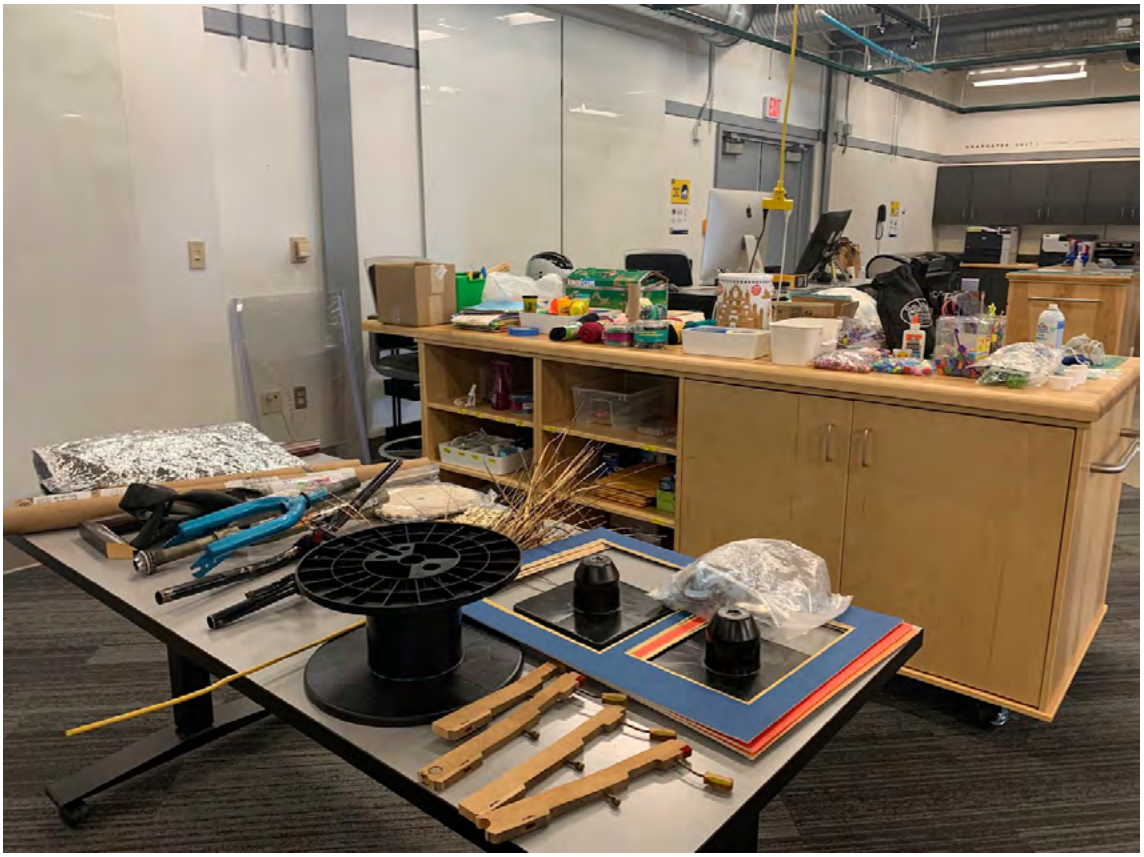


Figure 5. Materials provided to the participants during the part two of the workshop.

During the first phase, the teams developed a deep understanding of the topic from the perspective and lived experiences of black Detroiters. Some questions explored were: How can we imagine alternative energy methods? In the context of post-speculative& critical design and critical jugaad, this implied thinking about a local energy grid where water, electricity, and internet are mutually shared between the neighbors. However, after using the critical toolkit, the team later reflected that the existing power dynamics in Detroit would have to be navigated in doing so. The youth reflected on their experiences of water shutoffs and lack of infrastructure in neighborhoods with abandoned houses.

In thinking about the future with the intersection of critical jugaad and abolition, one team reflected on the importance of abolishing capitalism and establishing a trade-based market exchange. By “trade,” the participants referred to a barter system as an economic model. In the context of Detroit’s future, participants also expressed the desire to revamp the education system to create a flexible interest-based structure oriented to serve Detroit's black and marginalized communities (See Figure 3).

After understanding what critical jugaad signified in the context of abolitionist futures in Detroit, the youth participants were comfortable imagining futures where sharing and using what is available locally became central to futures thinking. Many ideas that had been visualized were practiced in Detroit at the time of this workshop, for example, urban gardens that shared food with neighbors and served as organizing places for connecting with others and seeking resources one might need at such community gathering places. Envisioning such currently marginalized practices as prominent Afrofuturist practices where belonging and care were placed as core values gave confidence to the youth as they expressed their future visions.

One of the youth participants mentioned, “I never knew I could imagine the future of my city and community using art and design.” Another participant felt that design practices could be emancipatory, and there was a lack of awareness in general regarding design as a practice in creating abolitionist Afrofuturist practices. They mentioned, “I did not know that (post-speculative) design methods could share common value with abolitionist principles.”



Figure 6. The final artifact created by one of the teams describes the future scenario.

In the making phase of the workshop, critical jugaad as a verb was instrumental in helping the participants create visions of Detroit's future. Critical jugaad advocates frugal decolonial methods for speculative and critical design practices for creating future imaginaries. One way to achieve that goal is to use materials deemed unworthy of purpose. The workshop, firmly grounded in abolition principles, introduced participants to the critical jugaad framework, where jugaad represents the art of resourceful problem-solving and creative improvisation. The amalgamation of these two paradigms allowed participants to reframe the dismantling of oppressive systems as an opportunity for constructing just and equitable alternatives—a notion at the core of critical jugaad thinking.

The participants navigated complex issues such as systemic racism and disparities in Detroit's black communities by making conversational artifacts from found objects. One of the youth participants conversed about the political conditions in Detroit using terms such as "tunnel of socialism and towers of capitalism," where the golden figure (as seen in Figure 6) represented capitalist power structures and socialist societies struggling to get to the top. While this was more about what they felt, another team created a model resilient future with urban gardens and food-sharing structures next to each other. This team also uses satire as a speculative tool to create a dystopian future scenario where shoppers at Walmart must shop in the fashion of "Squid Games,"- a popular Netflix show.

The "Making Just Futures for Detroit" workshop offered participants a transformative experience, blending critical jugaad with abolitionist design principles to reimagine urban futures. Participants, including local youth from Afrofuture Youth Detroit and MDES students, highlighted the workshop's capacity to break down traditional barriers in design, fostering a community-driven approach to addressing systemic issues. Through informal settings and participatory design sessions, they gained new insights into the potential of collaborative design, expanding their perspectives beyond conventional methodologies. Despite facing challenges in navigating the complexities of systemic change, the participants valued the workshop as a pivotal moment for personal growth and understanding the role of design in societal transformation. This reflection underscores the workshop's impact on individual participants and their collective vision for a more equitable and sustainable urban future in Detroit.

4. Discussion

4.1 The Significance of Engaging Marginalized Youth

Empowerment through Education and Political Awareness: Afrofuture Youth Detroit is crucial in educating young individuals on organization and political education. Integrating these youths into workshops that embrace abolition principles and critical jugaad thinking opens new avenues for them to understand the mechanics of oppressive systems and the importance of creative resistance. This approach educates and empowers them to envision and work towards just and equitable futures.

Addressing Unique Challenges: The youth participants, often marginalized due to their race, sexuality, or both, face systemic barriers that limit their opportunities for expression and innovation. Traditional educational and societal structures have failed to provide a supportive platform for their voices. Acknowledging these challenges, the workshop creates a space where their identities are affirmed, and their ideas are valued and nurtured.

4.2 The Workshop's Approach to Envisioning Futures

Reimagining through Critical Jugaad: The workshop introduces the concept of critical jugaad to navigate and dismantle oppressive systems through resourceful problem-solving and creative improvisation. This framework encourages participants to think outside conventional paradigms and use their unique perspectives to conceive solutions that reflect their desires for a just society.

Speculating on Future Possibilities: For many youths, the opportunity to speculate on the future in a structured and supportive environment is groundbreaking. The workshop validates their ideas and challenges them to expand their visions. By speculating on futures where equity and justice are central, they begin to see themselves as architects of change, capable of shaping their destinies and those of their communities.

4.3 Outcomes and Impact

- The workshop serves as a crucial outlet for these young individuals to explore and articulate their visions for the future by creating a safe space for exploration. It provides a rare, safe space where they can freely express themselves without the fear of invalidation or marginalization. This environment is vital for fostering a sense of belonging and confidence in their ability to effect change.
- Developing community-building solutions through collaborative discussions and activities encouraged participants to think collectively about their desired futures. This collective envisioning process not only strengthens community bonds but also leads to the development of innovative solutions rooted in marginalized communities' shared experiences and aspirations.
- Empowering Future Leaders by centering the workshop on the principles of abolition and critical jugaad, participants are equipped with the knowledge and tools necessary for leadership in their communities. They emerge as empowered individuals ready to challenge oppressive systems and advocate for equitable alternatives.
- Developing methodologies for post speculative design and training design students in community engagement.
- In the long term, design students were thoroughly impacted by the energy and stories of the participants and their capacity to hope for a positive future for all despite facing racism and oppression for most of their lives. In the short term, this workshop influenced their work in their efforts to imagine just futures for marginalized communities in Detroit.

5. Conclusion

The inclusion of youth from Afrofuture Youth Detroit in workshops centered on abolition principles and critical jugaad thinking is more than an educational endeavor; it's a transformative experience that validates their identities, amplifies their voices, and equips them with the tools to reimagine and build futures where justice and equity prevail. This initiative fosters individual growth and cultivates a generation of leaders committed to dismantling oppressive systems and creating inclusive, equitable communities.

Combining abolition principles with the critical jugaad paradigm presents a transformative potential beyond traditional urban development and social justice approaches. By intertwining the principles of abolition, which aim to dismantle oppressive systems, with the creative and resourceful problem-solving approach of critical jugaad, this methodology offers a unique pathway for reimagining and reconstructing urban spaces. It encourages the empowerment of marginalized communities, ensuring their voices and needs are central to developing equitable and sustainable futures. This approach challenges existing power dynamics and fosters resilience and innovation from the ground up, providing a robust framework for addressing complex urban issues.

The implications of this combined paradigm are vast, suggesting a shift towards more inclusive, participatory forms of urban planning and community development. It emphasizes the importance of grassroots involvement and the value of local knowledge in creating solutions that are genuinely responsive to residents' needs. As cities continue to evolve, integrating these principles can lead to more just and vibrant urban environments that reflect the diversity and aspirations of their communities.

Future research should explore the application of these paradigms across different urban contexts, examining the outcomes of such approaches in various settings. Studies could focus on how these principles can be effectively integrated into urban policy and planning, identifying best practices for fostering community engagement and empowerment. Additionally, research could investigate the scalability of projects developed under this framework, assessing their potential for broader impact on urban transformation and social justice.

Although there were no direct implications regarding projects from this workshop immediately after the workshop, the participants continued working on their individual projects with renewed perspectives. The author and the founder of the AFYD worked to develop a new version of the Afrofuture Youth Festival in Detroit and an exhibition for futures from Detroit, which is not within the scope of this article to discuss.

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P/REFERENCES OF DESIGN

FOOD FORWARD: DESIGN FUTURES TO SUPPORT ALTERNATIVE FOOD SYSTEMS IN URBAN AREAS.

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KEYWORDS | DESIGN-ORIENTING SCENARIOS, ALTERNATIVE FOOD NETWORKS, URBAN FOOD SYSTEM, REGENERATION

ABSTRACT | Environmental crises, social and economic challenges, and technological uncertainties highlight the urgent need for more sustainable food systems. While food affects climate change and inequality, these issues also influence food security. In this context, Alternative Food Networks (AFNs) offer promising ways to renew our relationship with food from production to consumption. This paper offers a speculative and design-led perspective on emerging practices within AFNs, proposing scenarios for Milan's food system in 2035. Two main uncertainties create these scenarios: Governance, which looks at power and decision-making dynamics, and Approaches, which examine how institutions and societies respond to environmental and social issues, emphasising either adaptation or mitigation strategies. Using the design-orienting scenario theory, we outline four possible futures in 2035, considering innovations at the actor level, their relationships with actors at the system level, and broader societal changes. This paper concludes by proposing the concept of "regeneration" as essential for shaping future food scenarios. "Regeneration" refers to the process of reclaiming, maintaining, and restoring the health of ecosystems to enhance resilience. This approach goes beyond ecological health to foster positive outcomes for and with urban ecosystems, suggesting the renewal of societal relationships and structures. It emphasises the crucial role of engaging diverse actors—AFNs, citizens, and mainstream stakeholders—in different ways to create food futures that are not only environmentally sustainable but also socially equitable.

1. Background: Food System Challenges and the Promise of Alternative Food Networks

As we face an environmental crisis, growing social and economic vulnerabilities, and technological uncertainty, it becomes clear that we need to move to more sustainable and resilient food systems (Serraj & Pingali, 2018). From production to consumption, food significantly impacts climate change and social inequality. At the same time, climate change disrupts food security, water security, and agricultural productivity, making it difficult to achieve Sustainable Development Goals (IPCC, 2023). In other words, food affects climate change and inequality, while these issues also put our food supply at risk.

The COVID-19 pandemic and the conflict in Ukraine have made it more evident that the current food system cannot provide food access to all (FAO, 2023). This has increased interest in alternative food networks (AFNs) as a potential solution, as more research focuses on how AFNs and shorter supply chains can drive sustainable change on a small, local, and connected scale (Gori & Castellini, 2023).

AFNs introduce different ways of producing, distributing, buying, and consuming food (Barbera & Dagnes, 2016). Since they work to minimise environmental and social damage, they adopt cleaner and fairer practices, which have a positive impact on the sustainability of the entire supply chain (Bush et al., 2015). A look at Milan, Italy, illustrates how AFNs create new supply chains and leverage the infrastructure of conventional ones (Food Policy di Milano, 2021). After the 2015 Expo 'Feeding the Planet, Energy for Life,' AFNs in the city began using the resources of traditional players to create new solutions for food access. This practical approach shows how AFNs can collaborate with the mainstream food system to develop alternatives.

In this context, we recognize the opportunity for systemic rethinking within Milan. The city, already transforming its food practices since the 2015 Expo, has developed multiple initiatives aimed at varied aspects of the Milanese food system. Although the AFNs in urban and peri-urban Milan have shown promise in creating more sustainable and equitable food practices, the broader context calls for a deeper transformation. How can we extend the impact of these networks? To this end, this paper presents an in-progress work of envisioning scenarios for peri-urban and urban areas of Milan to introduce a speculative perspective on existing trajectories of development driven by design.

These scenarios act as an envisioning tool, an "interaction platform," and a springboard for generating "design-driven conversations" with different food system actors through co-design workshops. They will help identify contexts that improve food access in the city and become a catalyst for creating pre-prototyping and design activism actions, highlighting potential evolutions of the Milanese food system. This research is a part of the ongoing project named OnFoods, a research programme dedicated to the Sustainable Development of Food and Nutrition, supported by funding from the National Recovery and Resilience Plan (PNRR). More specifically, this paper focuses on a series of research activities and design actions conducted by the Polimi Desis Lab of Politecnico di Milano within the OnFood project and focused on enhancing the efficiency of food value chains to ensure food access for the most vulnerable sections of society.

Following this introduction, the paper presents current trends and emerging practices in the agri-food industry in Europe. Section 3 then outlines the methodology for scenario building. Section 4 presents four scenarios for the Milanese Food System and their application in three co-design workshops with food system stakeholders. Section 5 reflects on the workshops' outcomes and suggests that the current scenario-building strategies, which focus on adapting to and reducing negative impacts, should shift towards the concept of regeneration. This approach considers both social and ecological aspects to envision food futures that are not only carbon-neutral but also socially equitable.

2. Design-Orienting Scenarios

Scenarios facilitate open conversations around visions and solutions between the actors shaping the food system. Exploring scenarios encourages actors to share their different positions, concerns, and future goals, activating new discussions and even shared visions (Manzini & Jégou, 2004). The importance of participatory approaches lies in the fact they can help create visions with a plurality of perspectives and a better understanding of preferences (Heidingsfelder et al., 2015).

The goal of the research project is to use these scenarios as triggers to develop pre-prototypes. In this context, pre-prototypes become design activism actions meant to showcase new Alternative Food Networks (AFNs) and cross-sector partnerships in the city, involving different levels of society and opening the discussion for policymakers and local actors. Working with scenarios also presents an opportunity to invite actors from the food system to sit at the same table and share provocations that could eventually spark changes at the food policy level. Given that scenarios will provoke participatory ideation, the method used during this first phase was the one of design-oriented scenarios (Manzini & Jegou, 2000).

Unlike policy-oriented scenarios (POS), design-oriented scenarios (DOS) are "design-oriented" because they are motivated, illustrated, and visualised with specific solutions, representing a range of perspectives to be discussed. They address specific actors, showing how their decisions affect a focused system to help them orient their future (Manzini & Jégou, 2000). DOS can have different goals depending on the project's focus and the moment of the process in which they are used. Teams can apply them in a phase of exploration or focalization focusing on actors or results. Setting these conditions allows teams to define if scenarios help explore opportunities and possibilities or individuate a product system or solution (Manzini & Jégou, 2004). Through the DOS framework, teams can also determine the motivation and practicality of their scenarios, understanding their aim and the steps to facilitate their implementation (UNEP, 2009). Scenarios are here geared towards exploration and results. They are Function-based DOS since they focus on the food system, sharing macro and emerging trends and how several actors and their behaviours could affect the evolution of the entire system and the actors themselves (Manzini & Jégou, 2000).

The actors within the designed scenarios address are the food system nodes. A 'node' is a pivotal point (digital, physical, or both) where significant activities and interactions related to food production, transformation, distribution, and consumption occur (Aucoin & Fry, 2015). The nodes in the scenarios presented in this paper are part of AFNs: actors that interact and share resources and infrastructure with AFNs, and actors that could play a role in developing and supporting current or new AFNs. As an example, in the Milanese context, these main nodes are the wholesale market, indoor and outdoor markets, the farmers' markets, the food waste hubs[1], and public canteens. Although characteristic of Milan, these nodes constitute an interconnected network in other European urban areas.

3. Developing Scenarios for the Milanese Food System of 2035

The scenario-building process comprised three main phases, each with different steps. The first phase involved case study research and analysis to identify promising practices and food system nodes to engage, including desk and field research, interviews, and internal problem-framing workshops. The second phase focused on research around trends, drivers, and policies related to the challenges and critical topics recognized in the previous phase and about urban and food matters in general. The scenario-building phase developed future visions using the 2x2 matrix technique and the design-oriented scenarios approach. Finally, a workshop tested the scenarios with researchers from OnFoods and from the departments of Politecnico di Milano.

[1] Milan food waste hubs have "the aim of reducing food waste and innovating the ways of recovering food for the people in need, designing and experimenting a model of collection and redistribution of food surplus, based on local neighborhood networks" (Milano Food Policy, n.d.).

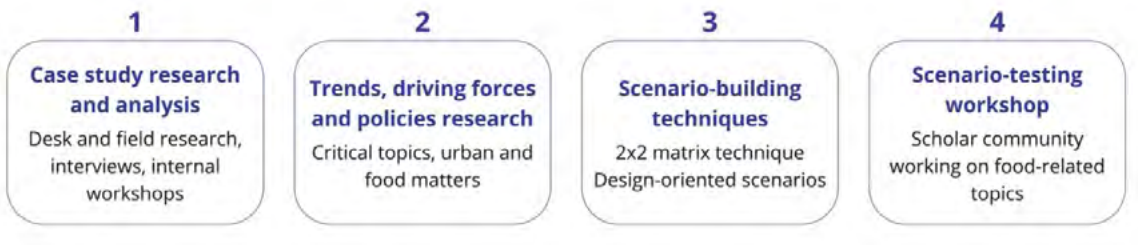


Figure 1. The scenario-building process.

3.1 Research Baseline

The process for creating scenarios began with case study research and analysis to create a detailed image of the Milanese Food System, its nodes and actors, and how these interconnect. This initial research helped identify active, inactive, and new nodes, their purposes, and barriers, which ones are enabling and part of AFNs, and which ones play or could play a role in supporting current and prospective AFNs. Interviews helped better define activities and barriers and understand their vision for the future. Finally, a workshop within the Polimi Desis Lab transformed barriers and opportunities into challenges to tackle, which the authors clustered into seven topics future visions should address: diet and sustainability, good and fair food, collaborations as integration of services, service model logistics, optimization, escalation and replication, and urban production.

3.2 Driving Forces, Trends, and Promising Practices

After identifying the nodes for scenario building, the team looked at the macro, emerging, and niche trends, driving forces, and policies at the local, national, and regional levels. This research allowed a deeper understanding of the seven topics and how Milan's food system might evolve. The aim was to identify emerging values and behaviours in AFNs and other players and detect signs of change at the micro, meso, and macro levels to understand how particular trends would react over time in determining the future of food in the city. This exploration considered food-related and food-influencing factors such as urbanisation, mobility, housing, migration, and health, including themes like the city's push towards sustainability, the growth of the elderly population, the immigration of the young population into cities, the increase of technology and digitalisation in all areas of life, European and Milanese mobility regulations for 2023, urban lifestyles, the customers' awareness of climate change, and their changes in health habits and routines.

As a result, the authors identified examples of food practices relevant to more sustainable and fair food systems in European AFNs, e.g.:

- A shift towards avoiding waste and reducing consumption (e.g., food rescue, purchasing "enough," locally sourced food) shows opportunities for more efficient food consumption.
- A shift towards self-sufficiency and including diners in transforming their food (e.g., urban farming; student-run canteens) shows how people move from food consumers to food co-producers.
- A shift from food ownership to food access (e.g., sharing, swapping) shows a different way to consume.

The authors integrated and projected these more virtuous practices to create four desirable scenarios for a fair and sustainable food system in Milan in 2035. Working within a 10-year timeframe allows for open discussions between food system actors that invite new and forward ideas while remaining grounded in what is feasible, viable, and possible today. Later in the research process, these conversations will serve to understand the priority issues for each actor and as the base to kick-start pre-prototyping actions that showcase the food system's evolution and new partnerships.

3.3 Polarity Mapping and Design-Orienting Scenarios

As anticipated, the project employed a specific scenario methodology - design-orienting scenarios (DOS)- to create visions for the Milan food system and specific nodes. We can identify these scenarios as preferable futures (Dune & Raby, 2013), concerned with practices that we, as designers, believe are promising and desirable for the nodes from business, social, and environmental points of view.

The scenario-building phase used the 2x2-matrix technique, crossing two critical uncertainties (highly impactful issues for the future of food) with opposing polarities to generate diverse future scenarios (Rydderch, 2017). Given the focus on DOS, meant to provoke specific actors, ten years was a time frame that allowed us to mix high-impact uncertainties with feasible technologies and consumer behaviours. The team based the selection of critical uncertainties on the idea that the scenarios should:

- Reflect on the topics and promising practices uncovered by the first two research phases,
- Differ from policy-oriented (POS) scenarios, allowing for actor-specific narratives,
- Reflect issues critical in existing research on sustainable food systems and production/consumption patterns.

The first uncertainty is about governance structures, focusing on the distribution of power, decision-making processes, and compliance. This leads to two polarities: Centralised governance, where decision-making is concentrated in a few hands, and Distributed governance, which spreads power across a wider network of participants. The second uncertainty examines the approaches to addressing environmental and social issues, questioning the innovation strategies employed by society and institutions. The polarities here are Adaptation strategies, which battle the effects of phenomena, and Mitigation strategies, aimed at tackling the root causes of phenomena.

Climate change research identifies mitigation options as those strategies that prevent or reduce the emission of greenhouse gases, which cause climate change. Avoiding or reducing emissions requires society to change everything we do—from our lifestyles to how we produce our food, energy, and products—for example, changing to plant-based diets or reducing consumption. On the other hand, adaptation focuses on tackling the effects of climate change and modifying how actors operate to become more resilient. These strategies work on adapting to the climate changes that are already happening or are soon to happen—for example, heat and drought-resilient crops (Wang et al.,2023).

Given that AFNs tend to pursue environmental and social aims, the impact of the climate crisis on the urban population, and the role of social behaviours in shaping future strategies, the social dimension was necessary for strategies in these scenarios. Following the same logic of adaptation and mitigation used in climate change strategies—addressing effects and causes—we also applied these concepts to social phenomena. For instance, when considering unemployment rates among migrant populations, an adaptation strategy might involve enrolling them in a food stamp or donation program to ensure they can access food. On the other hand, a mitigation strategy would address the root cause by including individuals in job insertion programs and integrating them into the workforce.

Mitigation and adaptation strategies are promising for improving environmental and social resilience, and feasible, effective, and low-cost options exist. We can bring significant environmental and well-being benefits by integrating these strategies into social programs, such as promoting consumption reduction practices or lifestyle changes (IPCC, 2023). Design can be crucial in this area, especially in the food system. Design has shaped food systems for a long time, starting from product, communication, and packaging, and moving to services, systems, and strategies. The food value chain offers several design opportunities for problem finding, framing, and solving, which can support the city's adaptation and mitigation strategies.

The combination of the two critical uncertainties created four possible future visions, each with specific features of governance and strategies (Figure 2).

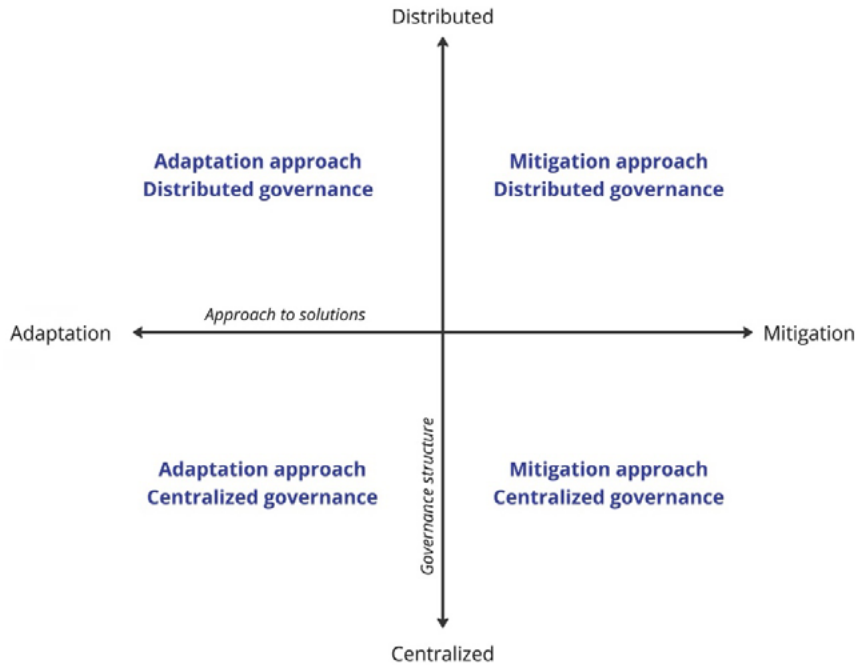


Figure 2. The 2x2 matrix and the resulting critical uncertainties.

3.4 Scenario Components

The drivers and trends coming from previous research informed the storytelling, creating a believable context to place our provocations, or story layer (Lindley & Coulton, 2014). Each scenario consists of five main elements. The story includes a name, a brief description, and a longer one that details three levels: micro (actor), meso (system) and macro (city and beyond). 'Sustainable qualities' (Manzini & Tassinari, 2012) — key elements from Alternative Food Networks (AFNs) that we aim to promote in services and interactions —support the story. Finally, technology serves as an enabler for innovation.

The scenarios take shape through the story layers. The first one, the Macro level, defines the overall context holding the food system together. It describes the macro changes in urban areas and frames the food system in an urban, regional, and national setting. Trends, policies, and driving forces were the main stimuli for creating this first layer. The Meso level focuses on the vision of the food system, and it works as a first provocation layer for the actors. It considers the future of nodes and actors' relationships and how power dynamics work around them. Therefore, governance highly influences this layer. Finally, the Micro level focuses on the vision for specific food system players and works as a second provocation layer. It describes the node-level strategies, practices, solutions, and features that could facilitate changes in that context. Consequently, the approach to strategies primarily influenced this layer.

In addition to the critical uncertainties and their polarities, other key ingredients influence and shape each scenario. These are the sustainable qualities and enablers, common elements that hold different weights depending on the scenario. Manzini and Tassinari (2012) define sustainable qualities as "features that are better than the ones proposed by the mainstream unsustainable production and consumption system" (p.08). Using this definition, we adapted these qualities for our scenarios, influenced by their reflection on Alternative Food Networks (AFNs). The result is four qualities and one enabler, detailed in Table 1 below. Together, the different weights of sustainable qualities and enabler(s) add an extra layer of information to build each scenario's identity.

Table 1. Sustainable qualities and enablers adapted for this project.

Sustainable quality	**Definition**
Integration	How integrated are services between each other?
Collaboration	Does the innovation promote collaboration among different actors? Does it promote cross-sector partnerships? Does it include final users in the design and delivery of the service?
Engagement	Does the innovation require a high degree of engagement or self-organisation from actors?
Building capacities	How much does the innovation build competence and capacity across society?
Enabler	**Definition**
Technology	How much is technology integrated into the solutions?

In our four scenarios, we see technology as an enabler of change, recognizing its potential to reshape food systems dramatically. In the Data-Driven Renewal scenario, we feature AI as the primary technological advancement to understand the readiness of various actors within the food system to adopt and engage with new technologies and to begin dialogues about their use. However, we're also aware of the broader impact of these technologies, from the energy they consume to the materials they require and the social repercussions they might carry, particularly concerning data use and materials sourcing.

4. Results

The resulting four scenarios are short narratives describing how actors—the food system nodes and their stakeholders—might behave and interact in 2035 Milan (Figure 3).

Food Communities

Food Communities shows a future in which food ceases to be an individual issue and becomes a communal one. Citizens and residents have adopted a shared approach to food and have taken to participate in the changes in the food system nodes. The municipality has taken a proactive step in facilitating this trend by providing regular meeting spaces for various stakeholders in the food system.

While neighbours now meet, co-create, and develop strategies to transform waste, schools teach children how to transform food surplus. Food swap, donation, and distribution are organised by each neighbourhood, with open communication between all. The city is repurposing buildings and revitalising neighbourhoods, and citizens are proud to learn new skills to make the most of what they have.

Farmers share strategies - such as crop rotation, crop adaptation, and water usage optimization - to adapt to the changing climate in the region while those most affected by droughts and floods receive financial support from the government.

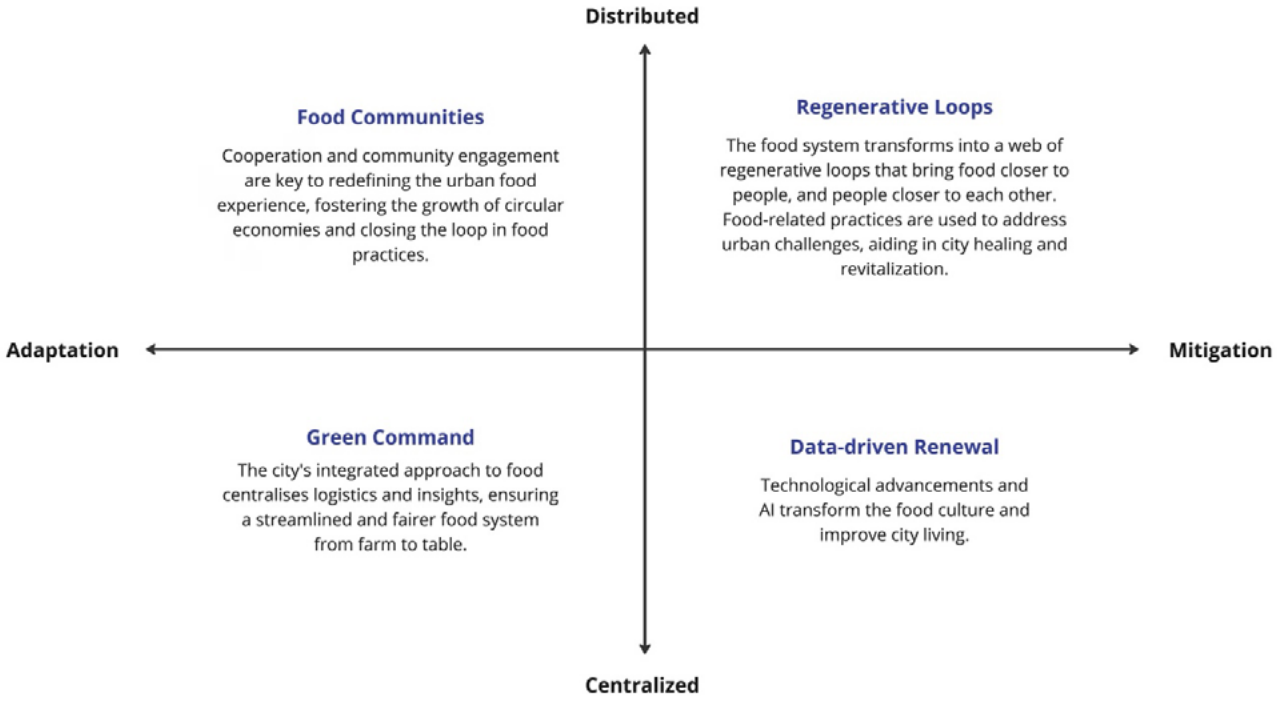


Figure 3. The resulting scenarios and their short descriptions.

Green Command

In Green Command, the municipality collects and integrates information about the food flows and food needs across the city to gain valuable insights. At the same time, they implement strong regulations regarding food production, distribution, and consumption as well as set standards for transportation and storage. These normative initiatives help in establishing markets and food hubs strategically and ensure changes from local producers and food system actors. This effort simplifies the process of donating surplus food and centralises logistics, making the system fairer and more effective.

There is a solid push to invest more in locally grown produce and to provide support programs, including skills training and subsidies, for farmers, especially those in peri-urban areas, enabling them to become more prominent players. New technologies around food are becoming widespread and accepted by the public as laboratory meat enters the market, dehydrated food, and similar technologies to prolong food life become widespread and government funds are dedicated to researching crops that are heat and drought resistant.

Citizens receive constant reports about the food they eat and are notified about existing more sustainable and healthy food alternatives. Motivation and awareness are rewarded and drive changes in everyday consumption.

Regenerative Loops

Regenerative Loops envisions a future in which the city's food system is more capillary, with urban and peri-urban farming flourishing. Parco Agricolo Sud Milano sets a precedent in regenerative agriculture and resilience against climate change, showcasing permaculture and agroforestry practices. Food production happens within and around the city, with an emphasis on high-quality food, accessible to all in the present and for future generations. While farmers gain more access to public incentives when they join cooperatives and networks, public institutions receive incentives to buy from urban and peri-urban farming.

These changes are supported by local policies that foster collaborations and strengthen emerging small-scale initiatives, encouraging the formation of localised food loops across neighbourhoods. Green areas are taking the space of cars and neighbourhoods have access to spaces for food production or transformation,

such as the neighbourhood food hubs, supporting the city's growing focus on self-sufficiency. These changes have generated new jobs in this field, and since everything develops in small areas, people can easily access all the services they need within a 15-minute radius.

People's perception of food transforms, embracing 'ugly' but delicious produce, leading to policies that reduce aesthetic standards for fresh food and promote hands-on school food lessons, helping youth learn practical skills. Household food waste significantly drops as residents adopt more responsible purchasing and consumption habits. They use apps to monitor expiration dates and to cook with whatever is at hand. Local policies encourage networks and technologies to minimise home food waste, to advocate for plant-based diets, to use unpackaged products, and to promote returning distribution packaging to suppliers.

Data-Driven Renewal

In this future, the municipality aims for high-quality food for all in present and future generations, through the support of technology.

The municipality uses AI and real-time data to predict challenges, react immediately by adjusting micro-policies and actions, and improve their impact. This focus on data, AI, and blockchain helps to optimise the system, minimise waste, increase the efficiency and transparency of the food system, and allow for continuous prototyping of incremental innovative solutions.

As the local government raises awareness and implements policies to support vegetarian and vegan diets to lower carbon emissions, people's shopping and eating habits gradually shift by having access to personalised and optimised menu options. Supermarkets, local markets, and canteens use this technology to offer a variety of fresh produce and vegan options, ensuring access to high-quality, affordable food all over the city.

Energy policies have transitioned from fossil fuels to renewable sources, encouraging food industry players to adopt renewables in transportation and logistics and to decrease transportation distances and displacements by optimising them.

Table 2. Summary of scenarios and their defining characteristics.

Scenario name	Food communities	Regenerative loops	Green command	Data-driven renewal
Quadrant	Adaptation approach + Distributed governance	Mitigation approach + Distributed governance	Adaptation approach + Centralised governance	Mitigation approach + Centralised governance
Short description	Cooperation and community engagement are key for redefining the urban food experience, fostering the growth of circular economies, and closing the loop in food practices.	The food system transforms into a web of regenerative loops that bring food closer to people, and people closer to each other. Food-related practices are used to address urban challenges, aiding in city healing and revitalization.	The city's integrated approach to food centralises logistics and insights, ensuring a streamlined and fairer food system from farm to table.	Technological advancements and AI transform the food culture and improve city living.
Scenario keywords	bottom-up initiatives, neighbourhood scale, engaged citizens, low technology, sharing	production, care, capillary and connected, specialization, future generations, 15-minute city	technocratic, normative, monitoring and tracking, optimization	high-tech, predictions, anticipation, rapid response
Integration	High	High	High	High
Building capacities	Medium	High	High	Medium
Collaboration	Medium	High	Low	High
Engagement	High	High	Low	Medium
Technology	Low	Low	High	High
Relevant nodes	Farmers market, Food hubs, Covered markets	Farmers market, Covered markets, Food hubs	Wholesale market, Farmers	Wholesale market, Farmers, Food hubs

4.1 The Co-Design Workshops

The project aims to use participatory approaches in specific contexts of experimentation to improve fairness, efficiency, and awareness around food systems. Here, scenario building is crucial. Therefore, three workshops tested the scenarios to initiate conversations around the key projects and actors that influence these future visions.

The first workshop involved researchers from different areas, including management engineering, architecture engineering, and design, currently working on OnFoods in Politecnico di Milano and on food-related topics. After an initial presentation of the four scenarios with the proposed visions of the Milanese Food System nodes, participants worked in groups around the nodes they felt more knowledgeable about. The nodes participants worked with were the wholesale market, covered markets, street markets, food redistribution hubs, farmers' markets, and canteens. Each group imagined how their node would change in each scenario, which node-related activities were the key for each context, and their node's relationship with other players in the system—a moment of reflection on the current situation followed this exercise. Then, participants identified existing projects or actors working on similar practices to the ones the scenarios presented or with enough influence to impact them. The workshop concluded with a shared space where the participants and facilitators shared and built upon each other's ideas, some of which were collaborations the scenarios did not consider.

This initial workshop was an opportunity to validate the scenarios and their use in a co-design session with an academic community. It also provided new knowledge about the Milanese food context and existing

projects working towards these future scenarios. This session's list of actors and projects helped define which stakeholders to involve in the second and third workshops.

The second workshop focused on the wholesale market, bringing together its market director, the institutional and external relations manager, and the project and property manager. This workshop explored potential developments in the wholesale market's main role—for instance, as an enabler of urban production or a facilitator of food logistics in the city. These roles translated into specific services that would link the market with various nodes throughout the city. The session aimed to pinpoint areas of interest and determine their priority.

The third workshop involved actors from the Milanese food redistribution hubs (the Milan Food Waste Hubs). By March 2024, the city had five hubs donating food to citizens in conditions of vulnerability, with three more planned. The workshop involved nine people working directly in the hubs or third-sector organizations connected to them. The hub system has several tasks: food collection, distribution, assembly, and delivery. The actors attending the session were involved in one or more of these tasks. The session followed the same agenda as the previous workshop. First, participants learned about the four scenarios and the evolution of the hub's role in them. Then, the facilitators presented six service ideas related to those scenarios, and finally, there was time to debate about those ideas. As a result, the session shed light on the importance of implementing optimised logistics systems and communication channels, as well as learning spaces for beneficiaries of the service. On the other hand, it highlighted the need to involve the public administration in the conversation to open the debate around food policy updates and regulations.

Further workshops will involve stakeholders representing the covered and street markets, public canteens, and the consumers and beneficiaries of the services impacted by the four scenarios. The final goal is to envision the priority work areas for each node and the food system, their drivers, barriers, and possibilities for collaboration. Having these issues apparent will help the team develop pre-prototypes of new possible services and collaborations in 2035 that the system could work towards today.



Figure 4. Workshop context, participants, and materials.

5. Discussion

The interconnection between food, climate change, and social inequalities highlights the need to redesign our food system. In this context, Alternative Food Networks (AFNs) suggest new directions for making food systems more sustainable and fairer. They highlight how food system actors and consumers are increasingly aware of the social and environmental issues within the food system and how ready and capable they are to create alternative solutions based on a different paradigm. They also reveal opportunities to renew governance structures for tackling food-related challenges.

This paper adds to the ongoing discussion around food system transformation by introducing a speculative, design-led approach. Drawing from current trends and alternative development paths, design-orienting scenarios (DOS) explore future visions for Milan. The four scenarios share ideas around food that seem more virtuous and promising, showcasing futures where increased well-being is not linked to increased consumption or more intensive use of resources. They also centre around the transparency of information and the active participation of mainstream and alternative food system actors as well as consumers—characteristics AFNs showcase. These are scenarios that aim to activate discussions between food system actors, visualising alternative solutions and collaborations that simultaneously produce environmental and social gains. Not one before the other, but ideally hand in hand.

Carefully looking into the three co-design workshops revealed that the governance axis of the scenarios provided an opportunity to address social interactions as the roots of change (through changes in behaviour, power dynamics, and decision-making processes). However, the approaches axis, which focused on how institutions and society address environmental challenges, fell short to represent the social aims AFNs also have besides the environmental ones. During the discussions based on the four scenarios, the participants aimed to develop ideas that not only focused on environmental care but also embraced a more comprehensive approach to consider social and ecological aspects together. Here is where the real challenge for envisioning more fair and sustainable food systems emerges: integrating these aspects and using them as the background to envision new and more sustainable solutions.

The adaptation and mitigation concepts can be further advanced into the future by considering the concept of “regeneration” as a transformative opportunity not only of practices but also of relationships. Building on the definition provided by the EMF (2015), regeneration involves the process of reclaiming, retaining, and restoring ecosystem health while improving resilience. We aim at expanding this concept as critical in shaping food scenarios, to include the development of positive outcomes with and for the urban ecosystem. This implies revitalising the system of relationships and society at large. This transformation must involve all actors—AFNs, citizens, and mainstream stakeholders—highlighting how to activate people and players in different ways and allowing us to envision food futures that are not only carbon-neutral but also more socially equitable. The concept of regeneration is based on adaptation and mitigation strategies, but it wants to go further and include an aspect of visioning an inclusive, generative, and proactive future, where a predictive approach is in fact linked to a capacity to react to unforeseen aspects. The capacity of actors to act, their agency capacity, is embodied in a collaborative approach that frequently materialises through cross-sector partnerships. This dynamic becomes a crucial element in effectively navigating the intricate contexts of relationships and interdependencies.

Even though the challenges and actors presented in this paper are characteristic of the Milanese context, the insights from the workshops carry general relevance, suggesting ways that similar cities might approach food system sustainability. The situation in Milan reveals the importance of continuously aligning city food policies with on-the-ground realities. The current mismatch between practice and regulation in the city results in food waste, inequalities in access to food, and complicated procedures for those trying to improve food security.

Workshop participants recognized the need for a coordinated effort that aligns different actors and their strategies. While individual efforts have an impact, a collaborative infrastructure can lead to more strategic

and responsive solutions. A systemic approach—one that addresses the entire food chain—is crucial for interventions to be resilient and long-lasting. The critical role of connectivity between different food system nodes, such as the dialogue between covered and wholesale markets or between food hubs, underscores this need.

The four future scenarios and the three workshops implementing them have set the stage to help us envision, alongside Milanese food system actors, new AFNs in the city and rethink different city nodes regarding food. This effort aligns with the Milano Food Policy, the municipality's strategic plan governing the urban food system since 2015 to make it more sustainable from all perspectives.

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P/REFERENCES OF DESIGN

YOU SHALL OWN NOTHING, GO NOWHERE, ‘EAT ZE CANCEROUS BUGS’ AND BE HAPPY.

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DOI: 10.63442/IZPF9031

KEYWORDS | CRITICAL DESIGN; SUSTAINABILITY; GRAPHIC DESIGN; T-SHIRT DESIGN, AESTHETIC RESISTANCE

ABSTRACT | Oppose 1984 in 2030: Keeping the UN Goals on an ethical path' (short: Oppose1984in2030) is a Critical Design project currently being developed by the author at The Royal Danish Academy – Architecture, Design, Conservation. This experimental academic practice-based research project involves communication design (graphic design on t-shirt artifacts) combined with ongoing critical meta-research in the political economy of sustainability issues.

The project aligns itself with the approach of critical design in questioning conventional design norms. However, it diverges from the typical speculative design by not aiming to create designs based on favored visions. Instead, it takes a contrasting stance, serving as a precautionary measure by designing against undesirable (totalitarian) future scenarios.

While oppose1984in2030 is grounded in the critical design discipline, its purpose extends beyond merely challenging established modes of thinking and behavior; it serves a more idealistic and impactful role: The emphasis is entirely on being critical to confront the totalitarian blueprints being pursued by an expansive oligarchic global system of monopoly capitalism who uses sustainability discourse to lead humanity towards '1984 in 2030'; a phrase inspired by the title of George Orwell's renowned novel but combined with the UN's sustainability visions of Agenda 2030.

Like typical critical design, the design activism of this project is not driven by commercial considerations. However, the design prototypes of oppose1984in2030 are not industrial design as in the work of Dunne & Raby (2001, 2013). Instead, the territory is communication design; the t-shirt artefacts with typography signify something about sustainability and totalitarian issues that are exterior to the actual prototypes. The prototypes can be reproduced in several copies to let the design engage in everyday life through t-shirt-wearing subjects. The subject's experience can then later be introduced into an exhibition space through visuals and written information. The concept of 'Aesthetic Resistance,' as formulated by John Steppling (2020), serves as a distinct source of inspiration. Stepping advocates for an art form existing outside of the mainstream cultural institutions, challenging dominant political and cultural narratives, and he emphasizes the importance of artists and activists in diverse forms of resistance, such as street art, graffiti, and performance.

The slides present the project with a focus on visual examples of artefacts as well as aspects like the project's theoretical and methodological foundations inclusive of oppose1984in2030's contribution to the fields of critical and speculative design and some of the employed design processes and internal project constraints. Two theoretical levels are operative: one pertains to the meta-theory employed in the critical pursuit, encompassing the project's ideological and analytical stances (e.g., Agamben 2021, Elmer 2023, McDowell 2020, Prins 2022, Wood 2015, Zuboff 2019); the other concerns the domains of critical and speculative design, alongside t-shirt design and Aesthetic Resistance as instrumental tools for resisting oppressive social, political, and economic systems.

What is 'oppose 1984 in 2030' ?

'Oppose 1984 in 2030: Keeping the UN Goals on an ethical path' is an academic research and Critical Design project currently being developed at the Royal Danish Academy. This design activist project aims to criticize totalitarian policies developed in the shadows of the UN's sustainability benevolence. It involves communication design (graphic design on t-shirt artefacts) meant for circulation through living subjects and exhibition events combined with on-going critical research in the political economy of sustainability. With a duration of 10 years, the project will also be a documentation of politics and power between 2021 and 2030. A looming period that could witness the resurgence of totalitarian regimes as a powerful force shaping the world, echoing the unsettling parallels with the early 20th century.



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- ***What this is not about?***
- ***Two theoretical levels***
- ***Meta-theoretical critical foundations***
- ***Project definitions***
- ***Design processes in use***
- ***What if … Stakeholder Fascism***



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Why This Project ?

The project name 'Oppose 1984 in 2030' is a symbolic jux-taposition of the title of the dystopian novel '1984' by George Orwell and the United Nations' resolution 'the 2030 Agenda for Sustainable Development' adopted by the General Assembly in 2015. Precautionary critical designing against undesirable future scenarios: the to-talitarian blueprints being pursued by a vast non-demo-cratic oligarchic global system of monopoly corporatism who uses sustainability discourse and legislation that point towards 1984 in 2030. Examples of control mecha-nisms promoted by entities like Rockefeller Foundation, WHO, WEF, BIS, and Trilateral Commission are biome-tric surveil l ance, digital programmabl e fiat (surveil - lance) money, personal carbon allowances, social credit points, and the destruction of small farming practices in order to create centralized controlled food production.



4/10

'Oppose1984in2030' is Not

- ***an attempt to analyze or promote sustainability visions that don't rely on global corporatist top-down management, e.g. community-based renewable energy; sustainable agriculture with local, organic, and regenerative agriculture practices; permaculture for self-sufficient ecosystems modeled after natural systems; reduction of reliance on centralized finan-cial institutions through community-based currencies and barter; cradle to cradle technology; decentralized energy sys-tems that are community-owned - the potential positive sides of sustainability.***
- ***meant to prove the existence of a global technocratic elite who conspires against most of humanity to install what could be described as a totalitarian digital surveillance technocrat-ic system. For theories and historical accounts on these oli-garchic networks, see for instance Carol Quigley (1966, 1981) and Antony Sutton (1976, 1981, 1985, 1995a, 1995b).***



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Two Theoretical Levels

A distinction should be made between two theoretical levels of the project: The first level encompasses critical design as a design field. The second level involves the meta-theory employed in the critical pursuit, the project's ideological and analytical stances.

Regarding the first level, 'Oppose1984in2030' is inspired by Critical Design. As the project evolves, there is a self-reflexive evaluation of its affinities with this type of design activi-ty, e.g. what is critical design and how is this project positioned within that field? Critical design and Aesthetic Resistance (Steppling, 2020) are proclaimed foundational theoretical inspirations but these disciplines also serve as methods: how to perform design activism through graphic design and communication design.

'Oppose1984in2030' is not about designing through preferred situations but the opposite, a warning. The speculative 'what if' elements are hyperbolic and dystopian. What if the unelected Davos billionaire's technocratic visions for humanity will be implemented? What if we the serfs will be ownerless, confined to 15-minute cities and forced to eat centrally produced and controlled artificial food that cull us off?

6/10

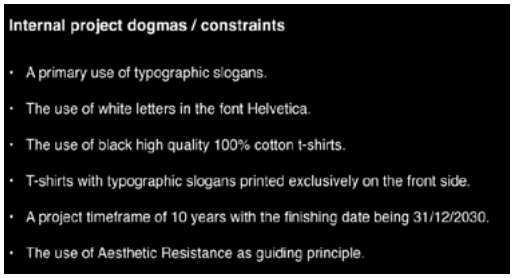
Meta-Theoretical Critical Foundations

Critical texts on global corporatist attempts to control the world economy and resources. Surveillance Capitalism (Zuboff, 2019) is the exploitation of human nature by tech-corporations who use digital surveillance technology to extract information from people. Simon Elmer uses the term 'Global Biosecurity State' to describe a 'globalist coup that is comparable to the rise of fascism in Europe in the 1930s' (Elmer, 2022). Nomi Prins' (2014, 2022) work on the power of the major banks, financial institutions and central banks serves as relevant historical background information on predatory financialization. Patrick Wood's (2015) work on Technocracy together with Jacob Nordangård's (2009) Swedish university study on the oligarchic network's influence on climate change discourse are also foundational theory.



7/10

Project Definitions



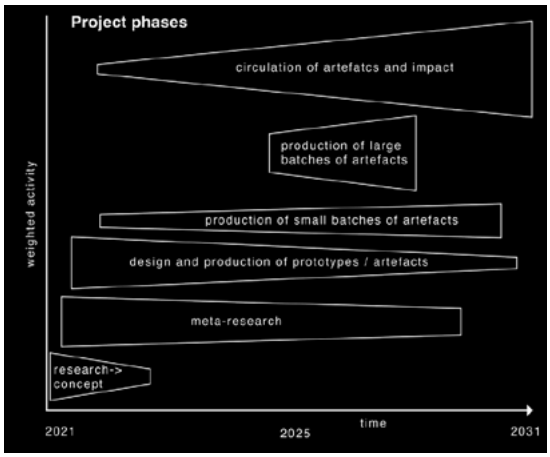
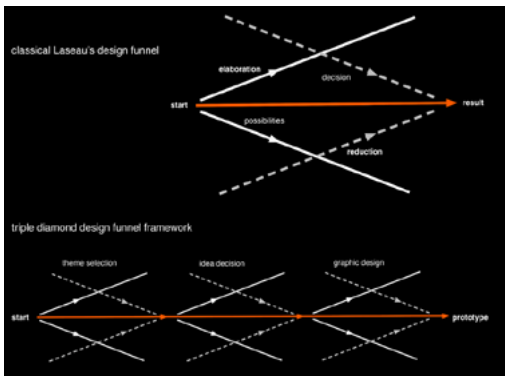


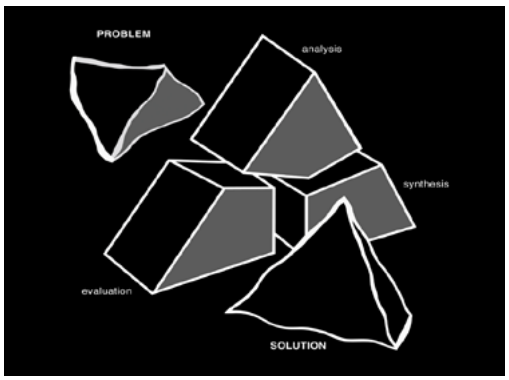
Illustration of defined internal project constraints and timeline showing the planned activities of the project. Each box's height at a given time shows the expected distributional weighted balance; e.g. in 2030 'circulation of artefacts and impact' accounts for more than 50% of the project activity.

8/10

Design Processes in Use



Mapping of design process for an artefact / prototype creation.



The project design process as a Lawson (2005) cube model where problem and solution have a strong temporal dimension symbolized by the two mutating parts.

9/10

What if... Stakeholder Capitalism = Global Fascism?



T-shirt with names of Danish stakeholder elitists who answer to the Bilderberg group and the Trilateral Commission. In Stakeholder Capitalism representatives of the 0,001% penetrate the cabinets, the corporations and the political powerstructures.

This t-shirt could just as well be made in a Dutch, Canadian, New Zealand, Australian, British, or German edition. The unelected Think Thanks are now pushing their technocratic policies for humanity through in many countries at the same time.

10/10

P/REFERENCES OF DESIGN

‘THE ART OF THE INVISIBLE: PNEUMA’– EXPLORING THE PHENOMENON OF DARK MATTER THROUGH ARTISTIC SPECULATIONS.

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DOI: 10.63442/XSRZ6259

KEYWORDS | SPECULATIVE ART, DARK MATTER, HUMAN PERCEPTION, INSTALLATION ART, ART AND SCIENCE

ABSTRACT | My research, called ‘The Art of The Invisible: PNEUMA’ (working title), is based on the cosmological phenomenon of dark matter. According to current models, this mysterious mass makes up the vast majority of the universe - while the material world as we know it only accounts for 5%. Science assumes that mystical matter does not interact with light but can only be perceived through its gravitational effect. Scientists can only detect this invisible matter indirectly through instruments. I aim to use the tools of speculative art to make the phenomenon of invisible matter experienceable directly to human perception. The main objective of the research is to create an experimental simulation in the form of a spatial installation in which the unknown phenomenon can be experienced through an interdisciplinary environment. It could open new and unexpected channels for human understanding, which refers to one of the main aims in the section summary, ‘More-than-human spatial complexities.’

One then might wonder, how can a perceptual interaction between the human body and invisible matter be created? In the timeless space alongside visual deprivation, the only point of reference for human perception would be matter. In this attempt, space and time would form a unity shaped by the ‘dark matter’ from within, which would enter into discussion with the human body. In the isolated situation, space, matter, and time would expand the boundaries of human perception as a non-linear entity.

The biggest challenge is to try to make an astrophysical phenomenon tangible at a more profound level. The most crucial questions in the research process are: How can ‘dark matter’ be experienced? How can the unknown take shape if we do not have the necessary material knowledge? How far can fiction and intuition go? What makes an interdisciplinary experiment a true empirical experience? Can it be collective and universal, or does every one of us decode stimuli according to their understanding? The interdisciplinary approach provides a methodological basis for understanding the work in a complex way. The different aspects of science (especially astrophysics and cosmology) and art provide an opportunity to examine the phenomenon from multiple perspectives. While physics emphasises an analytical, rational, and logical method, creative arts approach the process from a more intuitive and abstract perspective. With these tools, I aspire to create a discourse and experimental situation in which cosmology and installation art can form a common entity, bringing the abstract scientific idea closer to the spectrum of human perception.

At several points, the research is inspired by and connected to ancient Greek material theories and cosmologies (e.g., Anaximander’s theory of apeiron), various ancient mythologies about darkness (e.g., the Māori creation myth, the phenomenon of primordial chaos), the Zen Buddhist ideology of ‘vacuity,’ sensory-deprivation experiments, and the work of contemporary artists such as Yves Klein, Ad Reinhardt, Anish Kapoor, and James Turrell.

All this to say that my ultimate vision is to make the invisible material world tangible to human perception through the discipline of art.

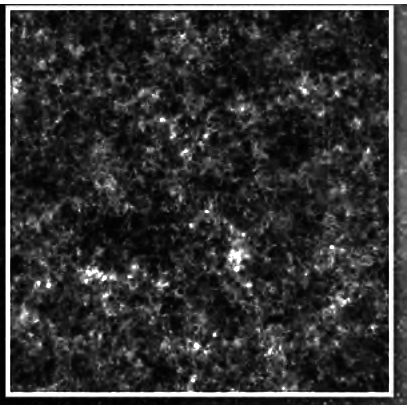
RESEARCH FOCUS

DARK MATTER — invisible mysterious mass: **26% of the universe**

How to use the tools of **speculative art** to make the phenomenon of invisible matter **noticeable and experienceable directly to human perception?**

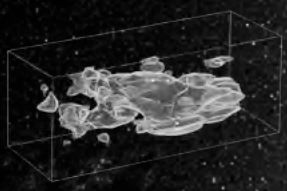
1

PERCIEVING THE INVISIBLE: WHAT IS DARK MATTER?



3

- Current theories claim that **dark matter does not interact with light**, but can be **perceived** only **through its gravitational effect**.
- The **filamentary structure** of this invisible matter **weaves through the cosmos, as well as the human body**. Without this defining mass, the Universe would fall apart, and so would we.
- How can dark matter **be sensed somatically**, if scientists can only detect this phenomenon through instruments?



2

MAIN QUESTIONS AND GOAL

QUESTIONS:

- How can **the unknown take shape,** if we do not have the necessary material knowledge?
- How far can **fiction and intuition** go?
- What makes **an interdisciplinary experiment a true empirical experience?** Can it be **collective and universal** or does each and every one of us decode stimuli according to their **individual understanding**?

GOAL:

- Based on the relationship between **ART** and **SCIENCE:** create an **art research process** that, beyond the representation of the observed phenomenon, can help science to **understand the unknown from a creative perspective.**

4

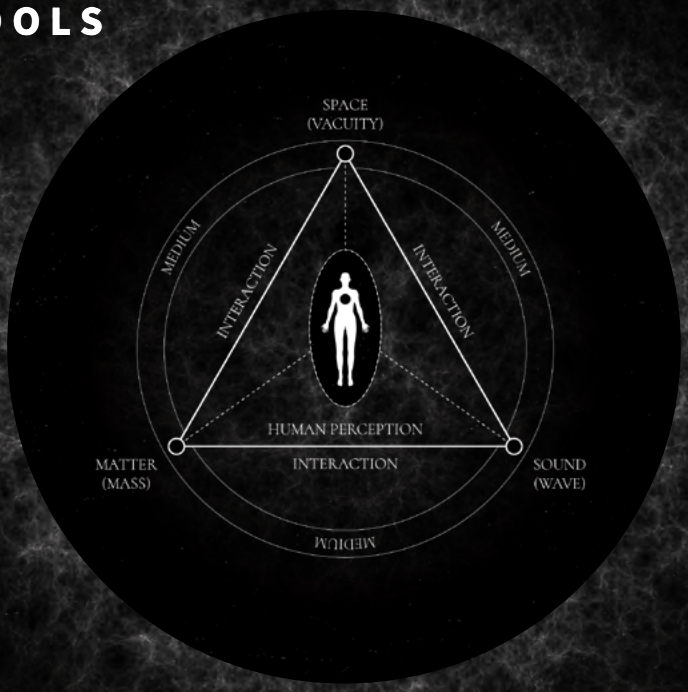
METHODOLOGY AND TOOLS

METHODS:

- Collaboration with different scientific fields and institutions
- Fieldwork: empirical data and information gathering
- Interview technique
- 'Waste-book' — researcher's diary

TOOLS:

- Interdisciplinarity
- Perception experiments
- Installation format



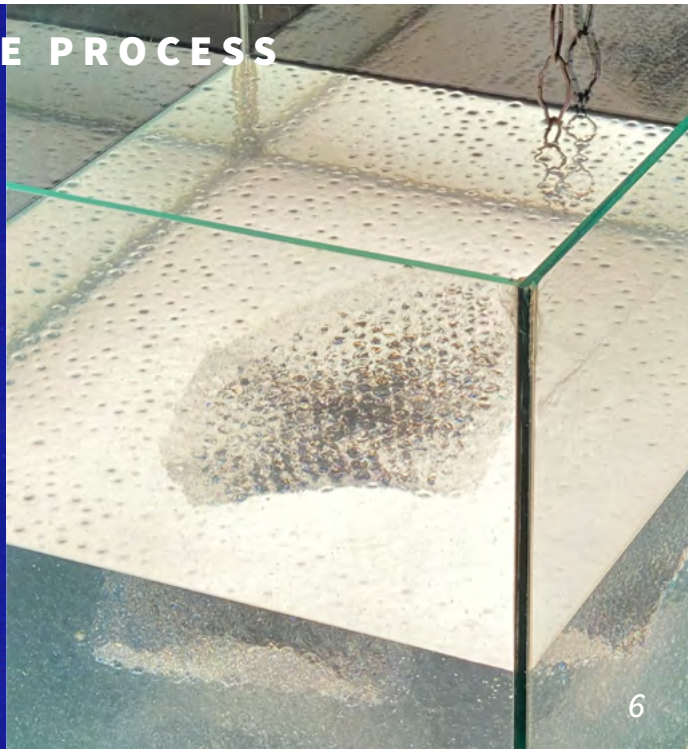
RESEARCH AND CREATIVE PROCESS

PRIORITY TOPICS IN THEORETICAL RESEARCH:

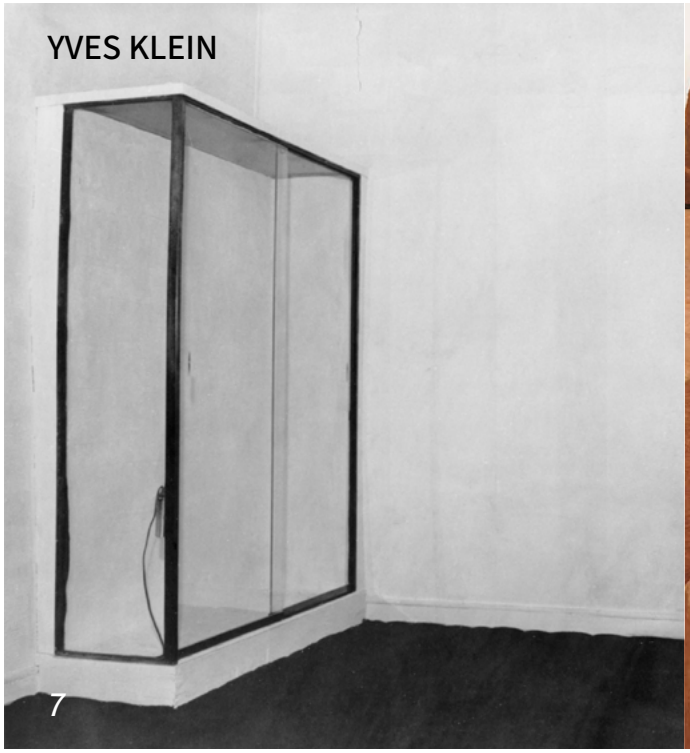
◊ **INVISIBLE MATTER** *IN* Anaximander's *apeiron* theory, Yves Klein's work, own works (URFORM/II performance-installation & APEIRON installation)

◊ **VACUITY/VOID** *IN* Vincent Keisen Vuillemin's (zen master & quantum physicist) and Yvon Myoken Bec's (zen master & philosopher) thougths about zen, quantums and intuition (interviews), Anish Kapoor's work

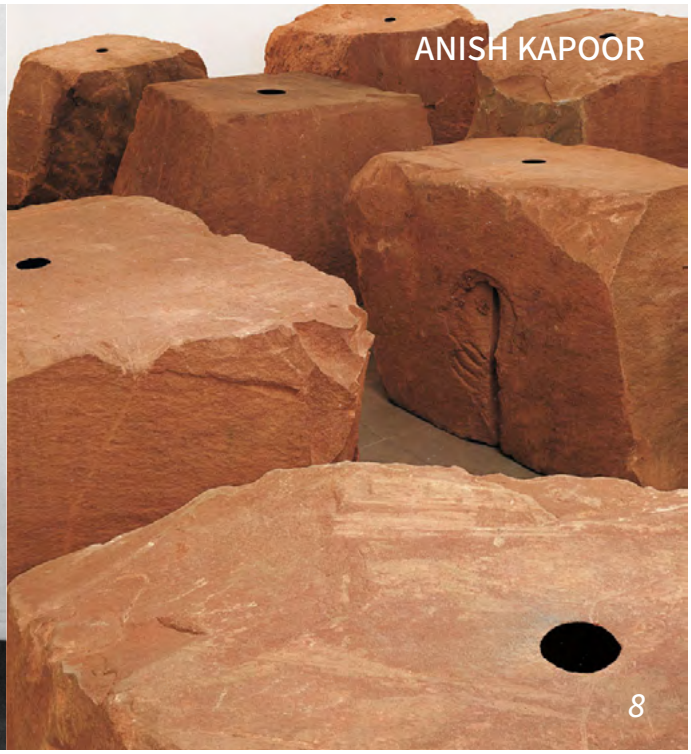
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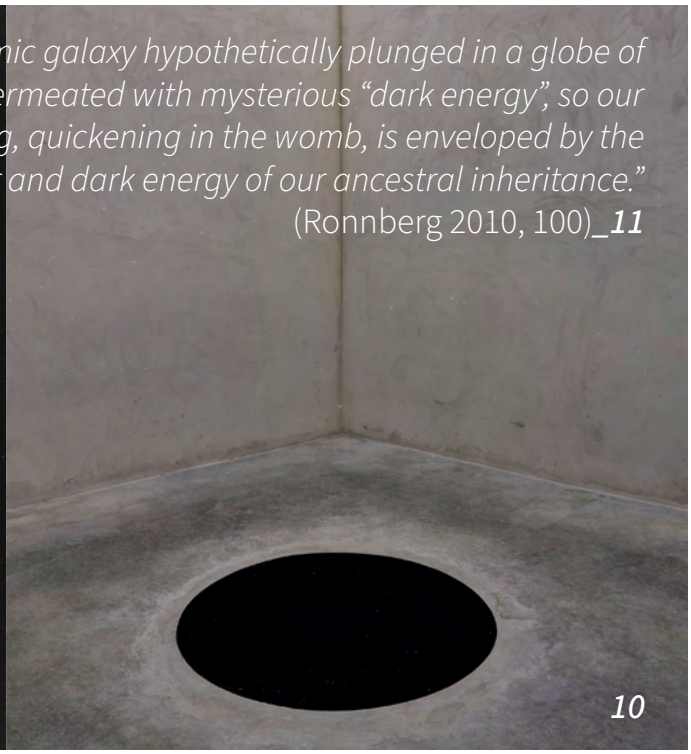
8

"Like the macrocosmic galaxy hypothetically plunged in a globe of "dark matter" and permeated with mysterious "dark energy", so our own microcosmic being, quickening in the womb, is enveloped by the dark matter and dark energy of our ancestral inheritance."
(Ronnberg 2010, 100)_***11***

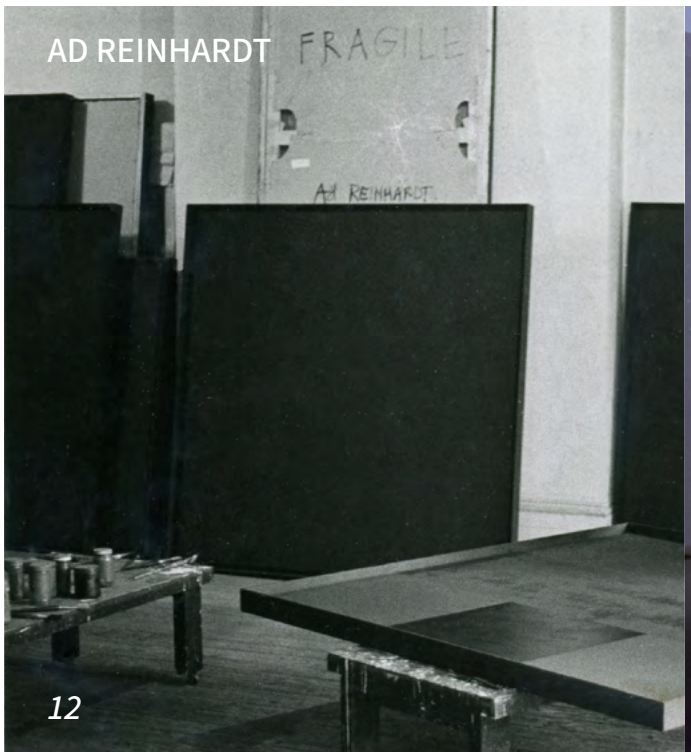
◊ **DARKNESS** *IN* Symbolism of darkness, Primordial Chaos, Maori creation myth, the dark matter theory, Ad Reinhardt's Work

◊ **ART AND SCIENCE** *IN* Sensory deprivations, empirical context creation, interdisciplinarity, James Turrell's work

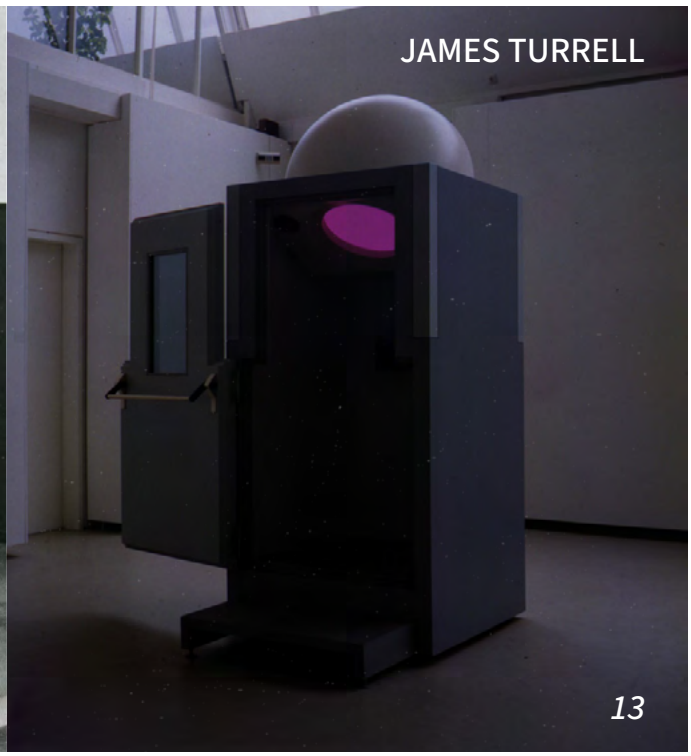
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PRIORITY TOPICS IN PRACTICAL RESEARCH:



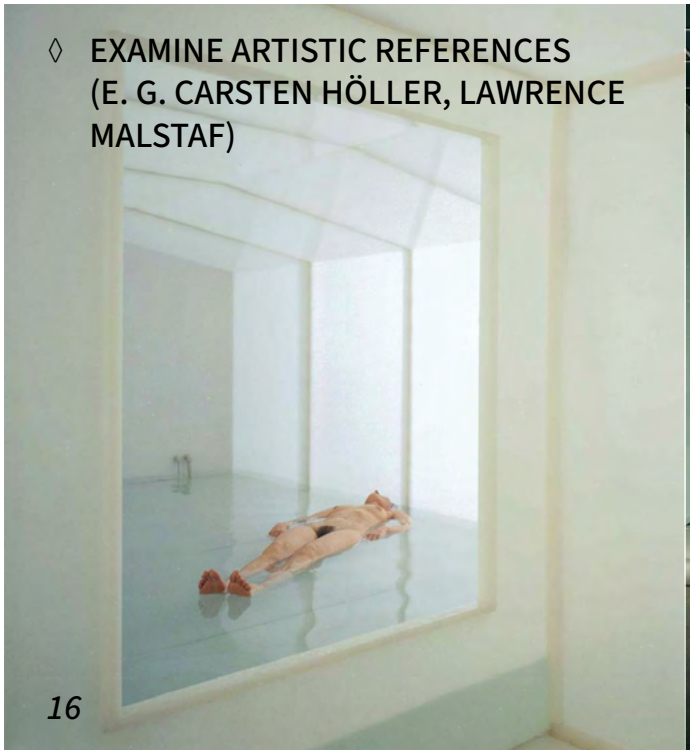
◊ SENSORY DEPRIVATION
◊ PERCEPTUAL EXTENSION

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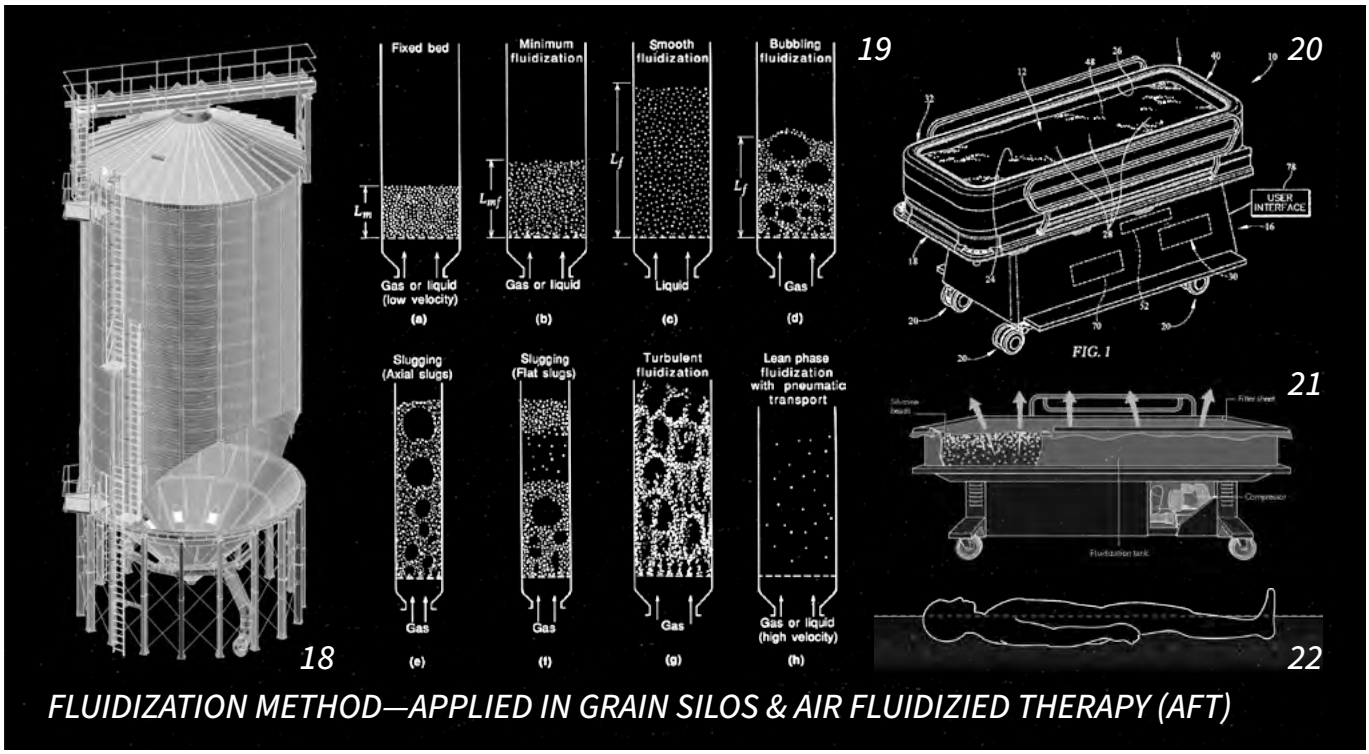
◊ EXAMINE ARTISTIC REFERENCES (E. G. CARSTEN HÖLLER, LAWRENCE MALSTAF)



16



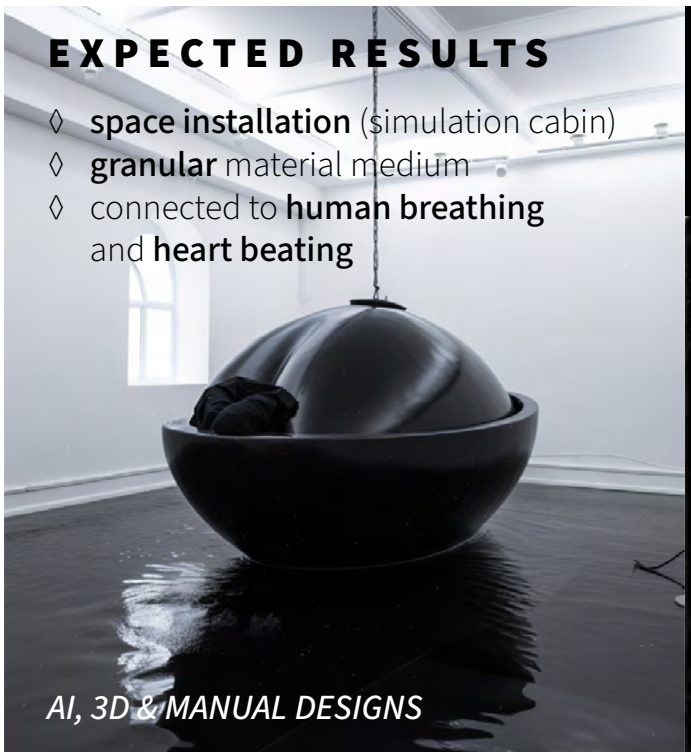
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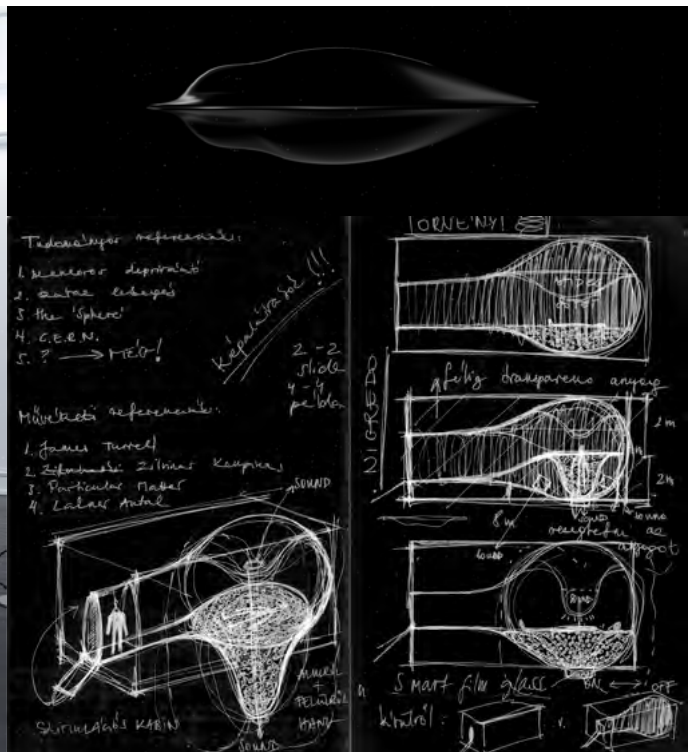
FLUIDIZATION METHOD—APPLIED IN GRAIN SILOS & AIR FLUIDIZIED THERAPY (AFT)

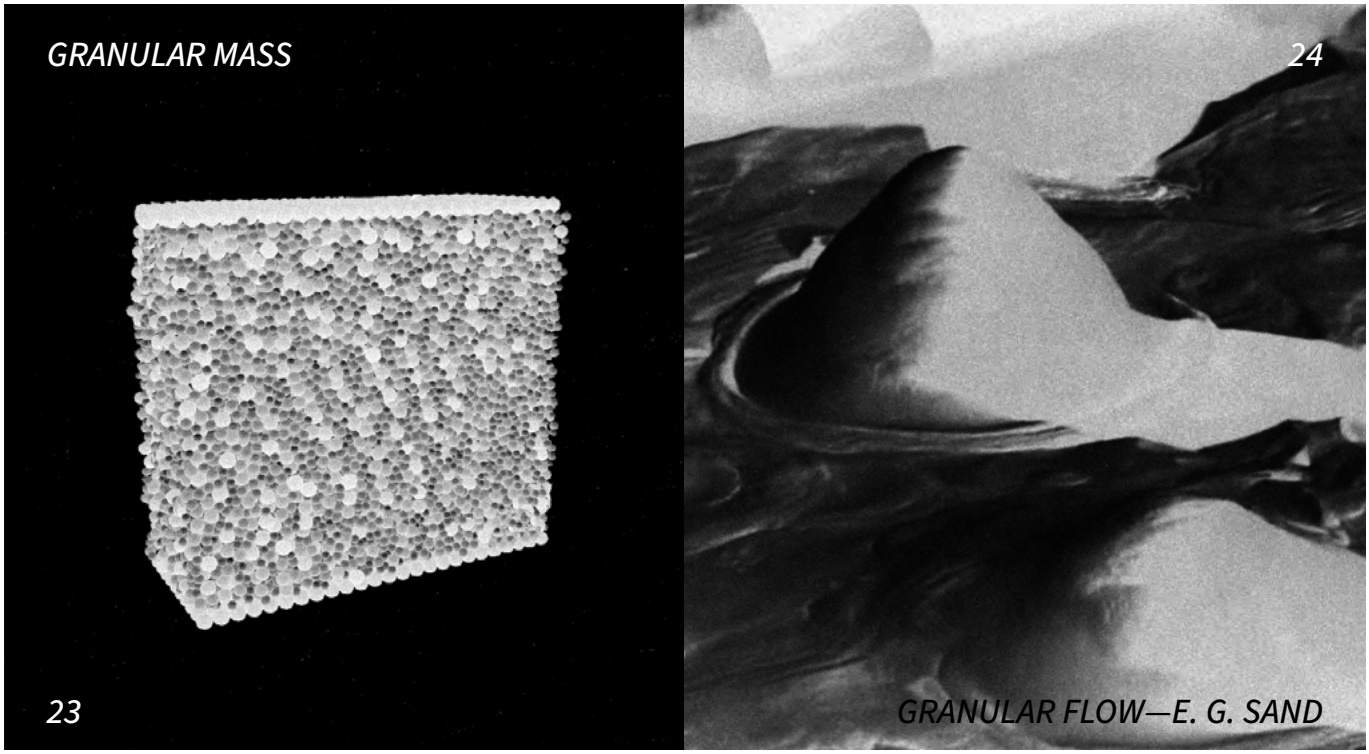
EXPECTED RESULTS

- **space installation** (simulation cabin)
- **granular** material medium
- connected to **human breathing** and **heart beating**



AI, 3D & MANUAL DESIGNS

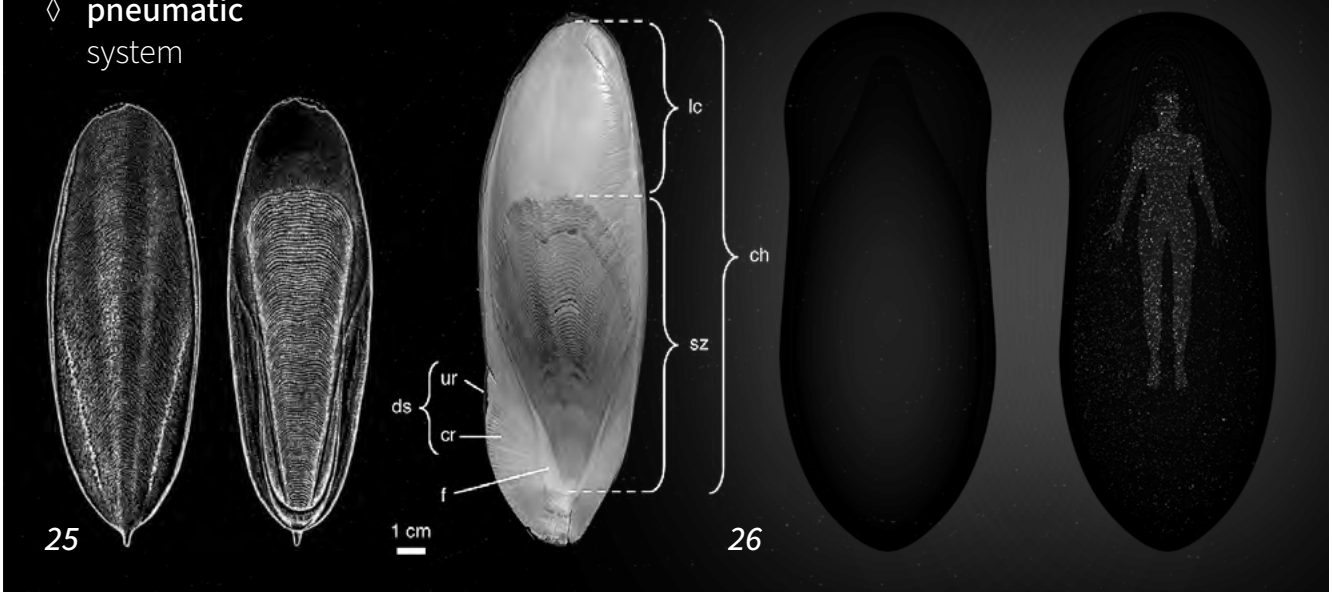




FORMAL INSPIRATION: *"We are not contained within an invisible, rigid scaffolding: we are immersed in a gigantic, flexible mollusc (the metaphor is Einstein's)."*

◊ **mollusc** form (Rovelli 2016, 59)

◊ **pneumatic** system



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P/REFERENCES OF DESIGN

PRACTICING ORDINARY SPECULATIONS: MUNDANE PROTOTYPES FOR MORE-THAN-HUMAN COHABITATION.

Antonio Bernacchi[a], Alicia Lazzaroni*[a]

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DOI: 10.63442/CAOW9497

KEYWORDS | MORE-THAN-HUMAN COHABITATION, DIY, CO-CREATION, ORDINARY

ABSTRACT | In titling a book about the work of their architecture practice, “It’s small, it rains inside, and there’s ants,” F. Soriano and D. Palacios (original title “Es pequeño, llueve dentro y hay hormigas,” 2000) somehow provocatively hinted at a question at the very core of the discipline, which concerns the inclusion or, more often, exclusion of bodies and substances that were not welcome in architecture’s modernist conception of space. The cohabitation and coexistence with a wide range of non-humans is a relevant sphere for exploration, where techniques of speculative design can be very instrumental. This paper elaborates on these ideas through a critical overview of the conception, development, and dissemination of a project of speculative prototyping originally developed by the authors in Denmark for an exhibition on the topic held in 2022 in Berlin.

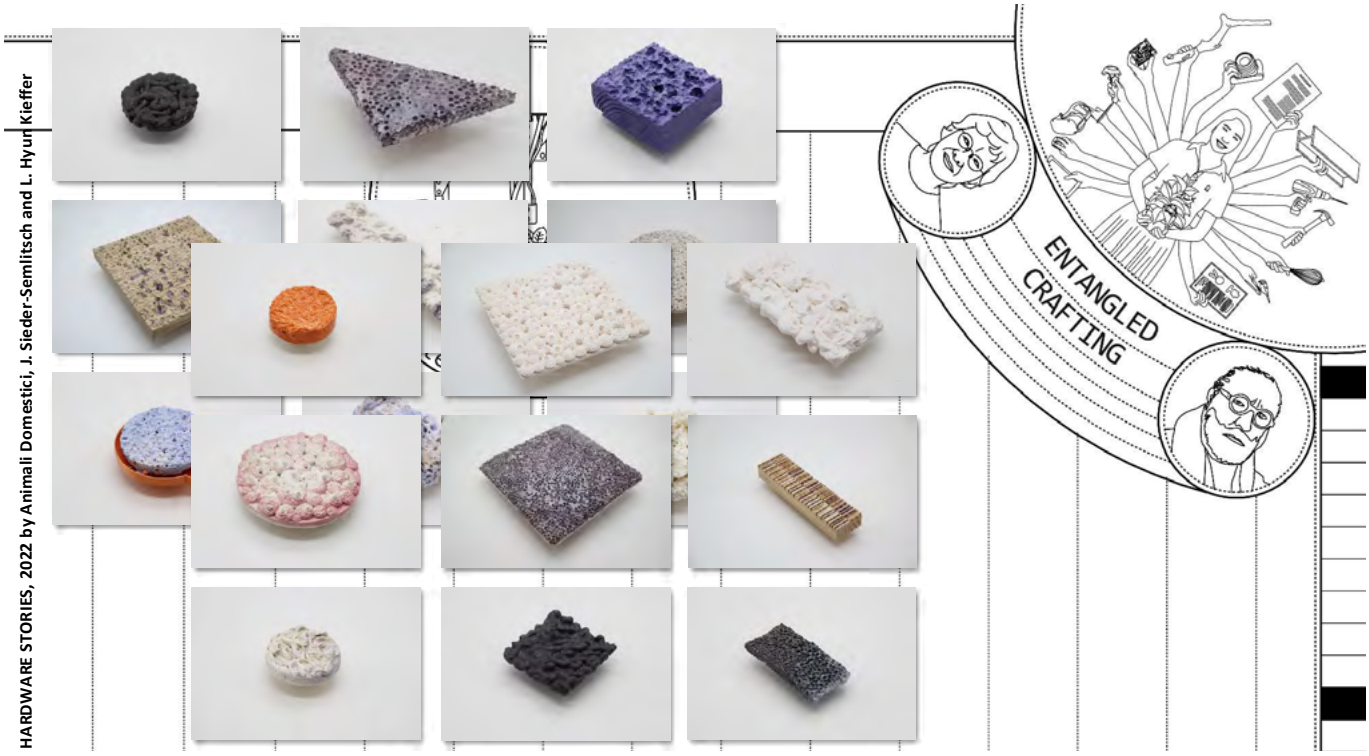
The project attempted to incorporate more-than-human perspectives through speculations grounded on different sources, from academic research to practical tips and hacks gathered from the web. “Hardware Stories” is a prototype of a floor, constituted by a patchwork of DIY-crafted tiles of different materials, textures, and geometry, which respond to the very diverse needs and spatial understandings of different beings, from African snails to small spiders, like barn funnel weavers.

The specificity of the Danish context, which often hosts crafting communities that exchange knowledge and experiments among friends and neighbours, shifted the perspective from a more conventional DIY to notions of Do-it-together (DIT) or Do-it-with-others (DIWO), allowing to extend of the speculation beyond an individual creative endeavor, as a form of “shared care” and collective co-creation. Manufacturing the tiles together over a long period, in weekends and marginal moments, the authors attempted to “practice” the speculation themselves first-hand, incorporating it into the sphere of the familiar and the ordinary.

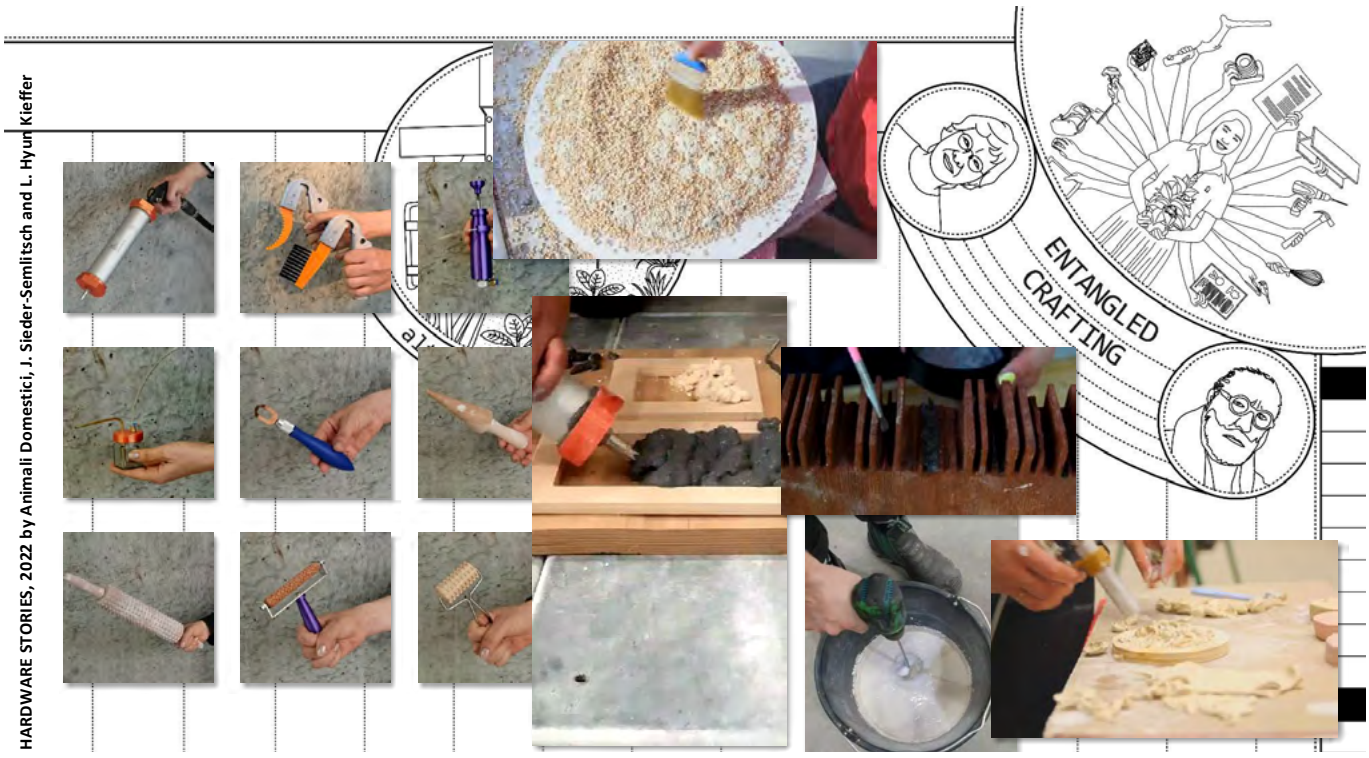
To articulate methodological reflections through comparative assessment, the project is contextualized within a broader inquiry on more-than-human coexistence by the authors through previous and successive explorations.

Three other projects of speculative prototyping are recalled, in that sense, and briefly introduced for comparison through the description of material sourcing, properties, manufacturing processes, testing, and installation: a festival pavilion with artificial vegetation made of e-waste used as perching spots for dragonflies (exhibited at Venice Biennale in 2021); a set of construction details for hosting insects and mosses on the envelope of ordinary houses (exhibited at Seoul Architecture Biennale in 2020); and a second chapter of the floor project with drywall of stacked recycled bricks with soil substrate.

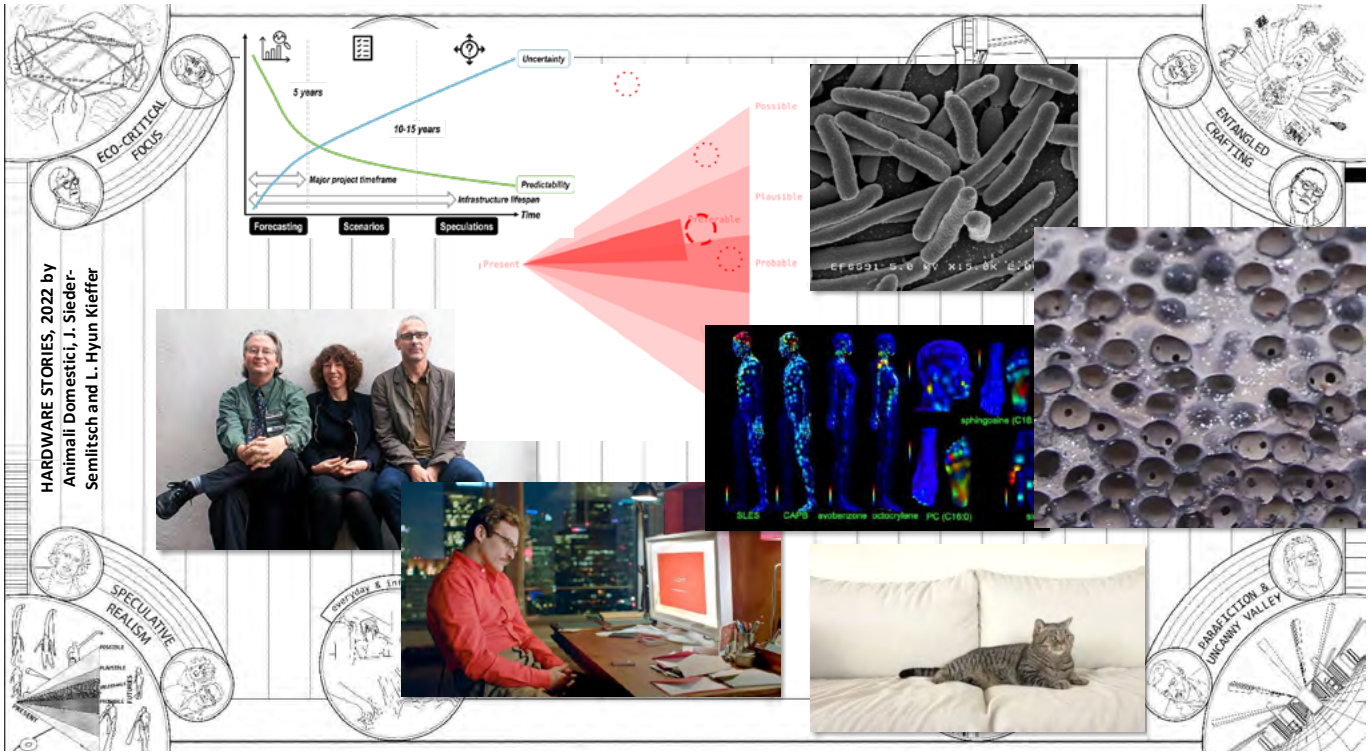

ECO-CRITICAL FOCUS
ENTANGLED CRAFTING
SPECULATIVE REALISM
PARAFICTION & UNCANNY VALLEY
HARDWARE STORIES, 2022
by Animali Domestici, Jakob Sieder-Semlitsch and Lynn Hyun Kieffer


HARDWARE STORIES, 2022 by Animali Domestici, J. Sieder-Semlitsch and L. Hyun Kieffer
ENTANGLED CRAFTING


HARDWARE STORIES, 2022 by Animali Domestici, J. Sieder-Semlitsch and L. Hyun Kieffer
WORKWEAR.
TÅLER ALT.
BASTA.
STARK
PROFESSIONELT
UDSTYR.
TJEK PRISEN
596.-
PARAFICTION &
UNCANNY VALLEY

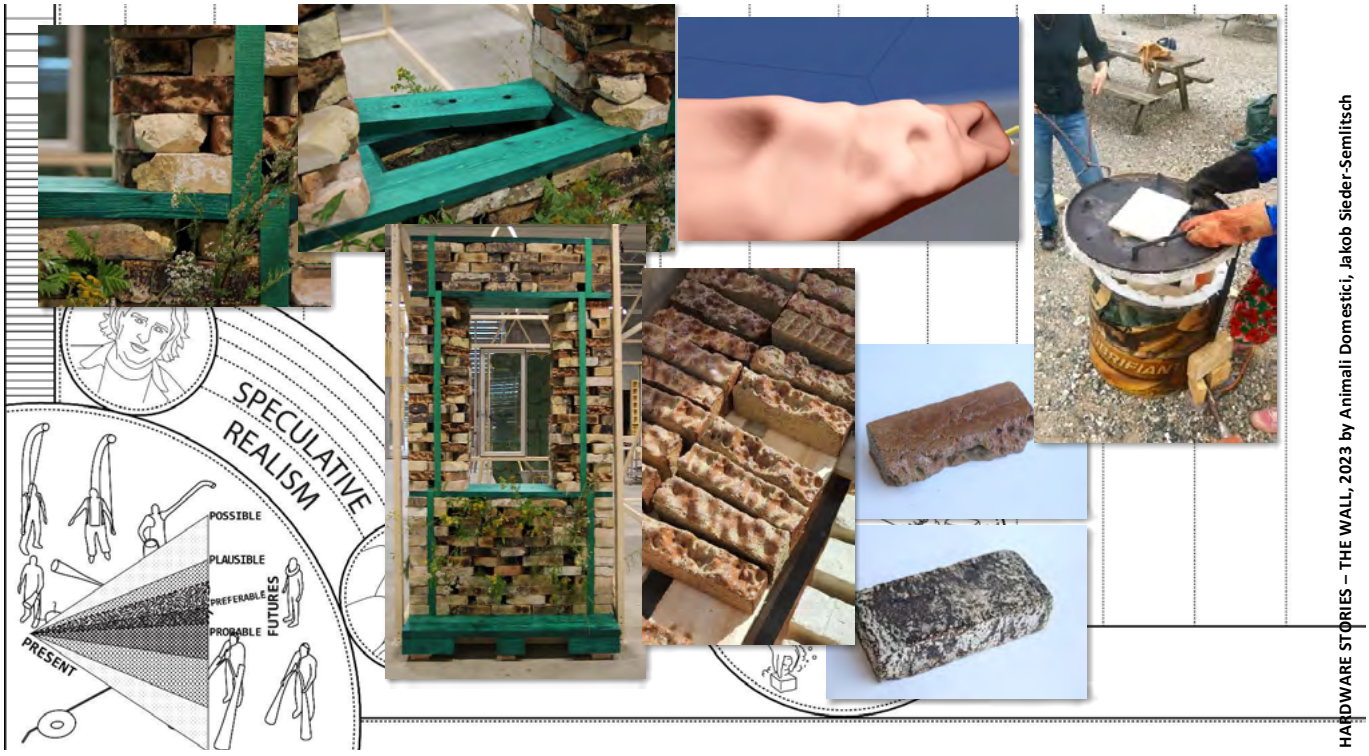

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ENTANGLED
CRAFTING


HARDWARE STORIES, 2022 by Animali Domestici, J. Sieder-Semlitsch and L. Hyun Kieffer
ENTANGLED CRAFTING

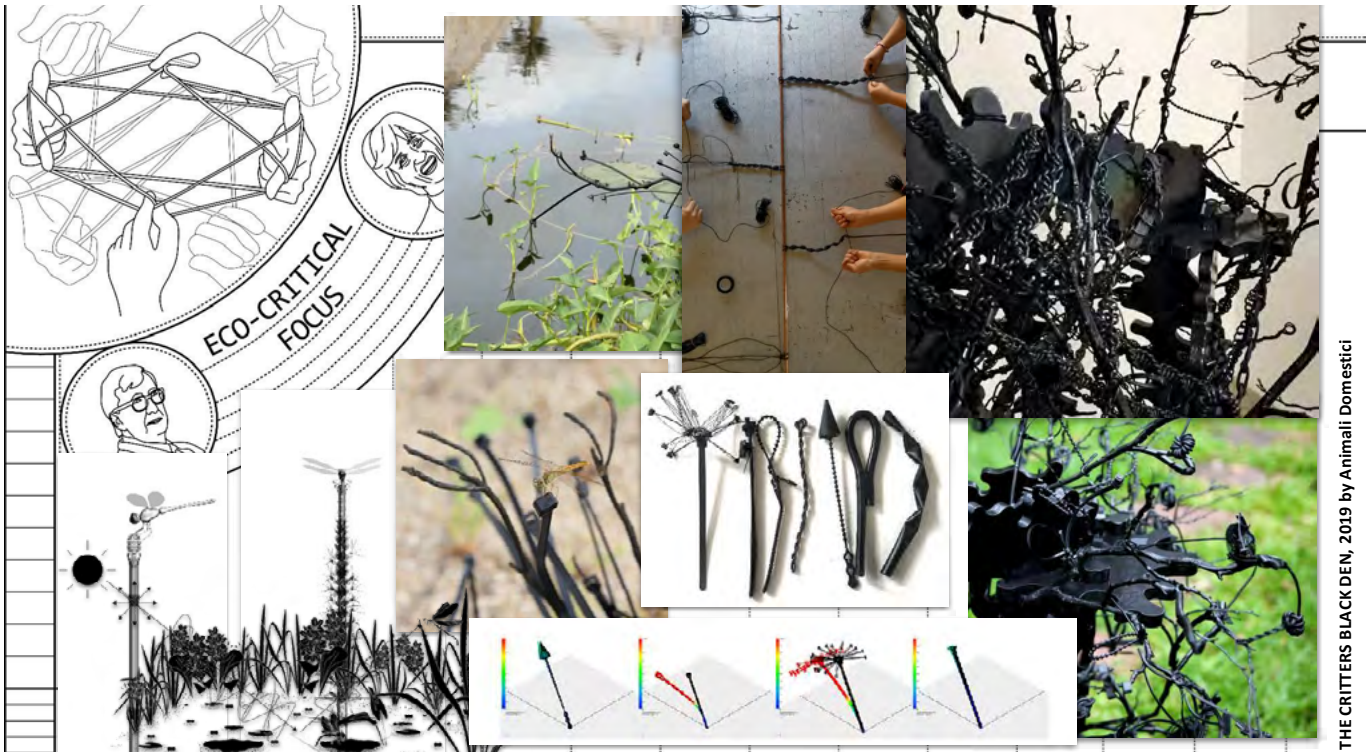

HARDWARE STORIES, 2022 by Animali Domestici, J. Sieder-Semlitsch and L. Hyun Kieffer
ECO-CRITICAL FOCUS
Uncertainty
5 years
10-15 years
Predictability
Major project timeframe
Infrastructure lifespan
Time
Forecasting
Scenarios
Speculations
Present
Possible
Plausible
Probable
ENTANGLED CRAFTING
SPECULATIVE REALISM
PARAFICTION & UNCANNY VALLEY



HARDWARE STORIES, 2022 by Animali Domestici, J. Sieder-Semlitsch and L. Hyun Kieffer



HARDWARE STORIES – THE WALL, 2023 by Animali Domestici, Jakob Sieder-Semlitsch



THE CRITTERS BLACK DEN, 2019 by Animali Domestici

P/REFERENCES OF DESIGN

ECOLOGICAL SPECULATIONS – PLANETARY FUTURES FROM GLOBAL SPECIES MOVEMENTS.

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* hello@sophiefalkeis.com

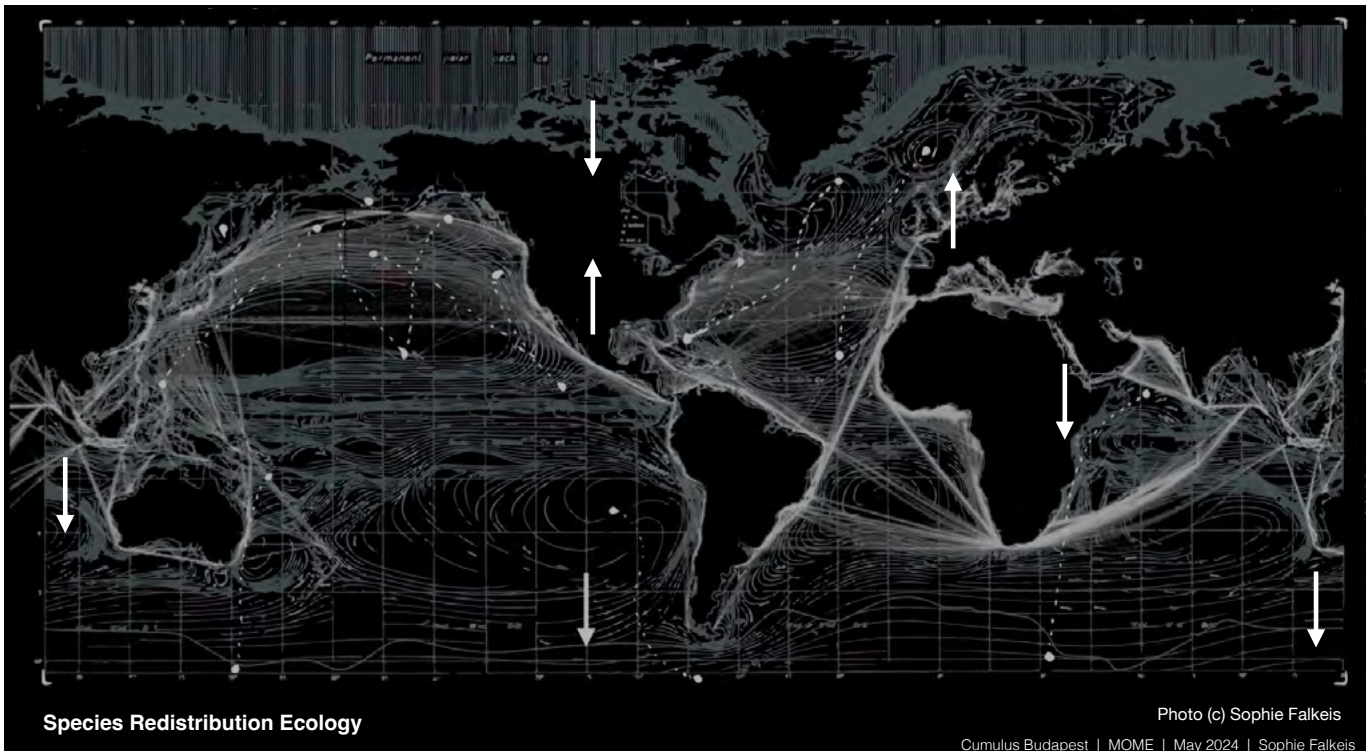
DOI: 10.63442/KYYQ6472

KEYWORDS | SPECIES REDISTRIBUTION ECOLOGY, MULTI-SPECIES SOCIETIES, (ECO)SYSTEM ENTANGLEMENT

ABSTRACT | We are currently experiencing a global redistribution of life on Earth, with species shifting their habitats in response to climate change. This creates novel species interactions, as species that have evolved in isolation from one another come into contact for the first time (’first encounters’). Envisioning possible impacts on ecosystems, this talk discusses how speculative design projects explore this state of liminality through the generation of future scenarios.

In an increasingly complex world, understanding planetary inter-species dependencies and anticipating futures will be key to developing ways of living together on this planet as a multi-species society. In this process, the craft of speculation serves as an axis to explore potential futures since other futures become possible as soon as they become imaginable. Working with a spectrum of possible futures rather than predicting one singular path aims at developing ways of living in a rapidly changing, connected world and how to navigate uncertainty.

Combining “Anticipatory Ecology“ with “Speculative Design, “three of my recent works will be featured in this talk: the immersive walk-in installation *First Encounters,* the digital platform *The Encounters Lab,* and the interactive exhibition *Turning the Ecological Gears.* Investigating cascading ecological effects, these projects unravel complexity in interactive immersive installation settings. Transforming empirical facts into emotional realities through visual storytelling makes scientific research tangible and accessible to a non-scientific audience. Exploring multiple possible futures by highlighting the entanglements between natural and human systems communicates views on ecological responsibility and conveys a sense of agency.



What happens if two species
that never interacted before
are now going to encounter -
due to anthropogenically changed
climatic circumstances?

Cumulus Budapest | MOME | May 2024 | Sophie Falkeis



First Encounters (c) Sophie Falkeis

Cumulus Budapest | MOME | May 2024 | Sophie Falkeis

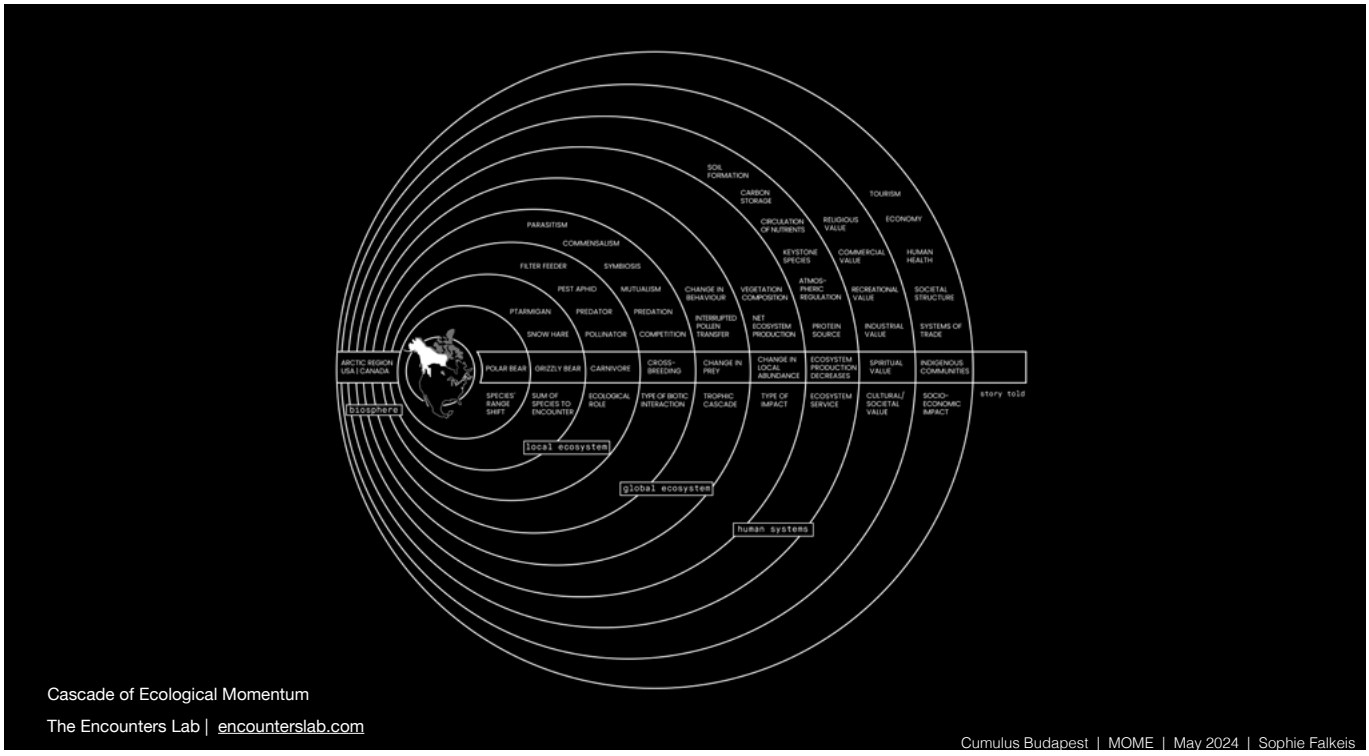
Anticipatory Ecology meets Speculative Design

Cumulus Budapest | MOME | May 2024 | Sophie Falkeis



First Encounters | Kornhausforum Bern, CH
(c) Sophie Falkeis

Cumulus Budapest | MOME | May 2024 | Sophie Falkeis



Cascade of Ecological Momentum
The Encounters Lab | encounterslab.com

Cumulus Budapest | MOME | May 2024 | Sophie Falkeis



Turning the Ecological Gears (c) Sophie Falkeis

Cumulus Budapest | MOME | May 2024 | Sophie Falkeis

Other futures become possible as soon as they become imaginable

Cumulus Budapest | MOME | May 2024 | Sophie Falkeis

P/REFERENCES OF DESIGN

DXT—DIGITAL EXPERIENCE THEATRE: EXPLORING POST-HUMANIST DIGITAL PRODUCT DESIGN THROUGH AI AND SPECULATIVE IMAGERY.

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DOI: 10.63442/SITT4866

KEYWORDS | HUMAN-COMPUTER INTERACTION (HCI), POSTHUMAN DESIGN, SPECULATIVE DESIGN, IDEATION TOOL, ARTIFICIAL INTELLIGENCE (AI) IMAGERY

ABSTRACT | The Digital Experience Theatre (DXT) is metaphorically characterised as a rubber band ideation tool, stretching from dystopias to micro-utopias. The ideation tool is supported by a website (https://dxt.cargo.site/) with resources for the DXT workshop focusing on developing post-humanist UX/UI design concepts.

The tool is characterised by a step-by-step method inspired by Augusto Boal's Theatre of the Oppressed (TO) (Boal 2019), which, in turn, is influenced by Paulo Freire's Pedagogy of the Oppressed (Freire 2014). Freire's pedagogical proposal can be summarised as a process of critical awareness of a social reality that allows the subject to intervene in it and, ultimately, their emancipation from relations of oppression. Boal also developed his methodology based on the desire to contribute to resolving social and political problems and thought of theatre as a tool available to everyone to develop strategies to escape oppressive relationships.

Within the DXT workshop, participants, who are also users of digital products, are regarded as vulnerable human beings who must contend with many useless and redundant solutions that place them in similar oppressive situations. The DXT, adopting the TO methodology, seeks to develop innovative solutions to represent a new post-humanist design paradigm (Wakkary 2021). An ideation tool with the capacity to operate with creatives in digital technologies to contribute to the transformation of unsustainable realities by promoting the creation of digital products that are simultaneously community-based and humanity-centred (Norman 2023).

The DXT workshop lasts 120 minutes maximum, starting with a brief explanation of the main theories that inform the research, the ideation tool concept, and the workshop mechanics. It's planned for 10 to 20 participant designers and creatives of digital products in groups of between 5 and 10 elements. Each group has two conductor-designers, and the remaining elements are the antagonist-designers. The goal is to discuss dystopian ideas (Featherstone 2017, Claeys 2016) and create a set of AI-based images (Manovich 2023). The starting point is selecting a problem based on threats to the earth's ecology or societal needs affecting a community (Norman 2023). The workshop has nine steps; the conductor-designers lead the process and begin the dialogue with the antagonist designers by creating the first AI image (step one). In turn, the antagonist designers confront the conductor designer's ideas with AI imagery iterations. After the nine steps, where both sides explore and deepen dystopian ideas through dialogue and participation, the whole group must propose digital design solutions that tackle the same problem that raised the discussion.

The DXT workshop can happen in a space with a good Wi-Fi connection, where groups can gather in conversation; each participant needs to bring their laptop; at the beginning of the workshop, a few AI tools for image creation are recommended.

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António Gorgel Pinto is a professor at IADE Universidade Europeia, researcher and designer whose primary interest is questioning social, technological, and ecological issues through a transdisciplinary and participatory art and design practice with vulnerable communities.

Paula Reaes Pinto is a professor at the School of the Arts, University of Évora, researcher, and visual artist developing a participatory art and design practice whose projects with at-risk rural communities revolve around the interconnectedness of place, labor, and culture.

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P/REFERENCES OF DESIGN

EMOLAB: A SPECULATIVE DESIGN APPROACH TO EMOTIONAL BIOPOLITICS IN A CAPITALIST WORLD WITH PERFORMATIVE TECHNIQUES.

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KEYWORDS | SPECULATIVE DESIGN, EMOTIONS AS A COMMODITY, BIOPOLITICAL POWER, CRITICAL PERFORMATIVE DISCOURSE ANALYSIS

ABSTRACT | “EmoLab: A Speculative Design Approach to Emotional Biopolitics in a Capitalist World with Performative Techniques” introduces a 180-minute workshop leveraging speculative design to explore the commodification of emotions in capitalist societies, incorporating performative techniques to allow participants to engage with various emotional states physically and psychologically. The workshop aims to dissect and critique the biopolitical mechanisms governing emotions, fostering immersive learning to challenge and rethink these dynamics. Through a sequence of activities, attendees will examine and embody emotions as both tradable commodities and pivotal elements of speculative capitalist scenarios, moving from abstract understanding to tangible experience and creative speculation. The journey encompasses discovery, consumption, manipulation, and the creative reimagining of emotional dynamics, employing props and performative methods to facilitate a comprehensive exploration. “EmoLab” seeks to inspire innovative thought and speculative solutions regarding emotional engagement and governance, challenging participants to envision alternative futures beyond current biopolitical and capitalist constraints.

1. Description

"EmoLab" presents a unique 180-minute workshop employing speculative design principles to delve into the commodification and manipulation of emotions within capitalist structures. This workshop integrates performative techniques, offering participants a safe space to embody and experience a range of emotional states. The aim is to critically examine and challenge current biopolitical power structures, using emotions as a lens and tool for immersive and experiential learning.

Participants will actively engage in a series of thoughtfully curated activities designed to examine, produce, and secure emotional states. These activities will not only allow participants to experience emotions as tradable and disposable entities within a speculative framework but also enable them to embody these emotions. The workshop is structured to facilitate a transformational journey, moving from conceptual understanding to physical embodiment, and ultimately to the creation of new perspectives on emotional commodification.

Utilizing the potential of speculative design, the workshop invites participants to challenge existing paradigms and envision alternative futures. This approach emphasizes the importance of performative embodiment, enabling participants to physically and emotionally experience the impact of various emotional dynamics set within speculative capitalist scenarios.

Phase 1 - Discovery of Emotions (30 minutes): This phase introduces participants to emotions as experienced in different societal constructs. Through physical movements, role-playing, and performative enactments, they explore how various biopolitical structures might influence emotional expression and perception.

Phase 2 - Consumption of Emotions (45 minutes): Here, participants engage in interactive games and improvisational activities to simulate the commodification of emotions in speculative societies. These activities, enriched with performative techniques, highlight the fluidity and tradability of emotions in different power structures.

Phase 3 - Manipulation and Control (45 minutes): Focusing on the manipulation of emotions under diverse biopolitical regimes, this phase involves exercises in empathy, mindfulness, emotional regulation, and performative reenactments. Participants gain insights into the control and manipulation of emotions in various speculative contexts.

Phase 4 - Reflection and Creation (45 minutes): In this culminating phase, participants use their experiences to develop speculative design projects. These projects aim to reimagine the role of emotions in society, challenging existing biopolitical structures and proposing alternative models for emotional engagement and governance.

The workshop employs a variety of materials and techniques, such as emotion cards, physical props, and tools for project development. This diverse range of resources ensures a comprehensive exploration of emotional dynamics in a speculative design context.

In summary, "EmoLab" offers a profound speculative design journey into the complex interplay of emotions, biopolitics, and capitalist structures, enriched with performative techniques. This workshop is an invitation to question, reimagine, and redesign the way emotions are understood and utilized in our society. Participants are encouraged to think innovatively and critically, using the workshop as a platform to consider how alternative realities and embodied experiences can inform and transform our understanding of emotional commodification and the role of biopolitical power in shaping emotional landscapes.

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Katarzyna Anosowicz is a Service Designer, UX Researcher, and Innovation Strategist with a distinctive track record in developing the CX division at Player, a leading VOD platform by TVN Warner Bros Discovery. She established Player Labs and has successfully led over 100 projects that deepened immersive narrative experiences in streaming films and series. In her capacity at WBD in Poland, she conducts workshops aimed at redefining future media landscapes, prioritizing community engagement, and ecosystemic sensitivity. Educated with a Master's in Psychology and a postgraduate in Service Design from SWPS Warsaw, she is now completing a Master's in Theatre Studies at the Academy of Theatre in Warsaw, focusing on performative arts. Additionally, she is a recent graduate of Futures Studies & Strategic Foresight at the Copenhagen Institute for Futures Studies and will soon be lecturing on Critical Futures, Speculative Design, and Design Fiction at SWPS University. Her work is dedicated to advancing social and gender justice through speculative design. She is constantly developing her methodology centered around feminist futures, performative presence, and speculative design, aimed at analyzing spatiotemporal ecologies and fostering social and environmental change. Her passion lies in existential, total, and post-feminist theatre. She resides and works in Berlin.

P/REFERENCES OF DESIGN

DECENTERING DESIGN PERSPECTIVES THROUGH THE UMWELT.

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KEYWORDS | UMWELT, MORE-THAN-HUMAN, SPECULATIVE DESIGN, DESIGN

ABSTRACT | This workshop is designed to explore the inherent subjectiveness of our being-in-the world. Drawing inspiration from thinkers like Bridle, Ingold, Tsing and others, it centers around von Uexküll's concept of Umwelt. In the workshop, participants will creatively explore the concept of Umwelt as a speculative design instrument through our proposed design methodology, Decentering Design. The exercises in this methodology help redefine the human position in relation to the more-than-human community through hands on observation and mapping exercises.

1. Workshop Theme

This workshop is designed to explore the inherent subjectiveness of our being-in-the world. Drawing inspiration from thinkers like Bridle, Ingold, Tsing and others, it centers around von Uexküll's concept of Umwelt (von Uexküll, 1992). Umwelt illuminates the unique way each individual perceives and interacts with their environment, emphasizing the deep connection between a being's sensory perceptions, their agency, and the world they inhabit (Lee, 2018). This results in the acknowledgement of multiple existing worlds, opening up a non-anthropocentric pluralistic worldview. Authors like Bird Rose (Rose, 2012) and others (Tsing, 2015; van Dooren, 2014) show us that we must understand these multiple worlds not as separate but as interwoven multispecies, highly localized communities.

During this workshop, participants will creatively explore the concept of Umwelt as a speculative design instrument. Our design methodology, Decentering Design, helps redefine the human position in relation to the more-than-human community in spatial design processes. The participants will explore the surrounding environment of the campus location through a series of observation and mapping exercises. The activities are divided into two main exercises. The first focuses on exploring Umwelt as a world formed by the individual's various sensory experiences within their own biological range. The second exercise challenges participants to creatively and visually approximate the Umwelt of another-than-human being. This two-fold process allows for speculations on the intersections or overlaps between human and other-than-human Umwelten, fostering a decentered experience and encouraging us to find meeting grounds to engage with the more-than-human community.

This hands-on workshop will culminate in the creation of mappings that act as artefacts, capturing and communicating the participants' experiences to a wider audience. In the concluding part of the workshop, there will be a round-table discussion where participants will share their insights and artefacts, leading to a rich exchange of ideas.

2. Target Audience

This workshop targets designers, architects and landscape architects interested in decentering their own perspective towards more-than-human perspectives. The workshop is focused on the plurality of perceptions of the environment.

3. Expected Number of Participants

We aim to organize the workshop for 10 to 20 participants.

4. Agenda

The workshop will take 180 minutes.

- Introduction 1 — 5 min
- Part 1 - observation — 60 min
- Part 2 - ideation — 60 min
- Reflection — 45 min

5. Equipment Needed

We require drawing paper, a minimum of 15 A4 sheets + 1 A4 cardboard per participant. Colored pencils, drawing pencils and wax crayons adapted to the number of participants. Two roles of paper tape. Additionally, we need an indoor space with easy access to the outdoor environment surrounding the building. In the room, we need chairs for all participants and the possibility of presenting the drawings made (tables or an empty wall).

If the campus environment has a green management plan or species inventory (planting and animals) this would help us in our preparation.

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Giliam Ganzevles, graduated as design researcher at the ArtEZ Institute of Arts Arnhem (NL) with an interest in global (non)-spatial phenomena and their regulations. He currently is part of Futures through Design, a research center at KASK Conservatory HOGENT Howest (BE), and is a researcher at Howest University for Applied Sciences. He employs design thinking and speculative design to explore the more-than-human and artificial intelligence. His latest research is focused on collaborative design initiatives with the More-than-Human community, particularly through their Decentering Design project.

Bert De Roo is an architect and researcher. He is part of Futures through Design, a research center at KASK Conservatory HOGENT Howest, School of Arts. He has been working as a freelance architect on self-initiated projects and for multiple Ghent-based architectural offices. He has executed research in the field of historic estates and more-than-human design and is currently exploring strategies for designers to become part of a socio-ecological community and act with care in the context of their research lab Decentering Design.

Glenn Deliège is a philosopher and works as researcher at Futures through Design, a research center KASK Conservatory HOGENT Howest, School of Arts. After having finished his PhD in environmental philosophy (KULeuven), working on the value structure of present-day preservation practices, he was involved in research surrounding the ethical aspects of rewilding (RU Nijmegen) and the role of animals in urban spatial design (HOGENT), a research line which has now broadened into a collaborative and transdisciplinary research project surrounding the role of design in a more-than-human-world: Decentering Design. Next to his research activities, he is also a lecturer, teaching landscape philosophy, animal studies and spatial design for/with animals, among other things.

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P/REFERENCES OF DESIGN

THE PROMISE AND PROBLEM OF PROVOCATION.

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KEYWORDS | DISCURSIVE DESIGN, CRITICAL DESIGN, SPECULATIVE DESIGN, DESIGN ETHICS, PROVOCATION

ABSTRACT

Topic

The goal of this Format X session is to unpack, problematize, and assert the ethical, emotional, and instrumental implications and principles involved when provocation is leveraged within discursive design practice. The session involves individual, group, and guided engagements with a few foundational and practical frameworks, as well as some provocative object examples to prompt participants' re-designs that are intentionally below, above, and right on "the" ethical "line." These re-designs operate as talk-tools to generate fundamental questions and considerations for design practitioners—a forum where what-if, how-to, WTF, and LMAO duke it out.

Provocation/the strangely familiar/dissonance has been identified as a common element across forms of discursive design (e.g., critical design, speculative design, design fiction). These practices leverage ambiguity and edginess in order to get audiences to reflect on substantive, consequential topics that may run counter to entrenched perceptions and beliefs. In challenging the status quo, designers employ more radical approaches and even justify tricking their audiences—for their own "intellectual good." As discursive designs are often presented as merely speculative, as not fully functioning, and as visualized thought experiments, they can be seen as "safe" and unburdened from the common mechanisms and attitudes toward ethical oversight. "How harmful could a well-intentioned design idea actually be?" "The potential rewards certainly outweigh any risks regarding such an important issue, no?"

Despite the prevalence of such provocation over the last quarter of a century, little has been written or established about its qualities when used in professional practice. More so than advocating for explicit codes of conduct and standards of practice, vigorous, longitudinal, reflective, inclusive, and consensual debate is posited as a responsible path forward for (our) community of practice. This session is an attempt at what part of that debate might involve or help to evolve

Timing, Tools, Infrastructure, Rules

The 90-minute session involves participants receiving a packet upon entering, which includes a brief description of an ethical framework, such as the Moral Foundations Theory (Haidt and Graham), and provocative real-world artifact examples, as well as purely speculative examples. Also included are simple evaluation forms that allow for judgments along moral dimensions. Participants' responses are shared, surfacing main points of friction, and participants are placed in groups based upon their responses. Groups are guided to determine criteria to support the re-design of one of the artifact examples. Teams are assisted through cards inspired by the "dissonance dimensions" described in the discursive design literature. These artifacts are shared with the entire group with emphasis upon where an ethical "line" might be placed within one or more contexts. Rules for this discussion encourage voicing positions both openly and through anonymized written responses. Beyond the goal of robust, facilitated debate based upon specific cases and contexts, a list of the most relevant questions and principled alternatives is an expected outcome.

THE POWER OF IMMERSION

P/REFERENCES OF DESIGN

CUMULUS BUDAPEST 2024



THE POWER OF IMMERSION: NAVIGATING INTERDISCIPLINARY REALITIES.

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In the past decade, a paradigm shift has emerged, with individuals actively curating their immersive experiences. These experiential landscapes play a pivotal role in shaping people's identities and their distinctiveness as individuals. Within this evolving landscape, a central inquiry emerges: How do extrinsic influences subtly impact our daily lives, encompassing domains such as urban planning and digital immersive design? Do these influences exert persuasive forces that guide our decision-making processes in the construction of immersive experiences? And what is the role of various User Experience (UX) solutions in facilitating this phenomenon?

In this track, we aimed to uncover the references of the designers of immersive environments, whether it's a theme park or VR environment.

Many of the submissions (from various regions) tackled the role of cultural heritage and how these artifacts can be integrated in order to create compelling immersive environments in museum settings. With the rise of attention to the visitors' experience, these approaches can indicate the aftermath of the 'experience economy'

– in terms of how every experience should be re-framed as a unique encounter. These approaches help us to compare them to the traditional formats of experiencing and knowledge sharing in exhibition settings and to establish new ways of experiencing from various corners of the world. The heritage of graphic design also offers interesting approaches in several papers on designing interactions, which can lead to novel interpretations of the media of prints. The role of creating meaningful and smooth interactions is also discussed in methodologically accurate papers that dive into UX experience design and its assessment.

The prevalence of VR and new technologies are an integral part of the field of immersion studies, therefore many of the papers also describe in detail their theoretical or human-computer interaction related assessments of VR applications. Virtual architecture and the theories arising from analog approaches also have a strong influence on the field of study of immersive environments and experience design. The various free time activities and how they are influenced by our everyday technological objects were discussed (in the paper assessing musical interfaces used for jogging) (Küçükkurt & Bahar, 2024). The question of embodiment and the presence of the viewer reminds us that the specificity of immersive phenomena relies on the viewer too – as the body of the viewer should be 'integrated into the experience.' This offers a sense of uncertainty to these experiences. This uncertainty could be calculated sometimes with engineering punctuality, but this gives the sense of losing agency, while the experiencers of these aim to have the illusion of agency. This inner tension is the specificity of immersive media experiences, that operate with interactive interfaces, and that always offer new pathways for researchers to reframe their power.

The papers in this section offer novel modalities to re-interpret immersive and interactive environments and present case studies and best practices that can be used by creators and theoreticians in their future work.

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PERFORMING CULTURAL HERITAGE: ADVANCING URBAN EXPLORATION THROUGH AUDIO-VISUAL-IMMERSIVE JOURNEYS ON PUBLIC TRANSPORT AND CINEMATIC VIRTUAL REALITY.

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KEYWORDS | LIVING HERITAGE, PERFORMING CULTURAL HERITAGE, SPECULATIVE PERSPECTIVE, THE POWER OF IMMERSION, FUTURE OF CINEMA

ABSTRACT | This paper explores the concept of 'Living Heritage / Performative Cultural Heritage,' an innovative series of audio-visual-immersive experiences designed to transcend conventional temporal and spatial boundaries. These experiences, accessible through curated apps and cinematic virtual reality (cine-VR), emerge as multifaceted tools, intertwining research, artistic practice, education, and cultural heritage preservation. The initiatives strive to foster awareness, observe sites, protect the environment, and celebrate cultural diversity by employing critical spatial practices. Inspired by the rich traditions of Situationists International, methods of urban practices assume a sensory, poetic, and critical stance in the exploration of urban spaces to stimulate curiosity, offering an alternative approach to experiencing the city.

The paper positions these projects within this theoretical framework, underscoring the imperative to deconstruct and reinterpret the city as a linguistic syntax. Furthermore, the initiatives leverage cutting-edge technologies such as VR/AR/XR, exemplifying how immersive experiences can enrich daily routines. Focused on public transport, particularly buses, and trains, as narrative protagonists, these initiatives carry histories and stories across historically significant sites.

The paper concludes by presenting two work-in-progress art-based research projects. Beyond their immediate impact, these projects endure within designated transport systems, remaining accessible to multiple users over time. The paper underscores the environmental impact, portraying the projects as instruments for promoting the knowledge of the effects of Climate Change, aligning with the vision of the United Nations' SDG, both in social and ecological dimensions. In conclusion, 'Performing Cultural Heritage' advocates for new formats in audio-visual-immersive experiences in public transport and cinematic virtual reality, presenting a compelling case for enriching urban exploration, cultural appreciation, and sustainable urban development, considering human and non-human actors and agency.

1. Introduction: Performing Cultural Heritage

As a means of expressing Cultural Heritage, we have conceived a storytelling format—a sensory and visual experience for public transport and cinematic virtual reality. This initiative aims to facilitate a process of speculative fabulation, encouraging the reconsideration and reimagining of the past, present, and future. The format presents two journeys: an audio-visual experience accessible through an app and a cinematic VR experience—a 360-degree video. These aim to guide users in discovering untold stories at familiar locations along public transport routes.

While commuting by train or bus, individuals can engage with the project via a QR code, allowing them to hear stories from the natural and cultural communities along the route. The interactive art project is equipped with augmented reality (AR) and virtual reality (VR) technologies to create an immersive experience, enabling local stories to be perceived through hearing, sight, and other senses. Based on the hypothesis that the fusion of art and technology can collectively enhance social life and serve as a tool to animate alternative sensory experiences during public transportation, a cultural heritage is performed and re-enacted. Through the narrative conveyed by various ethnicities, communities, and social groups, coupled with advancements in virtual technologies, intangible cultural heritage can be identified, interpreted, and reintroduced into contemporary consciousness.

The two projects, *Regional Express* and *Hidden Treasure Walks*, offer tours, guide participants through scenic landscapes, and collect memories of local communities. Heritage, in this sense, comes alive, as the projects facilitate engagement with the past, present, and future, enabling imaginative exploration through speculative perspectives. In her book *Staying with the Trouble* (2016), Donna Haraway advocates for a new form of storytelling, whether ‘story’ is political, social, gendered, or centred on non-human entities. To understand how our environment has shaped our society, and to address the challenges of our troubled times, characterized by a planet and ecosystem in crisis, we must provoke thought and imagine alternative ways of existence and coexistence. We have adopted Haraway's Speculative Fabulation as a method to learn and unlearn the world within worlds together. Old belief systems are reinterpreted, and new ways of living are proposed. Our format aims to stimulate new thinking through collective speculative storytelling, shifting the perspective from the human to the non-human, exploring the realms of objects, animals, and nature in a new relationship to seek answers to the pressing questions of our times, and guide us to a positive future.

2. An Audio/Visual Experience



Figure 1. Poster of *Regional Express* with QR Code that leads to the audio/visual experience on the train. Design: Ortner etc.

2.1 The Future of Cinema

The audio/visual experience is a new way of seeing and experiencing a possibly new form of cinema. The future of cinema is marked by a shift from traditional cinema to its possible future in image storytelling across a wide range of new and experimental practices. Accompanied by recent technological progress and the changing media landscape, the future cinema could transform from simply viewing a movie to participating in, engaging in, and sharing the image content, creating an alternative sensory mode. This future scenario also indicates an exit from a movie theatre to different places—to any public place or to virtual reality through VR goggles—which determines the social relation of viewing communities. The evolution of moving image storytelling changes ways of seeing and living.

A medium is not only a support or a device. A medium is also a cultural form, defined above all by how it makes us think about the world and others, through the type of experience it activates (Casetti, 2016). Audio/visual experience extends the idea of cinema, not only as an immersion in visual and sonic experience but as a confrontation with reality, enabled by technology. To gain experience also means to produce knowledge. “The re-elaboration of this reality into knowledge (to gain experience), and the capacity to manage this and similar relations with reality (to have experience)” (Casetti, 2016). Thus, the idea or function of cinema merges with site-specific theatre, playing with the cinematic space—auditory to VR environments—and merging it with the actual sites of the performance. The train or bus and the cityscape become a hybrid or speculative space between the stage, auditorium, “architectural space,” and “cinematic space,” as described by Éric Rohmer (1989, 19-29). Instead of the classic architectural setting of the black box that directs the audience’s focus on the screen and cinematic space, the immersive audio/visual experience is closer to Gropius’s idea of total theatre, with minimal physical interventions into the actual setting of the train or bus ride, which is also the site of the VR screening.



Figure 2. *Regional Express*, Cinematic Virtual Reality Shoot, Set-photo, Saline Ebensee and Dachstein Giant Ice Caves. Photo: Pia Fronia.

2.2 The Power of Immersion

In the contemporary landscape of entertainment and cultural experiences, immersion has emerged as a powerful tool to engage audiences on a profound level. Spanning a wide range of media, from audio-visual narratives to virtual reality (VR) experiences, immersive encounters offer unique opportunities for engagement and exploration. Whether through traditional cinema or cutting-edge VR technology,

audiences can immerse themselves in rich storytelling environments that evoke emotions and provoke thought. While the surging popularity of VR has spotlighted immersive storytelling, its foundational concepts have been explored in immersive theatre, which stands as a unique fusion of performance art and audience interaction, blurring the lines between fiction and reality by integrating actors into the audience space. Tracing its roots back to ancient performance arts such as tableaux vivant, ancient Greek theatre, and Commedia dell'Arte, immersive theatre invites spectators to become active participants in the narrative. This approach breaks down the traditional barriers of spectatorship, heightening the sense of immersion and fostering deeper connections with the performance. Therefore, the technology of virtual reality represents a paradigm shift in immersive technology, offering unparalleled levels of immersion and interaction. The spherical filmic space of cinematic VR extends traditional filmmaking techniques, providing audiences with a panoramic view of the narrative. By enveloping viewers in a 360-degree environment, VR enhances immersion, allowing for exploration from multiple perspectives.

In their *Handbook on the Economics of Cultural Heritage* (2013), Rizzo and Mignosa underscore the importance of narrative involvement in virtual heritage applications, arguing that the sense of presence in a virtual environment hinges not solely on immersion but also on narrative engagement. By seamlessly weaving compelling stories into immersive experiences, creators can enhance audience engagement and foster emotional connections.

Narrative engagement serves as a conduit between the present and the past, enabling audiences to connect with historical events and figures on a personal level. Through interaction with characters and narratives, audiences develop empathy and become more invested in the historical context, fostering a deeper appreciation of cultural heritage. Additionally, narrative engagement facilitates emotional connections with cultural artefacts and historical narratives, eliciting understanding and empathy from audiences.

By presenting stories from diverse perspectives and incorporating multiple voices and experiences, immersive heritage applications foster a more inclusive and nuanced understanding of history. Users are encouraged to reflect on the complexities of the past, promoting empathy, tolerance, and cross-cultural understanding. Moreover, narrative engagement stimulates curiosity and critical thinking, prompting users to question assumptions, challenge stereotypes, and seek out new perspectives. By presenting historical events and figures in an interactive format, immersive heritage applications encourage users to think critically about the past and its relevance to the present. This process of inquiry fosters intellectual engagement and empowers users to become active participants in the interpretation and preservation of cultural heritage. The power of immersion affects the boundaries of reality, transporting audiences into the realm of the imaginative real. By prioritizing narrative involvement and embracing new technologies, immersive experiences stimulate audience engagement and deliver meaningful connections with cultural heritage and storytelling.

2.3 Sensorial, Poetic, and Critical Urban Practices

The study of urban landscapes has become a widely debated and interdisciplinary area of great interest in urban studies, architecture, philosophy, and art theory in general. Many spatial theories have emerged since Michel Foucault’s introduction of heterotopias, places of difference, in 1967. Among them, Henri Lefebvre’s concept of spatial practice, involves regenerating sets of relations within each social formation. (Lefebvre 1974) The purpose of such spatial practice is to create knowledge of spaces and to observe sites, ecological environments, and transcultural experiences. This method of approaching the city through a sensory, poetic, and critical instrument has a considerable tradition developed by critical thinkers and artists such as Guy Debord, Michel de Certeau, and Georges Perec. They developed concepts for poetic urban space interventions, proposing practices of psycho-geography that demystify contemporary capitalist society through experimental research modes, including walking and field excursion techniques (Debord, 1995).

Moreover, Michel de Certeau's *The Practice of Everyday Life* (1980) and Georges Perec's *Species of Spaces* (1974) are practical manuals on walking in the city following psycho-geographical maps. The most pertinent aspect is that walking, as a form of bodily engagement, opens a cognitive process that can be researched. Observing, sensing, writing, and recording what is seen and heard in the streets encourage us to walk with an awareness of our environment, as humans not only yield social relations and use values but also produce their own social space—a process Lefebvre would term spatial practice. This invites us to experience the city differently, to change our perspectives and venture off the beaten track, in order to sense something new (Lefebvre, 1991). The urban space can, therefore, be full of markers that hold stories to be explored. These might be street signs, cemeteries, flood-level marks, shops, or buildings, the names of landmarks, or simply advertisements that refer to a specific area. Collecting and unfolding these fragments and building upon them are methods learnt from the Situationists. By writing the city like a text, listening to it like a symphony, and observing people's movements as choreographies, we create sensory poetic narratives. We not only walk through the city to reach a destination or consume the urban space but also become active through the 'speech act' or 'performative speech', reprocessing everyday activity to create our own discipline (J. L. Austin, 1962, 6-8). The re-process investigates a new audio/visual cinematic language based on associative principles through sounds, lyrics, and textual materials that resonate with the senses. The investigation of the city does not aim at descriptive proof but an enactment of its poetics. To capture the subliminal textures of a society through the performative is to rewrite individual stories as a poetic device according to bodily experience.

The concepts of Situationists International are still highly relevant today and are reflected in books and art projects. A recent publication by the NTUCCA Centre for Contemporary Art, *The Impossibility of Mapping (Urban Asia)* (2020), draws on these ideas. It focuses on Asia through the ideas of William S.W. Lim (1932-2023), a key architect, urbanist, and cultural figure in Singapore who attempted to imagine a future in Asia. Lim understands a city as a stage for various forms of life that interact, mix, and mingle with each other, and calls for poets and artists to celebrate an imaginative, visionary city.

To sum up, these spatial theories aim to acquire new knowledge about the world through creative, participatory, and critical spatial practice. These artistic methods continue to be influential for many artists, architects, and urbanists alike. Most pertinent here is the work of Janet Cardiff and George Bures Miller. They have created a series of audio and video walks since the 1990s using iPod, headphones, and recording guides to create narratives along the routes. The artists arranged actual backgrounds in their staged visual or audio settings to create real-life stories, blending the fictional with the actual as a 'physical cinema.' Since Cardiff & Miller, other immersive virtual guided tours have been developed. Most remarkable is the recently developed app *Seven Grams* (2021) by Karim Ben Khelifa, mixing augmented reality and animation into a journalistic project for people to understand the human and natural resources it costs to produce their smartphone. It takes them on a visual journey to Congo, Africa. The award-winning project successfully combines communication technologies to highlight the ultra-realism of the human plight of colonialism.

In the context of post-colonial thinking, counter-mapping practices can function as a tool for sharing reversal-narratives of a place, re-inscribing marginalized histories into the urban fabric and historiography of a place. African American thinker and activist bell hooks describes the margin as a space of radical openness (hooks, 15-23). Through listening to, collecting, and sharing the personal stories and perspectives on a place or the memories of significant spaces for marginalized groups within a city, this sensory experience can form an archipelago of counter-archives, becoming visible and tangible, reaching across times and neighbourhoods, and connecting the participants or audience of this audio and visual experience with people from various eras and walks of life within the complex urban structures. This practice of counter-mapping and remapping also has the potential to resist dominant narratives of entire regions with an ignored, and paradoxical history, like that of the Salzkammergut in rural Austria since the First World War.

In recent years, participatory and co-creative design and speculative research have contributed to a paradigm shift in spatial production in cities around the world, as municipalities have incorporated participatory processes into their urban agendas to re-centre the margins and create more liveable

environments in public spaces, combating heat islands and pollution (Fitz & Krasny, 2019). These co-creative strategies, like counter-mapping, can potentially increase visibility and agency, which the following case studies in Salzkammergut and Singapore aim to achieve through interviews, storytelling and filmmaking, as an epistemological shift to producing a new set of spatial relations.

3. Art-Based Research: Journeys on Public Transport in Cinematic Virtual Reality

3.1 *Regional Express* — A Project for the European Capital of Culture Bad Ischl - Salzkammergut 2024

Regional Express has been conceived as 'living heritage/performative cultural heritage,' by an international and interdisciplinary team of artists who developed a programme accessible on the train via QR Code. The audio-visual-sensory experience will be available via the Salzkammergut Culture Guide, the official app of *Salzkammergut 2024*, and through curated programmes, thus extending the temporal and spatial boundaries of the European Capital of Culture Bad Ischl Salzkammergut 2024. It offers two journeys: a primarily acoustic experience available on the train, and a cinematic VR experience accessed through VR Goggles.

Regional Express takes its name from the local train that traverses and connects the region. The train serves as the central protagonist in the narrative of the *Regional Express*. This journey carries the history and stories of various places and people. Private narratives intertwine with significant historical events. The immersive expedition extends across countryside, cities, lakes, and mountains. Nature acts as the backdrop that links personal stories with contemporary history and global transformations. The train provides the opportunity to retreat into the heart of the Salzkammergut, into the mountains, investigating the essence of its history. Simultaneously, it travels in the present moment, thus bridging the present and the past. The narratives extend beyond facts; fictions and fabulations establish a speculative connection between people and nature.

The acoustic sensory experience of space is paramount. The train resembles a journey into multi-sensory worlds that reveal the complexities of the region. The stories are always established in relation to different perspectives of narratives, nature, the mountains' inner worlds, the lake's depths, the mine, and its past. The train transports characters such as the conductor, commuters, and students who travel the route daily. The stories are unexpected, have never been told like this before, thus casting a new perspective on a pluralistic society that is itself in flux. The train in motion is a narrator, the passengers time travellers, and the passing landscape acts as the cinema. The moving train carries various connotations—it symbolizes the train of history, serves as the narrative's setting, acts as a heuristic device, and stands as an emblem of industrial progress (Michelson, 2020, p. 17). One of the earliest films made by the Lumiere Brothers, *The Arrival of the Train* (1895) marks the advent of modernity, showcasing the speed and progress of new technology. While rail transport opened the possibility of travel and tourism, facilitating trade and transport, it also played a role in the 20th century's horrors of fascism, serving as the infrastructure of the Holocaust, transporting millions of people across Europe to their fateful destinations.

In *Regional Express*, the train journey through Salzkammergut carries the narrative. The history of the landscape unfolds in a cinematic experience. Passengers become time travellers, journeying from the prehistory to the present of the region. The scenario writer Petra Ardai conducted a series of interviews with locals and collected their stories about the history and present of the landscape, nature and people, and the relations between them. This oral history and documentary material is embedded in a fictional framework of a conversation between three non-human entities: the Train, the Traunsee Mermaid, and the Mountain.

The main aim is not to reconstruct history in every detail but to build a bridge between the lives of the audience now and the historical past so that one can intimately relate to it. The researchers, including the directors, writers, actors, and participants, collectively use fictional narrative elements to change dominant perspectives and allow for a deeper understanding and personal engagement with the stories of the interviews and the region's history. While these characters—the Train, the Mountain, and the Mermaid—are non-human, they care deeply about humans and their well-being. They address passengers in human language, asking questions and offering reflections on the historical dilemmas raised in the story linked to the landscape that passes by. The Train, driven by time, faithfully follows its track; the Mountain stands firm and unmoving, and the Mermaid, a product of myths and sagas, exists only in the imagination. These characters, with their distinctive qualities, offer parallels to the people of Salzkammergut, who often perceived as traditional, steadfast, dutiful, and resistant to change. At the same time, the non-human characters' fictional view of humans creates a subversive distance and space for counter-observation, while fostering a sense of connection to the past, with stories of landscape and nature or people who lived long ago, performing a critique on anthropocentrism cantered on non-human entities. The train functions as a 'mobile monument' of modernity offering a speculative perspective of histories, where the narrative is inscribed into the historical textuality of the passing landscape along with the roaring engine. (McCalman, I. & Pickering, P., 2010, 61)

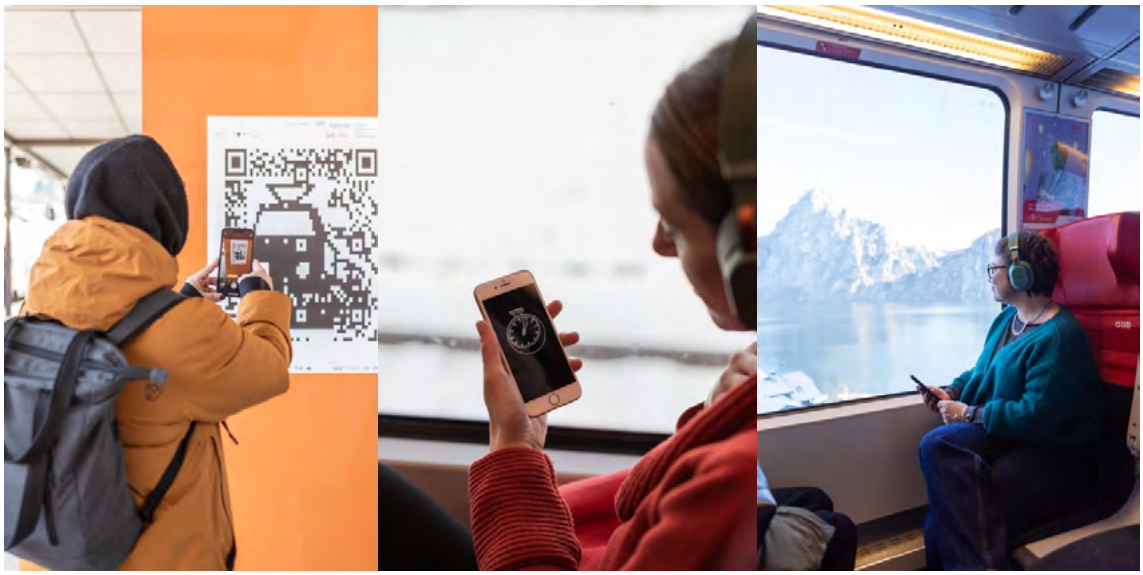


Figure 3. *Regional Express* Excursion on the train between Gmunden and Ebensee, Austria. Photo: Pia Fronia.

The train journey is divided into five excursions, each chapter corresponding to a specific segment of landscape and inhabitants. Excursion 1 [Gmunden to Ebensee] tells the story of the relationship of humans to landscape and how the existing landscape was shaped by the sea, the movement of the glacier, and the temperature changes that have created the characteristics of the landscape and its salt mines. Excursion 2 [Ebensee to Bad Ischl] focuses on the relationship between humans. The former concentration camp in Ebensee leaves its mark on the landscape, with visible traces of the stone mine shaping the mountain. Positioned along the train tracks, the concentration camp in Ebensee served as the arrival point for prisoners. Between 1943 and 1945, nearly 11,000 innocent prisoners, predominantly juveniles, perished in the camp. The segment is intercut with interviews with Wolfgang Quatember, the director of the Zeitgeschichte Museum in Ebensee, and the descendants of the survivors. For the scenario writer Petra Ardai, juxtaposing the landscape's beauty with the horrors that unfolded there was striking. Conversations with Dr. Leo Kuhn, son of the survivor Leo Kuhn, and Silvia Dinhof-Cueto, daughter of the survivor Victor Cueto Espina, shed light on life in the camp and the days of its liberation. Excursion 3 [Bad Ischl to Hallstatt] turns to the relationship of humans with their imagination, unravelling the region's importance for the Austro-Hungarian monarchy that claimed the salt-mine region as their chamber of wealth and commerce. The established and oft-repeated narrative for Bad Ischl, the summer residency of the monarchy, centres

on the House of Habsburg. To open up and change the perspective, the narrative of the *Regional Express* focuses on female leaders in society and trailblazers in their respective roles: the mayor of Bad Ischl, the director of the Saline, the Salt Factory, and Women's Forum Ebensee. Excursion 4 [Hallstatt to Bad Aussee] assembles quotes from the interviewees about the definition of Heimat and what it means for them. Excursion 5 is a soundtrack composed by Estonian composer Sander Saarmets; the way back from Bad Aussee to Gmunden allows for reflection, doing nothing, looking out of the window, immersing oneself in the train's speed, and viewing the passing landscape as cinematic experience.

The Salzkammergut is a region of tourism. In recent years, Hallstatt having been awarded World Heritage Site status in 1997, and has become as a premier tourist destination. Notably, its portrayal as a filming location in a Korean soap opera and replication as a real estate project in China, depicted in Ella Raidel's film *Double Happiness* (2014), ignited an influx of Asian tourism. During the peak season, as many as 10,000 tourists, predominantly from Asia, descend upon the town. This surge has proven overwhelming for the small community of 800 residents, sparking numerous controversies. In response, the European Capital of Culture Salzkammergut 2024 has undertaken several initiatives addressing tourism, aiming to devise strategies for sustainable tourism and the preservation of cultural traditions and architectural heritage.

As Konrad Wallinger from Kino Ebensee observes in an interview with Petra Ardai and Marlene Rutzendorfer for *Regional Express*:

> "The Salzkammergut, in the future, will resemble a colossal museum. It will be akin to a natural history museum where you gaze at the mountains, questioning their reality, whether the water is warm or cold, and if you can dip your finger in it. You purchase a train ticket in Attnang-Puchheim, traverse the landscape, examining whether there are still cows or anything else, and everything will come with a price tag. It is evolving into a colossal Disneyland, a scenario that, while not particularly prophetic, seems highly plausible." (Wallinger & Müllegger, Kino Ebensee).

Although tourism is economically vital for the region, over-tourism has become a major problem. The Salzkammergut is a closed mountain region with specific flora, fauna, and culture. Embracing new and diverse influences that challenge traditional values is essential for the region's future. However, opening up to change and admitting new values into the region's traditional monocultural social fabric, without losing its original character or damaging what should be preserved is a delicate process. The cultural and artistic programmes of the European Capital of Culture are a facilitating and mediating platform to find answers or at least to bring movement to solving the dilemma. Art, the power of imagination, can open dialogues and show ways of envisioning more inclusive and sustainable futures.

The second journey in *Regional Express*, premiering in August 2024, offers a similarly engaged outlook on the region but as seen from the future. The Cinematic VR (360-degree video) directed by Ella Raidel is an associative and sensory fabulation on the above topics. In this story, a female Asian explorer, like a retro-futuristic astronaut, returns from the future to the uninhabited Salzkammergut, which can no longer be physically visited but can only be experienced through virtual reality. The time traveller explores salt and ice caves, mountains, and landscapes. Her journey is narrated through a sequence of still images showing frozen sites and stills no longer inhabited by humans. She enters the image through a time machine that catapults her into different scenarios. Taking Chris Marker, *La Jetée* (1962) as an example for narrating a science fiction plot through still images, the explorer encounters these still images as relics from a former time; as if wandering through a museum, she transcends the epochs. Eventually, she discovers the last button shop, an actually existing shop in the town, and its owner, but this too may appear to be a dream, as no other traces of humans are present. As an example of "virtual dark tourism" this VR journey recognizes the audience as a tourist in an alien environment that takes place only in imagination and through immersive sensory stimulation as sound, images, and smell, a synchroneity of catastrophic here and now. (McDaniel, 2018, p.3)

As the explorer moves around, the audience feels, touches, and senses her surroundings along with her. The cinematic virtual reality allows us to immerse audiences in the scenario. The audio design is crucial; we

can hear and listen to the surroundings in a 360-degree range. Sonic inputs direct our gaze in different directions; when someone calls us from behind, we may turn our head and body to move towards the sensation. As we don't have legs in cinematic virtual reality, our bodies do not touch the ground as is they were ghosts and the sensation of floating can enhance the science fiction plot, though to some viewers this might create a sense of motion sickness.

To the audience, the landscape and scenarios appear like a museum, with the present time frozen and waiting to be accessed from the future. This experience draws inspiration from the film *La Jetée* (1962), in which a group of scientists undertake experiments in time travel at the apocalyptical time. As we advance with VR technology, VR goggles have a similar function as the time machine, helping us transcend our reality and immerse into the audio-visual surroundings to the uncertain temporal space. As technology lineally progresses, a messianic future scenario should be inscribed with the presence of our physicality in a virtual environment, where we could immerse ourselves *as if* we were in dream, or we could wake up in the horrific reality that humans have caused.

3.2 *Hidden Treasure Walks* — A Virtual Immersive Cultural Experience in Singapore

Hidden Treasure Walks (2024-2027) is a consecutive art-based research project that aims to offer an immersive experience from an app and a 360-degree video, to guide its users to the discovery of untold stories at familiar locations along a bus route in Singapore. Using the field findings from the natural and cultural communities around the route, the research combines AR and VR technology to produce an immersive experience for local stories to be heard, seen, and sensed. Besides raising awareness of Singapore's rich cultural heritage, *Hidden Treasure Walks* exceeds traditional artistic limits and operates on the hypothesis that art and technology can jointly improve social life. Through the narrative of sensory inputs, voiced by different ethnicities, communities, and social groups and equipped with new virtual technologies, the intangible cultural heritage of hidden treasures in Singapore can be identified, interpreted, and reintroduced. The project explores the city as a spatial practice, reflecting our subjective relation to ecological, urban, social, and cultural surroundings. The virtual experience will take place on a bus and through a walking tour of nearby communities and historical sites, exemplifying how art can engage the mind, and deepen our understanding of what lurks in everyday environments. The research project aims to deliver two results: (1) An app called Hidden Treasure Walks (HTW), designed as a GPS-triggered audiovisual guide. The soundscape is the main carrier of the narrative experience, punctuated by a site-specific AR experience. (2) A series of 360-degree videos based on the same story. Participants can access cinematic virtual reality episodes without being on the site.

This project creates awareness of Singapore's cultural heritage and collective social memory through diverse oral traditions and stories that foster local identities. The sense of belonging is inspired by awareness through connecting art, technology, and people. The app, HTW, will be developed in such a way that it serves as a walking guide, immersive storytelling experience, and an educational resource on cultural heritage. The app works through GPS location markers and will prompt related content to the user. This interdisciplinary project—including field knowledge from architecture, urban studies, sociology, and cultural history—combines art forms such as cinema, theater, music, and communication technology in AR and VR. It aims to document a vanishing past, preserve collective memory, and imagine a possible future of life in Singapore. Through research, communities and social groups of diverse cultural backgrounds will formulate a collective identity for creative and artistic interventions in a fast-changing urban space.

4. Conclusion: The Spatial Practice of Sensing Places

Through performing cultural heritage, these two art-based research projects offer an audio-visual sensory experience in a digital format that allows participants to connect to the unique identity of a place. The main aim is not to reconstruct history in precise detail but to traverse between the past, present, and future, and to offer alternative perspectives that audiences can not only relate to intimately, but also be alarmed to foresee. The storytelling provides an alternative way of seeing and listening to the spaces we inhabit, engaging in an otherworldly experience through cinema and the post-cinema of portable devices. The passing landscape visible from the windows of public transportation offers a supplementary cinematic experience and acts as a real backdrop to the fabricated temporalities of the audio-visual experience, in which participants transcend the present and fully immerse themselves into an imaginary audio/visual landscape of future.

These projects provide an alternative way to explore, walk, and experience the city using highly accessible mobile devices. Instead of acknowledging consumerism, the audio-visual journeys awaken the curiosity of discovering unfamiliar and lesser-known sites. These immersive journeys are, in effect, the spatial practice of remapping our sense of a place, based on the dialectical relation between the imaginary and the fixed reality. Beginning from a familiar place, these journeys carve a path through time, prompting us to discover, decipher and decode the histories and stories of places. Participants become active producers of one's own space, and the spatial practice in turn influences the individual in many ways. Through an approach that marries art and technology, the projects offer many entry points into research, artistic practice, education, and cultural heritage, and are intimately connected to the biosphere of local communities.

Rather than retreading the existing narratives of a space, novel stories of a space are thus told, and fresh modes of experiencing society produce anew the spaces we inhabit, affecting how we perceive a space. By counter-mapping the places that already bear the traces of colonialism, global conflicts, and omnipresent governance, forgotten stories can be reintroduced into the urban fabrics of lives. What Karl Marx said, "The forming of five senses is the labour of the entire history of the world down to the present," can hold true today, through the generation and redistribution of five senses through immersive technology. Individuals and communities can deepen their pride and find their roots in the native land by incorporating stories that were previously ignored or marginalized, never heard or seen, thus recovering more complete histories to be integrated into the virtual present.

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P/REFERENCES OF DESIGN

IMMERSIVE DESIGN THROUGH SYNCHRONIC PROCESSES BETWEEN BODY AND SPACE.

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KEYWORDS | CROSS-MEDIA, CROSS-MODALITY, HAPTIC RHYTHM, HUMAN BODY INTERACTION, SYNCHRONY

ABSTRACT | The diffusion of digital and digitized environments enables the increase of possible readings of space. At the same time, the development of wearable devices enables the body to multichannel interface. The research is inscribed in scientific and design reflection that explores the relationship between digital information and the human body. Through multi-channel modality, the scope of the project can act cross-modality on perception and cross-media on information. Following the development of research on the channel of touch and the technical possibilities related to the development of tactile communication on the body's surface, the research chose to carry out an experiment dedicated to the relationship of this sense with sight. We then introduce the phenomenon of rhythmic synchrony as a perceptual tool for creating a sense of immersion and attention management. After defining the properties of a cross-modal and cross-medial rhythmic signal, two experimental tests were carried out to verify the signal's effectiveness on perception. The test results show that cross-modal rhythmic stimulation has a good ability to direct users' choices. The experimentation lays the foundation for further research in cross-modal synchrony as an element of engaging people and supporting decision-making and attention processes in digital information-dense environments. Subjects' choices to synchrony effects highlights the opportunity for applications designed to increase the connection between the body and the interface in immersive experiences.

1. Introduction

In the contemporary context, in which the presence of digital technologies is becoming increasingly pervasive in real and virtual spaces, the physical and cognitive relationship aspects between the body and artifacts becomes an important element of interaction and communication processes. In this context of transformation, the body in its perceptual and motor complexity increasingly becomes a direct interface to digital services (Zannoni, 2022). The interface body can communicate through bidirectional processes of information exchange with the space it relates to and crosses in the architectures in which it lives in its daily life. These transformative scenarios, in which a pervasive relationship between human and machine emerges, are gradually introducing new design visions that have been identified with the term *Ubiquitous Computing* since the late 1990s (Weiser, 1999). In these, the quality of the relationship between tools and spaces augmented through the integration of digital services often results from the multisensory characteristics of the designed interactive systems. Spaces and devices that offer a digital experience increasingly have quality objectives proportionate to their ability to dialogue with the body using multichannel communication. This is also demonstrated by the fact that the research and market for technologies is increasing year by year and the amount of projects that take into account multisensory aspects in interaction processes. The rapid growth toward the integration of digital technologies in everyday spaces highlights on the one hand the possibilities of hierarchizing more of the information sent to people, and on the other hand it allows for imagining systems capable of making information more accessible. The museum setting is a relevant example on how multichannel information can be articulated by meeting needs related to the perceptual difficulties of categories of users (Eardley, Mineiro, Neves, & Ride, 2016).

An increasing number of digital environments are coming into common use. Examples are places designed for learning complex procedures (Sowndararajan, Wang, & Bowman, 2008) or for the health care setting (Bateni, Carruthers, Mohan, & Pishva, 2024). Frontier of the field that investigates multichanneling in partial or full immersion scenarios is that of e-sports and simulators. These applications aim to reproduce with high quality standards real experiences in controlled and distant spaces. In recent decades, multiple wearable or hand-held devices that integrate haptic perception have been experimented with to simulate real pressor experiences on our bodies. These experiments have been introduced into multiple commercial products becoming an established media channel recognizable by users (Lederman & Klatzky, 2009). The field of gaming and simulation are the most popular commercial vectors of these trends. In support of immersive design, two concepts support reflections on how enabling and emerging technologies should be more investigated from a multisensory perspective: cross-modality and cross-mediality.

We can consider cross-modality in this context as a mechanism through which sensory information is processed and decoded by the brain by exploiting features related to spatial proximity and synchrony (Balconi & Carrera, 2008). The convergence of congruent and simultaneous stimuli between the senses allows for the identification of recursive patterns that the body reads based on its prior experience and in an automatic manner. From the point of view of the design domain, this notion allows us to understand how important it is to consider the design of experience as a system where the body is always involved with all its parts and that any sensory information has repercussions on the entire perceptual and cognitive system.

At the same time, the cross-media introduced in the 1970s in the literature starts from the assumption proposed by Marshall McLuhan (1964), in which media are a translation of ourselves and an extension of our prosthetic system. With respect to this assumption, in relation to the contemporary technological debate, if we consider that most adult people use a smartphone on a daily basis to communicate and connect to the web, it is plausible to argue that these devices are an extension of our body. Media systems thus establish a symbiotic relationship with the body and modify the human perceptual and communicative capacity. Cross-mediality becomes evident in the integration with devices and media from the moment we have "hooked up" to the network and its services, speeding up more and more the processes of communication at a distance (Bauman, 2002) and delegating part of our memory to these devices (Bagnara, 2006; Bannon, 2006; Flusser, 1990). Concerning the evolution of the tools available to humans in the processes of relationship between interactive systems, regardless of whether they are

artifacts or spaces, it becomes crucial to investigate the role of haptics not only from the perspective of perception but in relation to design scenarios in the field of design. When we do not have direct human-machine relationship action mediated by an interface, in many cases the modes of relationship are naturally configured by activating automatic and uncontrolled cognitive processes. Tactile vibration and recognition of pressure rhythms fall into these case histories becoming interesting areas in the development of innovation in both real space design and emerging extended reality (XR) technologies.

2. The Relationship Between Haptic Languages and the Body

The sense of immersion and emotional involvement of people are among the aims of those who design digital or digitized environments. Among the characters that support these goals, multichannel information is an effective tool for hierarchizing content over time and providing feedback that increases the quality of control of the proposed scenario. In digitized environments involving more than one person, the channel of touch shows optimal qualities to increase the sense of immersion and emotional involvement in the experience. Acting on the surface of the body, thanks to an established development of wearable devices (Zeagler, 2017), the touch channel is distinguished by the quietness and invisibility of messages; these allow a high level of privacy to be preserved for the people receiving them (Jones & Sarter, 2008). Finally, the tactile channel, under conditions of sensory disability, can support perception by integrating information on the body surface (Shull & Damian, 2015).

The tactile channel can be used for complex information thanks to the diversity of stimuli it is capable of collecting-pressure, vibration, temperature-and the variations by which the same can be modulated-intensity, frequency, rhythm, pattern, symmetry with the body.

The complexity of haptic languages is further powered by the correspondence of the stimuli delivered with people's previous sensory experience. Indeed, research indicates greater perceived pleasantness in stimuli such as pressure than vibration (Pohl, Brandes, Ngo Quang, & Rohs, 2017), which is more foreign to the body's experiences in the world. The perceptual relationship of haptic messages on the body, however, has not only obvious potential with respect to the composition of messages on the surface; in fact, the literature shows how the use of haptic patterns in synchrony to other messages can support comprehension of written communication (Rovers & van Essen, 2004) and have emotional effects on receivers (Baumann, MacLean, Hazelton, & McKay, 2010; Koch, Fuchs, & Summa, 2014).

The types of information delivered through human-machine haptic communication is broad, as is the complexity with which languages can be constructed. To create codes that are recognizable by the human body, some research uses patterns of vibratory stimuli called *Tactons* (Brewster & Brown, 2004; Brown, Brewster, & Purchase, 2006; Brown & Kaaresoja, 2006; Brown & Kaaresoja, 2006; Barralon, Ng, Dumont, Schwarz, & Ansermino, 2007); others use patterns of pressor stimuli called *Pactons* (Zheng & Morrell, 2012). Finally, others use mixed systems of stimuli that alternate or work simultaneously (Kim, Castillo, Follmer, & Israr, 2019).

More complex codes ambition to tactually translate precise letters or phonemes (Enriquez, MacLean, & Chita, 2006). Other studies, on the other hand, aim to compose semantically simpler information and use stimuli to induce the body to react consciously or unconsciously or to suggest behaviors in space. In particular, several studies emerge in this regard that exploit haptics to support orientation in space through direction signals delivered in the sole of the foot (Frey, 2007; Velazquez & Pissaloux, 2014). An interesting solution has been studied in the automotive field to communicate the presence of cars in vehicle blind spots through haptic signals delivered on the surface of the steering wheel (Ploch, Bae, Ju, & Cutkosky, 2016). Previous studies by the authors show how it is possible to exploit haptic rhythmic variations to draw human attention to specific points on a pathway (Dall'Osso, 2021) or use a rhythmic pressor signal to unconsciously shift the body's center of gravity forward or backward at a given time (Dall'Osso, Zannoni, & Licaj, 2022). In all the haptic languages recalled in this concise examination, the rhythmic component plays a primary role in structuring sensory qualities. In his studies on form and figuration Paul Klee names touch among the

senses that have the capacity to recognize rhythm consciously (Klee, 1959) or unconsciously. People have a habit of rhythmic perception that is consolidated from the body's earliest experiences in the world and then refined over time. Human reactions to the presence of rhythm are natural and cross motor, social and perceptual behaviors. Rhythmic entrainment is, for example, one of the most studied mechanisms of the human-rhythm relationship. Rhythmic entrainment occurs when the body, in the presence of a specific rhythmic stimulus, changes its behavior unconsciously and tends to move closer to that specific rhythm. Rhythm entrainment is well known in the relationship between movement and hearing so much so that studies and smartphone applications show how certain music can modify movement performance (Moens, van Noorden, & Leman, 2010; Moens, 2018) or generate feelings of calm (T. Azevedo et al., 2017). Thus, rhythmic entrainment can be said to be a natural human tendency to seek synchrony with a perceived external rhythm in the surrounding environment or people in proximity.

In the technological-digital domain, the sense of touch associated with synchrony effects is evident in numerous commercial products. Primarily, these are vibration actuators used inside phones and smartphones that are activated in synchrony with the ringtone to reinforce human attention-getting. Similarly, joysticks use vibratory systems to communicate to players sensations related to the scenario proposed in the video monitor. The evolution of devices related to digital sports shows in the contemporary the highest degree of complexity related to the use of haptic stimuli. Dedicated e-sports workstations, in fact, use diegetic or mimetic interfaces (Calleo, Dall'Osso, & Zannoni, 2023) where haptic stimuli synchronized with the video or VR experience increase the sense of immersion. This effect is achieved by stimuli that go to characterize digital elements and by the synchrony between haptic feedback and body movements poised between real and digital space.

In the product sector dedicated to private homes, two interventions on the sofa object that use haptics in a different way in sync with video are worth mentioning. The first is the *Miliboo smart sofa*[1], a sofa with a grid of vibration actuators, speakers and RGB lights integrated into the seat. Through the multichannel system, the sofa offers sensations synchronized to the video experience that is present on the television. A less recent project is *Immersit sofa*[2] (2017), a platform on which to place the feet of a generic sofa. The platform, thanks to motion video conversion software, inflates and deflates by moving the sofa on the three Cartesian axes. The resulting effect is a home station that moves in synchrony with the digital movie or game, causing a strong sense of immersion in the user. Thus, in the digital environment, synchrony is an effect that causes a strong sense of immersion and allows the user to perceive details of scenarios with a sense of reality. Following the concept of cross-modality, the synchrony proposed by the stimuli of digital devices has effects that cut across the entire experience and act on both conscious and unconscious levels.

The literature review did not highlight the design use of video-aptic synchrony for specific environments. Imagining technological applications related to *Ubiquitous Computing* contexts, it seems evident that the human body needs the development of tools to support attention and choices among multiple proposed interfaces. The potential of the rhythmic component as the basic structure of a cross-modal, cross-media language becomes the focus of the present research, particularly in the dimension of the subject of cross-modal synchronic information.

3. Cross-Modal Rhythmic Synchrony for Attention Activation

Within the problem field circumscribed in the introduction and following the review of scientific literature, the research focuses on the potential of rhythmic synchrony as a tool for supporting spatial attention. This, within current and future scenarios in which the human body is immersed in VR scenarios or *Ubiquitous Computing* and AR environments. The synchrony investigated by the research is cross-modal and cross-media.

[1] https://www.miliboo.com/smart-sofa.html

[2] https://www.kickstarter.com/projects/423274566/immersit-awesome-motion-and-vibration-device-under

Cross-modal synchrony refers in the coherent connection between two stimuli on different sensory channels, sight and touch. Cross-modal synchrony is activated through a coherent rhythmic message between the video present in the space and the vibratory signals sent on the surface of the person's body. With the aim of generating clear answers that can be a tool for future research advances, two tests were designed and conducted. In the tests, the objective was to determine the effectiveness of rhythmic synchrony in influencing a choice with or without disruptive elements. Repetition of the tests then aimed to understand whether prior experience can help in understanding synchrony.

Further objective of the research is to identify application possibilities related to the use of cross-modal and cross-media rhythmic synchrony with respect to wearable or body-contact devices under conditions of use.

4. Experimental Tests

In order to assess the quality of synchronic cross-modal rhythmic stimulus, two test protocols were designed. A total of 20 people ranging in age from 22 to 37 years participated in these. None of the people had apparent perceptual problems in the sense of touch and vision. A proportion of 65 % women and 35 % men took part in the test. Of these testers, 18 said their dominant hand was right-handed, 1 left-handed, and 1 claimed to be ambidextrous. The tests were given to individuals pertaining to the subject area of design and trained in visual communications. None of the subjects involved had been previously introduced to synchronicity issues.

At the end of the test, some information about the subjects' prior experience was collected. Specifically, it was found that the majority of testers (85%) had experience related to the study of music and almost all (90%) had no experience related to wearing wearable devices using vibrotactile feedback. Responding to how they perceived vibratory feedback on a Likert scale of 1 to 5 (1 pleasant, 2 acceptable, 3 mildly irritating, 4 irritating, 5 unbearable) the testers averaged a value of 1.9.
The tests were conducted in a quiet environment with no moving visual stimuli in the testers' field of view. Before the test, subjects filled out an anonymous form with some data about themselves -gender, age, dominant hand-. With the aim of having more involvement in the experience, each tester was told that they would receive a small gift (chocolate bar) at the end of the experiment.

The subjects involved were made to sit at a table on which was a hand control with two buttons (Fig. 1), one on the right and one on the left. At 1.5 meters in front of the subject, a large screen was placed for the testers to look at during the test. Before the tests began, subjects were made to wear two wristbands, one on each wrist, with a small vibrator on the inside of the wrist.

The system was implemented using an Arduino Nano 33 BLE Sense board and the Processing 4 programming language. The decision to use Arduino and Processing was motivated primarily by the flexibility and accessibility that these platforms offer for interfacing with physical sensors and actuators. The visual experience was designed with modularity and flexibility so that it can be adapted and used for further testing and allows the choice of shape, speed, direction of perceptual input, intensity of the vibratory stimulus, and phase duration.

The software allows signals to be sent to the Arduino board via serial to synchronously activate the connected vibro-motors. In addition, the system allows the physical button choices of the testers to be read and the milliseconds used to be recorded (we have indicated 100 milliseconds in the choice as a “false start”).

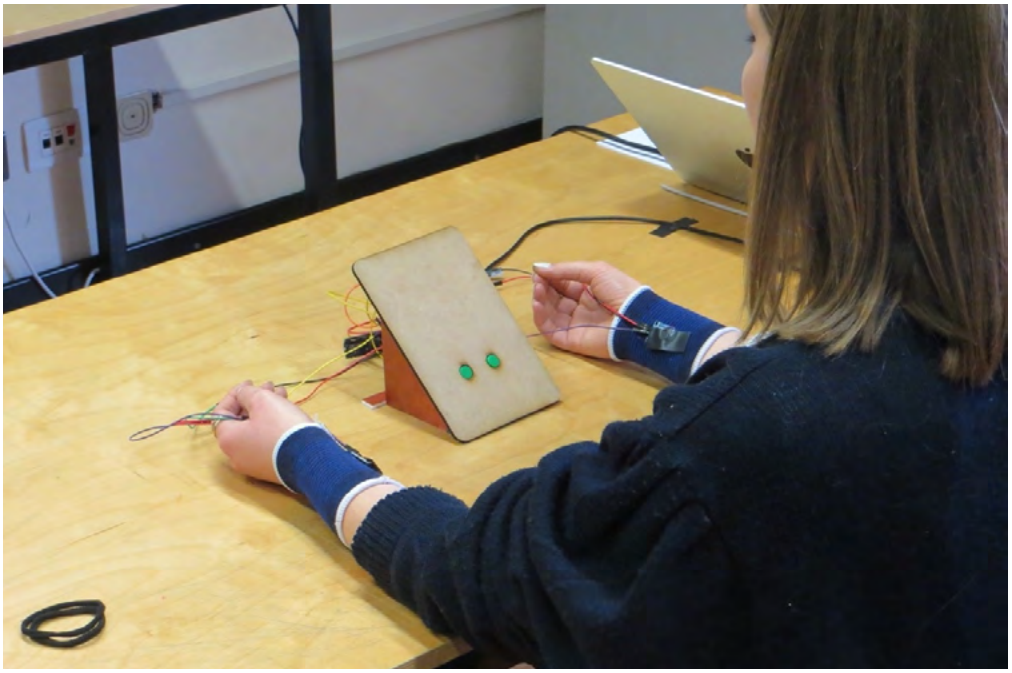


Figure 1. Detail of the prototype.

The objective of the tests (Fig.2) was to verify the effectiveness of rhythmic cross-modal signals to guide the testers' choice. To do this, the testers wore two wristbands with piezoelectric vibrators sewn into the inside of the wrist. In the first test (Fig.3) the vibrators send an identical and simultaneous rhythmic signal on the two wrists. During the test, subjects are asked to watch a video on which two identical circles are moving with the same animation but at two different rhythms. The rhythm of movement of one of the two circles is in sync with the vibration delivered on the tester's wrists (Fig. 4). The test has a duration of 20 seconds, and before the time runs out, the tester has to choose via a button one of the two circles. A countdown timer was introduced in the center of the screen so that subjects would be aware of the remaining time. The test was repeated twice in sequence for each subject. The second time the position of the circles on the screen was reversed.

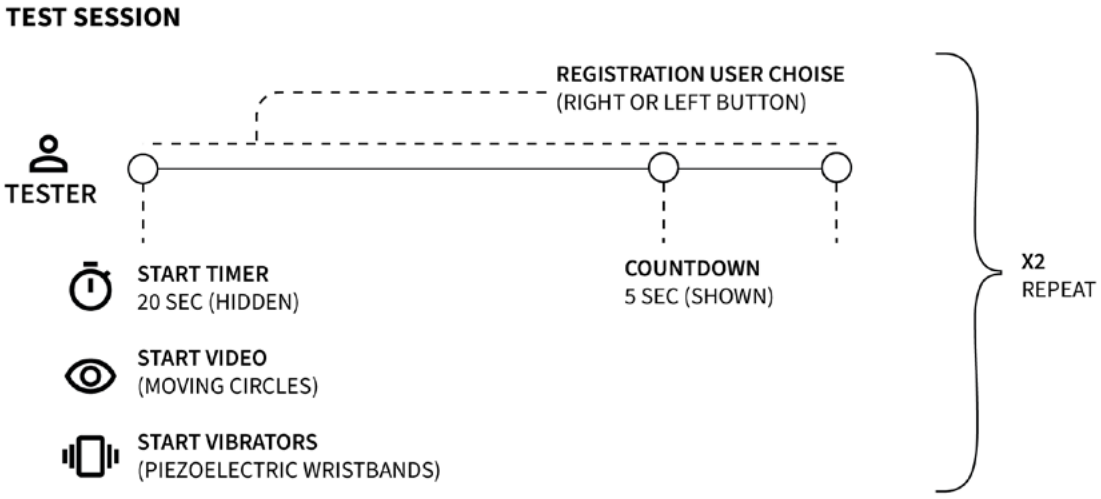


Figure 2. Experiment outline.



Figure 3. Layout of the experiment.

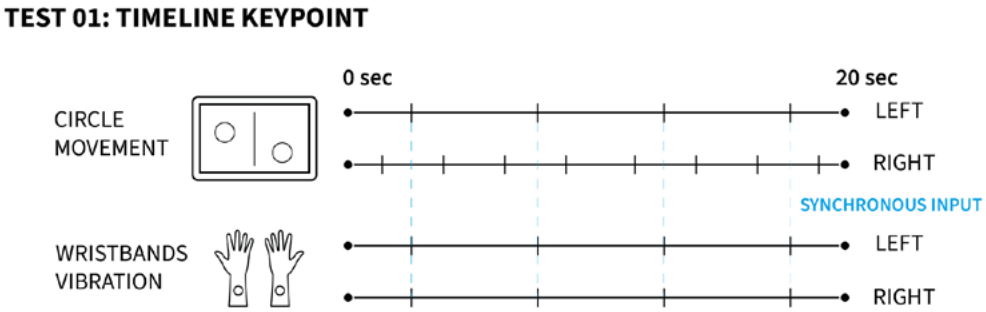


Figure 4. Test 01 process diagram.

The second test (Fig.5) introduces an element of interference in a manner similar to the experiments in the attentional domain that revealed the Simon effect (Simon, 1969). Specifically, the psychologist highlights a conflict between a spatially situated stimulus and a response required of the subject. If the subject is shown an object on the right side of the screen and asked to press a button on the left side, the response will have a slower reaction time than a location coherent with the question asked.

Coherently with the Simon effect in the second test, an asymmetry was introduced in the vibratory feedback on the wrists. The tactile feedback on the right wrist has a longer duration than on the left wrist. This results in a markedly stronger perception of the vibratory stimulus on the right body part. However, the rhythm of both wrists was equal and in synchrony with the circle on the left. The subject was then again asked to choose one of the circles before the 20-second time limit was exhausted.

Thus, two questions were tested with this test: the greater efficacy of choosing a synchronous stimulus over a persistent vibratory stimulus on one side of the body, the possible increase in response time compared with the test without an asymmetrical disturbance element. The second test was also repeated a second time by specularly reversing both the video and vibratory stimuli.

At the end of the exercises, each tester was asked to freely leave a written note about the sensations they felt during the test and the parameters on which they based their choice. Only at the end of this phase were some indications given about the objectives of the test and the research.

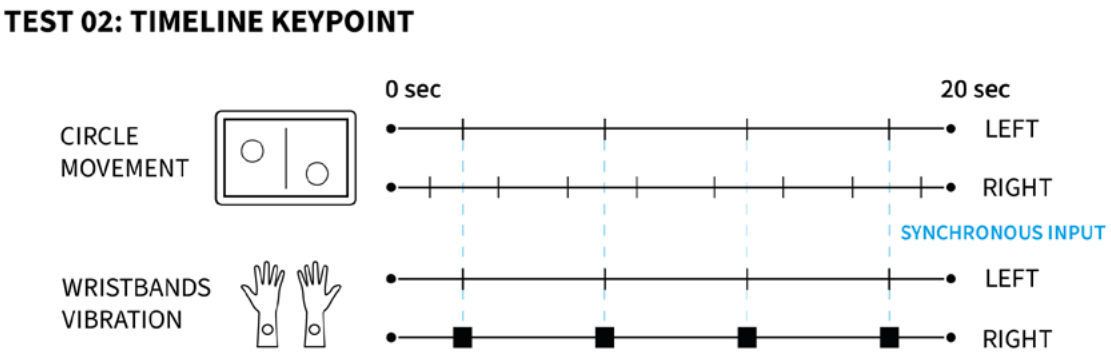


Figure 5. Test 02 process diagram.

5. Data Comparison

In relation to the group of subjects analyzed, the test results do not clearly show dominance in the choice attitudes of the subjects involved. Subjects who gave coherent choices with the cross-modal synchronic rhythmic stimulus investigated were 65.8 percent of the testers versus 34.2 percent. The positive percentage, while greater than the contrary choices, does not indicate a cross-sectional understanding of synchrony. However, it underscores the decoding of the phenomenon of synchrony for a good portion of the subjects.

The table below (Tab. 1) shows the results of the tests conducted. The data analyzed covers 19 subjects; tester No. 16 was cancelled because he reported in the commentary an abnormal functioning of the prototype.

In the Synchronic Choice column, the table reports when the tester's response was coherent with rhythmic synchrony (Y) or when it was different (N). The reaction time for the choice is reported for each question. When the choice was made after the end of the test, the maximum time of 20 seconds of the test was allotted.

5.1 Synchronic Choice

In test No.1A, the majority of testers (14) chose the ball that moved in sync with the rhythm of vibration. This number was significantly reduced in test No.1B where the percentage of testers who gave a positive choice (9) was smaller than those with a negative choice (10).

In test No.2A, the percentage of coherent choices with cross-modal synchronous perception became prevalent again with 14 coherent choices out of 5 inconsistent ones. The result is aligned with test No.2B with 13 positive choices out of 6.

Looking at the choices given by each tester, we can see that only 4 of them gave 100% positive choices, 6 gave 75%, 6 gave 50%, and 2 gave 25%. One subject gave all negative choices.

5.2 Reaction Time

Most of the subjects made their choice before the 20 seconds expired. Out of a total of 75 responses, 21 were given before the middle of the test (10 s) while 46 were given before three quarters of the test (15 s).

Observing the data in a comparative manner of test No. 1A and test No. 1B shows a general increase in reaction time. However, looking only at the data for coherent choices with synchrony, the average reaction time drops from 14.037 s to 12.685 s.

The comparison of reaction times between test No.2A and test No.2B is different. The overall average reaction time rose by almost 4 seconds as that for coherent answers with synchrony rising from 9.857 seconds in test No.2A to 14.467 seconds in test No.2B.

Analyzing the overall averages of the cross-modal coherent answers increased from 13.361 seconds in the first two to 12.162 seconds in the third and fourth exercises.

Table 1. Results of tests. Yes (Y) means a choice potentially based on synchrony, No (N) means the opposite. The Reaction time column indicates the time it takes for the tester to press the choice button (from the start of the test).

Test n.1A	
Synchronic Choice	Reaction Time (s)
Y	15,075
N	3,394
Y	14,332
Y	20,000
Y	20,000
Y	9,728
N	15,762
Y	16,097
Y	18,700
Y	3,937
Y	4,204
N	10,070
N	7,469
Y	18,371
Y	11,471
N	10,804
N	3,471
Y	10,969
Y	13,635
Y	20,000

Test n.1B	
Synchronic Choice	Reaction Time (s)
Y	15,879
N	10,659
N	12,661
N	17,593
N	12,995
Y	8,261
Y	12,330
Y	17,663
N	18,899
N	16,737
N	11,638
N	12,169
N	8,405
N	20,000
Y	13,599
Y	7,870
Y	10,802
Y	11,002
Y	15,433
Y	9,199

Test n.2A	
Synchronic Choice	Reaction Time (s)
Y	6,442
N	7,765
N	13,499
Y	6,527
Y	11,404
Y	5,426
Y	16,333
N	18,031
Y	15,564
Y	17,604
N	12,404
Y	6,342
Y	4,238
N	17,536
Y	9,971
N	5,869
Y	6,204
Y	8,271
Y	12,771
Y	10,899

Test n.2B	
Synchronic Choice	Reaction Time (s)
-	-
N	12,095
Y	12,862
N	3,865
N	20,000
Y	20,000
Y	17,294
N	20,000
Y	11,794
Y	17,171
Y	12,300
Y	17,937
Y	7,671
N	19,904
Y	11,769
Y	13,838
Y	7,871
N	11,538
Y	16,936
Y	20,000

6. Discussion

The introduction of test repetition is directed to verify an increase in coherent choices following the experience in the first test. In contrast to the initial assumption, test repetition shows a decay in coherent choices with the perception of a cross-modal synchronous rhythm. These results could indicate how synchrony is quickly encoded by subjects; however, over a longer time, other factors take over in guiding the final choice.

This observation holds true for both tests conducted. While in the former we see the actual decay of coherent choices, in the latter what visibly changes are the increased reaction time of the decision. This could be due to uncertainties the testers had.

Test No. 2 was designed to challenge the perception of synchrony. To do this, an interference factor was introduced. However, the results do not show a deterioration in coherence compared with test No. 1. On the contrary, the increase in vibratory sensation, although asymmetrically with respect to the body, led testers to choose a coherent choice with synchrony. This was also the case in the repetition of test No. 2. The diagram below (Fig. 6) compares the percentage for each tester of coherent choices in rhythm with the observations they wrote on a sheet of paper at the end of the two tests. The observations were read, and each was assigned the prevailing perception described by the tester (1 subject declared nothing, 2 subjects declared confusion, some testers placed greater importance on the sense of sight, and a greater number reported placing great importance on vibration). Finally, many testers indicated that they felt a shared rhythm or synchrony between the visual and tactile sensations even though this did not always then match the choices.

The graph is interesting because it highlights how testers were aware of the phenomenon of synchrony and tried to guide their choices based on this. In the testers' declarations, touch had a greater incidence than the sense of sight.

The data analyzed support further development of cross-media synchrony and application in multiple application areas. One example is the attention relationship between visitors and information content in museum and exhibit. Another area is safety in the workplace through increased awareness of body-contact information. Finally, the rehabilitation field could also accommodate further development of the topic.

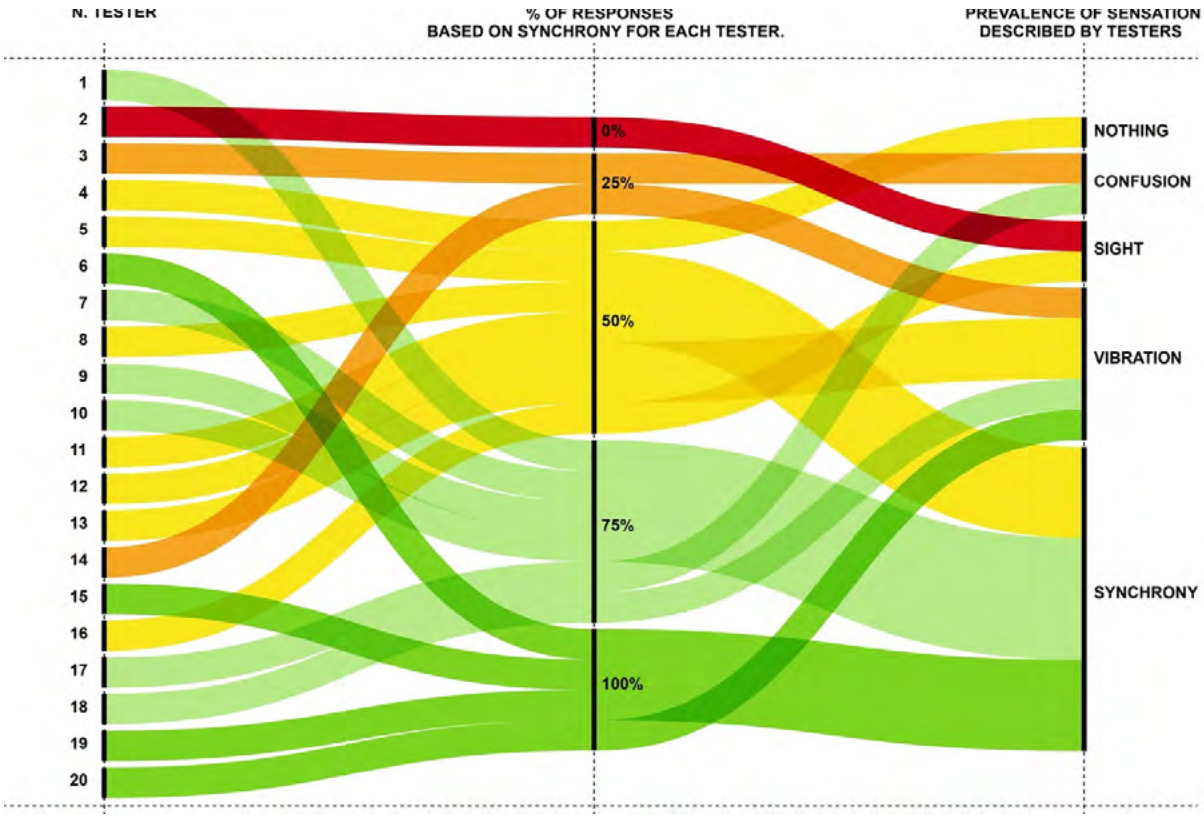


Figure 6. Alluvial diagram of research results. The diagram highlights the relationship between the percentage of responses consistent with the synchronic stimuli and the sensation communicated by the subjects after the two tests.

7. Conclusion

Public and private spaces are increasingly integrated with pervasive digital technologies and invisible human-machine interfaces. Therefore, in the field of interaction design, it is necessary to introduce design elements that support attentional processes capable of integrating naturally with human senses.
The characteristics of touch, such as noninvasiveness and proximity, grant haptic technologies a high degree of mimicry and personalization of information while respecting the user's privacy. This makes them useful for handling various types of messages between the body and the interactive systems around it.
One can imagine a personal scenario in which notifications arrive silently to only one user compared to other people in the same room. For example, the alarm clock in the morning vibrating on a wearable could wake only one person from a couple living together, or messages received within a crowded study room. These scenarios are already widespread in the haptic device landscape but anticipate broader design scenarios yet to be studied in the field.

Among the many components that come into play in the modulation of haptic technologies used in human-machine languages, rhythm is a determining factor in consciously and unconsciously suggesting responses in people's behavior. Synchrony is a rhythmic phenomenon that the body perceives with its senses, and there is evidence that the human body can associate multimodal sensations, that is, from different sensory channels. Rhythm has cross-sensory communicative capabilities (cross-mediality) and can relate multiple senses simultaneously (cross-modality).

The possibility of advanced integration of designs that work on haptic stimuli in the field of immersive and at the time expository technologies becomes central to the design of experiences regardless of whether they are physical or virtual. The complexity dictated by the addition of media that is conveyed through haptic vibration requires a long phase of design experimentation. The evaluation proposed in this contribution demonstrates that this direction is viable at both the conceptualization and developmental levels.

7.1 Limitations and Future Developments

The experimental tests conducted show that cross-modal rhythmic and synchronic stimulation has a good ability to guide users' choices. However, some boundary factors emerge within this study that need further analysis to check for possible interferences in the evaluation of the results. For example, additional factors come into play in determining a choice preference that may lead subjects to act differently.

Following the experiments, some evaluations emerged in the data analysis regarding the subjects' prior experience with respect to rhythmic perception. Previous musical experiences by the testers may have contributed in rhythm perception. Lack of familiarity in the use of smartwatches by some testers and lack of familiarity with vibration sensations in the wrists may also have influenced the responses. A larger sample that takes these factors into account could be the subject of a subsequent exploratory investigation in which these first two experimental tests could be supplemented by additional items for evaluation.
To improve the quality of stimuli sent to the body, wireless haptic bracelets will be used in future experiments. The use of wearables will allow testers to assume a more comfortable and less constrained position. In addition, the wearables will also allow some tests to be conducted with the body moving within a controlled space.

The experimentation lays the groundwork for further research around cross-modal synchrony as an element in engaging people and supporting decision-making and attention processes in digital information-dense environments. Subjects' response to synchrony effects underscores the opportunity for applications designed to increase the connection between the body and the interface in immersive experiences.

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P/REFERENCES OF DESIGN

XR_CODESTO: ANALYSIS OF EXTENDED REALITY COLLABORATIVE DESIGN TOOLS.

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KEYWORDS | EXTENDED REALITY, COLLABORATIVE DESIGN, DESIGN PROCESS, MAPPING, PRODUCT DESIGN VISUALISATION

ABSTRACT | The paper investigates Extended Reality (XR) advanced representation application paradigms in collaborative product design sessions. The research stems from the pressing need for innovative solutions to address the challenges posed by the global pandemic, particularly the necessity for collaborative telepresence due to enforced social distancing. In this scenario, XR and similar technologies as Virtual Reality (VR) have opened new design possibilities.

Therefore, the primary objective of the research is to investigate how XR technology, as an advanced representation system, can effectively contribute to industrial design, particularly in its collaborative phases. This study examines the technology landscape of XR in terms of challenges encountered by tools on a practical basis for industrial design.

This research addresses a central question: Can XR enhance “triggered” design practices by facilitating collaboration when sharing an unfeasible physical space?

The methodology includes a case study analysis conducted as exploratory studies, blue-sky research, and a thorough examination of academic and commercial XR applications. Each case study is categorised based on pertinent variables, focusing on collaboration and technological accessibility criteria. The outcomes offer a map that aligns case studies within the design process.

The map summarises the main results of the research. While not claiming to be exhaustive, its purpose is to provide an assessment framework and stimulate reflection on incorporating case studies into the design process. The map includes information on the strengths and weaknesses of current technologies and available resources serving as inspiration for future implementations.

1. Introduction

1.1 Background and Context

This research intends to explore and verify the possibilities of using eXtended Reality (XR) tools in collaborative design sessions. The study is based on a pressing need for innovative solutions to deal with global pandemic challenges, in particular, the necessity of collaborative telepresence due to enforced social distancing where Virtual Reality (VR) and similar technologies have opened new design possibilities (Strand, 2020; Vi et al., 2019). This requirement is thought to tackle challenges arising from the pandemic while generating lasting possibilities, such as improving remote collaboration and lessening the environmental impact of travel fields. Even beyond the immediate pandemic emergency, exploring this research area remains opportune, as it addresses workplace flexibility and enables design teams to simulate an in-person experience regardless of their location (Li et al., 2023).

Furthermore, there is a growing focus on exploring the collaborative aspect, particularly as co-design gains significance in addressing complex technological, social, and educational situations. An alternative approach becomes essential when no person has all the knowledge and skills to understand and solve these complexities (Zamenopoulos & Alexiou, 2018). In this paper, the collaborative session is to be taken as when stakeholders with different skills and capabilities work together towards a common goal to solve the design challenge, particularly during brainstorming sessions to define the brief, review sessions during project development, final refinement and testing and product presentation.

The future of XR technologies is envisioned as a collaborative and distributed infrastructure. As anticipated, users and specialists will interact and organise activities on a global scale through mediated environments (Nguyen & Bednarz, 2020). XR technologies integrated into collaborative user interfaces improve communication, facilitating seamless functional and cognitive workflows among users (Billinghurst & Kato, 1999) and augmenting the sense of co-presence. Schroeder (2002) summarised that co-presence refers to "*being there together*" and engaging with other users concurrently.

The Research XR_CODESTO (eXtended Reality Collaborative Design Tools) aims to explore and define new ways advanced representation systems, such as XR technology, can be effectively utilised in industrial design, mainly in its work-sharing phases. Given the evolution of technologies, this exploratory research, which still needs to be completed, aims to address the challenges XR technology faces in finding practical applications within the industrial design field. This would help designers and stakeholders overcome geographical limitations, achieve working continuity, and enhance the overall design experience (Ratcliffe et al., 2021). Additionally, the research aimed to contribute towards bridging the gap in knowledge and understanding of XR technology by providing insights into its practical implementation and benefits within the industrial design field and its related didactics.

Furthermore, the research aimed to contribute to the dissemination of XR technology and identify future research needs relating to pedagogical integration, digital skills, and digital infrastructure. Overall, the research aimed to explore and demonstrate the potential of XR technology in industrial design, address challenges posed by globalisation crises, establish XR as a valuable and widely used tool in the industrial design process, and contribute to the standardisation and future development of XR technology.
The subsequent paragraph aims to provide a concise theoretical overview of the primary subjects investigated in the research: Extended Reality and Collaborative Design session.

1.2 Extended Reality

Extended Reality (XR) is an overarching term that encompasses a broad spectrum of immersive technologies, including Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). Using the Reality-Virtuality Continuum is imperative to clarify the Extended Reality concept, engaging with the

framework posited by Milgram et al. (1994). The continuum concept is a critical analytical tool, facilitating a nuanced comprehension of AR, MR, and VR while elucidating the intricate interrelations that link these technologies.

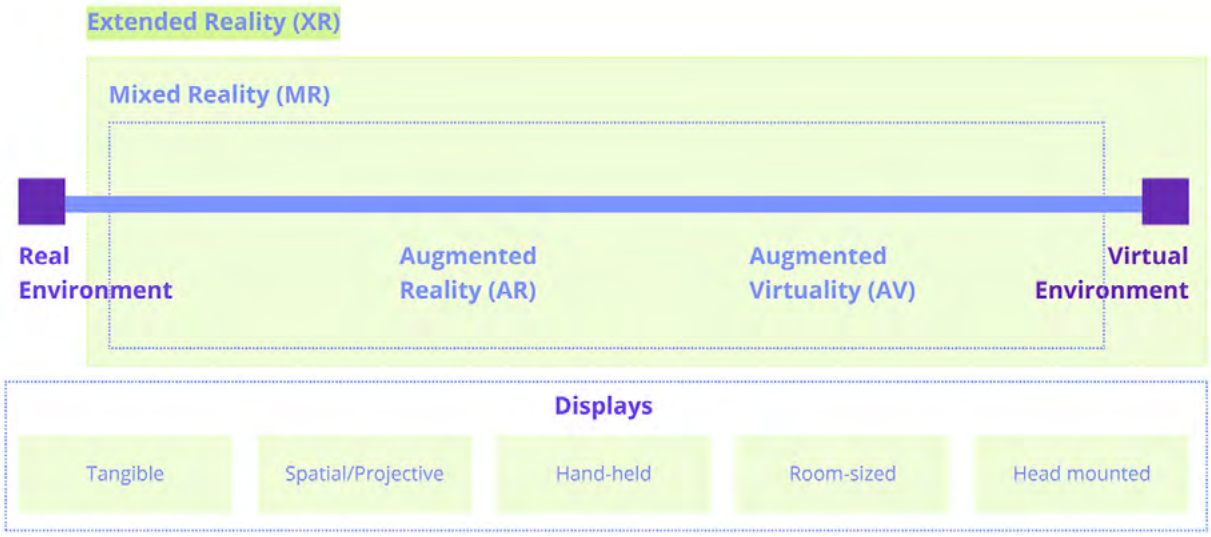


Figure 1. Diagram describing Milgram et al. (1994) Reality-Virtuality Continuum and adding the definition of the set of XR displays (Milgram & Kishino, 1994).

The Reality-Virtuality Continuum is articulated through two polar extremes: on one end, the not-changed real-world environment, and on the opposite end, a wholly virtual environment representative of VR. The intermediate space, which diverges from these extremes, is categorically delineated as Mixed Reality (Speicher et al., 2019). MR manifests in many forms within this intermediate domain, each uniquely characterised by varying degrees of immersion and the interplay between virtual elements and the natural environment. This diverse categorisation encompasses technologies such as Augmented Reality - wherein a predominantly real-world context is enhanced with virtual elements; Augmented Virtuality - a scenario that predominantly exists within a virtual realm yet incorporates elements of the real world to varying extents; Mediated Reality (Mann et al., 2018) (encompassing technologies like XY-R, designed to alter the perception of reality for specific purposes, such as augmenting the colour perception for individuals with colour blindness, thereby affording them a more accurate representation of their environment); and Diminished Reality (Cheng et al., 2022), which involves the technological elimination or reduction of real-world elements from the user's perception.

The delineation of XR has evolved in contemporary years, now being conceptualised as an amalgamation of Virtual Reality and all technologies that fall within the ambit of Mixed Reality. This broadened definition underscores XR's fluidity and expansive nature as a field, highlighting its capacity to integrate and synergise various immersive experiences. By encompassing a wide array of technologies that straddle the continuum from the entirely real to the fully virtual, Extended Reality stands at the forefront of technological innovation, pushing the boundaries of how digital and physical realities can converge to create novel and enriching experiences.

1.3 Collaboration in the Design Session

For this research, collaborative sessions are strategically integrated throughout the phases of the product design process, exhibiting variability in their type and frequency, contingent upon the intrinsic characteristics of the design process, its inherent complexity, and the phase of implementation. Individuals are engaged, assuming various roles, and may participate across different design project levels and stages. In line with the model of the Double Diamond (DD) (Design Council, 2005; Kochanowska et al., 2022) proposed by the Design Thinking approach, engagement in design starts with the "discovery" of nascent needs or opportunities within a specific context, proceeds with the "definition" of particular interest or

challenge to be addressed, the "development" of viable ideas capable of addressing such situations, and culminates in the "delivery" of a (prototyped) solution to a distinct problem or opportunity.

This iterative process, characteristically non-linear and frequently recursive, shows varied ways of interaction influenced by the participants involved and the degree of detail attained. Aligning the DD model with collaborative practices (Figure 2), we can see that at the beginning, collaborative sessions mainly focus on defining or analysing the project brief, using low-tech tools to facilitate meetings, image exchange and brainstorming activities. These meetings serve to outline the inspirations and define the project constraints. During the intermediary phases, as the concept idea advances towards materialisation, the nature of collaborative sessions switches to design reviews.

This phase aims to advance towards a more refined articulation of the project, demanding the involvement of a broader spectrum of stakeholders and ensuring that the fidelity of representations incrementally aligns more closely with reality.

The final phases are dedicated to prototyping and testing. Herein, collaborative sessions are convened with a focus on the iterative refinement of the project, aiming to rectify any discrepancies before transitioning towards actual production. In the last phase, the testing is better done with the final users to verify whether the project result meets their needs, and the collaboration becomes even more complex. To conclude, the crucial role of collaboration at every stage is facilitating a holistic and iterative design process that optimises outcomes and enhances the feasibility of the final product (El-Jarn & Southern, 2020).

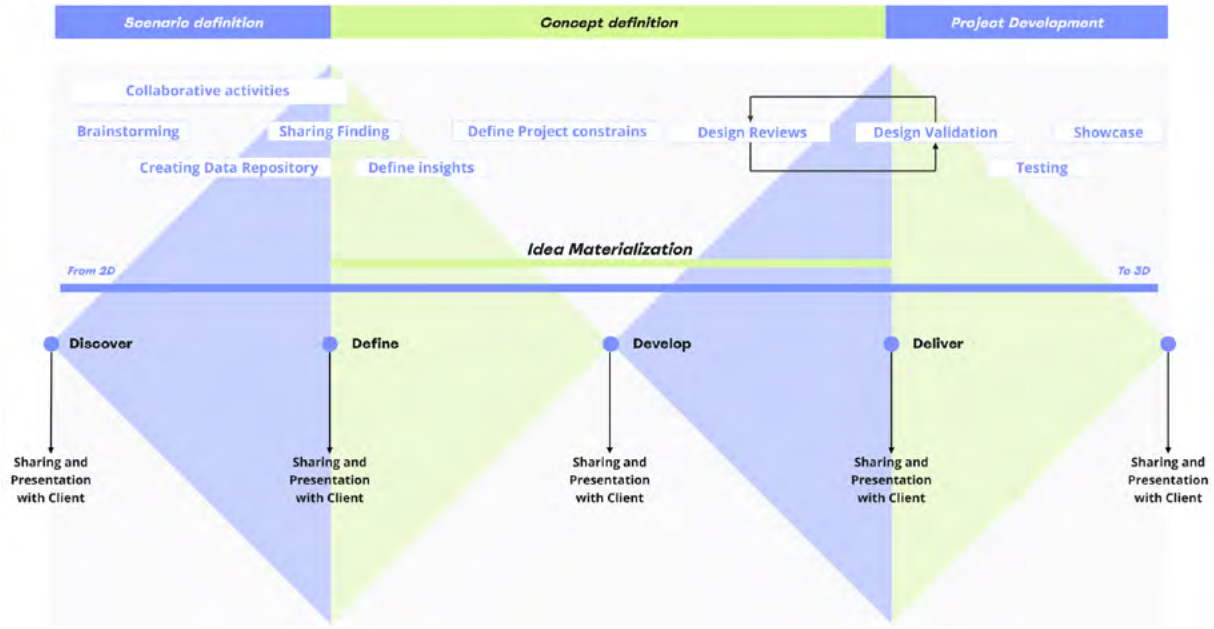


Figure 2. Collaborative session applied to the DD model, authors reinterpretation.

1.4 Representation Techniques

The methodologies and techniques employed in articulating ideas and concepts throughout the various phases of the design process are tailored to meet the unique requirements of each distinct phase within the process (Novoa Munoz et al., 2022). In the incipient stages of a project, representation is predominantly delegated to techniques of a fundamentally two-dimensional nature. This encompasses freehand sketches, which facilitate the exploration of initial ideas alongside reference images and mood boards. These tools are instrumental in delineating the project's conceptual framework and aesthetic ethos, providing a foundational visual vocabulary upon which subsequent development is predicated (Purcell & Gero, 1998).

As the design process advances, there is an evolution in the representation methods, which progressively embrace complexity since it is moving towards a three-dimensional perspective. This transition is exemplified by adopting a study maquette, which helps stimulate a tangible understanding of spatial dynamics and shape or provides volumetric three-dimensional constructs and a more realistic representation of the project. These instruments are pivotal, not merely for enhancing the visualisation of spatial relations and integrating elements but also for facilitating a simulation of the project with its context (Bellini, 2019).

In the final stages of the design process, the focus shifts towards generating lifelike models. These representations, often the product of modelling and rendering technologies, enable a precise visualisation of the project, meticulously accounting for variables such as lighting, materiality, and construction specifics. Thus, they accurately portray the anticipated outcome, significantly augmenting the dialogue among designers, clients, and stakeholders. This, in turn, allows for a comprehensive evaluation of the project's aesthetic and functional alternatives before its materialisation, ensuring a confluence of vision and execution that is both coherent and anticipatory of the project's intended impact (Kuys et al., 2023).



Figure 3. Methods and techniques of representation applied to the DD model, authors reinterpretation.

2. Methodology

Starting from a framework defined with the preliminary literature review, a qualitative research method was chosen for this research to explore the topic better. Qualitative research methodologies, encompassing case studies and best practices, are applied to explore the research question. Employing a mapping process, the research assesses diverse XR tools applied in design processes, specifically emphasising those supportive of co-design sessions.

This phase has been researched on state-of-the-art technology, emerging market trends and reports, and the implementations already in progress identified as opportunities. In this step, the team explores XR's possibilities by identifying interesting case studies and best practices.

The research process unfolds through four principal phases explored in the following paragraphs.

Table 1. Summary of activities, results achieved, and people involved.

Phase	People	Role	Type of activities	Outputs
Preliminary Exploratory	4	1 Research Fellow in Representation 2 Research Fellow in Design 1 PhD Student in Design	Analysis of the latest advancements in technology. Identifying and interpreting emerging trends within the marketplace.	**Collecting Data**
Collaborative Co-design Workshop	7	1 Research Fellow in Representation 2 Research Fellow in Design 1 PhD Student in Design 3 Students of MSc in Design	Understand the previously selected case studies, examine them, and define evaluation criteria.	**Case Studies Selection** **Case study "cards"**
Final Synthesis	5	1 Research Fellow in Representation 2 Research Fellow in Design 1 PhD Student in Design 1 Students of MSc in Design	Distil the information derived from the case study analysis into clusters, and to pinpoint the various connections within the design process.	**Case Studies Mapping**
Didactical Application	95	60 students of BSc in Product Design 15 students of Specializing Master TAD 20 students of an Elective course for MSc in engineering and design	Dissemination of the research findings and use as a didactical tool aimed to equip future professionals with the knowledge and skills to leverage XR technologies.	**Implementing tools for education**

2.1 Preliminary Exploratory Phase

In the Preliminary Exploratory Phase of the research, the initial objective was to examine and understand the contemporary XR technological landscape. This included an analysis of the latest advancements in technology, identifying and interpreting emerging trends within the marketplace, and recognising existing implementations that were deemed to hold potential for opportunity. This phase serves as a foundation for further investigation, aimed at collecting data and then analysing and synthesising it during the second phase.

At this stage, the team started with an exploratory literature review, examining the fundamental aspects of XR reality, with the methodology developed by Milgram et al. (1994) as a guide for the work. The focus was identifying research addressing design principles and illustrating practical applications through case studies. Simultaneously, the team engaged in an online XR MOOC (Nebeling, 2020) introductory course to understand XR technologies necessary for subsequent analytical phases. A trend analysis was also conducted using the Hype Cycle for Emerging Technologies, referencing reports from 2017 to 2022 (Gartner, 2017; 2018; 2019; 2020; 2021; 2022). The team selected emerging technologies relevant to their area of focus, using these trends to inform their commercial analysis. This involved thorough desk research to identify device systems and tools suitable for integration into the design process.

The output of this initial investigative stage was selecting a collection of case studies. Each chosen case study was explicitly aligned with the research goal that had been previously established. The goal serves as a filter allowing a focused examination of the technological landscape, choosing a case study directly relevant to the research.

2.2 Collaborative Co-design Workshop

The preliminary exploration phase laid the groundwork for an in-depth exploration, setting the stage for the subsequent phases of the research. A collaborative Co-design workshop followed the first phase. During the Collaborative Co-design Workshop, the primary goal was to understand the previously selected case studies, examine them, and define evaluation criteria. This phase was characterised by engagement, where participants were tasked with critically examining and classifying each case study.

The output of this workshop was case study cards that serve as a visual synthesis of each case study and related parameters. Despite the inherent diversity, these cards served as a pivotal output of this phase, offering a more precise and structured understanding of each case study.

Furthermore, this phase establishes the conceptual framework that allows us to bridge the theoretical underpinnings of XR with the design process.

2.3 Final Synthesis and Future Application

In the concluding phase of the research, the Final Synthesis and Future Applications, the effort was to amalgamate the insights into a coherent synthesis. The objective here was twofold: firstly, to distil the information derived from the case study analysis into clusters, and secondly, to pinpoint the various connections within the design process and understand where the technologies under consideration could be most effectively applied. Identifying these clusters was foundational to defining a conceptual framework for future explorations.

Equally important was the identification of specific steps within the design process where the technologies could be seamlessly integrated. This required a thorough understanding of the design process, including its various phases, requirements, and outcomes. The goal was to ensure that technology integration was not additive but transformative, enhancing the design process in meaningful and sustainable ways. The research aimed to provide actionable insights that could be directly applied to design challenges.
The output of this final stage was a comprehensive synthesis that mapped the case studies within the identified clusters and delineated the potential pathways for the future application of the technologies.

2.4 Didactical Application

This phase primarily focused on disseminating the research findings and fostering the professional adoption of XR technologies. This stage was essential in translating the theoretical insights and analytical conclusions drawn from the research into actionable knowledge and practices that could be readily applied within professional and educational settings. A strategy was employed to integrate the research outcomes into professional development and academic instruction to achieve this. The research serves as a groundwork to inspire various educational initiatives designed to cater to a diverse audience, ranging from industry professionals to students within the higher education sector.

The research findings were integrated into professional master's programmes, specifically within the automotive sector. Allowing the students to select among the case studies the ones that better fit their needs during the design process. Moreover, the conceptual framework will be used as an evolving tool to understand the technologies on the market and open up possible XR implementations and experiments. In this way, the integration aimed to equip future professionals with the knowledge and skills to leverage XR technologies to advance automotive design.

Furthermore, an elective course for master's degrees was also developed. This course was designed to foster interdisciplinary collaboration and innovation, enabling students from diverse academic backgrounds to explore the synergies between technological advancements and design principles through the lens of XR technologies. Additionally, the conceptualisation of a virtual laboratory represented a significant advancement in the educational application of the research findings.

Through these diverse educational initiatives, the Didactical Application phase sought to disseminate research findings and inspire and facilitate the widespread adoption of XR technologies. By embedding these technologies within the curricula of professional and academic programmes, the phase aimed to cultivate a new generation of professionals and scholars well-versed in applying XR technologies, thereby contributing to advancing the field and realising its full potential across various domains.

3. Collaborative XR Case Studies

3.1 Case Studies Selection

The case study method has been chosen because it is beneficial for understanding and generating explanations for complex phenomena (Anderson, 1993; Yin, 2009). Also, it provides the opportunity to investigate every case/project in depth. Therefore, the case study method could analyse the scenario through different design paradigms.

The first step to starting a case study is to draw the boundaries of the cases. Yin (2009) stated that more significant heterogeneity among cases could increase generalisations. Instead, the homogeneity might support internal validity.

According to these assumptions, the selected cases were chosen among XR devices/systems/tools that could be used in collaborative design processes. Then, these cases were examined regarding their availability and readiness to the market, their collaborative qualities, accessibility, and cross-integration between different platforms. Defined indicators have been applied to select and filter the first results according to the scope of this research, such as:

- Year of publication and date when the case study was conducted. Due to the growth rate of the rapid technological improvement of XR instruments and the depreciation of older ones, it must be considered that this type of technology undergoes a very rapid obelise. The release date is an essential indicator when looking at case studies;
- Field of application. As stated above, the research is focused on design-related industries that require the almost simultaneous use of XR tools among several stakeholders remotely, attending the session in the same physical space or a combination of them. For this reason, most research released in our selected timeframe regarding medical, military, and other external fields in which the interaction described is only human to machine or vice versa has been avoided;
- The level of interaction and collaboration such tools could offer to end users. It underscores the emphasis on collaborative aspects within the solutions being explored in the research. More interaction among more than two users is seen as having increased significance in the study context. Tools that, per se, were not designed for collaboration were not excluded because, when put into the system, they could still be of interest to the study.

The case collection and selection process in this research involved two distinct phases. Initially, cases were selected based on preliminary criteria and later refined during a co-design session. Consequently, the initial selection underwent a secondary review. During the first phase, 20 case studies were gathered via web-scraping by predetermined criteria. A subsequent screening process was conducted to exclude cases based on relevance to design collaboration, the quality of technology representation, and redundancy. When faced with similar cases, only the one best suited to the research requirements was retained. This approach resulted in the exclusion of 7 case studies.

Here is the list and a brief description of the selected case studies after the selection phase.

1. Gravity Sketch with LandingPad (Gravity Sketch, 2021): 3D design platform for cross-disciplinary teams to create and collaborate in virtual reality;
2. Spatial IO (Meta Quest, 2020): Customizable virtual space for meetups, NFT art exhibitions, and live events;
3. Campfire (https://campfire3d.com): A system consists of a headset and software for design collaboration in a remote world;
4. XR with Unity3D (https://www.khronos.org/openxr/): Cross-platform for designing and developing AR/VR/XR Experience;

5. 3DFrames for Webex (Grandis, 2022): A metaverse app for Webex. It helps teams meet virtually to conceptualise plans and present products;
6. Spark project (O'Hare et al., 2020): A tool that applies augmented reality in co-creative design sessions by projecting texture on 3D objects;
7. CAVE (Virtual Environments Group, 2013): A cubic room with projection screens aims to create a virtual environment. In which users wear eyewear to interact with visual stimuli;
8. Realtime VR projection(https://www.nuformer.com): Real-time projection on the environment's external surfaces while the user performs in virtual reality;
9. Tesla Suite & Tesla Glove (https://teslasuit.io): A full-body haptic feedback system provides the user with haptic feedback. Also, it captures the user's motion and biometrical data;
10. Sense glove (https://www.senseglove.com): Force-feedback glove that can be integrated with the VR system, allowing the user to gain a sensorial experience from the virtual environment;
11. Logitech VR Ink Stylus (https://www.logitech.com/en-eu/promo/vr-ink.html): VR stylus allows designers to create geometries in two-dimensional physical surfaces or three-dimensional room-scale space;
12. Touchable hologram (Baraiuk, 2014): System that uses sound waves to project "haptic holograms" into mid-air –letting the user touch 3D virtual objects with his bare hands;
13. InterHaptics (https://www.interhaptics.com): 3D design software for building interaction 'design hand tracking' and composing haptics for AR/VR applications for cross-disciplinary teams to create and collaborate in virtual reality.

3.2 Case Studies "Cards"

Upon selecting the case studies, the co-design workshop was convened to establish indicators that encapsulate the characteristics inherent to each case. This workshop was planned as a co-design activity to foster exhaustive comprehension among six participants. It saw the research team's collaboration with two young designers and was methodically organised, drawing upon insights from preceding research.

The activities conducted within this workshop were directly inspired by the selected case studies, engaging participants in a collective effort to review and refine the evaluation parameters.
The workshop served as a debate for exchanging perspectives and facilitating open discussions. The discourse that ensued was instrumental in refining the evaluation criteria for the case studies, culminating in the creation of evaluative cards summarising each case study's findings (Figure 4). These cards function as a comparative matrix, enabling a consistent comparison of case studies through the visual representation of parameters, enhancing clarity and comprehension.

This categorisation encompassed the following parameters:

- Device/System/Tool: This dimension delineates whether the case study is classified as a device (a tangible instrument such as a viewer), a system (a complex amalgamation of infrastructure, device, and software), or a tool (software developed to facilitate the use of XR);
- Academic/Industry R&D: This categorises the case studies based on their origin, differentiating between those emerging from academic research projects and those developed within industrial research and development contexts;
- Stand-alone/Add-on: This classifies the case studies based on their operational independence or requirement to use other devices, systems, or tools.
- Black/White box: This distinction is related to the potential for customisation the case study offers, primarily regarding software.

After this preliminary classification, the evaluative cards were enriched, adding other evaluation criteria. In this case, a value from 1 to 5 was given:

- Specific Equipment Required: This criterion assesses the extent of specific equipment necessity;

- Ready to Market: This evaluates the market readiness of the case study, awarding the highest score to those already available on the market;
- Collaborative: This measures the degree to which the case study facilitates collaborative efforts;
- Accessibility: This assesses the accessibility of the case study in terms of the requisite skills for users;
- Cross Integration: This evaluates how the case study can be integrated with other Devices, Systems, or Tools.

These evaluative metrics and classifications provided a structured approach to understanding the diverse case studies, facilitating a systematic analysis informing the subsequent research and application phases.

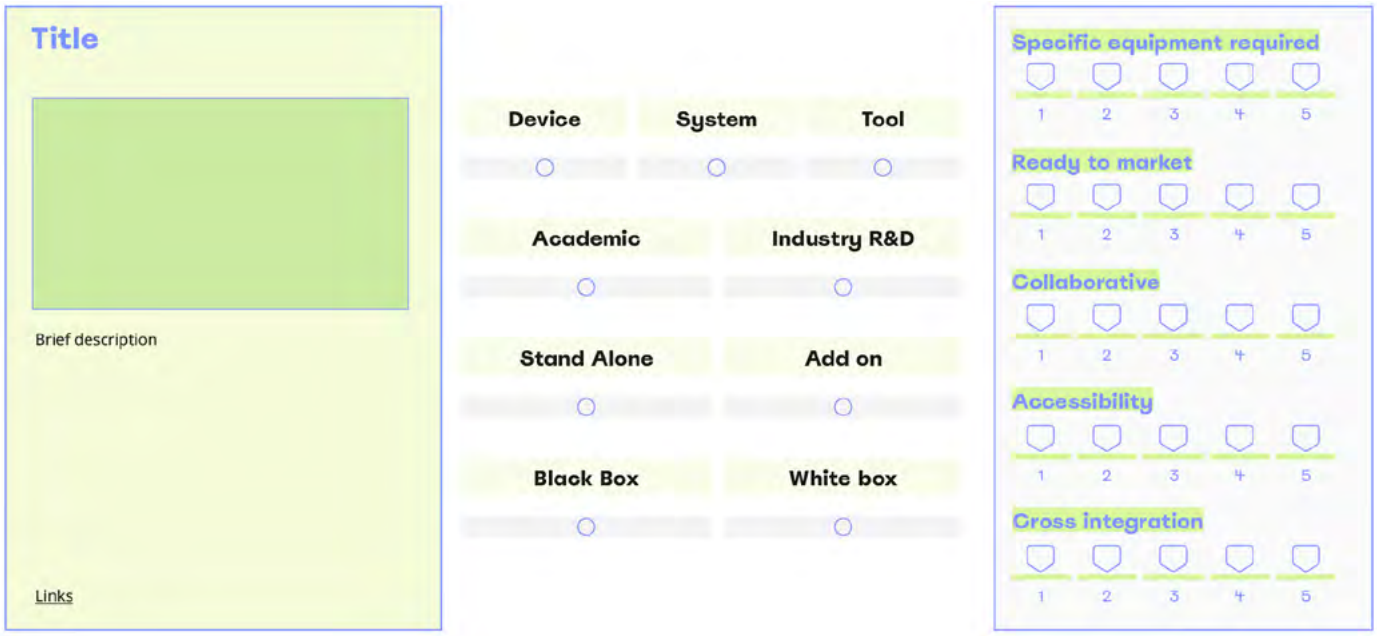


Figure 4. The case study evaluation grid.

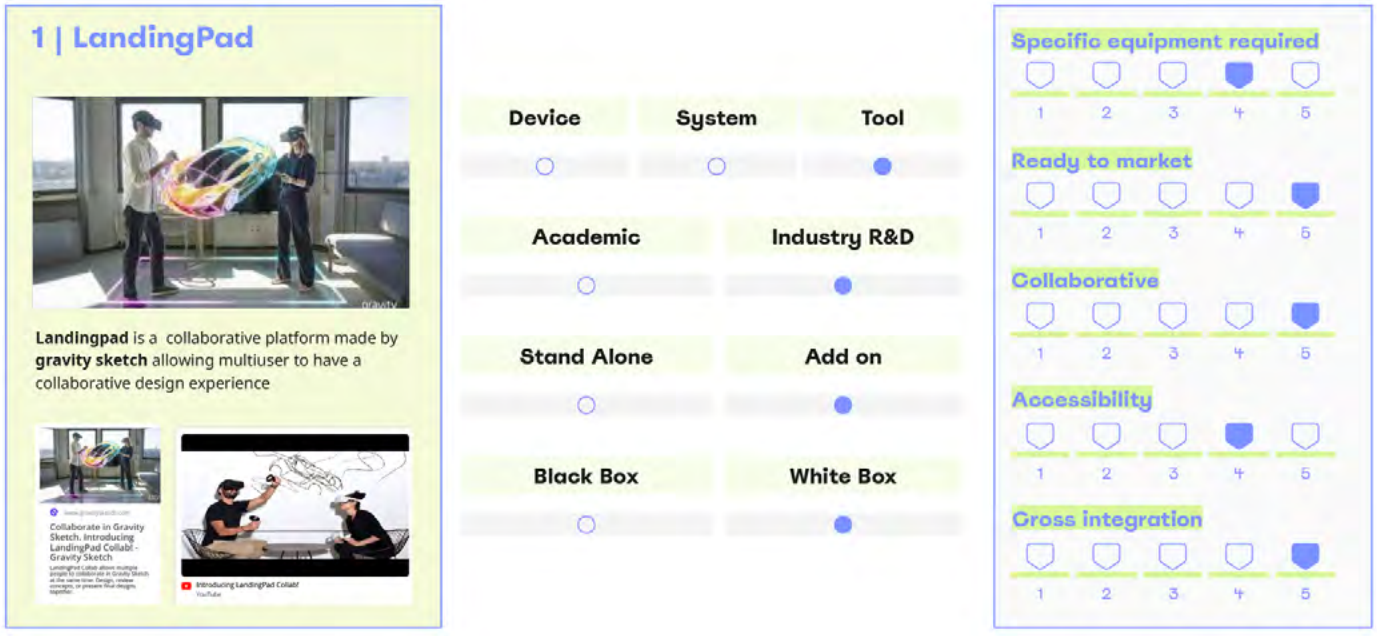


Figure 5. The case study evaluation grid, applied to a case study.

3.3 Case Studies Mapping

After this refinement and categorisation, the research established an additional evaluative stratum. This phase was characterised by creating a conceptual framework (Figure 5) that signifies an integration of two foundational models: the Double Diamond model, which delineates the structured phases of the design process, and the Milgram continuum, which represents the spectrum of reality-virtuality integration. The primary ambition behind this framework was to merge the Double Diamond model with the reality-virtuality continuum proposed by Milgram to combine the two concepts under inquiry. This phase produces a map that facilitates the strategic positioning of case studies concerning their congruence with the distinct phases of the design process, as well as their placement within the reality-virtuality spectrum. Consequently, the horizontal axis of the map delineates the alignment of case studies with the Double Diamond model's mapping of the design process, considering that a single case study may bear relevance to multiple stages of design, so it cannot have a single place but more than one. Meanwhile, the vertical axis categorises case studies according to their positioning within the Milgram continuum, from a fully real environment (bottom) to a fully virtual environment (top).

This map serves as a visual summarisation of the principal findings of the research. While it does not claim to be an exhaustive representation, especially considering the rapid evolution with which these technologies advance, its construction is intended to offer a structured framework for subsequent evaluation. Its objective is to catalyse reflection on the potential integration of the examined case studies into the design process. It provides a novel lens to consider the intersection of design methodology and the reality-virtuality continuum. Additionally, the map provides insights into the strengths and weaknesses of current technologies, thereby serving as a source of inspiration for future implementations. This evaluative tool facilitates a deeper understanding of the landscape of technology application within design, encouraging a vision of how emerging technologies might be harnessed to enrich and expand the boundaries of design practice.

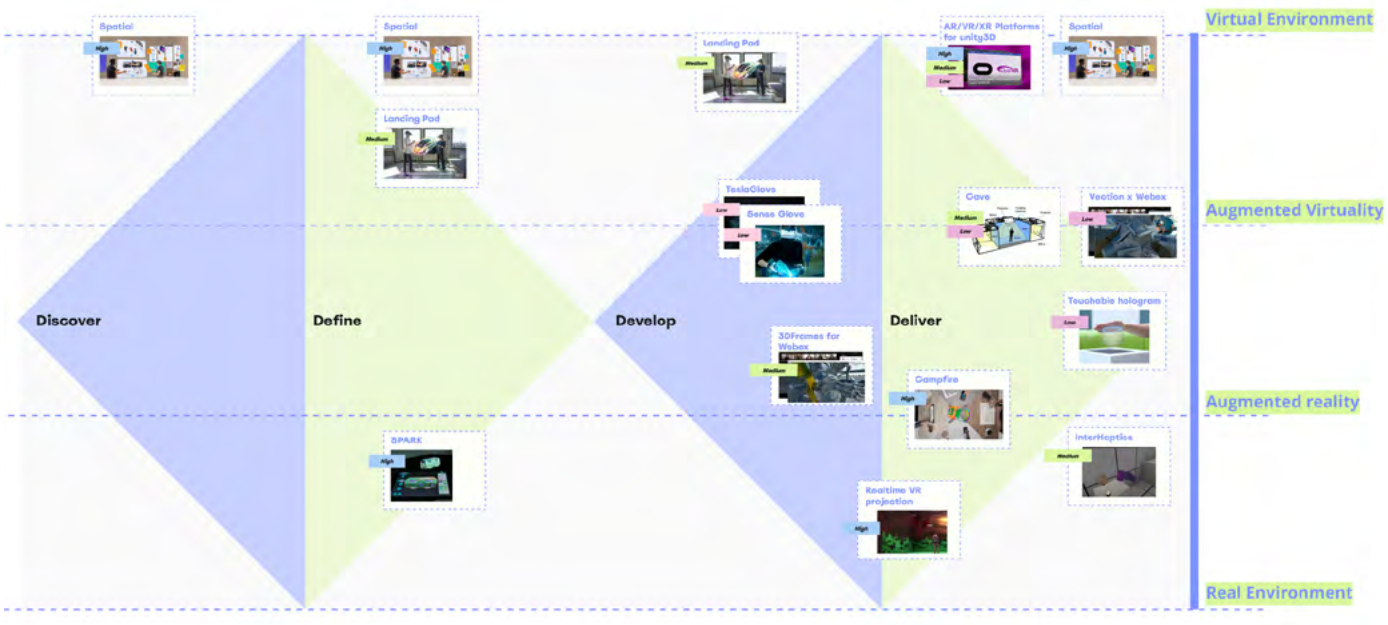


Figure 6. The mapping of the case studies on the double diamond model. The vertical distribution of the case studies is determined by their position within the Milgram continuum (ordered to the right of the diagram). The coloured flag indicates the level of possible collaboration: high blue, medium green, and low pink.

3.4 Implementing XR Tools for Education

Reflecting upon the utility of the most user-centric tools, the research team endeavoured to incorporate specific tools and devices into the academic curriculum, focusing on integrating XR within the educational sphere. This initiative aimed to devise and implement strategic action plans to discern the potential roles of XR in enhancing pedagogical practices. The investigative foray included conducting experiments with a second-year undergraduate cohort from the Product Design programme. AR visualisation software was introduced during the concluding phases of a Digital Representation Studio, categorised within the Showcase cluster. Additionally, students enrolled in the Specializing Master course in Transportation & Automobile Design (Poli.design, n.d.), were engaged in trials involving immersive Virtual Reality VR tools for the evaluative assessment of car interiors, alongside AR tools for the examination of car exteriors, aligning with the Review Together Cluster.

The insights garnered from this project have helped establish an elective course for Master of Science (MSc) degrees in engineering and design. This course is meticulously designed to equip students with an in-depth understanding and practical competencies in XR methodologies and tools. It aims to empower students to create virtual replicas of design solutions for industrial products throughout the various stages of the product development process.

Particular emphasis is placed on XR technologies that are particularly efficacious in representing design solutions during the conceptual and embodiment design phases, thereby fostering the creative process. In mid-2023, the project expanded its horizon by creating a small Virtual Lab. This laboratory is specifically tailored for students pursuing the Industrial Engineering-Design and Architectural Design degree at the XJTU-POLIMI Joint School of Design and Innovation (Polimi, n.d.). This venture represents a significant stride towards embedding XR technologies within the academic framework, facilitating hands-on learning and experimentation.

The forthcoming phase entails the structured evaluation of devices available within collaborative design sessions. Acknowledging the limitations inherent to these devices, conducting tests with designers in an organised setting is anticipated to yield direct feedback from end-users and validate the research findings. Such collaborative testing sessions, conducted within a virtual environment, are poised to delineate the boundaries and unveil XR's opportunities, thereby contributing to refining XR applications in design education and practice.

4. Results

The mapping exercises undertaken within this research have produced insights into the predominant tools that facilitate collaboration across various phases of the design process. An in-depth examination of the interplay between the analysed XR case studies and the principal tools employed during these collaborative stages has led to conclusions concerning the potential for the widespread integration of these tools into collaborative practices.

Recent advances in XR, which encapsulates VR, AR, and MR, have significantly increased the capacity for intuitive multi-user interactions within both co-located and remote settings. This growing technology affords a more enriched social presence through multimodal communication channels, elevating collaborative experiences and augmenting the quality of user experience and task-specific performance.

The analytical synthesis and consequent mapping of the case studies have facilitated their classification into four distinct clusters, each representing an application of XR technologies within collaborative contexts in the product design field:

1. Augmented Meeting. This cluster encapsulates virtual environments designed to enhance the immersive attributes of meetings, wherein participants can be partially or fully immersed. This category underscores the role of XR in transforming traditional meeting spaces into more engaging and interactive spaces. This cluster of XR technologies can be activated during all phases of the design process (Discover, Define, Develop, and Deliver);

2. Design Together. This category is characterised by a shared virtual experience accessible simultaneously to multiple users. It has proven especially effective in the collaborative design and modelling of complex products, demonstrating the profound impact of XR on facilitating collective creativity and problem-solving. This cluster of XR technologies can be activated during the central phases of the design process (Define and Develop), during the concept definition;

3. Review Together. Concentrating on the collaborative presentation of ideas, this cluster facilitates a unified user perspective, enabling the collective review and feedback process. It exemplifies the utility of XR in streamlining communication and enhancing the coherence of collaborative review sessions. Within this cluster, case studies in AR or VR can be found. This cluster of XR technologies can be activated during the final phases of the design process (Develop and Deliver);

4. Showcase. While this dimension may exhibit collaborative elements, it primarily functions as a platform for showcasing outcomes during the delivery phase or displaying products throughout the testing phase. This cluster illustrates the versatility of XR as a tool for demonstrating achievements and facilitating stakeholder engagement. Within this cluster, case studies in AR or VR can be found.

These insights explain the multifaceted applications of XR technologies within collaborative scenarios, highlighting their transformative potential across various dimensions of stakeholder interaction and project evolution. The emergent classification not only offers an understanding of the scope and efficacy of XR in enhancing collaborative activities but also lays the groundwork for future explorations into integrating these technologies within the broader landscape of design and development processes.

5. Discussion

While exploring the XR technologies, it becomes imperative to critically assess the landscape, particularly to demystify the overstatement that often surrounds emerging technologies. A discerning analysis reveals several aspects that deserve consideration (Ashtari et al., 2020).

Firstly, there is a noticeable trend within the domain of XR technology wherein new terminologies are frequently introduced to describe what essentially amounts to the same underlying technology. This proliferation of terminologies and the launch of new devices that exhibit only minor enhancements over their predecessors contribute to a landscape marked by confusion and redundancy. Such a scenario often complicates distinguishing genuine innovation from mere incremental updates (Nebeling, 2020).

Furthermore, promotional materials associated with XR technologies frequently suffer from a tendency towards over-promising. Videos and advertisements showcasing these technologies often portray capabilities and experiences beyond the reach of current implementations. This practice sets unrealistic expectations and obscures these technologies' progress and potential limitations.

Among the critical factors that significantly impact the efficacy and immersion of XR experiences are the display resolution and the field of view. These elements are paramount in defining the quality of the virtual or augmented reality experience, influencing the user's sense of presence and immersion within the digital environment. While many technical aspects of XR technologies are witnessing rapid advancements, these fundamental features continue to serve as benchmarks for assessing the maturity and capability of XR devices (Poulin et al., 2024).

Advancements in user interaction modalities, particularly hand, finger, and eye tracking, have reached a level that is now considered standard and performs quite effectively. These developments have greatly enhanced the intuitiveness and responsiveness of XR systems, allowing for more natural and engaging user experiences.

Despite these advancements, it is crucial to acknowledge that XR technologies are still subject to significant technical and design limitations. These constraints often manifest as less-than-optimal user interfaces, limited content availability, and challenges integrating virtual elements with the physical world (Speicher et al., 2019).

Moreover, the capability for environmental understanding, a critical component for creating convincing and interactive augmented reality experiences, remains relatively rudimentary. Current systems often struggle to interpret and respond to complex physical environments accurately, limiting AR applications' scope and realism.

In conclusion, while XR is expanding with potential, understanding its current state reveals a mix of rapid advancements and persistent challenges. This interplay of progress and limitation defines the current frontier of XR technology, highlighting the importance of tempered expectations and continuous innovation in overcoming the hurdles that lie ahead.

Only in some technologies or devices, which may be the case with the new Apple Visor Pro (Apple, 2023), released in June 2023, does the technology leap forward. In the case of Apple, in addition to improvements on the "visor" system by inserting various features already in use on other devices, the most significant new paradigm is represented by the possibility of gradually varying the immersion of the virtual environment between fully immersive or augmented.

6. Conclusion

This research has provided valuable insights into the potential applications and challenges of integrating such technologies into the design process, demonstrating that XR technologies offer promising solutions for remote collaboration, enhanced communication, and enriched design experiences.

This research has highlighted the transformative potential of XR in redefining collaborative design practices. The classification of XR case studies into distinct clusters, including Augmented Meeting, Design Together, Review Together, and Showcase, underscores the versatility and efficacy of XR tools across various phases of the design process. The findings of this research serve as a foundation for future exploration and innovation in integrating XR technologies within design education and practice. By fostering interdisciplinary collaboration, facilitating hands-on learning experiences, and addressing the evolving needs of design professionals and students, XR technologies promise to revolutionise how designers conceive, create, and collaborate on design projects.

While this research has provided valuable insights into integrating XR technologies in collaborative design sessions, it is essential to acknowledge several limitations. One limitation is the technology evolution: XR technologies are rapidly evolving, with new devices, platforms, and applications continually being developed. This research may become outdated as newer technologies emerge, potentially impacting the relevance and applicability of its findings over time. The findings of this research may be specific to the context in which the study was conducted.

Also, methodological limitations should be considered. The research methods employed, such as case studies, workshops, and literature reviews, may have inherent limitations, such as sampling biases or subjectivity in data interpretation. Future studies may address these limitations by broadening the investigation scope and considering the technology's long-term implications. Thus, the long-term impact of integrating XR technologies into design education and practice remains to be determined and solved by research. It is still being determined how these technologies will evolve, how practitioners and educators

will adopt them, and their lasting effects on design processes and outcomes. Nevertheless, this research provides a valuable starting point for further exploration and advancement in the field of XR technologies in collaborative design sessions by providing points for reflection and analysis that provide insights for future research.

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P/REFERENCES OF DESIGN

ENHANCING CRAFTSMANSHIP THROUGH VISUAL GUIDANCE USING MIXED REALITY: A STUDY ON LEARNING ORIGAMI.

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KEYWORDS | CRAFTSMANSHIP, AUGMENTED REALITY, IMMERSIVE LEARNING, ORIGAMI, KNOWLEDGE TRANSFER

ABSTRACT | In the contemporary educational landscape, the integration of mixed reality (MR) marks a significant shift towards more interactive and immersive learning experiences. The benefits include improved spatial awareness, a more context-specific and action-based experience and guidance, isolation, and focus. A current gap exists between manual operation and virtual assistance, where the actions could be supported in their embodied, physical context. Thus, this paper investigates the influence of MR on the learning process, particularly in the acquisition of craftsmanship skills, using origami as a case study. This research focuses on assessing how these technologies enhance understanding, engagement, and skill acquisition in origami, a craft requiring precision, patience, and spatial insight. The study encompasses a controlled experiment with five product development students with varying levels of origami and VR experience, assessed in a pre-test skill-level survey. They use a custom-designed MR application with the Meta (formerly known as Oculus) Quest VR head mounted display (HMD) to learn how to make the "exploded vertex" model, a model representative of David Huffman's curved-crease folding techniques. This headset provides a pass-through option with an improved camera quality. The experiment is structured into six phases, including VR headset adjustment, alignment, drawing, instructional video and 3D model interaction, origami making, and a final satisfaction assessment. These are supported by an AR-assisted visualization presenting step-by-step guidance projected on the physical paper underneath, a prerecorded instructional video, and a 3D model to be grabbed and viewed from all angles. The results indicate that MR significantly enhances the learning experience, offering real-time guidance and a deeper understanding of spatial relationships crucial in origami. Increased engagement and personalized learning adjusted to the individual pace were noted by the participants. However, the impact remained nuanced, where prior origami experience aided in overall performance within the VR environment, it did not translate consistently into higher precision. The leap to MR, despite challenges like visual distortion caused by the quality of the Meta Quest 3, reveals the potential of these technologies in enhancing traditional learning methods. This paper aims to highlight the capabilities and limitations of MR as educational assistive technology. Underscoring the importance of balancing novel technological approaches with traditional methods, areas for future research might include long-term skill retention and optimization for diverse learner demographics.

1. Introduction

Integrating technology into educational and skill development processes has been increasingly prominent in the last few years. One of these emerging technologies that has gained attention in this context is augmented reality (AR). Augmented reality is a technology that blends the real-world environment with digital information, such as a virtually created object, creating an immersive experience for users. The difference with virtual reality (VR) is that the user is then fully enclosed in a virtual environment. Furthermore, it is necessary to acknowledge the difference between AR and mixed reality (MR). While AR provides a view of the real world with an overlay of digital objects, in MR these physical (user or object) and digital elements can interact (Tremosa, 2022). Acquiring new skills and the potential to enhance learning experiences has made this a subject of significant interest, especially in craftsmanship and hands-on skills acquisition. For instance, spatial awareness allows a person to visually discern the spatial relationship between two or more objects, including their connection to themselves. This capability has been confirmed to improve in correlation with the aforementioned technologies (Azarby & Rice, 2022).

Augmented reality learning could enhance students' understanding of concepts and processes compared to the traditional teaching materials. Increasing the participants' interest, focus and motivation in learning new skills are critical factors for effective learning (Hung, Chen & Huang, 2017). The hardware technology applied in this research will be the Meta Quest 3, which is a head mounted display (HMD). An HMD is a screen device that is positioned directly in front of the user's eyes through a head-mounted mechanism. This setup allows digital content to be overlaid onto their field of vision (FOV), offering an immersive user experience that has been useful for skills acquisition such as cognitive skills related to comprehending spatial and visual information and knowledge (Jensen & Konradsen, 2018). The Meta Quest 3 was employed over other available options due to superior pixel quality and full color passthrough.

To research how people, specifically Product Development students, acquire hands-on skills through using MR, the focus is put on the craftmanship of origami specifically. Which entails a high degree of skill, precision and patience. Origami, the East Asian art of paper folding, embodies creativity and expression, allowing artists to experiment with a flat sheet of paper and turn it into three-dimensional models (Chen, 2023). Traditionally, origami has been taught through paper books, diagrams and hands-on demonstrations. However, with the advance of augmented reality technology, there is an opportunity to foster revolution in how individuals learn and engage with this ancient art form. Technology has been used before for 3D origami learning. The use of video recording for instance is significant, in which the folding technique is shown (Kustiawan et al., 2021)

This research paper uses an origami model built by David Huffman; a man known for his curved-crease paper models. The initial documented mention of curved crease folding traces back to a Bauhaus student who participated in a course instructed by Josef Albers during the years 1927 and 1928 (Demaine et al., 2011). Huffman’s work is known for its significant field in origami and mathematical geometry, involving complex curved creases. Origami artists and mathematicians use his work to build upon his knowledge and try to develop a theory for Huffman’s knowledge (Demaine et al., 2011).

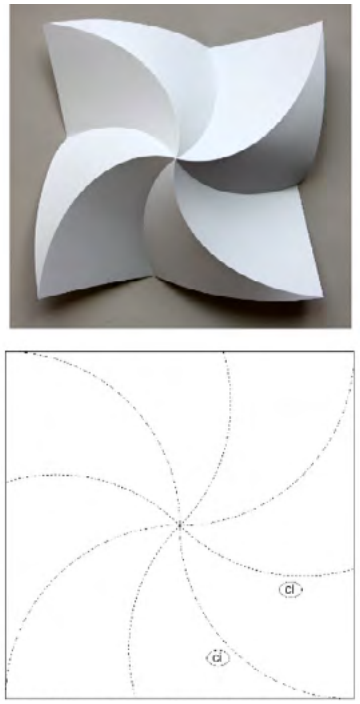


Figure 1. Exploded vertex pattern by Huffman (Demaine et al., 2011).

The specific model chosen for this research is part of a collection of patterns that include an “exploded vertex”, shown in Figure 1 (Demaine et al., 2011). The pattern consists of folding the paper so that all creases (in this exact case: circular arcs which alternate between mountains and valleys) seem to come out of a single point, usually located in the center of the piece of paper. This figure was chosen due to its specific pinching technique that would improve visual significance whether the participants were understanding the process and not just copying folds from instructions as in 2D origami.

The overarching research question in this study revolves around the impact of MR-enhanced learning experiences on the acquisition of craftsmanship skills, with origami as specific focus. Understanding the influence of MR on the overall learning process and engagement of individuals in acquiring such skills can have far-reaching implications in education. Not only in Product Development, including related in-print paper by Garcia (2024). But in numerous fields such as aerospace, mechanical engineering, skills development and even recreational pursuits (Yue, 2023; Turner et al., 2016). Prior research mentions the possibility that immersive technological experiences lead to higher levels of engagement and understanding of complex concepts and spatial relationships (Dede, 2009; Bodzin et al., 2020).

2. Method

The experiment explores the integration of origami and augmented reality in a six-phase process. Each participant first adjusts the headset and gets their first experience with an MR environment. The next phases include the making of David Huffman’s origami shape, with the exploded vertex. The final phase evaluates their satisfaction and completion of the task in comparison with the result of the expected outcome.

The think-aloud method for receiving feedback from the participants was utilized to acquire user insight and action reasoning. The think-aloud method is implemented in research when insights into participants cognitive processes during specific tasks are of importance. By having participants verbalize their thoughts, researchers get to understand the thought processes and decision-making strategies participants go through during their performance (Eccles & Arsal, 2017).

2.1 Participants

The study includes five participants, two males and three females, aged between 19 and 21 years. A set of pre-test questions reveals the following. All are Product Development students with up to three years of CAD experience in classes using SolidWorks, particularly in surface modelling. Their backgrounds in origami and VR experience vary, providing a diverse sample for the experiment. The participants' levels of origami experience ranges from very little or no experience during childhood and a general disinterest to a significant amount of personal engagement, folding during their free time as a hobby. Similarly, their mixed reality experience varies from no prior exposure to quickly using virtual reality to test a few functions and watch a video. More specifically, Participant 1 demonstrates solid origami skills but had limited VR exposure. Participant 2 has moderate origami familiarity and minimal VR experience. Participant 3 possesses basic origami knowledge and engaged in some VR activities. Participant 4 exhibits minimal interest in both origami and VR. Participant 5 has a higher origami skill level but was not actively practising and had no VR experience.

2.2 Apparatus and Materials

Apart from a table and a chair for the participant:

- VR Headset: Meta (formerly known as Oculus) Quest 3;
- MR Application: Specifically designed for the experiment within the game engine Unity and not based on existing layouts. It features functionalities for aligning paper with a virtual template, drawing over lines on paper, viewing instructional videos, and interacting with 3D origami models;
- Origami Paper: A4-sized paper cut in 21cmx21cm for origami crafting;
- A pen and standard stationery for the drawing phase.

2.3 Think-Aloud Method

During the experiment, participants are instructed to verbalize their thoughts, actions and feelings in real-time using the think-aloud protocol. This technique aims to capture their cognitive processes, problem-solving strategies and immediate reactions to the MR environment.

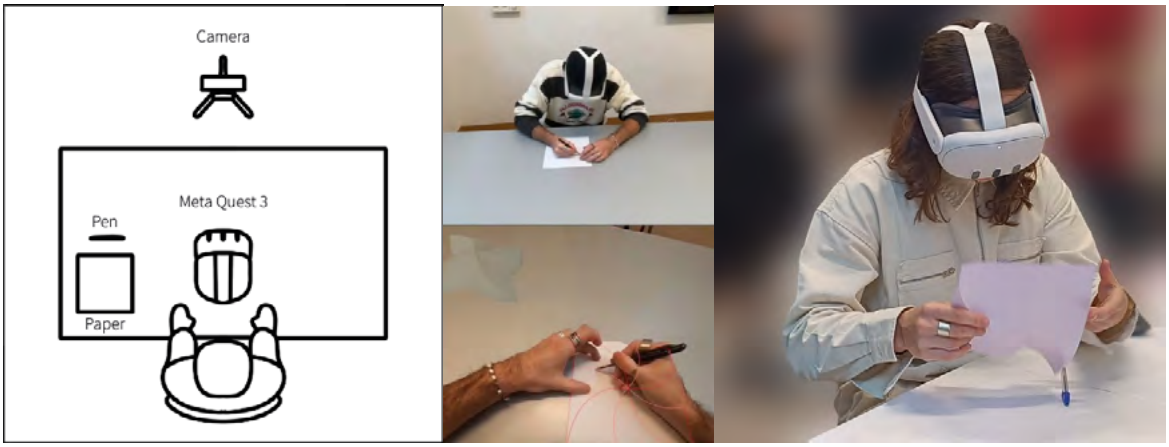


Figure 2. The test setup (left to right: illustrated top view; synchronized camera viewpoint (top), headset viewpoint inside headset (bottom); folding in action).

2.4 Procedure

The experiment is structured into six phases and pre-formed in an aforementioned setup, Figure 3 highlights the distinction between virtual and physical elements:

Phase 1: VR Headset Adjustment and Initial Task: Participants are asked to put on the headset. This phase assesses how participants adjust to the VR headset and their initial reactions, focusing on ease of use and interaction with the AR environment.

Phase 2: Alignment Task: Participants are instructed to take a piece of paper and align it with the template, visible in augmented reality. This phase involves observing precision, strategy and any adjustments made.

Phase 3: Drawing Task: Participants are asked to take a pen that is on the table and draw over the lines, visible in augmented reality. By doing so, the participants pre-crease the paper, effectively creating a guide for the folds in the next step. This phase focuses on their accuracy, method of tracing, and level of concentration. Time taken and normalized accuracy are documented.

Phase 4: Instructional Video and 3D Model Interaction: Participants are instructed to watch a small repeating video clip, showing the correct folding technique for the origami model. After which they are told to look at and grab a virtual 3D model of the final origami model. This phase focuses on observing engagement level with both the video and the 3D model, interaction style and comprehension of instructions.

Phase 5: Origami Making: Participants are asked to start making the origami model with no further instructions. This phase focuses on skill, technique, reference to instructions (technique video and the 3D model) and problem-solving strategies.

Phase 6: Completion and Satisfaction Assessment: Participants are instructed to end the test once they feel satisfied with their result or approve of a stalemate in their progress. This phase assesses when participants decide they completed the task and their satisfaction with the result, comparing the result with the expected outcome and noting the duration of completion.

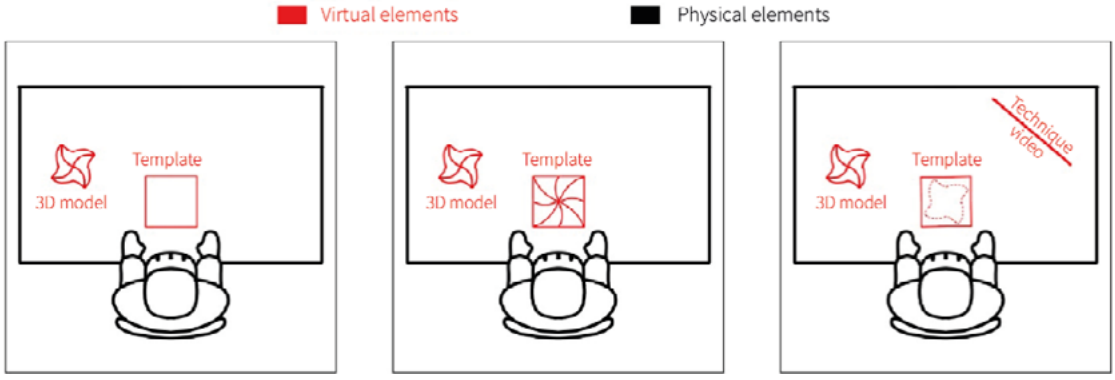


Figure 3. Visuals visible for the user in phases from left to right: phase 1, 2; phase 3; phase 4, 5, 6.

2.5 Post-Experiment Interview

A post-experiment interview is conducted to gather feedback on the overall experience, challenges faced, perceived usefulness of the MR technology in learning origami and any suggestions for improvement of the overall experience and the MR and real-life setup. The questions are inspired by the NASA Task Load Index (NASA-TLX) (Galy et al., 2018).

2.6 Data Collection and Analysis

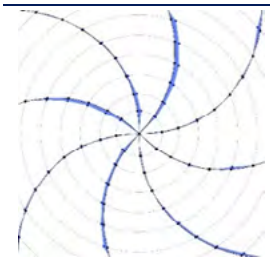
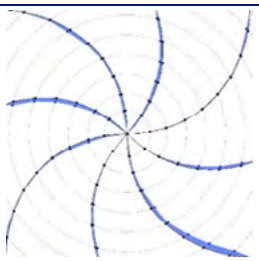
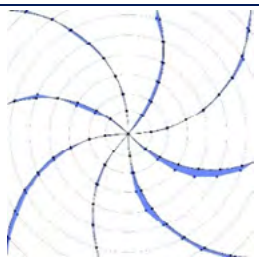
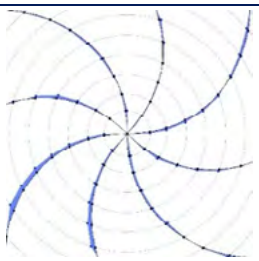
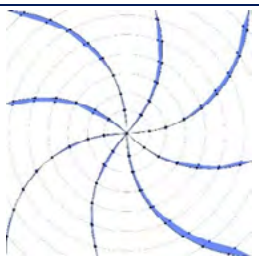
Quantitative data includes specific task times, normalized accuracy for the drawing task, and final scores of the origami models. Qualitative data encompasses observational notes from each experiment phase, think-aloud narrations and insights from pre- and post-experiment interviews. This comprehensive data collection aims to correlate participant backgrounds, in-task verbalizations and post-experiment reflections with their performance and overall experience. The final model score is decided by comparing the participant's result with the example model and placing them on a scale from zero to ten, defining 0 as a flat sheet of paper, and 10 as a perfectly folded model.

To assess the accuracy of each participant's drawings, we employ a method that quantifies the area between the participant's drawn lines and the template lines (Figure 3) shown in the overlay. This area represents the deviation from the desired line and serves as a measure of drawing accuracy.
We defined 100% accuracy, as a scenario where the participant's line perfectly overlays the mixed reality template, resulting in an area of zero deviation. Conversely, the worst-case scenario, representing 0% accuracy, was defined by the maximal possible area of deviation that could occur within the confines of the experiment's setup. To calculate the area of deviation, we digitize each drawing and apply image analysis software to measure the area between the drawn and template lines. The resulting area measurements are used to calculate the accuracy percentage by inversely scaling the measured area between the predefined maximum (0% accuracy) and zero (100% accuracy).

3. Results

Participants engaging with 3D models in MR report a more engaging learning experience and better understanding of spatial relationships. The immersive quality influences the participants' comprehension of complex shapes through the grabbable 3D model. The overlay for the drawing tasks received multiple enthusiastic responses from participants one, three, four and five. Stating that without the overlay they would have encountered more issues. Regarding origami skill acquisition, participants with prior experience demonstrated greater confidence in the virtual environment, though it did not necessarily improve drawing accuracy. Limited MR experience did not hinder performance significantly, but familiarity influenced task approaches. Participants displayed varying degrees of adaptation to the MR environment. In perceptions and interactions with VR features, participants recognized the utility of VR in enhancing learning, despite facing challenges like visual distortion. Quantitative results showed variability in drawing accuracy, differing approaches in task times, and variations in final model scores, reflecting differences in task execution and product quality. These can be found in Table 1.

Table 1. Point-to-point analysis, Think Aloud Method and Video analysis.

Participant 1	Participant 2	Participant 3	Participant 4	Participant 5
				
Self-rated origami experience 7/10, limited VR experience	Self-rated origami experience 3.5/10, minimal VR experience	Self-rated origami experience 4.5/10, some VR experience	Self-rated origami experience 2/10, no VR experience	Self-rated origami experience 5.5/10, no VR experience
Phase 1: Adjusted well to VR headset, impressed by the virtual 3D model.	Phase 1: Adjusted well to VR headset with minor distortion noted.	Phase 1: Adjusted well to VR headset with no confusion.	Phase 1: Adjusted well to VR headset with no confusion.	Phase 1: Adjusted well to VR headset, impressed by the virtual 3D model.
Phase 2: Successfully aligned paper with AR template on first try.	Phase 2: Successfully aligned paper with AR template on first try.	Phase 2: Successfully aligned paper with AR template on first try.	Phase 2: Successfully aligned paper with AR template on first try.	Phase 2: Successfully aligned paper with AR template on first try.
Phase 3: Drawing Task - Time taken: 1min 5sec, Normalized Accuracy: 59.18%.	Phase 3: Drawing Task - Time taken: 48sec, Normalized Accuracy: 55.10%.	Phase 3: Drawing Task - Time taken: 20sec, Normalized Accuracy: 53.08%.	Phase 3: Drawing Task - Time taken: 20sec, Normalized Accuracy: 53.08%.	Phase 3: Drawing Task - Time taken: 1min 5sec, Normalized Accuracy: 59.18%.
Phase 4: Watched instructional video, did not pick up 3D model again after initial interaction.	Phase 4: Focused on instructional video, analyzed 3D model thoroughly.	Phase 4: Focused on instructional video, interacted with 3D model.	Phase 4: Focused on instructional video, interacted with 3D model.	Phase 4: Watched instructional video, did not pick up 3D model again after initial interaction.
Phase 5: Successfully picked up folding technique but caused unintentional wrinkles.	Phase 5: Quickly picked up folding technique, noted difficulty in visual focus.	Phase 5: Understood technique but applied it slightly wrong, made adjustments.	Phase 5: Understood technique but applied it slightly wrong, made adjustments.	Phase 5: Successfully picked up folding technique but caused unintentional wrinkles.
Phase 6: Final folding time: 7min 20sec, Final model score: 7/10	Phase 6: Final folding time: 4min 14sec, Final model score: 9/10.	Phase 6: Final folding time: 3min 37sec, Final model score: 5/10.	Phase 6: Final folding time: 3min 37sec, Final model score: 5/10.	Phase 6: Final folding time: 7min 20sec, Final model score: 7/10.

The Normalized accuracy ranges from 40.74% to 59.18%, indicating variability in precision during the drawing task (Figure 4).

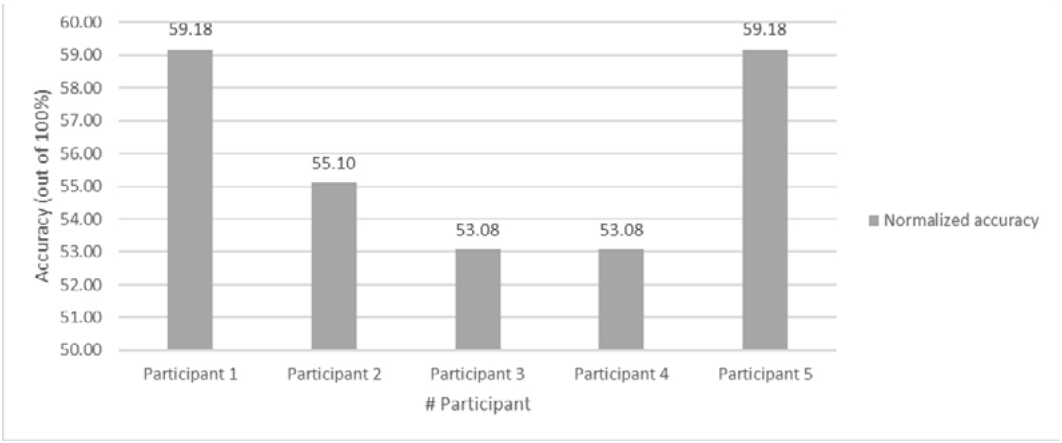


Figure 4. Normalized accuracy results.

Figure 5 shows the average time for Drawing Task, which ranged from 20sec to 1min 05sec, showing differences in pace and approach. However, the average time for Origami Making ranges from 3min 37sec to 7min 20sec, suggesting a generally consistent engagement with the task.

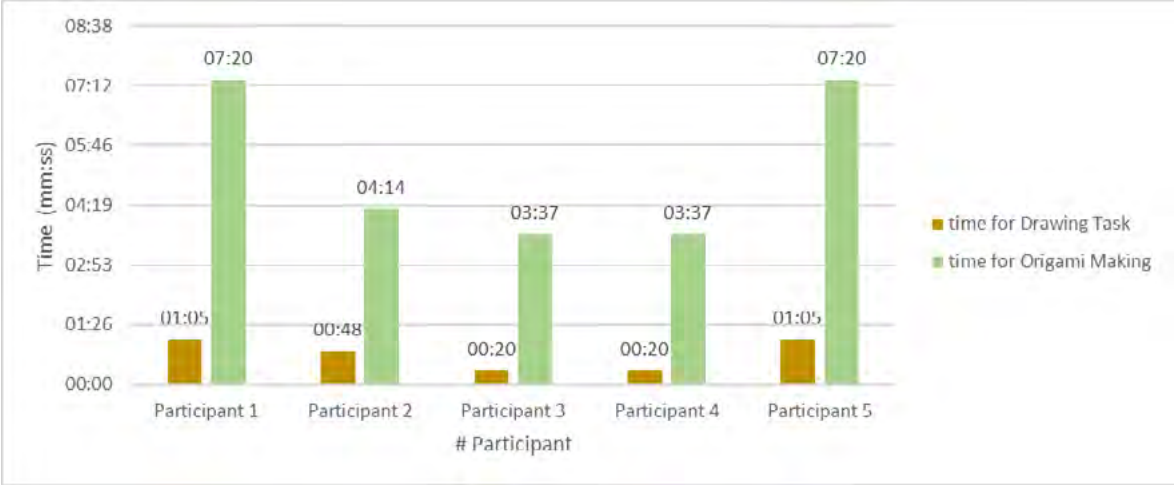


Figure 5. Time-based performance.

The final model scores, depicted in Figure 6, vary from 5/10 to 9/10, reflecting the differences in overall task execution and final product quality.

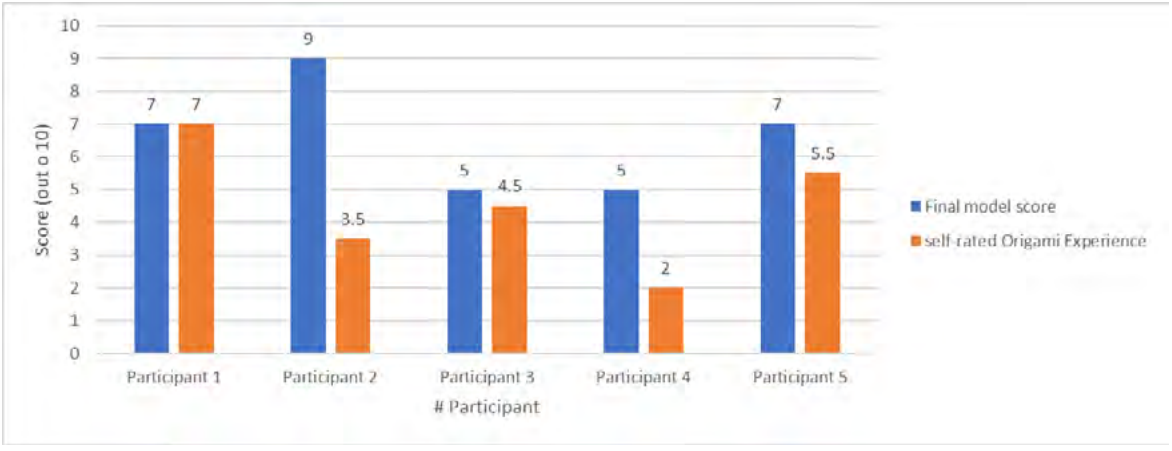


Figure 6. Quality-based results.

The post-experiment interview results indicate participants with higher self-rated origami experience, like Participant 1, showed more confidence and adaptability in handling tasks, despite initial VR adjustments. The participants additionally perceived the experiment to be mentally challenging. Only slight complaints purely about hardware-related issues were made such as warping of the view and dimness. The satisfaction of the origami creation result was mixed, some participants were not happy with their origami since their envisioned result was of higher quality. However, most considered their result fair enough and found the visual guidance helpful. The majority of the participants also found detail work tougher to perform than the general actions. Based on the instruction given through the MR setup, most participants were confident that they could recreate a similar origami design. Both with and without a headset, based on the gained knowledge. The repetition to perform the same sort of craft process with the use of the technology was however divided. Half of the participants saw this more as a one-time experience in its current state. In the end also half of the participants stated that they would use the virtual reference more. They focused most attention on the tutorial video, keeping the virtual reference more in mind would result in an improved execution and visually appealing origami product.

Across all participants the mixed reality setup was found to be a useful tool for certain aspects of the task, such as line drawing, but also introduced challenges like visual distortion and difficulty in detailed work.

4. Discussion

This study's findings contribute to the growing body of research on mixed reality (MR) as an educational tool, particularly in the realm of craftsmanship and skill acquisition. The immersive and interactive experiences provided by MR have demonstrated significant potential in enhancing the learning process for complex skills such as origami. However, this exploration extends beyond the mere affirmation of these technologies' effectiveness; it delves into the nuances of their impact on diverse learners.

The study underscores the benefits of immersive learning environments. MR's ability to overlay instructional content onto the physical world creates a more engaging and intuitive learning experience. This finding aligns with prior research indicating that immersive technologies can lead to higher levels of engagement and a deeper understanding of complex concepts. The interactive nature of these technologies, as evidenced by the learners' ability to manipulate 3D models, plays a crucial role in understanding spatial relationships – a key component in origami.

The findings suggest that learners benefit from progressing at their own pace, echoing the conclusions drawn in similar studies (Srithar & Selvaraj, 2015). This aspect of technology-enhanced learning is especially crucial in educational settings where learners' abilities and learning styles vary widely. The influence of prior origami experience and familiarity with VR on task execution was a critical aspect of this study. Interestingly, while prior experience in origami seemed to boost confidence in VR environments, it did not invariably lead to higher precision in skills requiring fine motor control. This observation raises questions about the transferability of traditional skills to technologically mediated environments, suggesting an area ripe for further investigation.

This study has its limitations. First, the sample size and demographic diversity of participants may limit the generalizability of the findings. Second, the study's duration did not allow for an assessment of long-term skill retention or the effectiveness of these technologies over extended periods.

Furthermore, the visual quality of the pass-through video was limited: participants frequently mentioned issues like pixelation and distortion, which occasionally broke the immersion and made tasks like line drawing more challenging. This underscores the current technological limitations of MR in delivering a consistently seamless and realistic experience.

5. Conclusion

Our study provides an examination of how mixed reality technologies impact the acquisition of craftsmanship skills. Focusing on origami as a test case, the study demonstrates the dynamic and engaging learning environment immersive technologies can create, offering significant advantages over traditional instructional methods. The use of MR allows for the overlay of instructional guides in the physical world and the manipulation of 3D models in real-time, enhancing the learner's grasp of complex shapes and spatial relationships critical in origami.

The effectiveness of MR in skill acquisition is influenced by factors such as the learner's prior experience with origami and their familiarity with immersive technology. While previous experience may increase confidence and adaptability, it does not necessarily correlate with higher precision or more effective performance. This underscores the importance of well-designed MR orientation programs to maximize the benefits of these technologies in learning contexts. Despite initial challenges like visual distortion or focusing difficulty, learners generally maintained their performance levels, suggesting that the potential benefits of MR in education outweigh the initial hurdles. The quantitative analysis shows variability in task outcomes, possibly implying the need for personalized learning approaches to accommodate diverse learning styles and paces. The post-experiment interview reveals that the line template was perceived exceptionally well, having a positive impression on all the participants and them stating its significant added value over the traditional video instruction. Most of the participants were not directly satisfied with the result of their origami creation, however found the MR experience pleasant and could see the implementation in the future with optimized visual capability and more support around the entire process in a step-by-step fashion of the craft.

By integrating MR with traditional learning methods, educators and learners can benefit from a more inclusive, adaptable, and engaging educational experience. Future research could explore longitudinal impacts of MR on skill acquisition and retention. Studies could also investigate how these technologies can be optimized for different learner demographics, including age groups and varying levels of technological proficiency. Furthermore, comparative studies between immersive learning and traditional approaches could yield deeper insights into the efficacy and adaptability of educational tools.

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P/REFERENCES OF DESIGN

EXPLORING THE INTERSECTION OF RUNNING AND MUSIC: INSIGHTS INTO USER EXPERIENCE AND INTERFACE DESIGN.

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KEYWORDS | USER EXPERIENCE, INTERFACE DESIGN, DIGITAL INTERACTIONS, MUSIC PLAYING, RUNNING

ABSTRACT | User interfaces for music devices and streaming platforms often neglect the needs of physically active users, who require interfaces optimized for dynamic activities like running. To address this, interfaces must offer intuitive controls, non-intrusive feedback mechanisms, and compatibility with runners' movements. Running, a popular activity for physical and mental well-being, combined with music listening, poses unique challenges and advantages. This study investigates runners' behaviors and interactions with various interfaces, using eye-tracking technology and interviews with 10 participants. The findings highlight the challenges runners face in managing multiple devices while running and emphasize the need for intuitive design.
The research explores the tension between expressive and utilitarian design in user interfaces, especially concerning digital music platforms for runners. It offers insights to enhance user experiences and bridge the gap between technological systems and user needs. By addressing these challenges, the study contributes to a deeper understanding of the intersection between running, music devices, and interface design, guiding future design developments for a more seamless and user-friendly experience.

1. Introduction

Music listening and running are two widely embraced activities that offer distinctive experiences for enthusiasts of both pursuits. Casual running is often pursued for reasons such as weight management, fitness, and meditative purposes (Bood et al., 2013) typically requires no specialized equipment. On the contrary, running with music can disrupt the overall running experience by requiring runners to carry supplementary devices, such as a mobile phone or music player, and a channel like a headphone or earphone, along with an accompanying audio output channel like headphones or earphones. The music control features can pose challenges due to physical movement, external factors, and the extra weight and bulk of the devices (Terry et al., 2012). Despite these challenges, many runners opt to integrate music into their routines to make the experience more seamless and enjoyable (Jebabli et al., 2020).

User interfaces for music devices and streaming platforms often overlook the needs of runners, focusing on static use rather than the demands of dynamic activities like running. Prioritizing usability for runners is crucial, necessitating interfaces that seamlessly integrate with their activity without interruption. This requires intuitive controls, non-intrusive feedback mechanisms (including e.g., auditory tones or vibrations) that confirm user actions without interrupting concentration, and compatibility with runners' movements. Although current mobile music streaming platforms and headphones offer diverse features to enhance the running experience with music, the overall experience can be ambiguous from the runner's perspective. This study focuses on the overall experience and specialized interactions between users and tangible as well as digital interfaces facilitating music for runners.

The researchers claim that by adapting music control interfaces for running activities, it is possible to optimize the user experience and create a safer and more enjoyable environment for runners. Through this study, the researchers aim to bridge the gap between technology and recreational activities, aligning them in a way that enhances rather than hinders the runner's experience. The motivation to explore and innovate in the field of music control interfaces for runners is driven by the belief that advancements in interface design can significantly contribute to optimizing performance, safety, and overall satisfaction during running sessions.

2. Running with Music

Running and music share a unique relationship, as running serves as a physical activity engaging individuals across various age groups and fitness levels. The running experience is multifaceted, encompassing physical sensations, bodily responses, psychological effects, emotional benefits, social aspects, and challenges. Crucial physical changes, such as alterations in heart rate, breathing patterns, and energy expenditure, are essential for meeting the heightened demands placed on the cardiovascular and respiratory systems (Foster et al., 2019). From a psychological perspective, running stands out for its positive effects on mental well-being, with research showing that running can induce a "runner's high" and reduce symptoms of depression and anxiety (Boecker et al., 2008; Dietrich and McDaniel, 2004). Regular running has been associated with enhanced self-esteem, improved cognitive functioning, and reduced symptoms of depression and anxiety (Hassmen et al., 2000; Stults-Kolehmainen and Bartholomew, 2012). Running can also evoke a wide range of emotions, such as joy, accomplishment, and empowerment (Lane and Wilson, 2011). These emotional benefits extend beyond immediate experience, contributing to overall emotional well-being, self-esteem, and body image (Sabiston and McDonough, 2009; Tiggemann and Zaccardo, 2018). Socially, running fosters a sense of belonging and camaraderie among runners, while challenges include the inherent risk of injuries and fatigue (Krabak et al., 2011; Niven et al., 2020).

Despite these challenges, the rewards of running are significant and often outweigh the challenges. Running provides a sense of accomplishment and achievement, contributing to improved fitness, maintenance of a healthy weight, and the overall promotion of physical well-being. Additionally, engaging in running can foster personal growth, heightened self-confidence, and a sense of empowerment (Moore et

al., 2020). The running experience encompasses physical, psychological, emotional, and social dimensions, offering a holistic perspective on its impact on individuals. By considering these dimensions, individuals can gain a deeper understanding of the holistic impact running can have on their physical health, mental well-being, and social connections.

Music proves to be a powerful motivational tool, especially in the context of exercise and physical activities. Studies have shown that music has the capacity to elevate affect, reduce perceived exertion, improve energy efficiency, and amplify work output and when chosen for its motivational qualities, music can exert a magnified positive impact on both psychological state and performance (Karageorghis and Priest, 2012). Motivational music is characterized by a fast tempo and strong rhythm, boosting energy levels, and prompting physical activity. It can synchronize with the body's movements, leading to improved performance and endurance (Bood et al., 2013). Listening to motivational music not only stimulates physical activity, but also enhances mood, reduces perceptions of exertion, and brings about changes in arousal. It can also serve as a valuable distraction from pain and fatigue, allowing individuals to overcome challenging moments during exercise (Bood et al., 2013). Music's emotive quality can create a positive affective state even in negative psychological circumstances (Van den Tol and Edwards, 2011). By understanding the motivational qualities of music and selecting appropriate tracks, individuals can harness the power of music to enhance their motivation, performance, and overall exercise experience.

The combination of the two activities 'running-with-music' generates a distinctive synergy that enriches the overall running experience. The rhythmic nature of running aligns well with the rhythmic qualities of music, creating a harmonious and immersive experience. Music, serving as a powerful motivator, provides a steady beat that helps runners to maintain their cadence and pace. It can also uplift spirits, and serve as a distraction from physical discomfort, enabling runners to push through challenging moments with greater resilience.

The incorporation of music into running routines has become increasingly popular, as runners recognize the positive impact it can have on their performance, enjoyment, and overall well-being. The impact of music on running performance has been explored in different contexts. For example, one study found no significant differences in heart rate and perceived exertion with and without music (Cabral et al., 2022). Nevertheless, distinct levels of music information were found to affect running performance, with participants covering a greater distance when there was more music information, particularly in synchronous conditions (Ramji et al., 2016). Auditory-motor synchronization represents a crucial dimension of the intersection between running and music. The beat and tempo of music can synchronize with the body's movements, leading to improved performance and endurance (Bood et al., 2013). Research indicates that synchronizing movement tempo to acoustic stimuli, such as music or metronomes, can positively impact running performance. Music's influence on psychological state during running is profound, shaping mood, arousal levels, and attentional focus. Karageorghis and Priest (2012) emphasize the positive effects of music on psychological state and performance, highlighting its capacity to elevate affect, reduce perceived exertion, and improve energy efficiency. Running with music offers a dynamic and engaging experience that combines the physical benefits of running with the emotional and motivational power of music. Although, some studies present contradictory findings, suggesting that the effects of music on running may vary depending on factors such as exercise intensity and individual preferences, additional research is needed to explore the specific mechanisms underpinning the effects of music on running and understand individual differences in response to music.

3. Research Methodology

The research outlined in this paper seeks to explore ways in which music platforms and their communication/interaction between headphones/earphones can be better designed to enhance the music listening experience of amateur runners while running outdoors. The study explores the user experience with the interfaces that runners use. To closely observe and inquire into runners' experiences, it was deemed essential to conduct in-context fieldwork where participants are observed while running with music devices. Therefore, a fieldwork setup was established, providing a setting where runners actively

engage in running with their devices. In addition, the participants wore an eye-tracking device to gather supplementary information on their interactions with the interfaces of music listening devices or app screens. Accordingly, a three staged fieldwork was set up consisting of the following three parts: i) Pre-Running-Interviews; ii) Running Activity on a Track, and iii) Post-Running Interviews. In total, ten participants were secured. Each part of the fieldwork was carried out with each participant individually.

Pre-Running-Interviews, was planned as an interview section in which participants were asked about their running habits, specifically their routines for running with music, the devices they utilize, and platforms they interact with. Additionally, the participants were briefed with more detailed information about the implementation of the study before the commencement of the fieldwork.

Running Activity on a Track, constituted a fieldwork procedure involving 10-15 minutes of running activity around Middle East Technical University's outdoor running track, incorporating the use of a wearable eye tracker. The participants carried their headphones/earphones and technological devices to enable music listening while running. The participants were given commands regarding music control during the running activity, and the sequences of performing commands were recorded through an eye-tracking device. The primary objective of this activity was to gain insights into participants' experiences with physical and digital interface components, aiming to uncover any challenges that participants encountered in relation to these interface elements.

Participants were given a period to wear eye-tracking glasses, wear their own headphones that they brought, and keep their smartphones connected to digital music listening platforms. When the participants were ready, the running activity commenced. Participants began running around the track, with each round covering approximately 410 meters. Throughout their run, eight banners, each featuring a distinct music playback commands (i.e., start the playlist; turn the volume down; turn the volume up; change the song; pause the song; resume the song; change the playlist; and finish the playlist) were strategically lifted up by the researcher in varied orders and at different locations on the running track to prevent participants from forming expectations based on a regular order. The commands were reinforced with both corresponding icons and written text. The eight commands were chosen by estimating the music playback controls that are likely to be interacted with the most during a run. Since more complex music playback controls, such as liking/disliking a song, preparing a playlist, following lyrics, are less likely to be used while running, the study only focused on the eight commands.

Figure 1 provides a diagrammatic representation of how the commands were displayed on the track, with each participant receiving a different command combination. Upon the completion of all eight commands (approx. four rounds around the running track), the running activity concluded. Participants were given a short break to rest and remove the equipment they used. Subsequently, they were escorted to the post-running-interviews, marking the final part of the fieldwork.

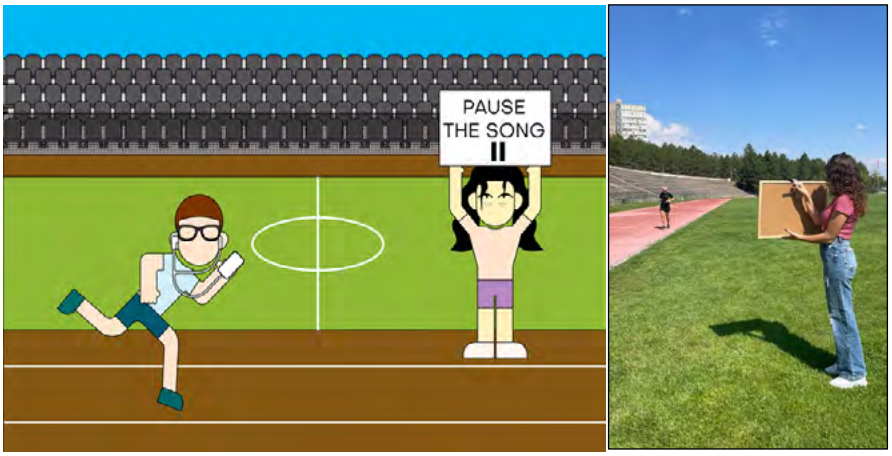


Figure 1. A representation of how the researcher instructed the participants on music playback commands was through a banner displayed on the track.

Post-Running Interviews, were conducted immediately after the running activity with the aim of gathering feedback on both the activity itself and the commands provided to participants. Participants were specifically inquired about the advantages and challenges that they experienced with the devices and interfaces to carry out the commands while running. Their recommendations for the design of product and digital interfaces were also sought. Additionally, participants shared their thoughts on the experience with the wearable eye tracker.

4. Results

The semi-structured interviews conducted before and after the running activity provided insights into the runners' experiences and expectations regarding their music listening routines and the interfaces they interacted with while running. Additionally, the running activity provided a measurable means of capturing the steps in the runners' experience of performing music playback commands and their corresponding execution times with the help of eye-tracking technology.

During the pre-running Interviews, participants disclosed details about their music listening routines and habits while running, highlighting the characteristics of the devices and interfaces they used. In the post-running Interviews, they evaluated the challenges encountered in performing the music playback commands during the field activity and elaborated on the underlying reasons.

The difficulty ratings of the music playback commands conveyed in the post-running Interviews were arranged in tabular format, and their respective percentage analyses were indicated. The fieldwork results and analysis are presented together with the design insights about the current digital and tangible interface interactions in the context of running and the discussion of the role of eye-tracking technology in capturing runners' experiences.

4.1 Difficulty Ratings of the Music Playback Commands

As mentioned before, during the running activity, participants were asked to perform the music control commands as soon as they encountered them. After they completed the running activity participants asked to rate how easy or difficult it was for them to execute the music playback commands given to them on a 5-point Likert scale [Very easy (1), Easy (2), Moderate (3), Difficult (4), Very difficult (5)] (see Figure 2). In addition, the participants were given multiple-choice questions to find out which commands were challenging and simple to follow.

In the Post-running Interviews, it became clear that the participants had trouble separating related commands into individual evaluations. Therefore, in this section, commands requiring opposite actions were decided to be paired (e.g., 'Volume Up/Volume Down') for easier analyses in contrast to the analysis in the earlier sections where the commands and reaction times to them were analyzed separately (e.g., 'Volume Up' and 'Volume Down').

	Participant no.	P_01	P_02	P_03	P_04	P_05	P_06	P_07	P_08	P_09	P_10	Aver.
Music Playback Commands	Change the Playlist	4	3	4	3	3	5	4	3	3	4	**3.6**
	Change the Song	3	2	4	3	2	2	3	2	1	1	**2.3**
	Pause / Resume the Song	1	1	3	3	1	3	3	1	1	1	**1.8**
	Start / Finish the Playlist	1	3	1	1	3	2	3	1	1	1	**1.7**
	Volume Up / Down	1	5	1	1	1	1	1	1	1	2	**1.5**

Figure 2. Rank order averages of Likert scale scores for music playback commands based on evaluations from 10 participants.

The distribution of responses for music playback commands is as follows (unmentioned scales indicate that none of the participants responded accordingly).

- *Change the Playlist*. 'Moderate' (5/10), 'Difficult' (4/10), 'Very difficult (1/10)'.
- *Change the Song*. Very easy' (2/10), 'Easy' (4/10), 'Moderate' (3/10), 'Difficult' (1/10).
- *Pause/Resume the Song*. 'Very easy' (6/10), 'Moderate' (4/10).
- *Start/Finish the Playlist.* 'Very easy' (6/10), 'Easy' (1/10), 'Moderate' (3/10).
- *Volume Up/Down*. 'Very easy' (8/10), 'Easy' (1/10), 'Very difficult' (1/10).

Participants were asked to identify the easiest and most challenging and commands. The majority of the participants (8/10) found 'Volume Up / Volume Down' the easiest, likely because of the convenience of tangible volume control buttons. They preferred using these physical buttons over navigating digital music platforms on screens, finding them more user-friendly.

In contrast, most participants (9/10) described the command 'Change the Playlist' as the most difficult due to the need for multiple interactions across screens. They mentioned that they could manage commands through their headphones except for 'Change the Playlist'. The participants' statements regarding the easiest and most difficult commands align with the results of the ANOVA analysis of execution times.

4.2 Analysis of the Command Execution Times based on Eye Tracking Data

This section concentrates on the analysis of the execution times of music playback commands, with a specific emphasis on data obtained from eye-tracking. The collected eye-tracking data involved measuring and ranking the time participants took to perform the commands. This ranking aimed to assess the perceived difficulty of the commands obtained from the interviews. At the same time, various screenshots were captured from the eye-tracking recordings. These screenshots facilitated a visual analysis of the participants' commands execution and the duration taken to perform them.

A one-way ANOVA (Analysis of Variance) test was used to determine whether there was a statistically significant difference between the execution times for the commands (discrete groups of data) and, if so, between which pairs of commands. In the test, 'p-value' is commonly defined as '0.05', such that < 0.05 corresponds to the presence of a statistically significant difference between at least one of the test pairs. The ANOVA was run with eight groups, corresponding to the eight music-playing commands, with data from the ten participants in each group (Figure 3). A Tukey's HSD post hoc test was used to identify which (if any) of the pairs from the ANOVA contained significant differences. An online statistics page (Statistics Kingdom, 2023) was used to calculate ANOVA and Tukey's HSD Test.

One Way ANOVA test, using F distribution df (7,72) (right-tailed) detected significant differences between some groups. The post hoc Tukey HSD test revealed the pairs of groups had significant differences. The results of the Tukey HSD test are shown in Figure 4, revealing (in bold text) the following pairs to have statistically significant differences: x1-x2, x1-x3, x1-x4, x1-x5, x1-x7, x1-x8, x2-x6, x3-x6, x4-x6, x5-x6, x6-x7, x6-x8.

Sample Size	Time Interval to Execute the Command (in seconds)							
	x6	x1	x5	x7	x8	x2	x3	x4
Participant no.	Change the Playlist	Start the Playlist	Change the Song	Pause the Song	Resume the Song	End the Playlist	Volume Up	Volume Down
P_01	10.2	18.1	5.8	6.5	2.1	3.7	2.2	2
P_02	15.8	16.4	2.3	2.3	2	2.1	3.2	3.1
P_03	12.3	17	2.3	2.1	3.5	2.3	2.4	2.2
P_04	15.2	8.7	5.1	2.1	2.3	2.3	1.4	1.4
P_05	18.5	5.1	8	6	5.2	2.7	1.7	1.3
P_06	10.1	6.5	3.2	2.2	2.5	2.3	2.8	1.4
P_07	8.3	10	3.5	3.5	2.2	2.4	1.8	1.7
P_08	9.5	5.3	5.3	4.1	2.1	3.1	1.4	2.2
P_09	13.5	12.3	3.1	3.2	2.3	2	2.2	2.5
P_10	15.8	8.2	3	2.1	3	2.5	2.3	1.8
Aver.	**12.92**	**10.76**	**4.16**	**3.41**	**2.72**	**2.54**	**2.14**	**1.96**

Figure 3. ANOVA and Tukey's HSD calculations (in ranked average order) with eight groups of music playback commands (in x) by ten sample sizes (in P).

Group	x2	x3	x4	x5	x6	x7	x8
x1	**8.22**	**8.62**	**8.8**	**6.6**	2.16	**7.35**	**8.04**
x2	0	0.4	0.58	1.62	**10.38**	0.87	0.18
x3	0.4	0	0.18	2.02	**10.78**	1.27	0.58
x4	0.58	**0.18**	0	2.2	**10.96**	1.45	0.76
x5	1.62	2.02	2.2	0	**8.76**	0.75	1.44
x6	**10.38**	**10.78**	**10.96**	**8.76**	0	**9.51**	**10.2**
x7	0.87	1.27	1.45	0.75	**9.51**	0	0.69

Figure 4. Summary of Tukey's HSD Test / Tukey-Kramer Test Results.

Both commands "Start the Playlist" (x1) and "Change the Playlist" (x6) took a significantly slower time to execute then all the other commands, except that no significant difference was found between "Start the Playlist" (x1) and "Change the Playlist" (x6). Apart from these results, none of the other commands had execution times that were significantly slower or faster. For example, the two commands with the shortest execution interval – "Volume Down" (x4) and "Volume Up" (x3)– were not significantly shorter than the other commands. With the help of the fieldwork, both the actions and the statements of the participants showed that the difficult levels of the music controls can be ranked and compared. In the running activity, thanks to the eye-tracking technology, participants' actions were recorded and the time intervals to manage music controls were detected. Also, the post-running-interviews obtained the statements of the participants about the music controls that they executed. For runners who prefer to listen to music while running, the difficulty or ease of music controls can vary depending on their preferences and the interfaces provided by their chosen devices and platforms. However, some general observations were made.

The play/pause button is typically the simplest and most intuitive control for runners. A large, easy-to-press button allows for quick management of music playback without much thought or effort.

Selecting a song and controlling the music can be challenging. Runners find it difficult if the interface is complex or if they have to navigate through multiple screens or menus to find and play their desired music. If a runner wants to search for a specific song, artist, or album while on the move, this can be quite challenging. Typing or voice recognition for searching might not be as accurate or quick as desired. On the other hand, an interface that allows for quick and intuitive music selection and control, such as a simple swipe or tap gesture, can make it easier for runners to manage their music while on the move. Interfaces that offer fine-tuned navigation, such as rewinding or fast-forwarding within a song, can be challenging to use while running. These controls often demand precise touch gestures or screen interactions that are not conducive to a smooth run.

Volume controls are often straightforward, especially when physical buttons or touch-sensitive surfaces are well-designed. Runners can easily adjust the volume to suit their preferences or situational needs. However, there were different scenarios when analyzing the volume control commands. As Figure 5a illustrates, one participant decided to control the volume from the digital interface of the digital music streaming platform while the other participants (e.g., see Figure 5b) were controlling volume through the tangible buttons of the smartphones. These two scenarios revealed the fact that digital interface interaction took more time than the tangible buttons with the help of eye tracking recordings.

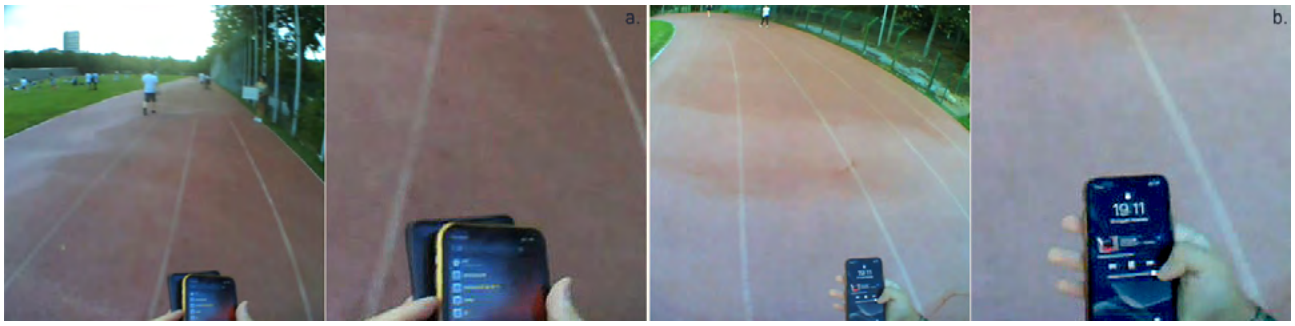


Figure 5. Screenshots from eye-tracking recordings while a participant: a. controlling the volume from the music platform interface; b. turning the volume down from the smartphone interface.

Creating or editing playlists on the move, like running, can be intricate. The reality is that our preferences and moods may change dynamically during the run, making on-the-move adjustments essential. This challenges the notion that this task is better suited for pre-run setup or post-run sessions when the runner can allocate more time and focus. Instead, we argue for the necessity of better-designed interfaces that cater specifically to the dynamic needs of runners, allowing them to seamlessly modify playlists as they go.

Modifying a playlist, such as rearranging songs or adding new ones, can be cumbersome if the interface lacks user-friendly drag-and-drop features. Accordingly, changing the playlist while running emerged as the most difficult command for the participants. Interacting with multiple icons and screens to change the playlist results in participants spending an extended period in this orientation. Another contributing factor to a runner's difficulty in altering their playlist is often the pre-existence of a single, pre-prepared playlist before the run. Consequently, they may have found themselves spending additional time searching for an alternative playlist to switch to as soon as they receive the command.

In summary, the most user-friendly music controls for runners are typically those that demand minimal effort, such as play/pause and volume adjustments. On the other hand, controls involving precise navigation, searching, or playlist management can pose more challenges during a run, necessitating extra attention and potentially distracting from the overall experience. Runners commonly appreciate devices and platforms that strike a balance between functionality and ease of use while on the go.

4.3 Design Suggestions

Based on the research findings, a range of insights, both general and feature-specific, can be proposed for the design of digital and physical interfaces for devices and the music streaming platforms tailored for runners. The design insights from this research have broad applications across disciplines encompassing design, development, health, sports, and design research, benefiting both researchers and practitioners.

The primary outcome of this research was the ranking of the difficulty levels associated with commands executed by runners while running with music. Data collected from the participants' verbalized and numerical evaluations from the field study revealed that changing the playlist ranked as the most challenging command, whereas volume up/down commands were the easiest to execute. In addition to this, design suggestions were offered for both tangible and digital interfaces, aiming to enhance the experience of listening to music while running. These suggestions are based on the insights gained through participant interviews and the eye-tracking recordings during the fieldwork. The design development suggestions can be organized under the following headings.

Intuitive Physical Controls
Elevating the running experience with music involves thinking carefully about how digital and physical interfaces work together in terms of user engagement and overall satisfaction. Central to this enhancement is the incorporation of intuitive physical controls. These controls should feature sizable, tactile buttons strategically positioned to facilitate common functionalities such as play/pause, volume adjustment, and track skipping. The tactile nature of these controls is designed to afford users the ability to manipulate music playback without diverting attention from their running focus.

Voice Commands
Complementing physical controls, the integration of voice command functionality introduces a hands-free dimension to music playback, track selection, and playlist management. The robustness of voice recognition, particularly in acoustically challenging outdoor settings, becomes a critical consideration. Concurrently, the incorporation of gesture controls on touchscreens aligns with contemporary interaction trends. These gestures, designed to be both intuitive and responsive, can be further customized to accommodate individual user preferences.

User-Friendly App Interfaces
In the digital domain, the development of user-friendly app interfaces emerges as a crucial priority. Mobile and smartwatch apps should be carefully designed to facilitate seamless navigation with minimal user input. This involves the provision of large touch targets for key controls and gestures, contributing to an interface characterized by both efficiency and user-friendly design.

Personalization
Playlist management plays a vital role in enhancing the user experience. A streamlined process for creating, editing, and organizing playlists is essential for user convenience, particularly before a run. Moreover, the implementation of automated playlist suggestions, tailored to a runner's preferences and past listening habits during workouts, enhances personalization to a greater extent.

Adaptive Interfaces
The notion of adaptability extends beyond interface design to the performance of the interface itself. Adaptive interfaces, responsive to a runner's pace and movement dynamics, help reduce unintended inputs during high-speed runs. This adaptability is further underscored by customization options, allowing users the ability to adjust interface sensitivity in accordance with individual preferences.

Integration with Health Data
Integration with health and fitness data amplifies the holistic nature of the music–running relationship. By integrating metrics, such as heart rate and GPS information, the design can facilitate the generation of

tempo-synced playlists aligned with the runner's pace. Furthermore, the incorporation of voice feedback on performance metrics, such as distance covered or calories burned, can augment the informational aspect of the running experience.

Social Features
Within the social realm, features enabling interaction and collaboration among users are integral. Incorporating social sharing mechanisms within music applications fosters a sense of community, allowing runners to share achievements and musical tastes. Additionally, tools for discovering new music through social interactions, such as playlist recommendations from peers, contribute to a collaborative and enriching environment.

Feedback Mechanism
Last but not least, a robust feedback mechanism is one of the most important experience improvement strategies. Providing real-time feedback upon reaching specific running milestones, whether they are distance goals or personal records, is crucial for sustaining user motivation. The customization of feedback to be motivational and encouraging fosters a mutually beneficial and positive relationship between the runner and the musical accompaniment, culminating in an enriched running experience.

5. Conclusions

The primary conclusion of this study, derived from semi-structured interviews and eye-tracking data from the fieldwork, is the identification of the most challenging aspects of runners' interactions with both tangible and digital interfaces of their music-listening devices. Changing the playlist was observed as the most time-consuming interaction, which was justified by the fact that there were multiple steps to complete in order to perform this interaction, all performed through the smartphone and digital music listening platform interfaces of. Conversely, the easiest interaction for the participants was increasing/decreasing the volume, largely performed using tangible buttons on their smartphones, explaining its quicker and more straightforward execution. Within the scope of this study on amateur runner experiences, it was discerned that users tend to navigate tangible interfaces faster and more easily than digital ones. Additionally, it was inferred that individuals engaging in outdoor mobile exercises prefer minimal interaction with devices when controlling music.

In addition, design suggestions were informed by the valuable insights shared by the participants during interviews and the eye-tracking recordings. These suggestions aimed to address variations in the digital music listening platforms used by the participants. Rather than suggesting changes or elimination of elements within a specific interface, suggestions were made to improve the interactions between different interfaces considering the overall experience. The primary approach for these design suggestions involved exploring options for multi-sensory interactions. Runners should not only interact through touch and visual feedback, but also through audible and haptic means. Another design suggestion emphasizes user-friendly interfaces for digital music listening platforms, specifically tailored to enhance running experience. This signifies a shift from isolated interface improvements to a holistic approach that considers the entire running experience. Lastly, the integration of social sharing mechanisms into the digital music streaming platforms is proposed to enrich the music listening experience for runners, aligning with the overall design approach.

Incorporating responsive design into music player interfaces for runners can allow adjustments based on activity level, preferences, and environmental conditions. For example, during running, the interface can prioritize essential controls while minimizing distractions for improved usability. It can adapt to user behavior and can dynamically adjust itself to environmental factors like lighting and noise levels, enhancing improved visibility and usability in different conditions. This flexibility, tailored to each runner's needs and context, contributes to a smooth and enjoyable experience. Our research findings have highlighted the intricate relationship between running and music, emphasizing the need for carefully tailored interaction features in devices and music platforms for runners. Effortless access to music controls not only enhances the overall running experience but also reflects a user-centric design approach, ensuring that the joy of running with

music remains undisturbed by cumbersome interfaces. By addressing the specific requirements of active users, music playing devices and streaming platforms can provide a seamless and enjoyable experience not only for runners but also for individuals engaged in other physical activities.

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P/REFERENCES OF DESIGN

LONGITUDE AND LATITUDE – EXPLORING THE RELATIONSHIP BETWEEN VIEWERS, ART, AND EXHIBITION SETTING IN IMMERSIVE DISPLAYS.

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KEYWORDS | IMMERSIVE EXHIBITIONS, EXHIBITION DESIGN, GIS, DATA VISUALIZATION

ABSTRACT | Currently, exhibitions known as “immersive experiences” constitute an important part of present-day media transformation and have become a major development direction in the field of exhibitions. Immersive displays within the realm of exhibition design entail two distinct requirements: firstly, they necessitate diverse stimuli to complement the artwork itself, and secondly, the exhibitionary complex and its affiliated institutions have to adapt and emancipate themselves from conventional exhibition methods. Based on this premise, the authors explain how the transformation of physical space in immersive exhibitions engenders a new relationship between viewers, art and the exhibition setting through the example of their new media artwork Longitude and Latitude. Shown in the contemporary art exhibition Infinity: The Sequence from Known to Unknown (2021-2022) in the Suzhou West Museum, the artwork utilizes HOUDINI’s point cloud technology and an enhanced cellular automata algorithm to visualize geographic data.
This project exemplifies the three stages of data visualization: data transformation - content transformation – and spatial transformation, which includes the output of data into an immersive spatial narrative within the exhibition space. The expansion of the exhibition space through immersive technologies aims to visualize geographic data and simulate the past and future land use in Suzhou for a better understanding of the city’s development. Our design approach aims to create specific modes of perception that affect the interaction between visitors, exhibition architecture, and narrative design.

1. Introduction

In both commercial and museum settings, the use of contemporary immersive media technology has become an important development in the field of exhibitions. These exhibitions, often referred to as "immersive experiences," employ new media forms such as virtual reality (VR), augmented reality (AR), and 3D mapping, leading to the facilitation of immersive communication and experiences, and they constitute a significant part of the broader media transformation.

Immersive exhibitions can emancipate from traditional gallery displays as they offer visitors a distinct mode of engagement. These exhibitions enable visitors to freely explore and interact with their surroundings, resulting in more captivating encounters. Visitors are empowered with autonomy through bodily engagement and spatial positioning, allowing them to plan their own routes and physically navigate through the exhibition space, thereby obtaining diverse and personalized visual experiences. These exhibitions provide multifaceted immersive experiences while also exploring curatorial strategies that create illusions and enhance engagement.

In his research on the digitalization of museums, Ross Parry has previously traced the process of compatibility between museums and digital media. This process includes the digitization of archival systems, the presence of digital objects in exhibition spaces, interactive displays, and the virtualization of museum visits through online resources. These changes have led to the "recoding" of museums, shifting from an emphasis on "object-oriented, conservative structures" to "experience-oriented, user-driven, multi-channel media systems" (Parry, 2007). This recoding encompasses a user-centric, media-driven system that reflects the evolving nature of cultural institutions in response to the digital age.

Overall, the integration of digital media in museums has transformed their operations and engagement strategies, allowing for new forms of interpretation, interaction, and accessibility, signifying a paradigm shift in the curatorial guiding principles of immersive exhibition design. This immersive shift has affected the perspective of visitors, particularly the dynamic relationship between visitors and exhibited artworks. This transformation can be examined from the perspectives of presentation, information dissemination, and aesthetic experience.

Nevertheless, physical architectural dimensions do not constrain spatial narratives, neither does the combination of immersive media technology completely subvert previous modes of exhibiting. Instead, conscious design choices during the art creation and exhibition design process have the potential to complement and extend spatial narratives with the help of new media technologies. Therefore, within immersive exhibitions, physical exhibition settings have the potential to seamlessly integrate with the artwork, offering visitors a holistic and immersive experience.

Based on this premise, the authors explain how the transformation of physical space in immersive exhibitions puts forward this experience-based relationship between viewers, art and the exhibition setting through the example of their new media artwork *Longitude and Latitude* (Zhang, 2022). Shown in the contemporary art exhibition *Infinity: The Sequence from Known to Unknown* (2021-2022) in the Suzhou West Museum, the artwork utilizes HOUDINI's point cloud technology and an enhanced cellular automata algorithm to visualize geographic data. In this case study, the expansion of the exhibition space through immersive technologies aims to visualize geographic data and simulate the past and future land use in Suzhou for a better understanding of the city's development without relying on displaying physical artefacts, embodying an “object-less” immersive experience.

This project exemplifies the three stages of data visualization: data transformation - content transformation – and spatial transformation, which includes the output of data into an immersive spatial narrative within the exhibition space. This approach does not aim to substitute the physical material of exhibits but rather creates specific modes of perception that affect the interaction between visitors, exhibition architecture, and narrative design. This paper aims to compare and analyze immersive

exhibitions from the standpoint of the interactions between the audience, the exhibition spaces, and the artwork. The analysis will be conducted by examining the digital artwork and its display in the context of the "experiential complex," (Hall, 2006), in which visitors no longer remain distant from artworks due to their representational nature, but are fully immersed in the theme of the exhibition.

2. Methodology

The exhibition *Infinity: The Sequence from Known to Unknown* (September 25, 2021, to February 16, 2022) was conceptualized as the first major exhibition of modern art in the Suzhou Museum West, officially opened in September 2021. Designed with a visitor-oriented interior architecture located in a prominent area at Shishan Square, the museum building itself serves as a cultural landmark of Suzhou, holding both permanent and temporary exhibitions that highlight the tangible and intangible heritage of the city (Chen, 2021).

Among the exhibition, the new media artwork *Longitude and Latitude* was created by Prof. Zhigang Wang's team at the Department for Information Art & Design at Tsinghua University, which includes Yuan Zhang, Zichen Xi, Shunni Feng, Ruitao Guo, and a collaboration with ImageSky Remote Sensing Technology Co. The artwork consists of a video display lasting two and a half minutes, displayed within a separate room within the museum. The exhibition design consists of a large-scale screen that projects the video in a loop, and two mirror installations that reflect the image content.

The concept of *Longitude and Latitude* is based on tangible and intangible heritage representing Suzhou's culture and history. The design is driven by data visualization and symbolizes the local customs of Suzhou, the characteristics of Jiangnan culture, and the city's past and future through geographic information data. By selecting the material properties of silk and water as elements that characterize the city's history and culture, the artwork explores the threads of urban development spanning thousands of years.

The image sequences in *Longitude and Latitude* use the motifs of silk and water by displaying horizontal and vertical silk threads as abstractions that correspond to the latitudinal and longitudinal coordinates of rivers, lakes, and commercial waterways on Suzhou's map. On the one hand, the concept of *water* embodies elements of the cityscape following the changes of time. Suzhou's urban development has been shaped the transformative forces of water bodies such as rivers, oceans, and lakes, highlighting the relation between urban growth and changes in the surrounding bodies of water. The water-based design in the artwork thus presents a macroscopic view of urban development, serving as an abstraction for the city's history and culture.

On the other hand, *Suzhou Silk* holds immense cultural value as it represents Suzhou's artisanry. The *Archives of Suzhou Silk from Modern and Contemporary Times,* which document the silk industry and silk production methods, have been registered as a "Memory of the World" by UNESCO and ICDH, establishing Suzhou as a prominent hub and leading city for China's silk-weaving techniques (ICDH, 2017).

However, the scope of *Longitude and Latitude* extends beyond the content regarding Suzhou's cityscape and cultural heritage. A crucial aspect of our artwork lies in its immersive display method. Our aim is to explore the transformation of physical space within the city, showcased through an immersive exhibition setting that creates a novel dynamic between the audience, the absence of physical objects, and the artwork within the limited physical space of the exhibition. As a result, the creation process of the artwork follows a three-stage artistic transformation model, encompassing not only the image sequence but also the innovative display approach (Figure1):

1. Data Transformation – Geographic data collection using historical documents and remote sensing technology.
2. Visual Transformation – Video production using Houdini, Blender, Procreate, Adobe AE, PS, AI and PR.
3. Spatial Transformation – Exhibition space production using Kinect, Resolume Arena Projector, Mirror Material, etc.

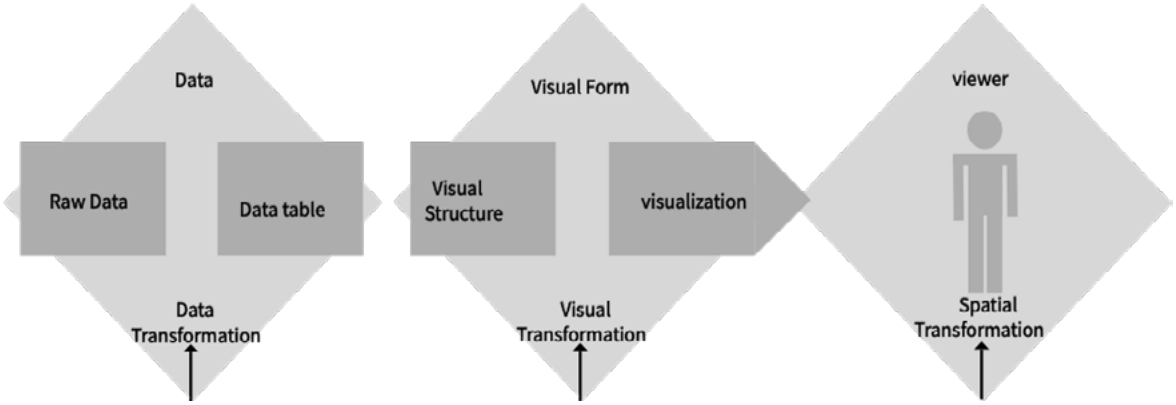


Figure 1. Three-stage artistic transformation model (© Yuan Zhang).

Our production process thus involved a data collection process of physical historical documents and remote sensing maps, followed by the organization, analysis, and transformation of the data into 2D vector graphics using manual and algorithmic techniques, and the visualization of the data through multi-dimensional methods, ultimately creating a comprehensive video format. The last step involves the spatial transformation of the exhibition venue.

2.1 Data Transformation

The process of data visualization allows for the transformation of complex datasets into visually compelling representations. In this context, the creation of *Longitude and Latitude* involved geographical data, processed in a multi-step approach, which was inspired by the information visualization model proposed by Card et al (Card et. Al, 1999). Our data transformation process is comprised of four steps (Figure 2), aimed at processing and transforming geographical data into visually meaningful 2D vector graphics for further video production:

1. Data collection;
2. Collation, analysis, and extraction;
3. Transformation into vector mapping through the manual and algorithmic generation;
4. Visualization.

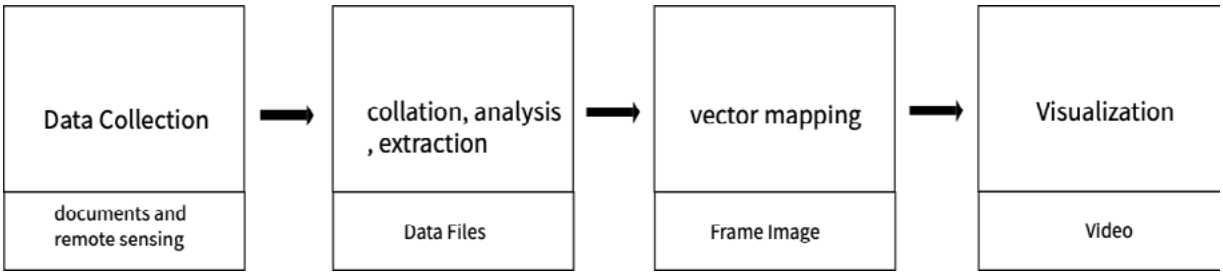


Figure 2. The Process of Data Transformation (© Yuan Zhang).

During the initial step, we collected geographic data derived from two primary sources – physical historical documents and remote sensing maps of Suzhou. We obtained the latter through a collaborative effort with ImageSky Remote Sensing Technology Co.

The physical historical documents serve to contextualize the development of Suzhou's landscape from ancient times to the present day, providing insights into the changes caused by rivers, agriculture, commerce, and various other societal and natural factors. In contrast, the remote sensing maps focus on the effects of specific economic and political decision-making, such as the establishment of water systems, scenic spots, national railroads, subways, green areas, and the impacts of congestion from 1984 to 2021. We recorded and saved information derived from both types of sources in the format of videos, pictures, and text for further usage in the subsequent stages of the data transformation process.

The second step of the data transformation stage involves the tasks of organizing, analyzing, and extracting geographical data, which includes the selection of appropriate technologies for different data formats, the transformation into desired formats, and the subsequent classification, compression, and decompression. We employed ArcGIS to transform the main initial remote sensing data and then used the built-in script module of Houdini to classify the land types in Suzhou based on the obtained information.

The third step involves the conversion of the extracted information into 2D vector graphics through a combination of manual and algorithmic generation techniques. The manual approach specifically focuses on utilizing information from archaeological historical materials and physical historical maps to create vector graphics. These graphics relate to several aspects of Suzhou's history, including water bodies, agriculture, commerce, and war, spanning from the Qin dynasty (221 BCE-206 BCE) to the Qing dynasty (1644 CE-1912 CE). For example, we manually extracted the topography in the case of a 1229 Song dynasty (960 CE-1279 CE) Suzhou city map, known as the *Pingjiang* Map, which remains as the largest surviving ancient city map of China (Zhang, 2013). Our effort included capturing details on Suzhou's *Water Network Change Map*, *Lake Boundary Line Change Map*, *Location Map of Human Settlements*, etc., in addition to vectorizing canals, moats, city rivers, lakes, ponds, bays, and other water-based entities that affected urban freight and trade exchanges of Suzhou's ancient commerce.

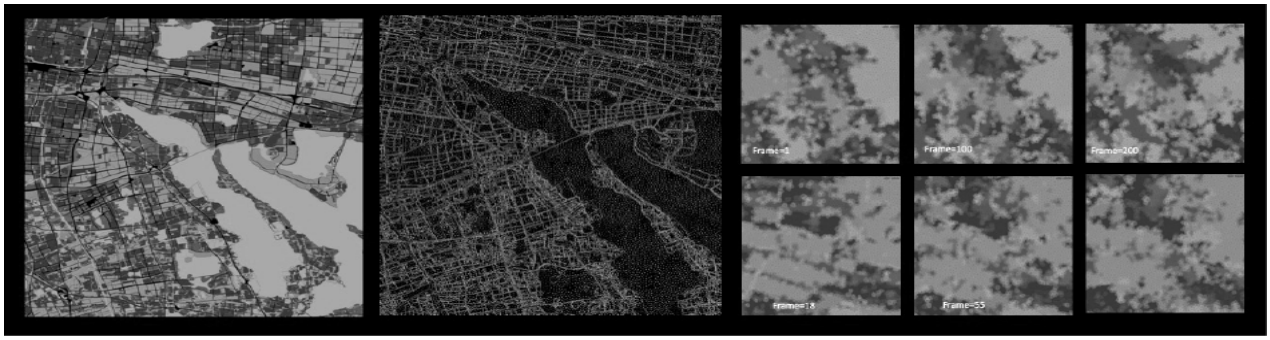


Figure 3. Algorithm Generation Process (© Zichen Xi).

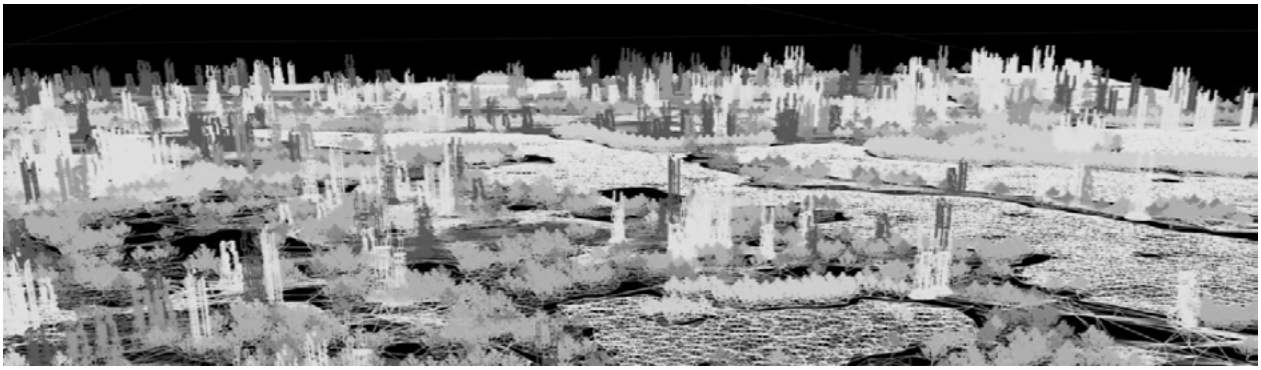


Figure 4. Algorithm generation process (© Zichen Xi).

In contrast, we employed an algorithm generation method to analyze the remote sensing satellite data provided by ImageSky Remote Sensing Technology. The quantity and data accuracy from these maps allowed for the automatic transformation of data into a two-dimensional vector graphic (Fig. 3), classified and graded according to the national Chinese land-use standard (Chen and Zhou, 2007). These encompass three categories of human-made land, vegetated land, and water bodies (Fig. 4). The utilization of Cellular Automata Algorithms enables a simulation the future trend of changes in natural vegetation due to human modification over time.

Finally, the fourth step consists of the visualization of these data points into a video format. We use multi-dimensional data visualization methods for the geographic data from the maps (Shneiderman, 1996), which include the parallel coordinate system method (Inselberg, 1985), RADVIZ method (Kandogan, 2001), scatter plot matrix method (Craig and Kennedy, 2003), and 2D icon-based visualization for historical geographic data. Here, data from different maps correspond to variations of icons, with variables such as "human settlement points", "water network lines", " Lake Boundary Lines", etc., that are represented by size, radius, location and color (Fig. 5). For the visualization of modern geo-data, 3D buildings are generated. The height and number of these buildings is based on records of changing land prices and population density. The 2D vector graphics from the previous step are used as the reference points for each building unit, supplemented by artistic embellishments such as particle effects and luminous effects.

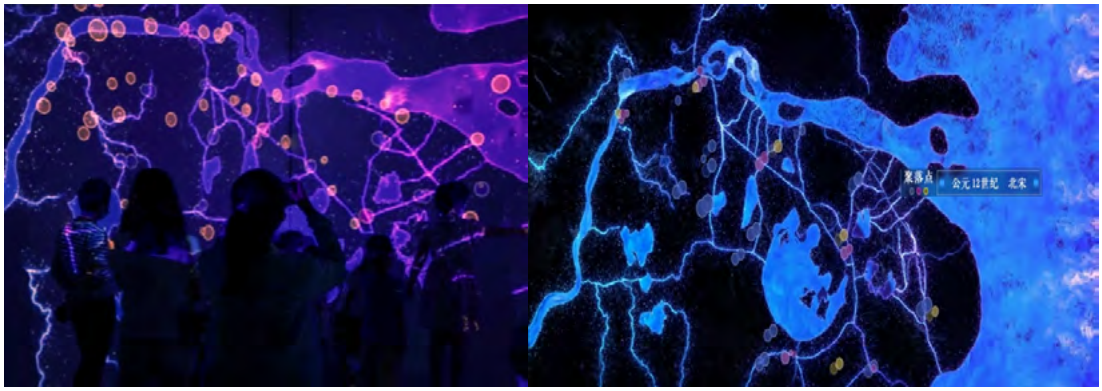


Figure 5. Exhibition Display. “Positive” correlation between the radius and number of human settlements-dots (© Yuan Zhang).

2.2 Visual Transformation

The visual output of the artwork involves transforming the geographical data into a video format, with water and silk serving as recurring motifs. We employed various multi-dimensional visualization softwares, including Houdini, Blender, Procreate, Adobe AE, PS, AI and PR, to showcase the graphics that resulted from the previous step. By relying on water as a narrative design element, the image sequences relay information on the city's development through a temporal division of four chronological sections:

- Water and continent - the formation of impact plains;
- Water and agriculture - the transformation of the natural environment;
- Water and commerce - prosperous urban development;
- Information Future - a new future blueprint for innovative Suzhou.

The video commences with an animation of the formation of the middle and lower Yangtze River plains through a visualization of the interactive nature between water and land (Fig. 6). It progresses to showcase the emergence of human civilization, represented by latitudinal and longitudinal locations of fire relics, early human rice relics, and the waterway irrigation. This information relay points out the close relationship between water, environmental and agricultural change, the development of human society, as well as the abundance of these water resources and its role in managing of the development of agriculture, fisheries and hunting.

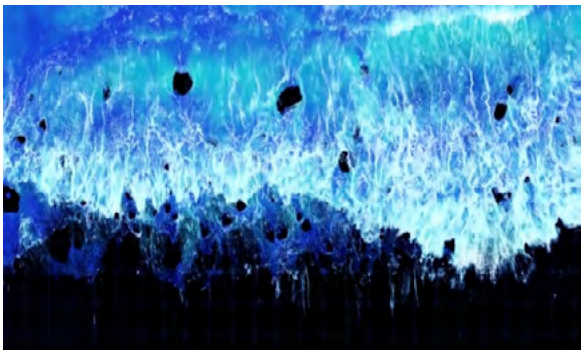


Figure 7. Lower Yangtze River Visualization (© Ruitao Guo).



Figure 8. Lower Yangtze River and Tai Lake Visualization (© Shunni Feng).

The relationship between water and commerce is based on the information collected from the *Pingjiang map* and other historical materials. Using artistic processing to interpret the cityscape of ancient Suzhou, we restored the appearance of the Suzhou night market during the first peak of the city's development in the Song Dynasty (Fig. 9). We used particle effects to accentuate the movement patterns of the busy crowd within the night market, the spatial distribution of commercial districts and commercial waterways, as well as the positionings of the main road network and other infrastructure elements. This particular video segment displays Suzhou's distinctive "water town" feature through a double checkerboard pattern that represents the interplay between land and water.

The final segment of the video uses the city's historical patterns of water, land distribution and architecture to interpret Suzhou's past and future urban development. In the final moments, the video concludes by revisiting the geographic coordinates (longitude: 120.54620735298157, latitude: 31.293915174794172) of Suzhou Museum West, providing viewers with a tangible reference point to comprehend their current position in relation to the potential future urban landscape of Suzhou (Fig. 10). This serves to establish a sense of connection between the present reality and the envisioned future, allowing viewers to envision the city's prospective transformations.

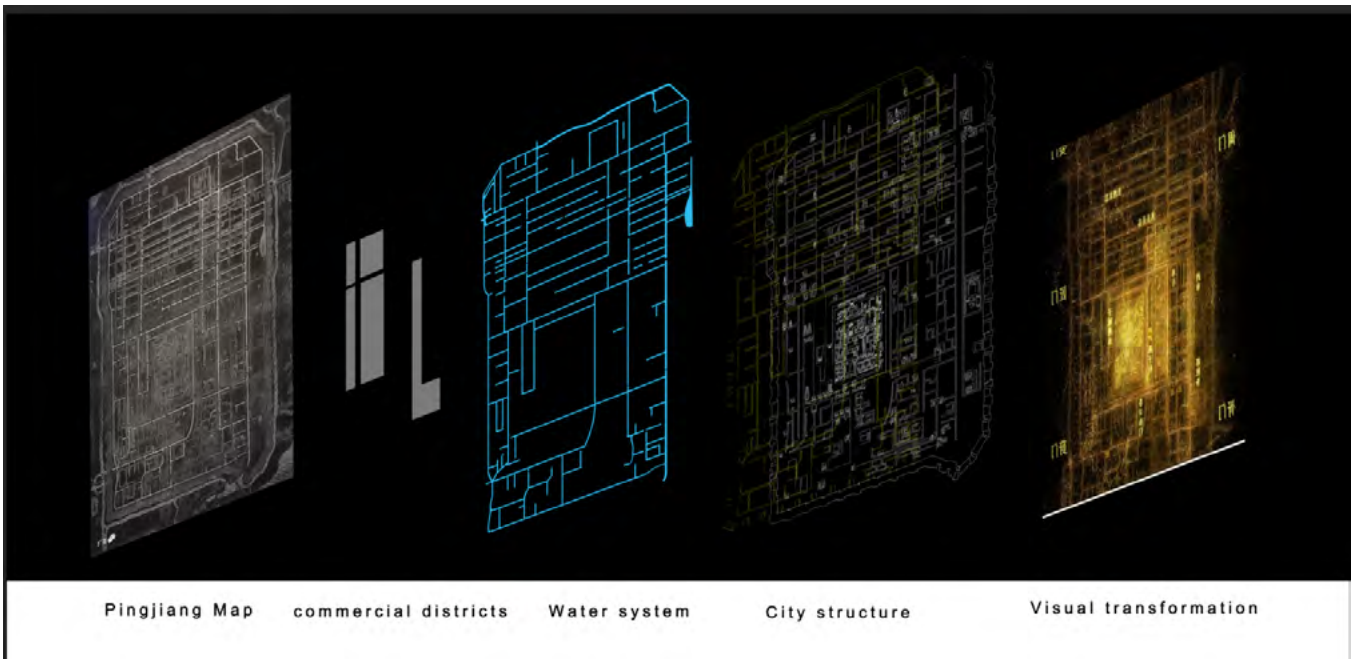


Figure 9. Rendering the Night Market of Suzhou during the Song Dynasty (© Yuan Zhang).



Figure 10. The Future Urban Landscape of Suzhou (© Zichen Xi).

2.3 Spatial Transformation

Longitude and Latitude completes the final transformation of data-content-space (Figs. 11, 12, 13) by expanding the exhibition space through video projection and specular reflection, creating an immersive experience.

Our approach to designing the exhibition display for *Longitude and Latitude* aims to substitute conventional exhibition methods of showcasing geographical information through material objects. Instead, we utilized new media technology to present the narrative of cultural history in a digital dimension within a physical space. By doing so, we intended to achieve a quantitative representation of extensive geographical data and bridge ancient history and intangible future development.
By combining physical space, virtual space, video content, and mirror reflection, the artwork attempts to break the spatial limitations of the physical exhibition environment and expand the scale of the entire artwork itself in the space, where the audience is able to envision geographic information from all angles, both from the physical space to get a wrap-around sensory experience, and from the virtual space to gain knowledge on Suzhou from ancient times to the present day. In addition to the physical and temporal location of the artwork, the virtual space serves to let visitors perceive various layers of immersion, exploring the transformative aspects of the city through a transformation of the exhibition space itself. This virtual realm – established through video projection and extended through mirror installations – supports the physical exhibition space by transcending the limitations of "material presence" and instead offering an experience imbued with an "auratic" sensation, which goes beyond the interaction between viewers and physical objects.

Our immersive exhibition design thus explores the fluidity of integrating the exhibition space with the artwork to provide visitors with a holistic viewing experience.

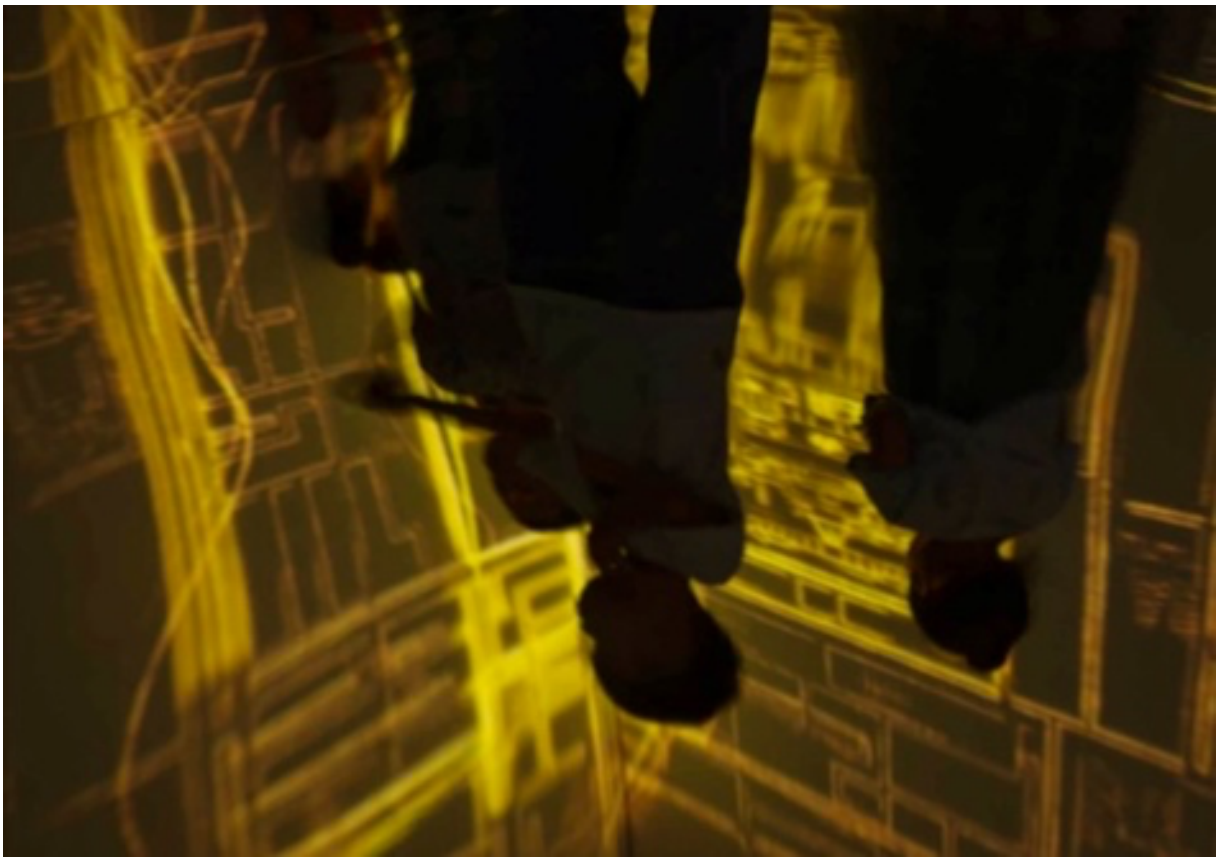


Figure 12. Mirror installation (© Yuan Zhang).

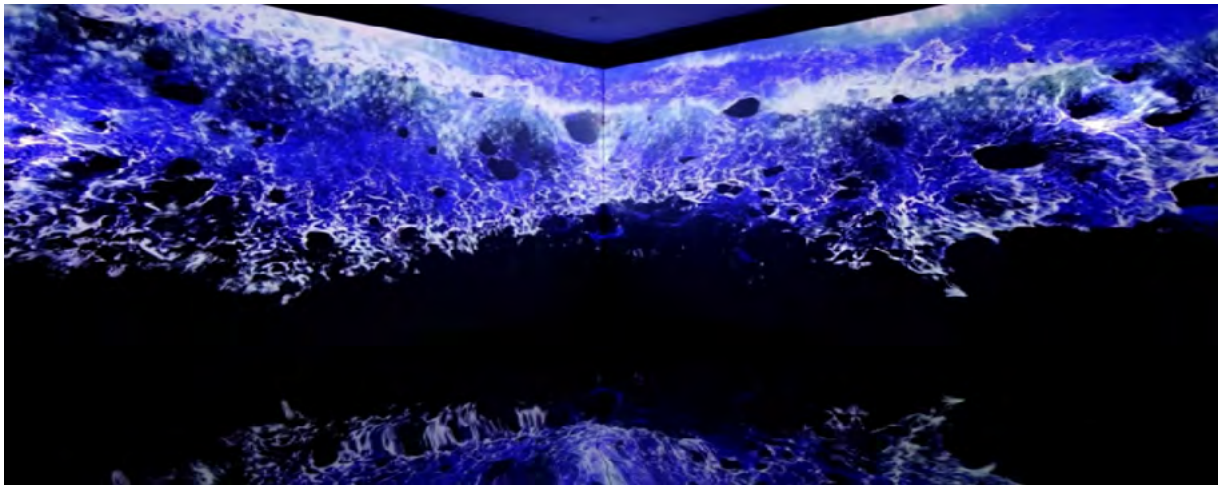


Figure 11. Exhibition site (© Ruitao Guo).



Figure 12. Mirror installation (© Yuan Zhang).



Figure 13. Exhibition site (© Shunni Feng).

3. Implications

We aimed to create *Longitude and Latitude* as an illustration of the departure from traditional exhibition methods by establishing an immersive environment within the context of the Suzhou West Museum. By reconstructing the past of the city, the primary focus during the design process involves translating data gained from ancient and remote sensing maps into a format that could understood and absorbed by the audience without the presence of original artefacts. Through the integration of the limited physical exhibition space and immersive display techniques, the inherent quantity of data can be showcased through the expansion of the physical space through the different layers of data transformation.

As a more recent evolvement in the history of exhibition practices, Martin Hall interprets this type of immersive exhibition mode brought about by new media as an "experiential complex" (Hall, 2006). Hall bases this model on the ideas of Joseph Pine and James Gilmore, who argue that "experience" has unique qualities compared to "commodities" and "services" – while commodities and services are external to individuals, experiences have the ability to touch people's inner selves and profoundly impact them (Pine and Gilmore, 2020).

While Pine and Gilmore argue that immersive experiences touch upon four domains – entertainment, education, escapism, and aesthetics – Hall provides further insights by emphasizing that education requires active engagement, while escapism necessitates immersion in the experience rather than passive observation associated with entertainment. Within this particular context, the gallery space assumes the role of an educational conduit, facilitating an environment that encourages active engagement and deep absorption. Consequently, it serves as an extension of the traditional method of exhibition display.
Our immersive approach to *Longitude and Latitude* takes two essential features of immersive exhibitions into consideration: the absence of material objects and the expansion of physical space.

In fact, one major concern regarding immersive exhibitions is the emphasis on "aesthetic adaptation" rather than "authentic presentation" (Huang, 2023). This issue arises when comparing the traditional exhibition complexes filled with "real objects," with the often "object-less" immersive experiences. Linking this viewpoint to Walter Benjamin's notion of the decline of traditional "aura-based art" and the rise of modern "reproductive art" (Benjamin, 2018), we can observe a shift in the aesthetic experience of spectators — from a state of "focused" attention to one of distraction. This transformation is equally applicable to immersive exhibitions, which can be seen as a contemporary form of art reproduction. According to Kim West, this phenomenon not only enables reproduction but also allows for the mobility, recontextualization, comparison, and combination of art (West, 2017)—a notion reminiscent of André Malraux's "Imaginary Museum," in which art "loses its object quality" and is "confined to a material experience" (Grasskamp, 2014). Malraux considers the "Imaginary Museum" as an "auratic museum" rather than a substitute for physical museums. The key element of this type of experience is the exhibition design itself. According to Pine and Gilmore, this "experience design is determined not only by the exhibit's instructions on how to use the space but also by the absence of functions that adhere to established uses" (Pine and Gilmore, 2020).

We thus aimed to transform the physical exhibition space by offering an immersive encounter that effectively embodies the distinctive qualities of Malraux's concept of the "auratic museum," all the while remaining firmly grounded in the physical realm. The amalgamation and recontextualization of historical data in its present setting enable immersive experiences to deliver the same range of entertainment, education, escapism, and aesthetics as emphasized by Pine and Gilmore. The physical exhibition space itself assumes a pivotal role in effectively conveying these messages – and further indicates that immersive exhibitions may not only be seen as a "transformation" of tradition but rather an expansion and modern adaption of the exhibitionary complex as previously described by Tony Bennett (Bennett, 2019).

In immersive exhibitions, the relationship between the audience and the artwork depends on the viewer's interpretation of the presented objects. According to John Hannigan, immersive reconstructions are not

intended to make visitors believe they are experiencing a real environment, on the contrary, part of the enjoyment comes from being aware of the immersive technology and admiring the simulation of realism in animation. Hannigan describes the pleasure derived from a "suspension of disbelief" from the paradoxical coexistence of recognizing a technological illusion while simultaneously experiencing an authentic sense of immersion through the interplay of exhibition design, space and the artwork itself (Hannigan, 2005).
As a result, the exhibition space is no longer merely a vessel for objects but an integral part of the art itself. In fact, the physical architecture of the exhibition room does not serve as a limiter for the exhibition experience. Ross Parry and Andrew Sawyer point out that architectural space “frees us from the limitations of the web page”. By merging the physical space with the virtual, a new spatial narrative produces a new kind of relationship between art, space, and people (Parry and Sawyer, 2005).

Guided by the above-mentioned principle that immersive media regards the exhibition space as an intrinsic component of the artwork, our design for *Longitude and Latitude* involved spatial configurations achieved by deliberately selecting and arranging various display elements. These included the strategic placement of video projection, the incorporation of reflective surfaces, sound design, and lighting techniques.

Longitude and Latitude thus intends to provide an alternative sensory experience for interpreting the history and future of a city by interconnecting ancient data with modern technology through an object-less display, forming a chronology of the city’s temporal dimensions without relying on a preprogrammed, “ritualistic” museum route (Duncan and Wallach, 1980).

The final, spatial transformation of our project thus allows visitors to experience the development of Suzhou through a “Spatial Narrative” that uses the scale and volume of space rather than the spatial sequences of exhibition settings to produce a narrative.

4. Conclusion

Within the context of museums, immersive experiences have the potential to fundamentally change the interaction between visitors, artworks, and exhibition spaces. Everett Ellin, referring to new electronic technologies as the "dominant medium of our time", suggests that these technologies teach people to interpret the world through multiple simultaneous sensory experiences (Ellin, 1967). On the one hand, this requires various stimuli to complement the artworks themselves, and on the other hand, it demands that museums break away from traditional exhibition models to enhance the visitor experience. Ellin believes that the emergence of these technologies creates an environment of "all-at-onceness" that enables individuals to constantly engage with one another and experience multiple forms of communication, ultimately altering our perception and modes of thinking, and giving rise to a new mode of subjectivity. The emerging immersive technologies not only complement but also enhance traditional practices by providing additional dimensions for exhibition experiences.

By triggering the audience's imagination and utilizing media and technology, exhibition venues can create immersive experiences that go beyond observation, allowing visitors to actively engage, escape from reality, and appreciate aesthetics. The interpretation and involvement in immersive exhibitions ultimately lie in the agency of individual viewers, and the level of immersion depends on the curator's and artists' ability to create suspense and the art itself.

Through *Longitude and Latitude*, we aimed to achieve this effect by transforming the historical display of the cityscape, as well as the exhibition space itself into a coherent spatial narrative as an integral part of the artwork. During the design process of the artwork, the three modes of transformation – data transformation, visualization, and spatial transformation – serve to provide the audience with a multi-layered immersive experience to educate on the city’s historical and future development. The transformative aspects of our design aim to establish a display system that uses new media technology to allow the creation of spatial narratives that go beyond the limitations of physical objects, enhancing the viewer's experience and creating a sense of collective immersion.

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P/REFERENCES OF DESIGN

APPLICATION OF EMPIRICAL AND ANALYTICAL USABILITY STUDIES TO THE USER-CENTRED DEVELOPMENT OF EXTENDED REALITY (XR) SOFTWARE.

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ABSTRACT | The theoretical section of the paper outlines the progression of the Internet from the Web 1.0 era to the speculative notion of Web 4.0. The latter is referred to as the symbiotic web, wherein the prevailing solutions such as Artificial Intelligence (AI), Internet of Things (IoT), Virtual Reality (VR) and Augmented Reality (AR) developments serve as the framework for advancements that establish a harmonious connection between the user and the software product. Web 4.0 is expected to demonstrate unique characteristics, specifically proactive, content-exploring, self-learning, collaborative, and content-generating solutions (such as extended reality (XR)). XR is an umbrella term derived from the VR-AR continuum, and as an emerging concept, it can revolutionise how people perceive and engage with their environment. The paper evaluates a prototype XR software product designed for fashion model agencies through empirical and analytical usability studies. The research aims to thoroughly understand the user requirements for forthcoming immersive environments, encompassing insights from potential users and experts in user experience (UX) design. To achieve this goal, we conducted a Rapid Iterative Testing and Evaluation (RITE) usability study with a sample of potential users (n=13). We assessed the system's overall usability and gathered subjective feedback by administering a System Usability Scale (SUS) questionnaire and conducting a follow-up interview. Besides that, a usability inspection method was applied, where UX specialists (n=6) were engaged within the framework of heuristic evaluation. Similarly, in this instance, the heuristic evaluation was accompanied by a subsequent interview, in which the experts imparted their subjective experiences and professional insights to us. The user-centred studies have resulted in diverse forms of feedback. The RITE test identified several minor usability issues, such as the absence of software affordances and familiar interactions. On the other hand, the heuristic test has highlighted suggestions for long-term improvements, primarily focusing on the ergonomic design of the XR space across various sub-dimensions. We systematically compare and contrast usability observations from empirical and analytical studies, demonstrating the practical value of applying these methodologies in developing XR software products. Consequently, this paper provides a comprehensive analysis of the results derived from the different types of usability studies that could be useful for creating and developing future immersive spaces.

1. Introduction

Information technology (IT) has rapidly advanced, breaking barriers of time and space and enabling limitless communication. This transformation affects our lives, including work, leisure, thoughts, actions, and related media consumption or software usage (He et al., 2021; Megyeri & Szabó, 2024).

The Internet is the central force of today's digital revolution, acting as a powerful and unstoppable network that connects people across borders and time zones, serving as a worldwide hub for communication, broadcasts, and information sharing. It has evolved from a simple information-sharing tool to a dynamic social interface connecting individuals across changing physical and virtual environments (Tarnoff, 2022).

The evolution of the internet has been remarkable, advancing from the static nature of Web 1.0 to the promising potential of the upcoming Web 4.0 through significant progress. Every advancement has redefined software user interfaces, expanding the limits of what can be achieved in the digital domain (Aghaei et al., 2012).

The continuous evolution of information technology (IT) across the successive epochs of Web 1.0, Web 2.0, and Web 3.0 has profoundly influenced different software's user experience (UX). The transformations of actual UX trends have been driven by a gamut of technological innovations (e.g., radio frequency identification (RFID), mobile technology, virtual and augmented reality (VR/AR) devices, and artificial intelligence (AI)). Such advancements have heralded the arrival of novel and pioneering software across diverse industrial sectors (Khaleel Ibrahim, 2021).

The current path of advancement in IT suggests that several noticeable trends are expected to dominate the latest developments in the software market. Among these trends are the burgeoning domains of big data analytics, machine-to-machine (M2M) communication, cloud computing infrastructures, a variety of AI-driven products, and the burgeoning arena of extended reality (XR) innovations (Hendler, 2009). XR solutions combine augmented reality (AR), virtual reality (VR), and mixed reality (MR) to improve our interactions with the internet and the environment (Bharadiya, 2023).

These developments increasingly constitute integral facets of cutting-edge IT initiatives that contribute to the emergence of the fourth-generation Internet era, Web 4.0. Web 4.0 symbolises an envisaged frontier wherein the fusion between cyberspace and the tangible realm undergoes further augmentation. With the support of numerous emerging IT solutions, this synergistic convergence is ready to give users more customised, intelligent, and immersive experiences, offering designers new UX challenges and opportunities (Pfeiffer et al., 2016).

This paper presents a user-centred approach employed to enhance XR software pertaining to Web 4.0 by comprehending user and UX experts' requirements and insights.

2. Theoretical Background

2.1 From Static Web to Metaverse

Tim Berners-Lee conceptualised the World Wide Web in 1989 as a continuously developing system for organising information (Machado et al., 2019). In the past thirty years, the Internet has evolved significantly, progressing through different stages known as Web 1.0, Web 2.0, and Web 3.0, with the first signs of Web 4.0 currently in progress. Various eras can be distinguished by unique characteristics that have impacted the UX of the associated software (Eftekhari et al., 2011; Hung et al., 2010; Khaleel Ibrahim, 2021).

In the Web 1.0 era (1989-2004), known as the cognition web, the online space resembled a static, read-only environment. Information dissemination dominated, and user interaction was limited, marked by one-way

information flows. Developers wielded significant influence on the design of webpages, focusing on the logical structure and visual meaning, thus creating a cohesive UX (Benford et al., 2009; Choudhury, 2014; Fleming & Koman, 1998).

Transitioning into Web 2.0 from 2004, dubbed the communication web, user participation became the focal point. Coined as the read-write web, this phase facilitated user-generated content through social networking, blogging, and interactive web applications. Web 2.0 spurred advancements in responsive design and dynamic content, enhancing user interactivity and shaping a more engaging, multi-model UX (Law & Van Schaik, 2010; Pranay & Chhetri, 2015). Web 3.0, the Web of Collaboration, was introduced in 2013 and inspired by John Markoff's vision in 2006. The fundamental concept of executive or intelligent web involves improving the ability to understand and process information effectively. Machine-readable data is integrated with metadata to allow software to interpret and analyse web content, resulting in an intelligent and contextual UX. This evolution aimed to enhance machine systems' ability to understand data and aid in decision-making, thereby enhancing the creation of immersive software (Hiremath & Kenchakkanavar, 2016).

The rise of the Web of Integration (Web 4.0) signifies a new paradigm in the IT sector, marked by the integration of various models, technologies, and social interactions. This new version of the internet represents a significant departure from previous versions, introducing a more extensive and interconnected structure. Web 4.0 is a vision of the internet that involves increased personalisation and contextual awareness. The discussed idea envisions a seamless integration of physical and digital realms, where interconnected devices, sophisticated analytics, and intelligent algorithms collaborate to offer customised and intuitive metaverse services (Almeida, 2017).

The metaverse is a concept associated with Web 4.0, representing a globally interconnected virtual 3D environment accessed through the internet, enabling individuals from different locations to engage in shared social experiences. A metaverse integrates the physical and digital realms, allowing users to engage with virtual content in their surroundings. Digital information and virtual objects are tied to particular physical locations, enabling users to access and engage with them in real-world situations (Pangilinan et al., 2019).

For example, utilising XR technologies and incorporating intelligent algorithms (e.g. AI) in a virtual setting can provide consumers with immersive and realistic experiences (Ahuja et al., 2023). It allows digital content to be superimposed onto the real world, creating immersive experiences and new opportunities for communication, collaboration, and information access. Users can navigate and engage with digital content in real time in their actual surroundings, allowing interactive UX in fields like gaming, education, design, and retail (Kuhn & Ballatore, 2015).

2.2 Definition of Extended Reality (XR)

Milgram & Kishino (1994) introduced a fundamental visual representation to demonstrate the range of immersive experiences, encompassing the concept of XR (Figure 1). The AR-VR continuum, illustrated in their diagram, provides an elementary basis for comprehending the different levels of reality-virtuality integration. The virtuality continuum represents a range of actual and virtual environments at opposite extremes (Ribeiro et al., 2021).

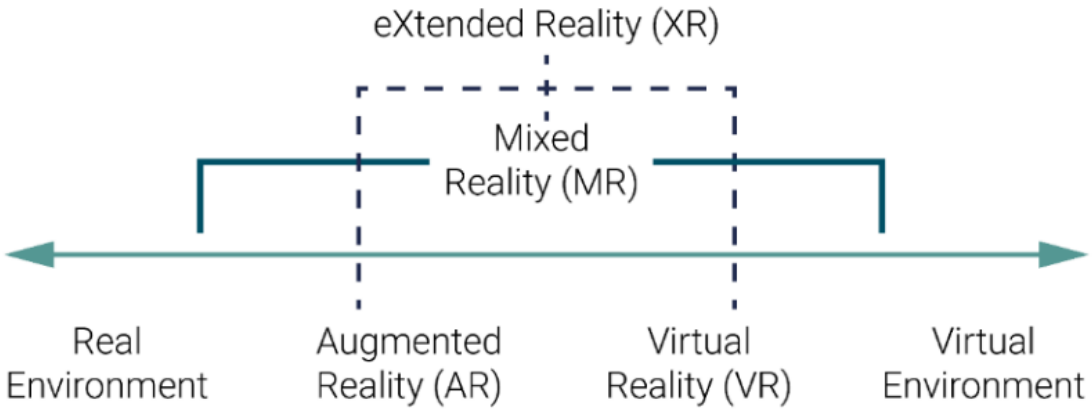


Figure 1. XR adaptation of Milgram and Kishino's virtuality continuum.

AR has a historical lineage dating back to the 1950s; nevertheless, the term gained prominence primarily in the 1990s (Berryman, 2012). AR enhances the user's perception of the environment by superimposing digital information, focusing on a more realistic experience. In subsequent years, AR has undergone multifaceted characterisations, with its central essence commonly construed as a dynamic and real-time amalgamation of digital information and the physical environment (Billinghurst et al., 2015; Javornik, 2016). The evolving nature of AR's conceptualisation underscores its capacity to seamlessly integrate digital content with the perceptible world, indicative of its continual evolution as an interdisciplinary field bridging computer science and human-computer interaction (Fjeld, 2004).

Since World War II, the military has utilised simulators to train combat pilots. The Link Trainer application, used for pilot training before World War II, was one of the earliest instances of a technology similar to modern VR (Jeon, 2015). Virtual reality (VR) encompasses an extensive collection of perceptual experiences generated via the application of various technological devices (Boas, 2013). VR leans towards the virtual reality end, completely involving humans in computer-generated settings and disconnecting them from their immediate physical surroundings. The concept pertains to a synthetic domain in which individuals strive for complete immersion, thus facilitating their active engagement and exposure to many occurrences (Sveistrup, 2004).

Defining the concept of MR is challenging (Rokhsaritalemi et al., 2020). Scientific studies have shown that even experts in the field need help to determine what defines MR. Speicher, Hall, & Nebeling (2019) conducted expert interviews with various academic and industry stakeholders to elucidate the main characteristics of the concept of MR. Based on the research findings, it can be stated that MR is commonly associated with the terms AR and VR. Sala (2021) defines MR as a medium that combines physical and virtual environments through immersive, computer-generated settings. This concept can be easily grasped when considering Milgram and Kishino's (1994) perspective.

As an overarching term, XR encapsulates the entire spectrum that Milgram & Kishino (1994) delineated. XR transcends the confines of AR and VR, encompassing a continuum of immersive experiences from augmented real-world environments to entirely virtual ones (Ziker et al., 2021).

XR usually acts as an inclusive umbrella term, acknowledging the interplay and convergence of virtual and real-world elements. Nonetheless, researchers have discussed the significance and relevance of the letter X in terms of XR. One perspective argues that the X is inaccurately interpreted as extended, as VR does not extend reality but substitutes it. X in the proposed interpretation can be replaced with the actuality utilised in the development, similar to an algebraic variable. It can be interpreted as future developments, which refer to the unknown reality that lies ahead (Rauschnabel et al., 2022)

Lee, Moon, Ko, Lee, & Yoo (2020) state that the concept of XR, which combines VR and AR, is becoming increasingly popular as it revolutionises how humans interact with the digital and physical realms, providing users with novel perspectives and methods of engaging with their surroundings. As a result of its radical redesign of the software user interface, XR introduced unknown challenges, which were noted in the discourse of UX experts.

The primary focus of UX for screen-based software was optimising the user interface to meet the users' needs and expectations and essential business key performance indicators (KPIs), such as conversion rates. Meanwhile, in XR environments, where all senses are fully exposed to artificial and immersive stimuli, the directness and impressive potency of the UX impose an entirely new set of obligations on designers. Exploring the user's emotions and gaining their trust is essential when designing the user interface of XR software (Hillmann, 2021).

3. Aim of the Research and Methodology

The research aims to improve an XR software program prototype for modelling agencies through empirical usability testing and analytical assessment.

The research plan was designed to answer the following research questions:

- What are the user needs for designing XR spaces?
- What are the similarities and differences between empirical and analytical user feedback?

3.1 Introduction of the Prototype of the XR Software

The software prototype is a high-fidelity product developed by a Hungarian IT company specifically for the Meta Quest 2 device. The software enables fashion companies to view models from an existing model agency, assisting decision-makers in selecting future collaboration models in an XR environment. Using a head-mounted display, fashion professionals can pre-screen and select models without travelling, saving them considerable time and effort (Figure 2).



Figure 2. The Meta Quest 2 head-mounted display and the XR fashion model selection software handles.

The main innovation of the development is that users can interact with UI elements using their hands instead of relying on a control tool to navigate in an immersive environment. This is made possible by the hand-tracking feature, which utilises software to track and map hands (Figure 3).

Users can view the models' presentations and catwalks in various environments ("Rooftop" and "Studio"). Besides that, models can be selected as favourites and then emailed to the decision-makers at the model agency.

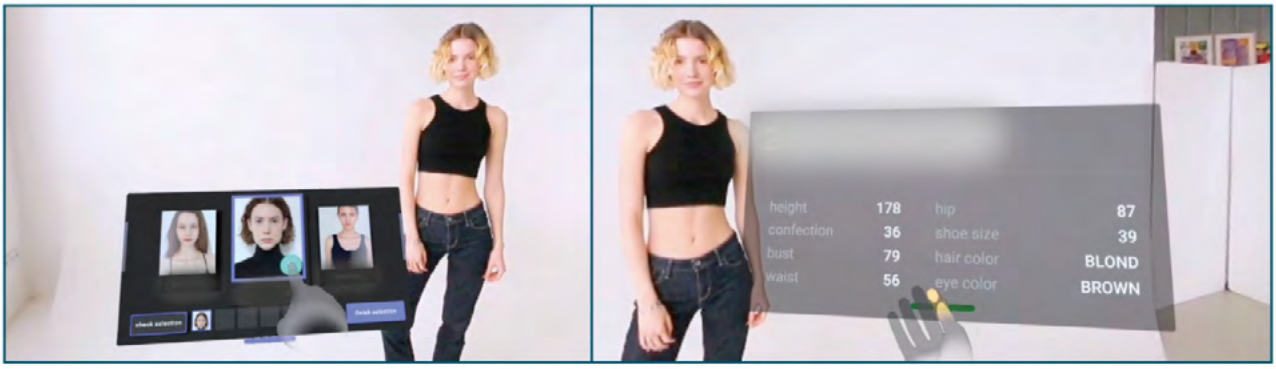


Figure 3. Hand-tracking control and parts of the XR fashion model XR software's user interface.

3.2 Research Methods

The study was consecutively divided into two qualitative sections in the spring of 2023. The first was an empirical usability study (n=13), using a pre-designed study to identify usability issues in the XR environment (Svedberg, 2020). Besides that, we supplemented the usability testing methodology with a System Usability Scale (SUS) questionnaire to assess the software quantitively by the participants (Grier et al., 2013). To gain a deeper understanding of user expectations, the experiment concluded with a follow-up interview in each case.

In the second phase, we used an analytical approach as a heuristic evaluation (n=6), in which digital product design experts offered comments on the specific software product and the XR environment (Becker & Freitas, 2023). The tests were conducted this way because, when designing an innovative product, it was vital to get feedback from potential consumers and experts to steer the prototype in the right direction.

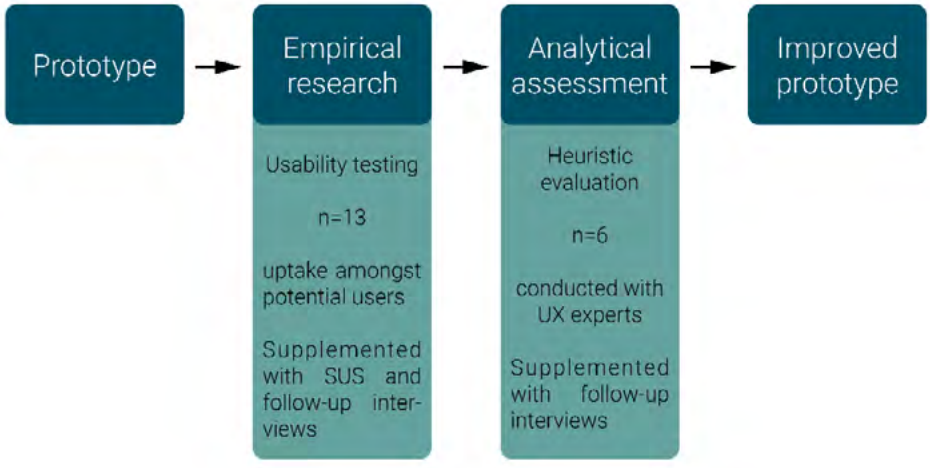


Figure 4. Research plan.

Methodological details of the empirical research:

- Usability testing

Usability testing is a qualitative approach that utilises user testing to assess various software products (Issa & Isaias, 2022). The method examines how well a product can be used for its intended purpose and evaluates whether specific product functions are met. The methodology assesses if an interface is usable by its intended users to carry out the tasks it was created for (Rubin et al., 2008).

We conducted the test using Rapid Iterative Testing and Evaluation (RITE). RITE is a usability test variation that emphasises quickly identifying and implementing solutions rather than pinpointing problems (Medlock et al., 2005; Szabó & Hercegfi, 2023). After conducting usability testing with a small group of participants, we refined the software based on user feedback for the subsequent testing phase. This ensured that modifications were made using a user-centred and iterative approach.

The usability study was carried out in three phases with varying numbers of participants: the first with four, the second with five, and the third with four individuals. Most participants were university students at the BA/BSc, MA/MSc, or PhD level, aged between 20 and 34 years (Table 1).

The development team had a two-week period to implement the modifications identified during the iterative phase before the next round of testing.

Table 1. Demographic information on empirical research participants grouped by iterative phase.

Iterative phase	1	2	3
Number of participants	4	5	4
Identification numbers	ID1, ID2, ID3, ID4	ID5, ID6, ID7, ID8, ID9	ID10, ID11, ID12, ID13
Age range	20-23	20-24	23-34
Gender distribution	Male (100%)	Male (20%), Female (80%)	Male (75%), Female (25%)
Studies	mechatronics engineer, electrical engineer, computer engineer, international management	industrial designer, psychology	computer vision, oriental languages and cultures, molecular bionics, building services engineer

During the usability test, participants were required to solve model selection tasks and scenarios outlined in predetermined descriptions. The scenarios outlined specific business challenges faced by a senior employee at a fashion agency, allowing participants to easily relate to them and creating a clear decision-making situation. To obtain a more comprehensive understanding of users' requirements, the think-aloud protocol was applied to understand the user's cognitive processes during their interaction with the product. (Jääskeläinen, 2010). Continuously using this moderation technique throughout the usability testing would likely introduce bias in the immersive environment. We created the protocol with concurrent probing (CP), a moderation technique where participants respond to questions from the facilitator at different stages of the task solution (Usability.GOV, 2013).

- System Usability Scale (SUS)

After usability testing, the research progressed by administering a System Usability Scale (SUS) questionnaire to quantitatively assess the software's usability (Bangor et al., 2008). SUS is a widely used user-centred method in scientific research and industrial practice to measure subjective usability. The questionnaire was primarily designed to assess the overall usability of complex systems and is also suitable for evaluating XR software products. The questionnaire evaluates the user's views on the system's usability using a five-point Likert scale and ten statements. The System Usability Scale (SUS) consists of an equal number of positively and negatively worded statements that are used to derive a percentage score ranging from 0 to 100 (Lewis, 2018).

- Follow-up interviews

After finishing the SUS questionnaire, participants could express their opinions about the XR software in follow-up interviews. We inquired about their cognitive processes during the tasks, enjoyment of the software, and motivation to use it. The interviews explored the participants' experiences with hand tracking as they used it to operate the software programme.

Aside from the visual aspects, the interview questions focused on immersion, precisely the arrangement of software elements in the XR environment and evaluating the auditory features (model presentations and the audiovisual effects) of XR fashion shows.

Methodological details of the analytical assessment:

- Heuristic evaluation

Heuristic evaluation is a commonly used method in industrial UX practice where a small group of experts assess the user interface's suitability for the design problem based on established ergonomic guidelines (Delice & Güngör, 2009). When evaluating screen-based software products, evaluators frequently employ established guidelines (e.g., Shneiderman, Nielsen) to assess the user interface (Delice & Güngör, 2009). Given the unique features of the XR environment, experts were asked to conduct a comprehensive and expert evaluation of the XR environment, openly addressing all relevant UX factors. In the absence of predetermined guidelines and checklists, evaluators possess the capacity to approach interface evaluation with a flexible mindset (Nielsen, 1994). This approach facilitates the identification of novel issues or opportunities that might remain overlooked when employing rigid criteria. Consequently, evaluators are empowered to leverage their creativity and domain expertise, enabling a holistic assessment of the interface encompassing aspects such as aesthetics, overall functionality, and other pertinent factors influencing UX. Heuristic evaluation thus prioritises the collection of comprehensive feedback concerning the efficacy of an interactive system, eschewing the mere enumeration of issues based on specific usability principles (Hertzum & Jacobsen, 2001). During the heuristic evaluation, we also implemented the think-aloud technique to enable participants to rapidly articulate their professional thoughts (Alshammari et al., 2015).

Six individuals with extensive experience in UX design or previous VR/AR projects participated in the study (Table 2).

Table 2. Demographic information on analytical assessment participants.

Identification number	ID1	ID2	ID3	ID4	ID5	ID6
Age	43	30	31	48	43	40
Gender	Male	Female	Female	Female	Male	Male
Experience in years regarding UX	8	1	9	7	20	24
Current work	Researcher on VR development in human resources (HR)	Junior researcher of an interaction and immersive research group	Senior researcher in the field of human-computer interaction (HCI)	Freelance web designer and developer	Mentor of designers and product design managers	UX consultant and design team mentor

- Follow-up interviews

After the heuristic evaluation, experts participated in a follow-up interview to discuss their subjective experiences and professional insights. We also sought to understand the participants' perceptions of the XR environment, its influence on them, and the emotions it elicited. We also requested their input on the professional suitability of the hand-tracking feature and any ergonomic challenges they faced. We asked the experts to provide information about themselves, including their current activities, areas of interest, research field, and experiences.

4. Results

4.1 Empirical Research Results

The results of the empirical research are presented in three iterative phases, following the characteristics of usability testing, which was applied to the RITE methodology.

- Usability testing results (iteration phase 1)

During iteration phase 1, the model selection process proceeded without any issues. When asked to select a particular model, comparable results were noted. The majority of the participants found this task easy to solve. One considered the "Add to favourites" option not the default choice for a final selection but a preliminary selection for further consideration. The text "Add to favourites" confused some of the participants as they expected a different function: "I thought it would lead to a separate list of favourites, like on clothes shop websites." (ID4)

Multiple users experienced a sudden limitation in their field of view at the periphery of their visual boundaries while using the software, leading to discomfort: “I feel confined and restricted, like being in a matchbox.” (ID1)

The initial pop-up window provided instructions on hand-tracking control, but the model selection area appeared in the background, leading to confusion among the participants during the onboarding process. During usage, participants found it beneficial to observe the outline of their hand while manipulating and moving through the XR environment using hand tracking, eliminating the need for extra information. They

claimed that onboarding not, but affordances and past physical life experiences aided their intuitive understanding of control.

The hand-tracking technology was criticised solely for its sensitivity. The participants found it frustrating when the software failed to accurately detect the users' intentions. A moderator had to help a participant activate the button he wanted to press during an assignment. The issue arose from the user's lack of perceived tactile feedback in the software, leading to uncertainty in interacting with the button: “I struggled because I had only lightly touched the button.” (ID3)

ID3 was also unsure about interacting with different elements during the usability testing due to his lack of familiarity with the hand-tracking mode of operation. Despite its challenges, the hand-tracking control was seen as a positive feature of the XR software.

Participants encountered difficulties multiple times while in the XR environment, failing to find tutorial videos or additional onboarding support during usage to overcome the problem.

The models' proximity particularly unsettled participants. Therefore, they looked for traits that would allow them to stop the models in space. During the "Introduction" mode, they struggled to understand and analyse the models' speech due to the audio recording quality.

The participants reported that the user experience was greatly improved by the highly realistic way the models moved and the presence of various locations. The rooftop view was described as "dizzying," suggesting it was authentic and made the participants feel like they were there.

Participants expressed a positive impression of the XR software during follow-up interviews, describing it as "futuristic" and "very exciting." They verified the recognised usability issues, such as onboarding difficulties and hand-tracking limitations. They expected a bright future for XR software in different sectors, including home decoration, driver's licence acquisition, long-distance travel, virtual amusement parks, and online conference participation, with possible cost reductions in a business setting. Some participants emphasised the need for increased realism in the XR environment and technological advancements to improve the user experience.

- Usability testing results (iteration phase 2)

Participants did not encounter navigational difficulties when selecting models in iteration phase 2, but some needed help establishing the selection criteria. Participants remarked that the XR environment was blurry, especially towards the edges. As a result, many participants needed help understanding the characteristics of the models.

Some criticised the software's user interface for having elements that were too closely positioned and being interrupted by disruptive pop-up windows.

Participants rapidly left the "Rooftop" view due to distractions caused by the white background behind the models, prompting several users to quickly switch to the "Studio" view because of feelings of spatial anxiety.

Participants in Iteration 2 were concerned about models approaching too closely in catwalk mode, prompting them to seek software solutions to prevent this.

The low audio recording quality made understanding and analysing the models' introduction challenging: “I was annoyed by the models' constant speech, so I tried to keep it under control.” (ID6)

Participants' perceptions of being within the XR environment space varied. Some participants were dissatisfied as they could not experience detachment from reality: "I could see through the bottom of the glasses, so it was less realistic.” (ID5)

In addition, some participants in the usability testing expressed concern about being in a physical environment: "I was afraid of hitting the real wall.” (ID7)

The hand-tracking feature generated mixed reactions from the participants. All of them were irritated since the software often failed to react to button pushes, and it was unclear how to click. Nonetheless, they enjoyed it due to the novel and unusual experience: "It was interesting to press into the space and interact with something." (ID9)

Several participants, however, claimed that calculating the proper distances to reach the buttons took much work. Some said that activating the buttons with one finger was complicated and annoying (both found it easier to contact the button with two fingers). Some participants recommended creating an onboarding solution that includes all manipulation operations to overcome navigation issues.

Participants maintained a positive impression of the XR software during the interviews in iteration 2, describing it as "great," "exciting," and "particularly interesting." Interviewees appreciated the realistic environment and the opportunities for controller-free interactions. Feedback was generally positive, although some struggled with pop-up windows. The importance of onboarding was highlighted. Participants predicted increased adoption of XR software for design, medical applications, office work, entertainment, and business meetings but emphasised the need for improved immersion.

- Usability testing results (iteration phase 3)

In iteration 3, the model selection process was relatively easy. However, there were visual disturbances in the XR environment, with the space shaking and blinking at the start. Several individuals have raised concerns regarding the image quality of the stationary models.

The revised panel layout implementation after iteration phase 2 was successful, leading to enhanced clarity and transparency in the user interface.

Pressing buttons continued to present difficulties due to the need for tactile feedback. Furthermore, the system's slow performance impeded the software's navigation.

The participants found the software's response time slow and were unsure why they couldn't press a button or activate a function. Participants also complained about the lack of clarity in the system's feedback: “The response of the overall environment is painfully sluggish.” (ID11)

Frequently, the pop-up panels were positioned too close to the user, causing the text to be difficult to read. Most people instinctively reacted by stepping back: "I want to move away”. (ID10)

The "Rooftop" perspective caused users to lose their sense of space, leading them to prefer the "Studio" view: “The studio perspective was more realistic.” (ID13)

Hand-tracking generated negative feedback during this iterative phase, most likely as a result of the slower system speed of the improved prototype: "The hand control is unusual and odd. I don’t like it." (ID12)

Participants in the interviews expressed positive assessments of the design of the XR space, particularly appreciating its cleanliness and intuitive structure. They recommended improvements like increasing the size of action buttons and text and adding arrows for straightforward navigation. The need for more onboarding information and irritating pop-up windows were also mentioned. Some users expressed dissatisfaction with the display quality and the lack of background music. Participants acknowledged the software's potential for academic and recreational purposes, foreseeing a promising future but recognising the necessity for additional improvements.

- System Usability Scale (SUS) results

The SUS questionnaires validate the findings of the usability studies. During iterative phase 1, participants assessed the software product's usability with a mean score of 77.5% and a standard deviation (SD) of 6.12. In iterative phase 2, the mean was 76% (SD=11.81); in iterative phase 3, it was 78.75% (SD=4.33).

The high SUS values were attributed to the participant's ability to appreciate the novelty of the software. The XR Environment and the innovative hand-tracking control overcame several minor issues identified for improvement in the usability evaluation.

4.2 Analytical Assessment Results

The results of the analytic examination are provided alongside the follow-up interviews, in which the experts primarily re-emphasized, clarified, and concluded the issues raised throughout the inquiry.

- Heuristic evaluation results

The experts' overall product assessment was optimistic based on the heuristic tests.

All experts felt confused throughout the onboarding process since photos were utilised to demonstrate non-interactive capabilities. As a result, most of them raced through this portion without thoroughly reading the directions.

During model selection, there were several instances where participants mistakenly pushed the selection (+/-) button while scrolling (swiping) between models, deleting or adding models to the selection.

The models' proximity distracted everyone in the area, leading users to step back: "I have to step back to see the legs." (ID2)

The aesthetics of the panels provoked various emotions among the participants. They were all pleased with how the content was organised, but using colour, contrast, proportions, and alignment within the panels was controversial.

Moving the panels was a common challenge. Some couldn't recall how to move them, while others decided not to make the appropriate motion. Many people saw the panels as static, preferring to adapt their stance to their surroundings.

At the end of the selection process, everyone was frustrated and unclear about the "done" feedback, which appeared interactive but produced no change or input. Moreover, it was necessary to clarify what actions to take and whether the selection had been accurately submitted.

Hand tracking received a wide range of reviews, with some considering it immature and complicated, while others found it simple and enjoyable to use.

> "What I found more challenging than my prior controller experience was the absence of tactile input when I hit the button. It made it much more difficult to understand how hard to press was. It's also unusual to see a panel and occasionally have to press behind it." (ID2)

In other situations, the issue was that they found it challenging when they attempted to break from the tool's usage patterns (2D tools). Manual navigation includes all interactions inside the software; even specialists reported a high sense of uneasiness among users about whether they were doing something wrong. When a gesture did not work the first time, many people would try a more extensive interface, palm or multiple fingers, and maybe double- or many consecutive clicks to remedy the problem.

> "I was trying to pick up patterns of behaviour that we use on 90% of devices, so it was a bit weird for me to find out ... that I was touching it and moving it, but it was cool."(ID4)

Overall, participants indicated good feelings about the XR program and constructive remarks concerning the space's architecture and increased realism.

> "The direction is nice from a UX standpoint. I believe it tries too hard to mimic real-life, realistic model choices while failing to realise the space's possibilities completely. It's a good thing there aren't any hidden panels because I believe they detract from the added real-world potential that comes from the fact that the area is completely changeable. I suppose people are seated in a typical model selection, but I can also envision them moving about, etc." (ID6)

5. Discussion

The applied research methods proved effective, and the empirical and analytical studies have revealed a relevant set of user needs that can support the user-centred development of the XR prototype.

The onboarding part of the software is likely to receive greater attention and engagement if it were interactive. To inform users what actions they can take in the XR environment, additional information should be added to the software features during the onboarding process (e.g., introduction of models, catwalk function, steps of the selection process).

After learning how to move the panels, everyone was eager to customise the interface. In addition, individual panel layouts should be saved, and it would be helpful to demonstrate this to users during onboarding.

After customising the user interface, the specified location of the pop-up windows caused issues in all testing to varied degrees. This was due to information showing behind other windows outside the perimeter. Because some of these elements were fixed, the users had to adjust their location relative to the panel to proceed.

As the users perceived the introduction to allude to a spoken speech, this feature proved to be deceptive. Therefore, it would make sense to incorporate a more direct and personal introduction to the models into the software. While it is true that the selection process is impersonal in real-time, the models might be placed in the XR environment closer to the decision-makers, for example, by providing optionally displayable extra information about their residence, hobbies, and modelling experience, among other things.

Users also felt they could not control the software because of the instantaneous, self-running video of the models. The models' inconsistent stopping points at the end of walks, which caused the movements to terminate in the middle of the sequence and gave the appearance of a software freeze, proved confounding in a few instances.

The demand for personal space is also evident in the XR environment because the models come uncomfortably close to the users. The design should ensure that the users do not feel that any part of the user interface is disturbing their personal space.

Users found the hand-tracking feature innovative and intriguing, yet they believed it required improvement.

Making the software more user-friendly would include translating components from ordinary life and reality into immersive environments. These solutions may include lifting the panel with two hands, like lifting a sheet of paper, or even a virtual board, like a corkboard, on which you could use tweezers to place pictures of particular models. (Figure 5).

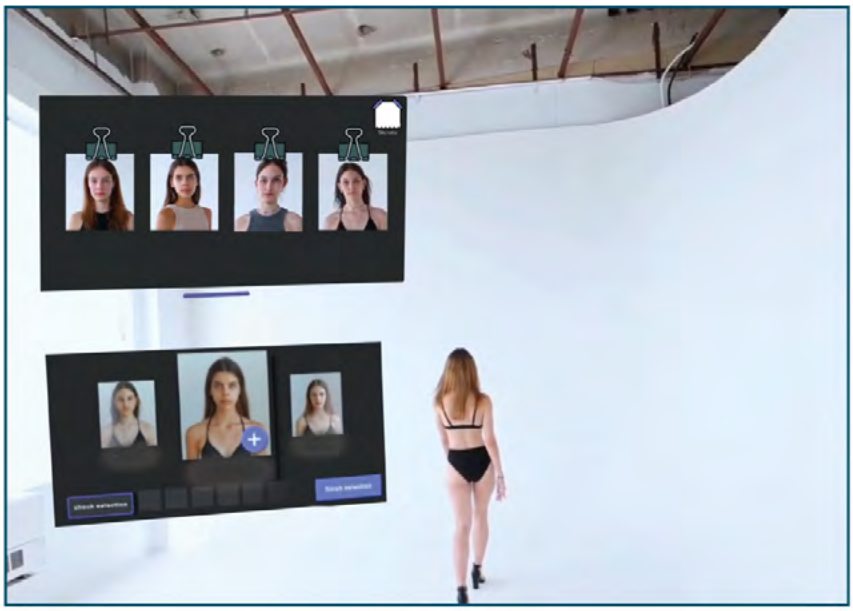


Figure 5. An example of using real-life boards and tweezers to increase the realism of the workflow in the XR environment.

The "done" caption at the end of the selection process was troublesome and caused doubt and annoyance, significantly reducing the UX. The system did not indicate that clicking on it would prompt the user to take action.

These insights will significantly help customise the software and XR environment to meet the user's needs. In the future, educating potential users through well-designed onboarding will be essential for users of XR software to be informed about, utilise, and benefit from the opportunities provided by the immersive environment.

6. Conclusion

In terms of the applied methodologies, participants in the empirical research found a notably more significant number of design flaws (such as distracting background colour and smaller button sizes) that were easily fixed but had no impact on UX. Of course, similar observations were also made during the analytical assessment. Still, the experts were concerned about more profound factors that could impact UX, such as overcrowding, consistency problems, and recurring errors in design (e.g. inadequate location of pop-up windows, lack of feedback).

The empirical research highlighted the lack of guidance and training on correct gestures, particularly about software usage. Furthermore, the analytical study discovered other significant results. These insights involved integrating components that were already present in various applications and real-world scenarios. The analysis confirms that XR software design should follow traditional UX design standards (e.g. Shneiderman's guidelines). The heuristic assessment found instances where it was suggested that the XR environment should allow the user to take control of the conversation, such as following traditional design principles. Users should be able to start and stop the video manually, and a progress indicator should display their position on the timeline.

The models selected in several cases were chosen randomly, and the analytical assessment offered a sophisticated improvement proposal to address this. The experts emphasised that errors could be reduced by placing the action button that triggers the selection in a separate bar from where users intended to scroll. Moreover, using the familiar check box instead of the selection option can help streamline the process. The participants in the empirical study made many general suggestions about expanding or limiting the selection options but did not offer any specific advice.

Aside from optimising load times and durations in different use cases, focusing more on specific aspects like hand gestures, visual prompts, movement, and sound design in XR environments is crucial.

Experts assert that allowing the user to have control over the design of their XR environment and the ability to add panels to customise it is crucial.

Creating software versions for different age groups is necessary due to the product's compatibility with diverse users and their significant usage habits. One way to achieve this is by incorporating various features to help users unfamiliar with technology, such as providing thorough onboarding, implementing hand tracking, and including traditional features like a drop-down menu. These characteristics should be optional or deactivated once abilities and routines are established.

Moreover, the analytical assessment also showed an improvement in ecological validity. Examples include integrating functionalities from different software, such as note-taking, video scrolling, and profile settings, and implementing real-life gesture recognition, like lifting a panel with two hands like a sheet of paper. Contact with other individuals in the XR area and realistic mapping of real-life movements, like sitting on a couch, changing perspectives, and exploring models, have been proposed as essential.

It can be said that both empirical and analytical studies have provided useful feedback. The fundamental difference is that the analytical insights were more comprehensive and thus can be used to design any XR circular design so that their consideration highly enhances the UX of the software. In contrast, the empirical results gave concrete development ideas for concrete software. The joint observation involved enhancing non-design parts (such as controls and audio-based sub-elements) to enhance the overall realism of the environment (Table 3).

Table 3. Summarising the results of empirical and analytical usability studies

Empirical research	Analytical assessment
Design flaws (e.g. distracting background colour, smaller button sizes)	Overall design insights (e.g. overcrowding, consistency, recurring design errors)
Inappropriate visualisation, location and grouping of functions	Ability to customise panels and settings, furthermore creating software versions
Absence of onboarding	Developing product learnability (beyond onboarding)
Greater emphasis on certain aspects of the whole environment (e.g. hand gestures, visual prompts, movement, sound design)	

6.1 Limitations

Consequently, when creating an XR software product, an analytical assessment is recommended after developing a high-fidelity prototype in the initial iteration. After considering the suggestions of analytical assessment and constructing the product, empirical usability testing is a valuable tool.
The empirical research should have a 2-week development duration to implement the development ideas effectively. One limitation of our study was that the participants fell within the age range of 20 to 34. Thus, we could not collect the viewpoints and experiences of other potential users.

We could not hire fashion industry experts because of the significant financial implications. Upon product completion, it would also be advantageous to gather their feedback.

The experts who participated in the analytical assessment included some with less experience in UX (e.g. ID2) or no experience in VR/AR development (e.g. ID4). This may have slightly affected the results.

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P/REFERENCES OF DESIGN

DESIGN FICTION GRAPHIC NARRATIVES: DESIGNING WITH RATHER THAN FOR EXPERIENCES.

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ABSTRACT | The emergence of concepts such as pervasive computing, blended spaces, augmented and virtual realities, related here to technologies associated with so-called extended reality (XR), challenge many of the best practices associated with user-experience design (UX). In particular, the environmental qualities of XR technologies that require a strong synthesis of digital content with, and within, virtual and physical socio-spatial contexts challenge many aspects of product-oriented approaches to digital design. As interaction design (IXD) lecturers who have spent much of the last two decades focused on developing approaches and methods for teaching the design of digital products such as websites and mobile phone applications, we recognize that preparing students for future careers involving the design of XR systems requires reconsideration of theories and practicalities that have become entrenched over the recent past in digital design education and practice. Furthermore, as educators working in the Global South, we aim to engage with the constraints afforded by limited access to much of this high-end technology in a designerly manner. In response, this study addresses two objectives: firstly, to engage design students with technologies in a more systemic manner, focusing on interrelationships of socio-spatial temporal contexts and XR technologies, recognizing student's prior knowledge of UX while not being beholden to it; and secondly, to ensure a criticality in the resulting process towards design outcomes which extend beyond subjective speculation to incorporate evaluative reflection.

1. Introduction

As interaction design (IXD) lecturers who have spent much of the last two decades focused on developing approaches and methods for teaching the design of digital products such as websites and mobile phone applications within a user-experience paradigm, we recognize that preparing students for future careers involving the design of extended reality (XR) systems requires reconsideration of theories and practicalities that have become entrenched over the recent past in digital design education and practice. Here, we understand XR as a composite term for a collection of diverse digital fields unified by a focus on spatial computer interactions (Hillmann, 2021, p. 241). These include virtual reality (VR), augmented reality (AR), blended space design (BSD), as well as smart things and environment design.

Furthermore, within what we associate with the normative conventions of user-experience and service design practices, we have also begun to experience a lack of technique for adequately communicating and evaluating, high-level strategic thinking at the level of systems, services, and environments. This limitation, brought about, we would argue, by a product orientated legacy is a general concern for human-centred design practices highlighted by their struggle to address complex, large-scale systemic problems (Mani-Kandt, 2021). However, for XR design, due to its implicit focus on environmentally structured solutions, the need to ideate at a level detailing the value of systemic solution formation is a fundamental.

With these concerns and concepts as an initial point of departure, this study describes what we would refer to as the opportunistic design of a new teaching unit, positioned at the third year of a three-year digital media design program, taught in the Department of Multimedia at the University of Johannesburg. We refer to our approach as 'opportunistic' because while our essential responsibility was to deliver a unit that introduced students to XR broadly, and to IXD concepts and techniques relevant to XR, our recent teaching practices have begun to appreciate futures thinking. That is, design fictions (DFs) is broadly considered as a conceptual approach for projecting proposed complex design scenarios in accessible relatable, and evaluable forms. Furthermore, drawing on previous experiences teaching Internet of Things-themed projects, we have recognized the positive impact of visual storyboarding for the communication of complex, innovative solution systems. Lastly, while recognizing key differences between spatial and product-oriented design, we wanted to leverage student's prior knowledge of UX/service design research, analysis and strategic thinking and communication.

Consequently, and drawing on tacit and explicit objectives for the teaching unit, this study addresses two objectives: first, to engage design students with technologies in a more systemic manner, focusing on interrelationships of socio-spatial temporal contexts and XR technologies, recognizing student's prior knowledge of UX while not being beholden to it; and second, to ensure a criticality in the resulting process towards design outcomes which extend beyond subjective speculation to incorporate evaluative reflection. In this regard, the study articulates the key considerations that informed the design of the teaching unit, the application of the unit in the context of our experience teaching it, and a selection of reflections outlining a set of general insights and perspectives gained from these activities.

2. The Design Landscape of the XR Teaching Unit

This study, and its summative contributions, are contextualised within a taught unit of a third-year digital media design programme. As there are multiple conceptualisations of what digital media education can and should include, we will briefly provide an overview of the key design approaches and techniques that foreground the unit, and subsequently this study, from the perspective of how they are regarded in our programme.

First, our digital media programme emphasises a creative, socially aware approach to the design of digital services and systems. All students share a general digital media education that includes units dedicated to visual design, design thinking, critical design theory and professional practice but specialize in either

interaction design or digital arts. In this broad framing of the programme, the two module specialisations focus respectively on user experience design (UX) and filmic communication including but not limited to animation, motion graphics, video editing and video compositing. In respect to these two established specialisations, XR is recognized as an emerging set of design approaches and technologies that converge aspects of both interaction design and digital arts, and, it is anticipated, will become an ever more important focus in the education of future digital media professionals. Our UX approach, which all IXD students would have completed earlier in the year, is positioned as the design of interactive products and services that provide good experiences for their intended users. In the UX specialization, the notion of experience is informed by a range of critical, phenomenological and pragmatic theoretical perspectives but can generally be equated with systems and services that are enjoyable to use, are fit for purpose and enhance the everyday activities of the people who use them (Benyon, 2019). As exemplified in Table 1, the UX offering in the programme is structured on a generic design thinking process within a human-centred paradigm (Giacomin, 2014).

Table 1. Overview of UX module.

RESEARCH	STRATEGY	IDEATION	PROTOTYPING	EVALUATION	KEY CONCEPTS AND THEORY
Secondary research Ethnographic research methods Ecology Maps User modelling Customer journey maps	Problem framing Experience models Strategy framing Strategy ideation Customer swim-lanes Customer journey maps	User journeys Sketching Interface flows Task-models	Interface flows Wireframes Design comps Low-res digital prototypes	Paper-protypes Expectancy tests Cognitive walk-throughs	Landscape of digital technology. Business by design Experience Human-centred Design

Second, and within the larger UX module design process, customer journey maps (CJs) (Følstad & Kvale, 2018) are defined as visual, typically schematic, representations of an archetypal journey, and the service environment in which the journey takes place, that an aggregate of users (customers) of a service would undertake as they move from their initial point of entry to the successful completion of their engagement with the service (Adaptive Path, 2013). Typically, CJs reflect the users' journey, across multiple interactions, touchpoints and channels. In this manner, CJs can be considered as a type of service blueprint (Polaine, Løvlie, & Reason, 2013, p. 91) that emphasize the 'front-end' relationship between customers and a specific service.

As noted in Table 1, CJs are applied in two differing ways in our taught UX process. The first application is to map current services or environmental contexts, typically highlighting 'pain-points' and other opportunities for design intervention. The second application is the use of CJs to project an envisioned service or systemic solution. In this application, CJs provide the service context for the subsequent development of potentially multiple, composite digital, non-digital and blended products and environments. A critical point that we identify in CJs used in this manner, is that they are the key conceptual pivot in the design thinking process that both account for the data-driven, but inherently subjective framing of the design problem, and the responding proposed strategic and tactical approach for resolving the design problem.1 It is this second interpretation of CJs that is the ongoing focus of this study. Third, as described in Section 5, students were tasked with engaging with the specific XR practice of blended space design (BSD). BSD can be understood as a spatial view of IXD and UX (Benyon, 2014, p. 1) concerned with the integration of physical and digital spaces to create novel ways for people to engage with the world around them (Benyon, 2014, p. 80).

[1] This consideration draws on Cross and Dorst's notion of problem-solution conjectures in the resolution of wicked problems (Designerly Ways of Knowing, 2006, p. 80).

Lastly, in the context of this study, 'design fictions' refer to designed artefacts that embody and communicate concepts as opposed to offering any utilitarian function. While the concepts of DFs has its precedent in the discursive design fields of speculative design (Dunne & Raby, 2013), (Tharp & Tharp, 2018) and design fiction (Bleeker, 2009),2 in this study, DFs are framed in reference to an emerging set of design research approaches including metrofitting, (Fry 2017), projective research (Geldof & Janssens, 2014; Figueiredo, 2020), and anticipatory design research (Morrison, 2018) that employ DFs to enquire into "putative and contingent" states to "reach for tomorrow's worlds today" (Morrison, 2018, p. 125). The central tenet of these futural approaches is not to predict a definitive future but rather to anticipate possible, plausible futures ultimately relating to concepts of "preparation, expectation, and valuing something probable" (De Smet & Janssens, 2016, p. 2762). Towards this agenda, these anticipatory practices employ DFs to suspend belief about functional and immediate contexts and to challenge audiences to think beyond their expectations and comfort zones (Morrison, 2018, pp. 123, 129), and, as such, expose and explore the implications of plausible near futures (Lindley et al., 2015, p. 58). Examples of DFs in these approaches include highly 'scientific' mappings of future environments (Geldof & Janssens, 2014, p. 8), web-page blogs for a genetically engineered cyborg narwhale (Morrison 2018, p. 134), and streetscape leporellos describing a community's ideal future smart neighbourhood (Fenn, 2023). However, the work that resonates most strongly with our intentions for our students is O'Keefe et al.'s (2020; 2021) 'design fiction storyboards'. In these works, the aforementioned authors utilize graphic storyboards in rich visual narrative sequences to articulate a 'speculative blended experience'. Key to the effectiveness of these near future narratives is the situatedness of proposed blended technologies within very relatable, social worlds, be they the experience of a tourist attending a garden show and being gifted a digital seed to 'grow' on their computer back home, or an audience providing real-time feedback of a standup comedian performances via their smartwatches 'laugh-o-meter'.

3. Methodology

The method of the study is premised on constructive design research (CDR) (Zimmerman et al. 2007; Forlizzi et al. 2008; Zimmerman & Forlizzi 2014; Forlizzi et al. 2014), a general methodology for practising research through design or in our case, research through design teaching. The research contribution of CDR is concerned with holistic practice, that is, how researchers have framed and responded to complex problems and how they have negotiated the various paradoxes, conflicts, and intersecting perspectives to create the 'right thing' (Zimmerman et al. 2007, p. 498; Zimmerman & Forlizzi 2014, p. 177). In the case of this study, the 'right thing' was conceived as the teaching unit described in 5. The Design Process. Following, Zimmerman and Forlizzi (2014, p. 185) we first provide a high-level description of the range of activities involved in the design process of the teaching intervention. This process description is followed by an evaluative discussion reflecting on the *Process, Relevance, Invention* and *Extensibility* (Zimmerman et al. 2007, p. 499; Forlizzi et al. 2008, p. 27) of the designed teaching intervention.

4. Limitations of this Study

This study is primarily concerned with the methodological development of the teaching unit within the design contexts of XR, UXD and anticipatory DFs. As such, its focus is largely on our experience as researchers and educators aiming to contribute, through our teaching practice, theoretical knowledge on a novel design technique. As such, while this research involved design students in a classroom setting it does not focus on their experience, outside of reporting very generally on their response to the project.

[2] Although, they have earlier precedents in commercial conceptual designs, such as, for example, car shows, and avant-garde design movements such as Archigram and Memphis Design.

5. The Design Process of the Teaching Unit

In the second semester of the 2023 academic year, 46 third year IXD and digital arts students from the Department of Multimedia, participated in a 12-week module, the aim of which was to critically engage learners with XR technologies from a designerly perspective.

Two objectives were formulated which would provide the foundational structure of the course. Firstly, to expose and explore Design concerns to be found at the intersection of IXD and XR through the theory. This took the form of a series of lectures which provided a theoretical and philosophical backdrop to the socio-technological contexts of XR and a discussion of related IXD principles, methods, and models. The second objective was to facilitate a practice-based learner engagement using research-oriented design practices, with a futures focus, from a systemic / services perspective, rather than a product-oriented mindset.

As the focus of this research study, the remainder of this section provides an exposition and reflection upon this second objective including the research orientation and approach, process, and outcomes of the six-week student practical project.

5.1 Practice-Based Learner Engagement

In a developing economy context such as ours, access to both XR hardware and software, and the knowledge and skills resources required to facilitate authoring with XR technology, is limited. A challenge is thus presented in having students directly engage with XR technologies in the making of design solutions for the purposes of learning.

Historically in our department, when IXD has been taught through practical assignments at the third-year level, it has been with a product-oriented mindset where students will develop (product) design solutions within the general rubric of user experience design (UX). More recently, we have worked to integrate systemic and services-oriented thinking in the development of UX strategies which first require integrated multi-channel considerations using CJs, prior to detailing user journeys aligned to digital channels and digital product design. Additionally, storyboarding CJs has been featured in our teaching smart things projects.

The intent for the practice-based learner engagement with XR technologies was thus to further develop upon the use of CJ thinking with an emphasis on (probable) projective futures rather than merely mapping. Central to the development of this intent would be exposing students to David Benyon's taxonomy of spaces[3] and his work relating to the design of blended spaces in *Spaces of Interaction, Places for Experience* (Benyon, 2014) in the IXD and XR theory classes which would precede the student's practical assignment.

Building upon Benyon's blended experiences framework (ibid), the application of design fiction storyboards towards conceptualising speculative blended experiences by O'Keefe et al (2020; 2021); would serve to complete an initial framing of our intent for a practice-based learner engagement with XR technologies.

5.2 Approach

The research orientation was developed to underpin the practice-based engagement by students integrated research as making and research in making.

As making, design fiction served as the overarching design methodology for the student practical assignment with the requirement of designing an anticipatory concept for an 'extended blended experience'.

[3] Benyon's categorization identifies physical, digital, information, conceptual and social space.

This was alternatively expressed in the student assignment brief, as an ‘extended reality experience’ (XRE) that was to be ‘anticipatory in its speculative thinking’.

The medium to be employed for the visualisation of the XRE concept was further required to take the form of a ‘comic’.[4] The student assignment brief identified the summative deliverable as a ‘graphic design fiction’ and as such, a concept was to be considered as an object of design.[5] Here, the effort of research as making aimed to tell us something about how the future could or should be designed in general relation to an engagement with XR technology. In making, the XRE concept would function as a design product which would be iterated in various forms and at various times over the duration of the practical project, culminating in a user-centered evaluation of the concept expressed as a comic. This evaluative research in making aimed to tell students something about how their concepts could or should be designed for an engagement with particular XR technologies at play in their concepts.

5.3 Process

Students were required to conceptualise and communicated an XRE that enhances the experience of Halloween for tweens (9-13 years).6 Design criteria for the XRE included: the use of both physical and digital components; presentation of an African interpretation/styling of Halloween; inclusion of services, performances, locations, objects, software, broadcast media, etc. if necessary, and; highlighting the human experience as well as key technological attributes.

The XRE concept was to be developed by students, working in pairs, over six weeks progressing through a four-stage process identified as: 1. Ideate; 2. Extend; 3. Communicate; and 4. Evaluate.

The core of the process involved developing storyboards and comic visualizations, supported by the creation of CJs in a staged progression. In this way, the XRE concept was able to be iteratively developed while each of these activities/tools influenced each other’s development. Table 2. provides an overview of this process including the time allocated to each design stage, a stage summary, activities, deliverables, and iterations upon the deliverables.

[4] Although ‘comic’ has in contemporary times been replaced with terms such as graphic novel etc., we use it here to contrast the visual literacies of comic art with the stylistic convention of storyboards.

[5] The XRE concept was required to be submitted for grading as an A3-sized printed comic.

[6] It is worth noting that Halloween is not a traditional South African holiday and has no established cultural practices.

Table 2. Overview of the Student Assignment Process.

	STAGE SUMMARY	ACTIVITIES	DELIVERABLES & ITERATIONS
IDEATE Week 1	Developing initial extended blended experience concepts (the XRE) using storyboard sketches	1. Storyboarding concepts at the detail level of stick figures and text boxes 2. Presentation of concepts for feedback	Storyboard (iteration 1) Storyboard (iteration 2)
EXTEND Weeks 2-3	Elaboration of narrative concepts in the analytic form of a customer journey	1. First draft customer journeys defining key interactions and channels for the XRE 2. Second draft journey enrichment *using Benyon's blended experience framework (2014) 3. Presentation of journeys for feedback 4. Final customer journey map deliverable	Customer journey map (iteration 1) Customer journey map (iteration 2) Customer journey map (iteration 3)
COMMUNICATE Weeks 4-5	Re-conceptualizing the customer journey as a graphical design fiction (comic)	1. Final hand illustrated storyboard for delivery 2. Creation of a first draft (70% complete) Comic for XRE concepts. ** 3. Presentation of XRE Comic for feedback	Storyboard (iteration 3) XRE Comic (iteration 1) XRE Comic (iteration 2)
EVALUATE Weeks 5-7	Audience evaluation of the graphical design fiction	1. Co-creation of evaluation tool with students 3. Evaluative-testing of XRE Comic 4. Submission of amended and final XRE Comic	XRE comic (iteration 3)

* Enrichment included consideration of ontology, topology, volatility and agency, and how they effect, and are affected by, channel correspondences as described in Benyon's Blended Experiences Framework (2014)

** At this stage, students were introduced to comics as a medium of communication

Concluding the student assignment project process, and this discussion of process, a user-centered evaluation of the XRE concepts was conducted using students to peer-evaluate the XRE comics. Prior to conducting the evaluation, a workshop was conducted, facilitated by the authors, where the evaluation of concepts, rather than a product by intended end-users, was discussed and problematized. Thereafter, students were engaged in an open session of brainstorming possible criteria for such an evaluation. Following the workshop, five criteria were taken forward for use in the peer-evaluation, where each XRE comic received feedback from five participants.

This evaluative research in making an effort constituted the last round of feedback and input into the iterative process of the development of the student's XRE concepts.

5.4 Outcomes

In total, 19 student teams received the initial assignment brief, and all went on to complete the design project.[7] All the student teams participated in the evaluative research and, with the exception of two student teams, all assignments were delivered on deadline. Table 3 presents the assessment criteria provided in the assignment brief and that was used in the grading of the projects.

Table 3. Assessment Criteria for Grading Student Assignments.

Quality of final design fiction narrative:	30%
Quality of final design fiction visualisation:	30%
Ability of customer-journey to communicate design concept visualisation:	30%
Timeously completed rough storyboard:	10%

Although a high degree of variation in quality was observable across the student teams, and across individual deliverables from across teams, all teams were able to develop and deliver XRE storyboards, CJs and XRE comics.

Three examples of student work from the design project are presented below: a storyboard (Figure 1), a customer journey map (Figure 2) and an XRE comic (Figure 3).

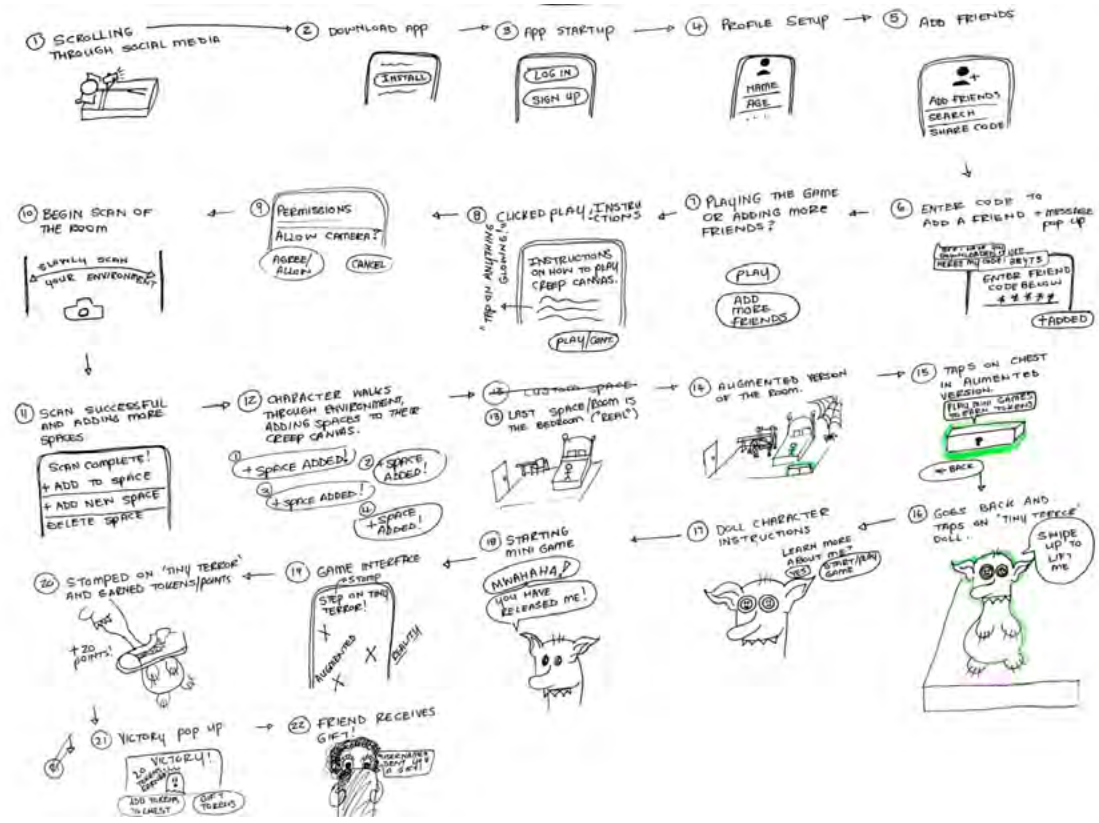


Figure 1. Example of a student group's storyboard. (Image: Sarah Davis & Devorah Hodes, 2023).

[7] The shift in language from 'student pairs' to 'student teams' relates to a small number of working groups being constituted by three rather than two students.

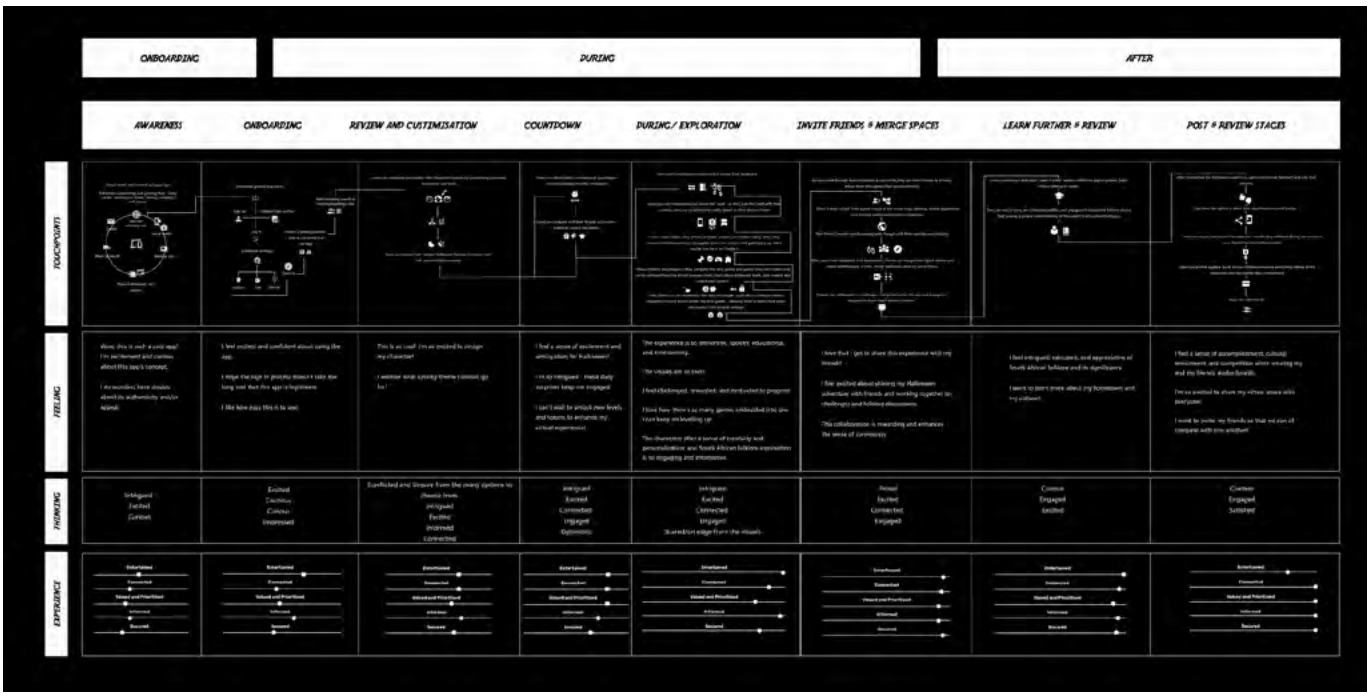


Figure 2. Example of a student group's customer journey. (Image: Sarah Davis & Devorah Hodes, 2023).

5.5 Reflection on the Teaching

Overall, we felt the project exceed our initial goals for the projected research effort and the various conceptual and theoretical threads converged in a rigorous yet enjoyable class to teach, and from all accounts to participate in as a student. At the end of the unit, students completed assignment feedback forms. The scope of feedback spanned both project objectives, the initial theoretical exploration of the subject matter and the practice-based learner engagement. Students were anticipated to have struggled more with the theoretical aspects of the unit however feedback was favourable overall.

Students are taught a number of units which focus on storyboarding and general visual design in the first and second years of their studies, however, comics as a communication literacy and visual storytelling format, do not currently feature within the curriculum of the digital media design undergraduate programme. To the student's credit, almost all teams were able to translate their storyboards and CJs into a competent comic format, but for future editions, teaching the formal elements of comic design should be factored into the structure of the unit in a considered way.

Lastly, the manner in which the user-centred evaluation played out in the design project was arguably light touch. While the workshop conducted was felt to be of significant value and peer-evaluation not without its benefits, 8 the evaluation was felt to lack the full force of feedback which can be experienced when garnered from detached participants.

[8] A notable benefit of peer-evaluation considered by the authors, is how participants might come to reflect more critically upon their own concepts and designs through the act of evaluating those of their peers.

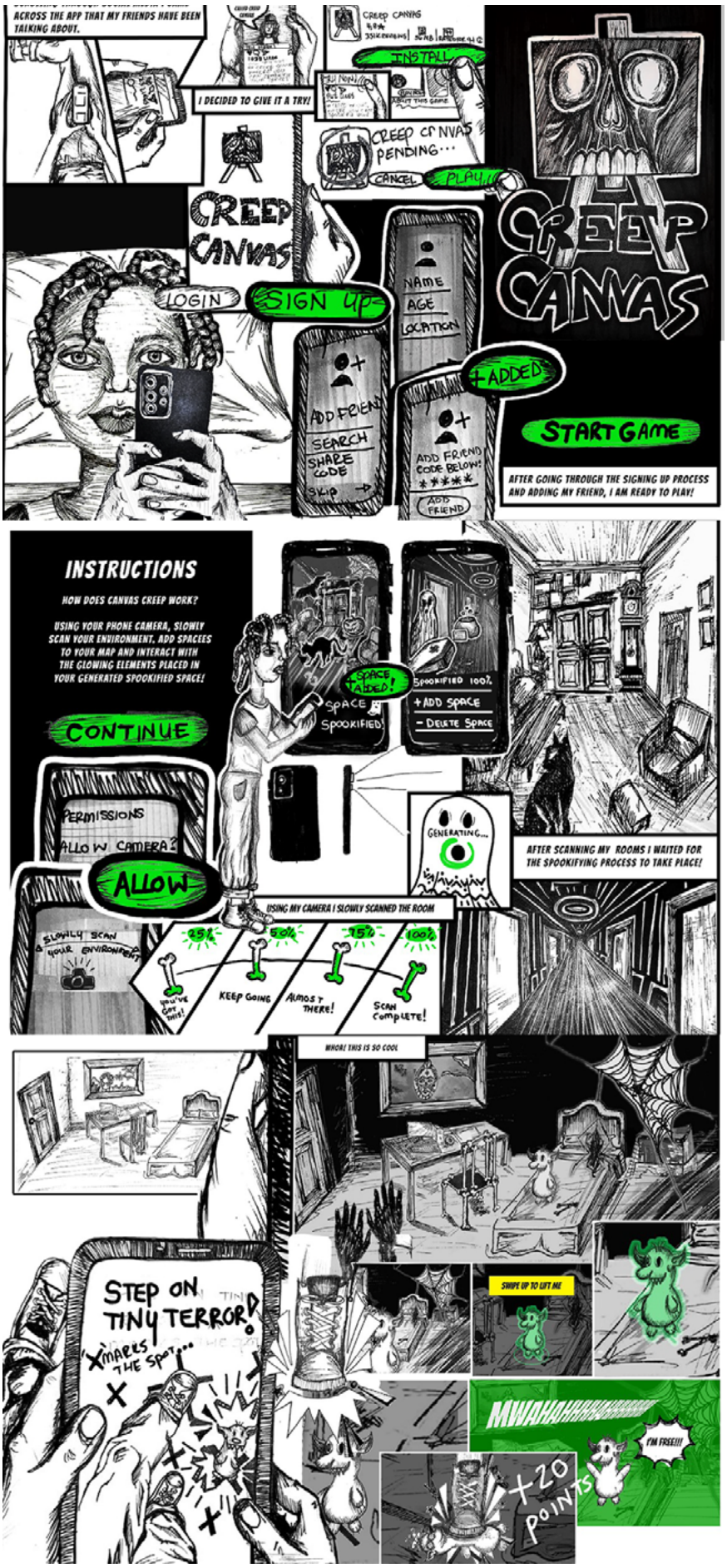


Figure 3. Example of a student group's final graphical design fiction (XRE comic) (Sarah Davis & Devorah Hodes, 2023).

6. Discussion

The discussion to follow draws upon the rich descriptions and reflections offered on the unit's enactment provided in the prior section, 5. The Design Process of the Teaching Unit. Three discussions will now be presented which, in line with the CDR methodology, have emerged through consideration of the criteria of Process, Relevance, Invention and Extensibility (Zimmerman et al. 2007, p. 499; Forlizzi et al. 2008, p. 27).

6.1 The Value of Narrative Design and Visualization in the Design of Concepts

When the design fiction storyboards, CJ maps and XRE comics are presented in the context of a process description they appear as stand-alone artefacts created in a fairly linear, step process towards a final design outcome: the XRE comic. This process narrative fails to capture two important aspects, or perhaps aspirations, of this teaching and research effort.

First, the role of the use of CJs should be understood and enacted towards enriching both the design fiction storyboard and visualization, not just the latter as the process suggests. Second, there is a particular way in which the DF narrative and the DF narrative visualisation aim to operate in relation to one-and-other both in their making and in what and how they communicate the final XRE concept.

Figure 4 provides an alternative to the process narrative by offering a visual description of the conceptual model intended for the construction of the XRE concept. In this view, both the storyboard (*1.1*) and the comic (*1.2*) are foregrounded and sit in connected relation to each other. The CJ map (*2*) is positioned as a background to both the storyboard and comic, while further acting in support of their relationship. Lastly, all three elements (*1.1*, *1.2* and *2*) are presented as parts which aim to constitute a whole larger than their sum, being the XRE Concept (*3*).

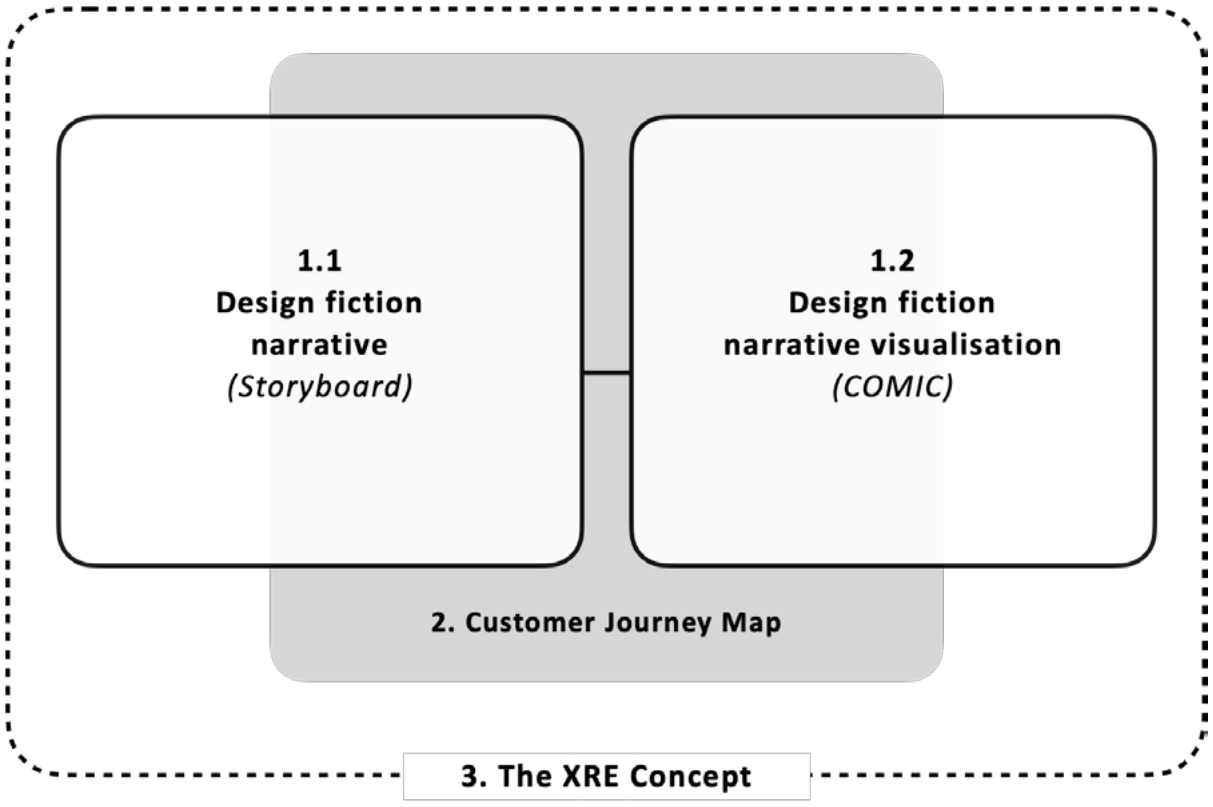


Figure 4. Conceptual model of the Extended Reality Experience Concept.

Although these parts were delivered at different stages in the process, they remained distinct deliverables required by the student assignment brief, and each received an equal weighting of 30% in the assessment criteria.9 As such, student's work produced over the course of the design project was graded as three equally weighted deliverables which, when tallied, constituted a grade given for their design of an XRE concept. Alternatively, if storyboarding and CJ mapping had been viewed as necessary activities, but ones which ultimately were throw-away aspects of the final deliverable (that is, the comic as XRE concept alone), then the weighting of the assessment criteria would have reflected as much.10

The reader will also have observed the introduction of a new set of terms to identify and describe the storyboard (1.1) and the comic (1.2) in Figure 4: Design Fiction Narrative and Design Fiction Narrative Visualisation, respectively. These terms denote a literal and functional relationship between two artefacts and / or two aspects required for the making and communicating of the XRE concept. Further understood as storyboard and comic, two individuated and very distinct kinds of artefact and forms of communication, force consideration and crafting of their relationship to support a mutual dependence towards a higher order of making.

This act of relabelling and (minor) distancing from a specification of artefact type, at least in the first instance and in the context of the conceptual model diagram, intends to open a door to a discussion and body of theory better suited to support the kind of relationship desired for the storyboard and comic in aid of concept design.11

Lastly, in this view, the CJ may come to be understood more deeply as a third part of a whole which allows for a broadened reach into solution possibilities at systemic 'scales' while also operating as a conceptual bridge between the DF narrative and the DF narrative visualisation. This becomes achievable without having to sacrifice the value to be found in a design object/product as an output of design in research and as research.

6.2 The Value of Design Fiction Graphic Narratives to the Communication of Systemic Solution Propositions

Reflecting upon the teaching engagement, a further insight regards the nature in which the graphic language of the comic narrative compliments and extends CJs. The foremost example of this is the ability of the artefactual presence of the graphic narrative to directly communicate the embedded role of the novel technology in the social fabric of peoples' lived experiences in a directly accessible manner. In contrast, the abstract schematic nature of the average customer journey can be unintuitive, particularly to a non-design audience. As such, graphic narratives allow for considerations of human experience, such as sensing, emotions, understandings, cultural dispositions, behaviours, and activities to be utilised as material in the creative process of design. From a pragmatic frame of reference, this allows for the meaning of the design to emerge through the communicated engagement between 'user-characters' and technological solutions. In this way, we argue, graphic narratives allow for designing with experiences rather than only designing for experiences. Tying these two concepts together, the relatable artefactual presence allows for the significance of the suggested experiences to be easily evaluated with audiences to ensure they resonate.

[9] The remaining 10% was reserved as a partial grade contribution for the timeous completion of a rough storyboard at the end of the Ideate Phase in week 1. The rationale being the necessary sequencing of the production of the storyboards, customer journey map and comic for the effective development of an XRE concept.

[10] For example, the storyboard and customer journey map could each have been weighted at 20% and the comic at 50%.

[11] The theory of 'message-content' and 'message-form' proposed by Tharpe and Tharpe (2018, p. 166) in their discussion of the design of concepts by way of objects, which intend to engage those with whom it encounters in critical dialogue over a particular subject matter or meta-discourse (Tharp & Tharp, 2018, p. 169) is the most likely candidate for future exploration given parallels observable between DF narrative and message-content, DF visualisation and message-form and their respective inter-relationships.

In a related point, the concreteness of graphic narratives, as opposed to the abstract nature of CJs, provides discursive positionality on how best to implement design strategy and tactics. By suggesting the application of these factors in 'real' world scenarios, these narratives prototype an approach that can be agreed upon, evaluated for impact, challenged, or discarded. Whether evaluating proposed experiences with target audiences and clients or within the design team, the value to testing the impact of solutions at a strategic level, prior to detailed product design, is of value.

6.3 The Value of Customer-Journey Thinking for Anticipatory Design Research Fiction

The application of CJs in anticipatory design research activities demonstrates a reciprocal value to that discussed in section 6.2. While CJs are well known to provide a method for the structuring of composite elements as a systemic response, they do so by foregrounding the designerly act of synthetically resolving that which is required to shift from what is, to what could be (Hobbs & Fenn, 2013, p. 200). From this perspective, CJs make visible the transformation of knowledge, facts and findings from prior research activities to futural narrative scenarios such that the 'synthetic integrity' of otherwise tacit strategic / design thinking may be interrogated by the traceability afforded by designing CJs (Ibid).12 Binding design fiction graphic narratives to an explicit and rigorous data-driven development of design strategy, as embodied in CJs, adds credibility to the design effort in general, and in particular, can help to negate any perception of conceptual weakness that might be implied by stand-alone graphic narratives.

7. Conclusion

This study explores, through teaching practice, how the converging theory and practices of UX and anticipatory design research can enhance an introductory XR teaching unit focused on the meshing of emerging technologies into the fabric of the human world. Through our experience of conceptualizing and teaching the unit, we discovered the following:

- Integrating CJs, and design fiction narratives in the form of storyboards and comics allow for highly structured, richly conceptualized and emotively communicated articulations of XR solution environments.
- Design fiction narrative visualisations are a powerful communicative modality for experience-led design.
- Design process associated with UX and service design, in which knowledge and facts are explicitly modelled into strategic design solutions, embodied in customer journeys, ensure design fiction narrative visualisations are based on rigorous research methods.

Looking to the future, again, since most of the research reported on, or generated herein, is derived from qualitative data capture, greater consideration of mixed methods designs would stand to extend and enrich the teaching and learner experiences, as well as the design work of students, the author's evaluation of course outcomes and possibly industry. Section 5. The Design Process of the Teaching Unit, in particular sub-sections 5.3. Process, 5.4. Outcomes and 5.5. Reflection on the Teaching, and all of Section 6. Discussion, relate.

Additionally, research in this area should include better understanding students experience of the course and more developed approaches for user-evaluation of their comics. Lastly, and on a somewhat practical note, in the next iteration of this unit, students will be exposed to the language and design of comics in a more formal manner.

[12] Also referred to as a 'Golden thread' by the authors (Hobbs & Fenn, 2013, p. 200)

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P/REFERENCES OF DESIGN

THE EFFECTS OF THE SOUND NARRATIVE OF AN ARTISTIC INSTALLATION ON CULTURAL HERITAGE LEARNING.

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KEYWORDS | SOUND NARRATION, ART INSTALLATION, CULTURAL HERITAGE LEARNING

ABSTRACT | In the realm of digital cultural communication within cultural tourism, visual experiences have traditionally held dominance. However, visual information overload can lead to issues including dispersion of user attention, comprehension difficulties, and constrained imagination. Sound possesses the capacity to enhance attention, cultivate an atmosphere, stimulate the imagination, facilitate deep thinking, and establish intimacy. Despite the potential of sound for cultural heritage communication, research on the impact of sound narration in cultural heritage learning is currently limited. Although some studies have confirmed that sound can enhance the learning experience of visitors at cultural sites, a comprehensive theoretical framework to encapsulate these effects has not yet been established. This study aims to investigate the effects of sound narration on cultural heritage learners through the design of a sound interactive installation based on the Changsha Kiln ceramics. Our aim is to systematically compile these impacts into a theoretical framework. The experiment utilized reflective sessions and observations as the primary data collection methods, based on text and interview data, primarily employing grounded theory for qualitative analysis and supplemented by bloom for quantitative research. Through a three-level coding process, the interview data were categorized into concepts and categories, leading to the proposal of a theoretical framework. The pilot results revealed that, regardless of qualitative or quantitative analysis, sound narration has a positive impact on learners of cultural heritage. We ultimately summarized the effects of sound narration on cultural heritage learners into a theoretical framework, encompassing perceptual, affective, conceptual, connecting, and strategic aspects.

1. Introduction

1.1 Current Research Status of Cultural Heritage Communication

Cultural heritage-themed exhibitions are essential in showcasing local culture, preserving collective memories, and integrating cultural experiences with tourism opportunities. With the advancement of digital technology and the rise of new media art, a growing number of exhibitions have begun to incorporate gaming elements, interactive installations, and immersive experiences. This fusion introduces innovative and interactive methods for experiencing cultural heritage. These innovative exhibition methods primarily utilize visual experiences for dissemination, such as *Virtual Reality* and *Augmented Reality* applications, developed and popularized within cultural heritage sites due to their entertainment and educational potential. Museums, serving as the main venues for cultural heritage exhibitions, create a visually demanding environment, where multiple exhibits, objects and displays compete for visual attention (Bitgood 2013). Visitors' visual attention is characterized by its fleeting and variable nature. The overload of visual information can result in distractions within user attention. Research indicates that sighted visitors often only glance briefly at individual exhibits or artworks, with the average dwell time being less than half a minute (Smith 2017). The majority of a user's gaze is directed towards the visual features and layout of the exhibit, whereas less consideration and understanding are given to deeper aspects such as the function and history of the exhibits. Visual elements inherently provide an intuitive representation, allowing users to grasp pictorial information through their visual senses without the need for imagination, thereby achieving the goal of understanding images. This characteristic partially impedes users' ability to reconstruct or creatively reinterpret images, curtailing their imaginative capacity. Anabela (2021) suggests that incorporating a multi-sensory experience, including the auditory, olfactory, tactile, and gustatory senses, in cultural heritage communication could inspire fresh perspectives and ideas, thereby leading to increased curiosity, exploration, and discovery among users. Despite the increasing trend towards multi-sensory experiences in museums, auditory remains overlooked. Less attention, less investment and very few infrastructures, human professional resources and less time are devoted to sound simulation, sound composition and sound design accompanying the visual narration in the field of cultural heritage and education. Underlying this refusal of museums is a somewhat unconscious distrust of sound, seen as a disturbing, uncontrollable, and unstable nuisance within the silent and reverential museum space, which was created for and by the objectifying gaze, particularly along visitor routes and in front of exhibits, where silence typically prevails. If present, museum staff tend to keep the volume so low as to be almost imperceptible. Considering the restrictions on museum visitation, sound can be delivered unidirectionally or multi-directionally through headphones in the context of cultural tourism or museum experience design.

1.2 The Advantages of Sound in Cultural Heritage Communication

Sound possesses significant and unique communicative abilities, and the experiential design of contemporary museums presents considerable potential for integrating sound. This article compiles the relevant advantages of sound in the dissemination of cultural heritage. (1) Sound can enhance user attention. Williams (2023) suggests that the delayed unveiling of an unseen sound source elicits suspense and tension, prompting users to focus on the exploration of reasoning and the construction of the full content of events. Although users have agency over visual imagery, allowing selective filtering of undesired content, the continuity of sound means users must passively accept all sounds, thus ensuring prolonged attention. (2) Sound can render atmosphere and evoke emotions. Cortez (2020) observes that sound is capable of creating specific atmospheres through soundscapes to evoke certain emotions and highlight thematic ambiance. Bertens (2019) has demonstrated that the use of sound in museums is able to stimulate visitors' emotional engagement. (3) Sound has the potential to stimulate users' imagination. Sighted participants viewed a series of photographs from *the Museum of London*'s collections presented in a digital format, and a comparison was made between the use of an audio descriptive guide (AGD), a traditional audio guide and visual exploration alone (Hutchinson and Eardley 2021). The study found that participants

who listened to an ADG when viewing photos demonstrated richer memories of the artworks. They not only recalled more visual details such as the content elements of the photos and their spatial arrangement, but also recorded more thoughts and emotional reactions to the artworks. (4) Sound possesses the capacity to stimulate profound reflective engagement among users. For instance, an ancient bridal headpiece designed with enlarged, spiky hair accessories, which a visitor would be invited to touch, manipulate, and wear. Embedded microphones within the headpiece emit a loud, piercing noise, prompting reflection among visitors. Ingold (2000) suggests that the purpose of the emergence of soundscape is not to represent, but to reveal, to penetrate beneath the surface of things in order to reach deeper levels of knowledge and understanding. (5) Sound can foster a sense of intimacy. Due to its directional nature, sound requires visitors to approach closely to the source. For example, Brackenbury (2023) crafted ceramic tiles into sound devices within a museum setting. When visitors pass through illuminated areas, directional speakers activate, and the tiles emit sounds narrating the stories of female artisans working in prisons. This proximity to the sound-emitting tiles subtly cultivates a sense of intimacy.

1.3 The Study of Existing Sounds in Cultural Heritage Education

Only recently have the acoustic properties of museum spaces or the acoustic horizons created by audio guides been discussed. A more comprehensive approach to the multifarious presence of sound in museums was published in 2019, in a special issue of curator: *The Museum Journal*, co-edited by Eric de visscher and Kathleen wiens. Turning to the application of sound in cultural heritage, the *The Sounding Object* project, a collaboration between the *Royal College of Art* (RCA) and *VARI*, showcased the immersive power of sound in cultural heritage. The project used sound design to critically engage with the museum's historical narratives. Additionally, Caroline devine's *Resonant Bodies* (2018) brings the sounds of a number of Indian classical instruments to life on the glass of their display case. The work was diffused using resonators attached to the case that made the glass surface vibrate with recordings of the sounds of the instruments—effectively acting as a giant speaker and allowing the instruments within the case to “Speak” to a visitor. This innovative use of sound not only enhanced visitor engagement but also fostered new connections with the audience. This research (Cortez 2022) resulted in the identification of five sound-based multi-modal museum practices, namely, 1. Sound as a mode for lecturing, 2. Sound as an artifact, 3. Sound as "Ambiance" or soundtrack, 4. Sound as art, 5. Sound as a mode for crowd-curation.

Despite the wealth of cases and innovative perspectives offered by existing research, research into the role of sound in cultural heritage learning is still limited, with an even smaller number of studies addressing the impact of sound narratives on the learning of cultural heritage. Hence, we are initiating a pilot exploration to examine the effects of sound narratives on cultural heritage learning, with the goal of developing a theoretical framework that encapsulates these impacts. This pilot exploration aims to offer insights and guidance for scholars and practitioners in the relevant fields.

2. Related Work

2.1 Sound and Narration

Sound possesses a unique narrative function, serving to represent and narrate aspects of artistic conception, characters, and plots. Language, sound effects, and music constitute the three core elements of sound narration. For instance, in the sound narrative of *A Man Escaped*, language not only conveys explicit semantics but also intricately links storylines and vividly depicts character images. Sound effects extend the visual space, represent character psychology, and enhance environmental realism. Music propels plot development, communicates character emotions, and acts as a metaphor. Gopalan (2017) emphasizes that employing rich layers of ambient sound in narrative strategies can create an immersive sense of realism. For instance, In *The National Treasure*, the artifacts' southward migration is compellingly narrated using multi-layered ambient sounds—bombings, car crashes, fires—thereby enriching the introduction of the *Stone Drum* in the museum's collection. The advancement of sound narration necessitates an understanding of

specific cultural backgrounds, thus unavoidably embodying national cultures. For example, *Night Banquet in Tang Dynasty* merges virtual scenes with real stages through *5G+AR* digital technology, where sound narration carries the national spirit and culture, eliciting a sense of national emotional resonance among the audience, strengthening cultural identity, and thereby facilitating cultural dissemination and enhancing cultural confidence.

2.2 Sound Narration in Cultural Heritage

In recent years, numerous curators have shifted their focus towards the development of multi-sensory exhibitions, with a particular emphasis on auditory experiences. For instance, the sonic cultural artifact, *Diabolo*, is depicted in the *Beijing local chronicles* as producing sounds that are “As resonant as a bell and as delicate as the flutter of an insect's wings”. The sonic heritage encompasses a variety of traditions, significant sounds, music, individual instrumental or vocal techniques, and soundscapes. However, current exhibitions primarily focuses on the display of tangible objects and images, overlooking the perception of sound within cultural heritage. This neglect of sound representation can lead to a gradual erosion of sound folklore. In the realm of cultural heritage and the dissemination of sound, sound categorization encompasses multi-character sounds, cultural heritage sounds, and environmental ambiance sounds. For instance, the sound narrative in *China in Classics* employs a multi-layered sound source including vocal language, background music, and acoustic scenes. This enriched sound quality enhances the listener's imaginative space and conveys deeper connotations. Michalis (2023) has designed a context-aware audio guides tailored to the actions and interests of museum visitors. These systems make use of wearable cameras and advanced machine vision algorithms, enabling real-time recognition of scenes and inference of context. In the realm of *Audio Augmented Reality* (AAR) applications, the exhibits themselves become narrators, emitting sounds or telling stories in the first person. This approach not only reveals "Hidden" sounds within the environment but also significantly enriches the visiting experience. Moreover, it affords users the opportunity to physically interact with the exhibits. Despite considerable expectations, the application of sound narration in the preservation and interpretation of cultural heritage is still limited, with a lack of comprehensive research into its effects on learners of cultural heritage.

In this study, we will systematically review and analyze the latest research on sound narration and installation design. The purpose of this pilot study is to explore the potential positive impacts of sound narration in art installations on learners of cultural heritage. We aims to summarize the theoretical framework regarding the effects of sound narration on cultural heritage learners and provide an initial theoretical basis and reference recommendations for other researchers involved in the design of cultural heritage-related learning.

3. Research Methods

3.1 Designing a Ceramic Art Installation

This pilot exploration is based on the design of a series of sound interactive installations centered around the ceramic culture of Changsha Kiln in china. It aims to study the process of visiting and learning experiences of cultural heritage learners within exhibition halls. Art installations refer to conceptual frameworks or digital environments created by artists (Giulio 2016), which invite participants to explore and experience. Through interaction, participants are encouraged to discover, interpret, and reflect on the meanings of the installation and its components, thereby establishing a connection with the installation throughout the experiential process. Changsha Kiln ware was one of the primary commodities along the maritime silk road during *the Tang Dynasty,* embodying a unique style that integrates eastern and western cultures. We have selected iconic items from different stages for abstract design, incorporating metaphorical features such as scratches on the surface to provide users with ample room for imagination. To facilitate a "Dialogue" between visitors and the historical craft behind the culture, we embedded a speaker inside the ceramic items and used the ceramic space as a mini sound field to emit sounds. Please refer to figure 1 for

details. The sound and touch systems were developed using *Arduino* software (a professional programming platform). The four ceramic installations are arranged in chronological order, each representing a different development period. Initially, users are required to touch the sensors located on both sides of the ceramic object simultaneously, triggering brief sound clips of craftsmanship, as if ancient artisans were demonstrating their skills right in front of the users. These four sets of ceramic audio correspond to the manufacturing states of the four objects, as illustrated in figure 1. Subsequently, by touching the sensors on the ceramic objects again, users can listen to sound narratives in which the ceramics "Reveal" their mysterious origins, conveying knowledge about history, culture, and craftsmanship in the first person. We utilize multi-character narratives, cultural craftsmanship sounds, and environmental ambient effects to strengthen the connection between users and historical culture. Tactile feedback upon touching the body or handle of the ceramics enriches users' perception of the ceramics, thereby creating a tangible cultural experience as if users are shaking hands with history through time and space. Meanwhile, visual cues such as background information and introductions are projected onto a sailboat backdrop using a projector, as shown in figure 2. This pilot study aims to explore the influence of sound narrative on cultural heritage learners and to develop a theoretical framework informed by the findings.

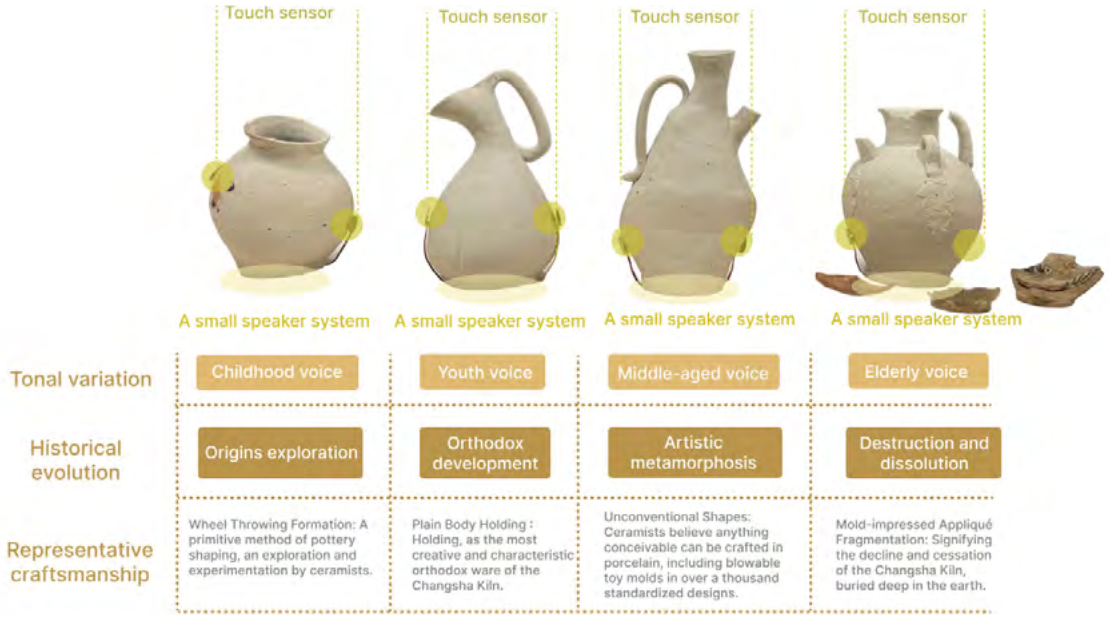


Figure 1. Functional interaction diagram of the art installation.



Figure 2. Experimental setup overview.

3.2 The Experimental Procedure

Our experiment spanned 8 days, encompassing a pre-experiment phase, a formal experiment, and a reflective session. Participants were recruited through advertisements in school general education courses and social groups, ranging in age from 18 to 32 years (median age: 24 years), totaling 68 university students (30 males, 38 females). The experiment was randomly divided into two groups: an experimental group that utilized a sound installation (33 participants) and a control group that engaged with paper materials (35 participants), with each group conducting experiments for an average duration of one hour. The experimental procedure was structured into three modules. In the "Narration about ceramic sounds" module, participants were guided to contemplate the origins of four sounds from the pottery-making process. The "Voices about ceramics" module aimed to assist participants in purposefully seeking answers, revealing how the initial sounds were produced and enhancing their understanding of Changsha Kiln culture through sound narratives. In the "Collaborative narration" module, participants acted as narrators for the Changsha Kiln, working in groups of 2-3 to review and assess the learning outcomes. Images, served as the dependent variable, were displayed via PPT projection. For the control group, the task process remained unchanged, except that all auditory materials were converted into paper materials for reading purposes. The task process for the experimental group is depicted in figure 4.



Figure 3. Experimental group (sound narration) on the left and control group (text reading) on the right.

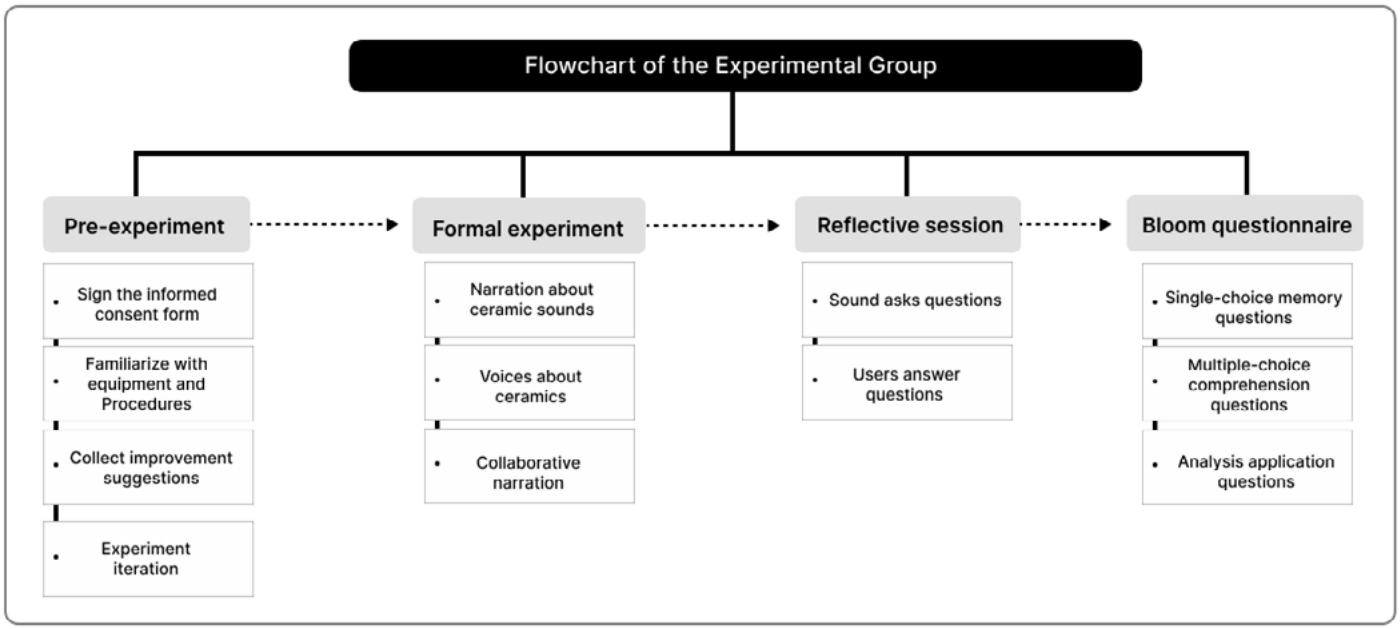


Figure 4. Flowchart depicting the procedure for the experimental group.

Pre-experiment

Initially, participants are provided with a concise overview of the process of this pilot study and invited to sign the paper informed consent form. Researchers offer concise oral instructions to familiarize participants with the equipment. Subsequently, participants engage in the experiment, evaluating the design process and compiling suggestions for enhancements, which leads to iterative modifications of the experiment. Following the pre-experiment phase, participants are required to complete a questionnaire that includes bloom's learning effectiveness assessment and an evaluation of the sound interaction device.

Formal experiment

(1) Stage 1: Narration about ceramic sounds

The sounds encapsulate the quintessential craftsmanship scenes of the Changsha Kiln. At this stage, the installation presents four sets of sound experiences associated with the Changsha Kiln's production process: the kneading of clay, the thudding sound of clay manipulation; the sound of bisque immersion in glaze, the clink of object collisions. The roar of the fiery blaze, the crackle of porcelain fissuring. The shatter of ceramics, the sound of sweeping porcelain shards. The sounds correspond to four states of the objects in the installation. Upon user activation of the sensor, the four sets of sounds are played sequentially. After the sounds end, participants are engaged in a reflective session with structured inquiries such as "What sounds did you hear?" and "What associations did these sounds conjure?"

(2) Stage 2: Voices about ceramics

This study delineates four developmental stages of the Changsha Kiln, each narrated through distinct vocal tones corresponding to different life stages (child, youth, middle-aged, elderly) to represent the kiln's evolution. These vocal tones symbolize the kiln's evolutionary stages. Adhering to Lissa's (2016) recommendation, a first-person narrative approach was employed to enhance emotional engagement and comprehension among the audience, thereby potentially augmenting their learning experience. The sound narration is methodically segmented into three explanatory layers to improve content coherence: (a) Appearance, which includes the form properties of Changsha Kiln artifacts, such as material, decorative patterns, and shapes. (b) Craftsmanship, which includes the techniques and production methods used in the ceramic creation of Changsha Kiln, such as under-glaze painting, applique (applique involves adding low relief clay forms to slurred, scored leather-hard surfaces for embellishment). (c) Culture, which includes the local culture activities related to ceramic production in the Changsha Kiln, such as kiln workers in the *Tang Dynasty* used advertising slogans as characteristic decorations. Complementing the sound narrative, projected visuals and textual descriptions aid users in comprehending the narrative content. The second interaction with the installation's sensor is designed for users to further explore the narrative. For example, initially, users experience the sound of shattering, and in a subsequent round, the sound narrative elucidates the reasons behind the disrupted firing process of the Changsha Kiln. This approach of posing questions and seeking answers through a progressive auditory experience can subtly facilitate users in acquiring knowledge related to the Changsha Kiln. Interview questions include: "Please recall and describe its production" and "What were the most impactful aspects of the sound narrative?"

(3) Stage 3: Collaborative narration

We invite 20 groups of users, each comprising 2-3 individuals, to engage in collaborative narration based on their newly acquired knowledge of Changsha Kiln. Participants are encouraged to adapt, reconstruct, or share the learned content, aiming for a collective narration of a complete story. This method enhances memory retention and clarity for all participants, creating a unified narrative thread and fostering a sense of achievement through team performance. Collaborative narration between two people combines the benefits of cooperative discussion while avoiding the confusion and distractions common in larger groups. It also allows sufficient time for free expression, especially when opinions diverge. Gurtner (2010) notes that individuals differ in their perspectives and focal points in information reception, suggesting that through

mutual complementation, effective cognitive regulation can be achieved, thereby establishing an interdependent learning network.

Reflective session

Participants were invited to partake in semi-structured interviews aimed at delving into their creative conceptualization process and addressing any uncertainties they encountered throughout the process. Reflective interviews encourage users to engage in deeper thought beyond their initial responses that come to mind, for instance, by asking participants to provide reasons or explanations for their actions or occurrences during the interaction. Finally, participants were required to complete a learning assessment questionnaire, devised in accordance with bloom's taxonomy, encompassing single-choice memory items, multiple-choice comprehension items, and analytical application items. Upon the conclusion of the experiment, three experts were invited to evaluate the learning outcomes and related impacts through both qualitative and quantitative methods.

3.3 Experimental Method

In this study, we employed a combination of methods for data collection and analysis. In the pre-experiment phase, semi-structured interviews were primarily used to collect user feedback and opinions, facilitating adjustments to the experimental design while also acquainting users with the experimental process. Upon completion of the experiment, we primarily conducted reflective interviews to collect primary data. This was supplemented by observational methods to document alterations in participants' facial expressions, movements, and behaviors. At the experiment's conclusion, a reflective session was conducted to prompt participants' engagement in reflective thinking and assessment of their learning outcomes.

Our data collection is predominantly achieved through reflective interviews. Posing reflective questions assists users in understanding and articulating their latent needs and goals. Following Atkins (2018) three stages of reflection: noticing, understanding, and planning future actions, we crafted a sequence of sound-based prompts for questioning followed by user responses. By asking "Why" twice, we introduce reflection touch-points, prompting users to take additional time for contemplation and response. Data were collected using a variety of methods, encompassing observation, written and oral responses, surveys, in-depth interviews, stimulus recall exercises, and dialogic interactions.

Our data analysis is based on grounded theory, a qualitative methodology introduced by Glaser and Strauss, is a qualitative method that aims to develop a theory grounded in the data collected. This method emphasizes identifying core concepts within the data, summarizing these, and utilizing coding procedures to construct a theoretical framework. The coding process unfolds in three distinct stages: open coding, axial coding, and selective coding, facilitating a structured analysis. Through the application of *NVIVO* software for analysis, we initially dissected and organized the interview content into over 6,000 original sentences. We extracted high-frequency words, categorizing them into 95 concepts and 27 distinct categories. In the process of axial coding, categories were reclassified based on their logical relationships, leading to the development of primary and secondary categories. Subsequently, during selective coding, all categories were interconnected and integrated, clarifying the relationship between core and main categories through specific cues. The preliminary establishment of a mechanism model for the impact of sound narration on cultural heritage learning. To ensure the objectivity and accuracy of the coding results, we randomly selected 18 participants for interviews as a sample for saturation testing. The coding analysis did not reveal any new concepts or categories, indicating that the conceptual model constructed in this study is theoretically saturated. Ultimately, the effectiveness of user learning was quantitatively assessed using bloom's taxonomy, objectively evaluating different groups of users on their retention of knowledge, comprehension, and application through a written test.

4. Result and Discussion

This study based on textual and interview data, primarily employs grounded theory for qualitative analysis and supplemented it with bloom questionnaire for quantitative research. Through a three-level coding process, the interview data were categorized into concepts and categories, leading to the proposal of a theoretical framework. The pilot results revealed that, regardless of qualitative or quantitative analysis, sound narration has a positive impact on learners of cultural heritage. This framework encompasses five core concepts: perceptual, affective, conceptual, connecting, and strategic, as shown in table 1 and figure 5.

Table 1. Coding analysis of the impact of sound narrative on cultural heritage learners.

Categorization	Categorization	Conceptualization	Connotation
Perceptual	Auditory perception	Sound immersion...	User sound perception and cognition
	Tactile perception	Close-range tactile interaction...	User tactile perception and cognition
	Immersion(objective)	Sense of engagement...	Feeling of immersion during interaction
	Presence(subjective)	Immersed in descriptive setting...	Feeling of being in the described situation
	Curiosity	Reason for curiosity...	Curious or questionable content
	Attention	Point of attraction...	Attention-grabbing aspects
	Memory	Short-term memory...	Users' memory of what they hear
	Quotation	Famous quotes and sayings...	Exact quotation or approximate paraphrase
	Identification	Recognizing sound changes...	Point out things that need attention
	Characteristic	Characteristics of exhibits...	Say the content and other characteristics
	Understand	Deeper understanding...	Understand certain reasons, principles.
	Learning ability	Active learning..	Learning methods, content mastery.
	Retelling ability	Retelling interest...	The ability to retell and express the process
Affective	Emotional understanding	Emotion perception...	understanding of character emotions
	Emotional expression	Confusion; shock...	Emotional expression in face/body posture
	Emotional regulation	Emotional adjustment...	Reframe emotional emotions
Conceptual	Simple reasoning	Inference part connection...	A single analysis or interpretation section
	Complex reasoning	To make assumptions...	Deep inference or system overview
	Ability to predict	Predict the plot...	Predict what's going to happen
	Ability to reflect	Reflect on current cognition...	Reflect on yourself currently or in the past
Connecting	Life-connection	Personal experience connection...	Contact personal life analogy comparison
	Knowledge-connection	Contact history...	Think of existing knowledge
	Inter-exhibit connection	Exhibit contact...	Connect elements between different exhibits
Strategic	Use	How to find the answer...	For device usage procedures
	Sharing	Share understanding;...	Share knowledge,encourage others to participate
	Performance	Body affirmation...	Evaluate performance when working together

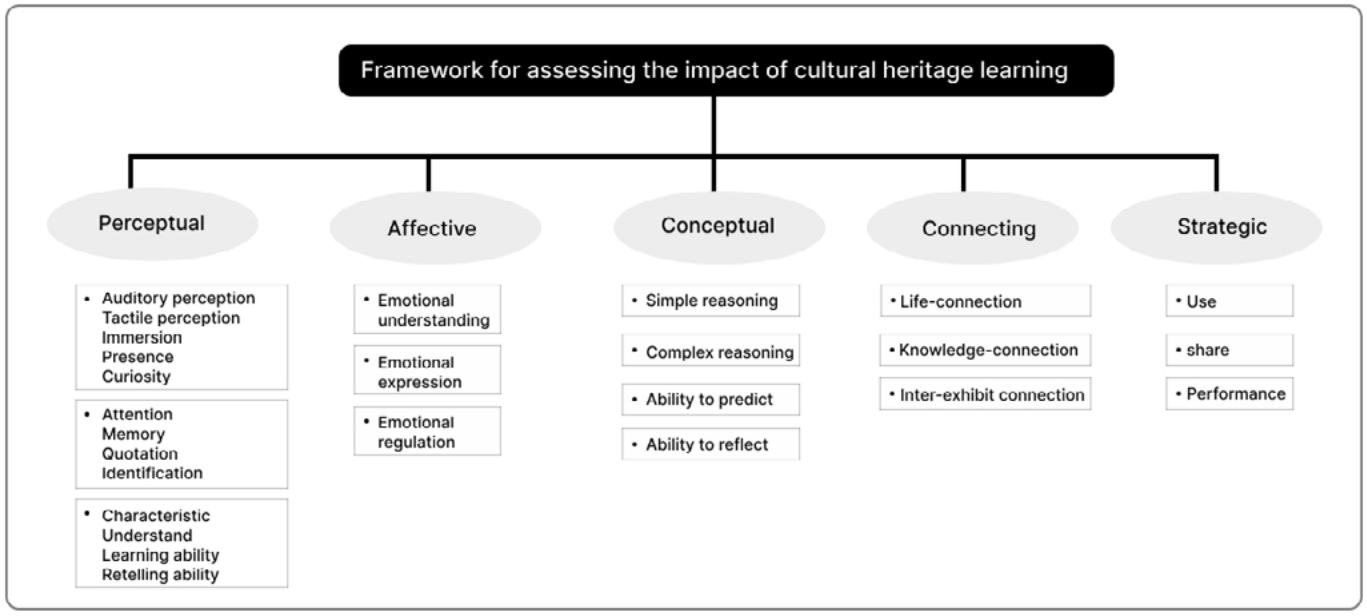


Figure 5. Theoretical framework of the impact of sound narration on cultural heritage learners.

4.1 Perceptual

This category encompasses discussions related to participants identifying elements within their environment. Allen (2002) posits that when users pinpoint and share essential content in complex settings, it denotes learning. This behavior is considered indicative of learning, as it involves recognizing and communicating significant elements in a complex environment. The category is subdivided into areas such as auditory perception, where the user acknowledges the perception and cognition of specific sound content, for example, "The sound conveys a sense of historical ambiance." Tactile perception involves users discussing perception and cognition related to touch, such as "Touching artifacts up close feels as though they are narrating a story." Immersion is experienced when interacting with artifacts, creating a sense of being transported and immersed in the experience, illustrated by "The sound narration engenders a sense of immersion." Presence refers to the user expressing a subjective feeling of being immersed in the described setting, stating, "It feels as if I have truly entered a war-torn era, embodying a pottery jar and sensing the urgency of their escape." Curiosity is manifested when the user expresses curiosity or doubt, with questions like "Why did it break? was it because of a tradition? I have heard about the tradition of breaking pottery before." Attention is drawn to elements that capture attention during interactive experiences, for instance, "This tone is very pleasing", "I would love to keep listening." Memory involves the user's recollection of the content, with comments such as "I remembered all the key details very clearly." Quotation includes accurate quoting or close paraphrasing during the user experience, as in "During the prosperous cultural period of the Tang Dynasty, emissaries from eight nations paid tribute." Identification occurs when the user highlights something noteworthy, for example, "The deep and resonant sound also symbolizes power and authority." Characteristic involves the user describing features of the exhibit, sound, narrative content, saying, "The sound also represents the growth of history, making it clearer and more enjoyable to listen to." Understanding is the user grasping certain reasons or principles, mentioned as, "It is easy to understand." Learning ability refers to the user learning through interaction and gaining insight into the learning process, as in "It naturally expands my knowledge." Finally, retelling ability is the user's performance in recounting, for example, "There is a master craftsman named Wang Er who has purchased a kiln factory..."

What sound narration enhances is auditory perception, tactile perception, immersion, and presence experience. Abundant sound variations and interesting narrative content attract participants. They describe it as "Immersing oneself in the experience of listening to stories." Coffey (2023) indicates that the immersion process can maintain learners' interest and motivation, leading to increased engagement, better understanding of the learning material, greater persistence, and increased resistance to potential obstacles. It was found that the participants in the experimental group exhibited stronger attention and curiosity

compared to the control group. They displayed greater patience in exploring the reasons behind the generation of sound. Compared to the control group, the experimental group demonstrated a higher ability to incorporate quotations. For example, in the case of the Changsha Kiln firing incident, 82% of the participants used historical allusions or famous quotes to express their sadness, such as "No member escapes unscathed from a family disaster." After listening to the sound narration, nearly 67% of the users were able to infer historical changes by recognizing changes in tone or the characteristic features of objects. For example, they identified that "The pottery changed from weakness to triumph and then declined" or that "The sound implied destiny." Sound narration can stimulate users' active learning and enhance memory. 88% of the participants in the experimental group actively asked more questions during the recall interviews, such as "Does the gender of the sound affect people's associative effects? are there women among the kiln workers?" Results from the bloom's taxonomy-based questionnaire indicated that the experimental group achieved higher memory scores, with the experimental group achieving an accuracy rate of 80%, the control group had an accuracy rate of 70%. However, from the interviews and questionnaires, it was observed that the two groups had different memory preferences. The control group focused more on the product's appearance and craftsmanship, whereas the experimental group placed greater emphasis on cultural stories, particularly regarding customs and historical narratives. The bloom questionnaire revealed that the experimental group demonstrated superior performance in the dimensions of comprehension and analysis, enabling them to draw connections among political, economic, and cultural contexts, and to elucidate the interrelations among these aspects. For instance, one participant cited *The An Shi Rebellion* as an illustrative example. Furthermore, we also found that experimental group users showed high confidence in the events described in the sound narration, such as "Although i'm not familiar with history, i am certain about how the sound is produced." The study suggests that sound can evoke a rich imagination and enhance users' comprehension abilities. They also demonstrated a more complete and logical retelling of the story during collaborative narration, while incorporating more historical references. In conclusion, the findings suggest that sound narration significantly improves participants' ability to retell stories, incorporating a richer array of historical references.

4.2 Affective

This category encompasses user emotions, including emotion understanding, emotion expression, and emotion regulation. Emotion understanding involves comprehending character emotions, as exemplified by statements such as "I sense a sadness akin to that of a kiln worker," while emotion expression refers to how emotions are conveyed through facial expressions or body language, such as users frowning, smiling, or appearing contemplative, and emotion regulation concerns adjusting emotions, as demonstrated when someone states "Initially proud of the era's technology, the outbreak of war and the potters' demise led me to reassess my feelings."

Two caveats merit attention regarding the "Affective talk" category. First, verbal measures serve as crude indicators of an exhibition's emotional impact at best. Capturing affective learning talk is valuable, and we believe that capturing the use of emotional words in conversations is a key aspect of reflecting users' emotional engagement. Roberts (1990) provides a comprehensive review of alternative methodologies for understanding affect. Second, visitors' expressions of displeasure do not inherently critique the exhibition. For example, although the sound of robbers smashing objects and harming kiln workers may elicit feelings of anger and sadness, it simultaneously deeply engages visitors and may even evoke a sense of immersion. 82% of the experimental group acknowledged that the sound enhanced their understanding of the emotional dimensions and historical context, fostering deeper reflection and a more nuanced comprehension. They demonstrated a more nuanced understanding and expression of emotions, for instance, deeply sensing the brutality of war and the powerlessness of the lower-class people through sound. In contrast, control group participants were more reserved, with some struggling to focus on the text and overlooking details they were not inclined to explore. They also noted the advantage of text in controlling reading pace. The bloom questionnaire revealed differences in expression between the two groups. The experimental group utilized more emotional and descriptive language in analyzing the questions, such as "The tiny monkey cuddling its mother, creating a highly heartwarming scene," while the control group used more precise vocabulary closely aligned with the text provided, for example,

"The techniques and production methods used in the ceramic creation of Changsha Kiln, such as under-glaze painting."

4.3 Conceptual

This category pertains to the cognitive interpretation by users of items they find intriguing within the exhibition. Discussions should not necessarily be abstract but ought to involve multiple steps and lead to insightful conclusions. The active construction of new knowledge is essential in the learning of cultural heritage. For instance, the experimental group asked additional questions to deepen their understanding of cultural heritage. The subcategories of conceptual talk include simple inference, which is an interpretive statement or interpretation of part of an exhibit. For example, "During the prosperous Tang Dynasty, people loved writing poetry, which they incorporated as decorations on ceramics." Complex inference involves generalizing exhibit information, formulating hypotheses, or discussing the relationship between objects or their properties. An example is "The item serves not only a functional purpose but also as a means for craftsmen to express their ideas through its shape, conveying their thoughts and memories." Prediction refers to an expectation of future events, including what visitors are about to see or do. For instance, "The Changsha Kiln culture is expected to regain prominence in public interest." Reflection involves considering one's current or previous state of knowledge, like "What inspired me is the idea of adding olfactory interaction to sound and tactile interactions."

Upon analyzing the discussions triggered by exhibition elements, we observed no significant differences between the experimental and control groups regarding simple inference and prediction. However, the experimental group demonstrated more profound and systematic conclusions in their complex inferences. Notably, 86% of its members discussed three or more dimensions, including "Policy," "Diplomacy," "National culture," "Writing," "Poetry," and "Ethnic minorities." In their reflections, the experimental group excelled in their mentions of "Future," "Self," "History," and "The fate of the people," totaling 26 times. They also contemplated the more effective application of their disciplinary knowledge (History, Ournalism, Design) in their future professional endeavors, discussing this application 14 times. Notably, a design student expressed an intention to explore the olfactory aspects of cultural heritage in future studies.

4.4 Connecting

This category focuses on the dialogue where users integrate cognitive aspects of an exhibition with their existing knowledge and experiences. Exhibits serve as catalysts for sharing personal stories or previously acquired information, marking a significant part of learning. The three subcategories include life-connection, knowledge-connection, and inter-exhibit connection. Life-connection involves making personal associations, likening elements of the exhibit to familiar experiences. For example, one might say, "This reminds me of the audio-books I read before, the male protagonist's voice captivates me." Knowledge-connection is about expressing prior knowledge, such as identifying a historical period of turmoil. Inter-exhibit connection involves drawing links between different elements of the exhibit, akin to comparing artifacts to the relationship between a father and son.

During our experimental process, we discovered that all instances of learning-related dialogue involved some degree of prior knowledge. This suggests that specific elements within the exhibition served as catalysts, prompting participants to recall additional knowledge or past experiences. In the experimental group, 82% of participants explicitly linked their observations to various knowledge domains, such as "Geography," "Diplomacy," and "Economics" actively drawing comparisons between exhibition elements and familiar concepts. Furthermore, 62% of these users referenced their past visitation experiences during discussions, linking them to previous learning encounters. Reflective interviews revealed that visitors in the experimental group were more actively engaged in sharing personal stories or previously acquired information, even when these narratives were not directly related to their current observations.

4.5 Strategic

This category captures the collective discussions and behavioral dynamics through which participants strategically engage with exhibits to co-create narratives. Use provides guidance on how to interact with exhibits. An example is instructions such as "Touch it like this to produce sound," which facilitate interactive engagement. Sharing which involves the dissemination of knowledge and the encouragement of participation, illustrated by invitations like "I'd like to share a topic with you." This subcategory emphasizes the importance of knowledge exchange and collaborative learning. Performance focuses on evaluating collaborative efforts, as seen when two participants acknowledge their agreement in a discussion through a congratulatory gesture, such as "High-five". By examining these subcategories, the study aims to understand the nuanced ways in which participants interact with the exhibition to collectively construct narratives and share knowledge.

Sound narration enhances interactive communication among visitors through use, sharing, and expression. The experimental group engaged more deeply, evidenced by longer viewing times and more frequent stops at exhibits. Notably, 85% of participants in the experimental group actively participated in discussions, especially during pauses by their interlocutors. They demonstrated increased physical engagement, including hand clapping, smiling, leaning forward, nodding, and arm crossing. They also offered verbal support, using phrases like "Yes, i agree," "I feel the same," and "Me too." We conclude that sound narration enhances learning, communication, and discussion among visitors. Cortez (2022) posits that sound can foster a highly social environment, encouraging dialogue and engagement. In contrast, visitors in the control group engaged in brief discussions, focusing on narrative elements or factual information without detailed explanations of their choices. They also showed a lower frequency of interactive behaviors and expressions.

5. Conclusion

This pilot exploration investigates the impact and potential of sound narration in the context of cultural heritage learning through a sound interactive ceramic installation based on Changsha Kiln. Sound narration serves to extend the history presented by the exhibits and establish new connections between visitors and cultural heritage. The results of the pilot study indicate that both qualitative and quantitative studies can validate the positive impact of sound narration on cultural heritage learners, influencing them in terms of perceptual, affective, conceptual, connecting, and strategic aspects. One limitation of this pilot study is the limited output of content from the corpus. We plan to integrate with artificial intelligence dialogue systems in the future to provide users with more detailed and accurate answers. Overall, the evaluation of the art installation experience was considered effective.

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P/REFERENCES OF DESIGN

PRINT INTERACTION: HINTS AND NOTES FOR A NEW DESIGN SPACE.

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KEYWORDS | PRINT INTERACTION, INTERACTION DESIGN, INTERACTIVE PRINT MEDIA

ABSTRACT | Interaction design focuses on the creation of digital and physical products that enable users to interact with media and technology in intuitive and meaningful ways. While it has traditionally been associated with digital screen-based interfaces, recent advances in printed electronics and paper-based media allow interaction with information on traditional media related to print industry and visual design. This, along with the willingness to understand behavior in print media, as an additional element in visual design, and a consequent need to identify the knowledge involved and how it can be articulated in a single design project, sets the stage for a new design space. There are several hints and notes that can be used to portray print interaction design as a new design space, drawing on relevant literature, observed cases and design experiments. I elaborate and discuss on the notions of physical/digital interaction and tangible interfaces with the idea of transposing interaction elements to traditional media, arguing that print media have an interactive ability, which can be considered at the time of their design and, consequently, of being produced to offer diversified experiences, maintaining cognitive and haptic advantages. An explanation and systematization of the main points is provided, which could lead to the definition of a design space for interactive print media, as grounded on existing information and material and technological possibilities. The result understanding will be relevant for design projects involving print media and for future research about the materiality of interactive systems.

1. Introduction

When we think of print media, we remember reading a book on vacation, studying from textbooks, flipping through magazine or newspaper pages looking for news, consulting product or museum catalogues, receiving letters from various companies. We think of static, unalterable objects, with no possibility to be modified by people who use them. Those who produce such objects follow an established process of material production, in order to adapt to expectations of use and circulation. Those who conceive them respond to communication requests, which are more influenced by commercial pressure and which turns these media into objects of attention and work by designers and marketers. As we have found digital equivalents for most of these media, they have come down in terms of circulation, sale or use. Their replacement brings, in some cases, material optimization or immediate updating, but it can also generate difficulties in learning, interpretation, access to knowledge, cognitive development and well-being.

I argue that print media have an interactive ability, which can be considered at the time of their design and, consequently, of being produced and made available to offer diversified experiences, maintaining cognitive and haptic advantages and contributing to reduce print media disappearance and the economic impact it creates on several sectors of human activity.

Interaction can work as a positive feature since it has expanded to a spectrum of physical and hybrid situations. This places the concept of interaction as extendable to print media and also resulted in some experimental technological-driven prototypes, where print media became available for transformations, using flexible displays, foldable interfaces, E-ink displays, conductive sensors and conductive ink. These prototypes show variables not yet considered in print media and reveal a proximity of areas of knowledge and practical activity, which allow us to anticipate the creation of a specific design space.

From the report of these cases, a few hints are highlighted that suggest aggregating characteristics for them. I elaborate on these hints, discussing partial and specific contributions that certain areas of design can make and I present some notes, which can lead us to the definition of print interaction design as a new design space.

2. The Transition of Print

Print media are conceived by graphic designers and graphic producers, who combine elements of visual communication (such as images, typography, colors and shapes) with materials and printing processes. These media give way to typologies, which we know and use on a daily basis, such as posters, books, magazines or newspapers, but which had their circulation reduced due to changes of habits and digital transition (Johnson, Goidel & Climek 2014; Rose-Wiles 2013; Twenge, Martin & Spitzberg 2019). This reduction of circulation affects the printing industry and related sectors, such as education or journalism, and disturbs cognition, reading and interpretation, especially of younger generations, for whom screen time affects well-being (Strouse & Ganea 2017; Twenge & Campbell 2018).

Activity sectors focused on printed products, such as the printing industry, the publishing industry or news organizations, have undergone profound changes, which have led to a reduction in revenues and employment (Franklin 2008). Transition to digital alternatives is also affecting education, accentuating unequal access to knowledge and interfering in learning (Mangen, Walgermo & Brønnick 2013; Stoop, Kreutzer & Kircz 2013). Transformation of print artifacts into digital equivalents can be seen as a loss of physical contact (Zhou, Kiesow & Guo 2021), as paper-based material is known to increase comprehension of texts (Delgado et al 2018), and of several advantages associated with these media, such as tactile aspects, linear progression of text, memory cues, annotations and less fatigue (Ackerman & Lauterman 2012; Mizrachi 2014). Print remains an essential part of our culture and society, as a production technology and a means of communication, and its contribute to critical thinking, safeguarding our citizenship and democratic participation seems relevant in a time of information overload.

In demanding user participation scenarios, digitization of products and services has been the prevailing way to deal with print media, although this seems to be a way of accommodating technological innovations that generate doubts about the cognitive, social and cultural capacity of individuals and groups. Media that resort to hyperlinks have been replacing print media, with the digitization of newspapers, books, and magazines, among others, transferred to computers and smartphones (Bødker, 2006). Hyperlinks, which allow dynamic, up-to-date and accessible information, together with the proliferation of the personal computer, the Internet and the consequent technological expansion, led us to believe that print media would become expendable (Nel, 2012). Predominant here was hyperlinking based on the 'point and click' interaction (Moggridge, 2007), which progressed afterwards to include 'drag', 'slide', 'scroll', 'swipe' and other actions that mimic physical manipulations. Then, business cards became profiles on social networks, packaging used RFID technologies and QR codes, and signs became screens. In this context, in which designers were interested in digital representations, the contents of print media transitioned almost directly to digital, maintaining the basic elements of graphic design. When they are not replaced by digital counterparts, print media has provide transition of information, from print to digital, or served as flat surface for overlapped augmented reality (AR) (Gönen & Zeybek 2022; Nadolny 2017; Pellas et al 2019; Sonderegger et al 2019). Still, even such cases do not retain haptic properties of paper and analogue reading and do not integrate interaction as part of the design project. Using print media in interaction scenarios can lead to alternatives to deal with its lack of circulation (Dourish & Mazmanian, 2011). Print media can be contested to not only be limited to transitioning to the digital environment but can also serve as interactive material, enhanced through technological augmentation.

3. Explaining Print Interaction

To help explain ‘print interaction’, i.e., the design of interactive print media, I observed what can be hints of its existence and point out a few notes that can be used to portray it as a new design space, drawing on a relevant number of cases and in research references on related subjects, particularly material or technology-focused.

3.1 Hints

Print interaction acknowledges two parallel or interconnected views: a) print interaction is achieved, within the scope of a circumstantial and limited understanding of interaction, using materials and techniques typical of graphic production, when designed for manipulation and intervention of people; b) print interaction is obtained through the use of materials that resort to printing technologies in some way, connecting in whole or in part to digital systems or artifacts. The latter involves the combination of materials that allow the flow of information and enable interactive printing artifacts to be integrated into digital ecosystems.

a) Interaction through Graphic Production

It may be debatable if print media can be considered interactive without the inclusion of any sort of digital elements, as observed in figure 1. Even detailed accounts that see interaction as a dialogue, transmission, tool, behavior, embodiment, experience or control, are limited to an HCI (Human-computer Interaction) point of view (Hornbæk & Oulasvirta 2017), although interaction can be, most of all, attentive to people's concerns (Bolter and Gromala 2003) and not exclusive of computerized systems (Hallnäs 2004). This would take us on a discussion on interaction as a concept, regardless of technology and focused on its nature and purpose. For a more complete vision and understanding of what print interaction can be, here we can consider as interactive, when it comes to material possibilities that elicit people’s actions and allow anticipated reactions from designed objects (Neves 2012), even if, this takes us to an uncharted context for interaction design. Given its close connection to HCI and computer sciences, interaction design always had stable views on interaction. It emerged as an area to create digital products but has expanded in the meantime, to a spectrum of physical and hybrid accomplishments (Gullick & Coulton 2016; Höök & Löwgren 2021), privileging people's experiences with artifacts and systems. The potential of these designed

objects that use print, together with material opportunities resulted in some experimental technological-driven prototypes that involve print media, or that are related to these media in some way, as seen in figures 2a and 2b. Existing projects point to diversified artifacts, based on technological augmentation of surfaces and information networks. Interaction in print media has found form in works such as *Elektrobiblioteka* (Węgrzyn 2012), *Papertab* (Tarun et al. 2013) or *Interactive Newsprint* (Frohlich et al. 2017).



Figure 1. 'Books with a View' conference poster/book by Marco Neves. This poster contains two perforated lines, so that each person can pull four small parts, join them and fold, thus forming a small book.



Figure 2a and 2b. 'Interactive journey against design fixation' by Mariana Pires. Printed poster with conductive ink, Arduino board and sound column. The poster areas with conductive ink play recorded sounds when activated by touch, which complement the visual experience of the poster.

b) Interaction through Technological Augmentation

Print media are available for transformations and provide an interesting starting point for interaction design initiatives, using various materials or technological resources. In known cases, flexible displays have been used to improve the workspace (Holman et al., 2005); foldable interfaces allow content navigation (Watanabe, Mochizuki & Horry, 2008) and message exchange with material interaction (Khalilbeigi et al., 2012; Tarun et al. al., 2013). E-ink displays together with Arduino microcontrollers experimented in a mobile context (Lahey et al., 2011) and when connected with conductive sensors allow physical manipulation of digital information (Girouard, Tarun & Vertegaal, 2012). Hybrid books (Kelaidis, 2015) with placed sensors and conductive ink, which allows these objects to be input devices, perform tasks and connect with other screen-based devices. Other case presents an augmented experience through a wearable connected to a sensor (Heibeck et al., 2014). These experimental cases advanced in known possibilities for using print media, by adapting materials with technological increment and establishing conditions for interactive resources. They are examples that value such combinations and different uses for known formats, maintaining haptic properties and increasing digital performance. These cases show variables that were not considered in print media until now: i) reaction of the object and the information contained; ii) need for proper affordances to communicate use or interaction; iii) dynamic articulation between parts of the artifact and different human senses; iv) integration of materials that cannot be reproduced on a large scale. Some also resort to paper as a material, which is likely to become interactive through 'technological augmentation' (Margetis, Antona & Stephanidis 2015; Qi & Buechley 2010), with the advantage of providing natural interaction more immediately. Paper is present in various objects with which we already relate, and its interactive inclusion in environments adapted to users is beneficial as it does not become intrusive (Han et al. 2021; Nadolny 2017).

c) Printed Electronics

One of the most immediate aspects is the requirement for material circumstances that allow some form of interaction with media that can be printed. A material and technological possibility that presents a good convergence of this work direction is printed electronics. While some authors have addressed and emphasized the inclusion of new technologies such as AR (Gönen & Zeybek 2022; Nadolny 2017; Sonderegger et. al 2019), or sought to describe the apparent conflict or coexistence between print and digital media (Ballatore & Natale 2015; Nel 2012; Livingstone 2004), printed electronics can allow for planned behaviors between people and artifacts of hybrid manifestation (physical and digital). It is a way to concede interaction to print media, being a technology that involves printing electronic components, such as sensors and circuits, onto flexible substrates, such as paper and plastic (Ramakers, Todi & Luyten 2015). This technology enables the creation of interactive print media by integrating digital elements directly into printed materials (Olberding et al. 2015). For example, printed electronics can be used to create touch-sensitive buttons, sound-emitting components, and light-up displays.

The main features of printed electronics that relate to print media and interaction include: i) flexibility, since printed electronics can be printed on flexible substrates (Khan et al. 2020), allowing them to be incorporated into a wide range of print media, such as posters or packaging; ii) integration, as they can be integrated directly into printed materials or with other electronic substrates (Rivadeneyra, Loghin & Falco 2018), creating seamless and natural interactions between digital and physical elements; iii) low-cost, for they can be produced at a lower cost than traditional electronics, making them more accessible for a wide range of applications (Subramanian et al. 2008); iv) sustainability, as they can be produced using eco-friendly materials and processes (Sudheshwar et al. 2023), making them a sustainable option for interactive print media.

3.2 Contributing Areas

As important as the mentioned materials and technologies can be, in helping explain print interaction, they are not enough to define it as a design space. There are bordering design areas which can contribute to the necessary conceptual framework. These are areas that we can observe in the mentioned cases, but also

and above all, they accumulate knowledge about design and interaction practices, from which lessons can be learned for the future development of print interaction.

Print interaction is based on partial or extensive knowledge and practices from different areas and disciplines, namely interaction design, tangible user interfaces, graphic design and graphic production.

a) Interaction Design and Tangible User Interfaces

Interaction design has been an umbrella designation to encompass different understandings about people's relationship with things, whether specific technologies, systems, artifacts, products or environments. If the recurring vision of a practice centered on the computer and other computerized devices, made common by computer sciences and HCI, prevails as the most considered, it is certain that other positions open the way to contemplate different practices and disciplines (Goodman, Stolterman & Wakkary 2011) or to ease the tension between interaction design and research (Forlizzi, Zimmerman & Evenson 2008). Yet, there is much more that the area has to offer for print interaction, whether in terms of interfaces (graphic, tangible, natural, multimodal) or modality (interaction by touch, gesture, voice).

Research on an interactive perspective of print media so far, has focused on a comparison with most common digital artifacts (Neves 2017). Interaction features were identified in digital artifacts such as operating systems, websites and web-based applications and found their way into printed material. Such physical requirement is consistent with a material turn on interaction (Robles & Wiberg 2010; Wiberg 2018) and can be grounded on the concept of tangible user interfaces (Zheng, Gyory & Do 2020), explained by Fishkin (2004) in three steps: 1) an input event through physical manipulation by hands/gestures on a physical object; 2) a computer system receives such input and changes its state; 3) the system provides an output event, which is the physical change of the object.

Tangible user interfaces, as stand-alone or as shape-changing, meant for individual or collaborative experiences, build on a progressive physical/digital combination, where print media can fit, as other two or three-dimensional products, environments or wearables. Interaction is recognized, perceived and useful in broad, ubiquitous circumstances and without material or technological restrictions.

b) Graphic Design and Graphic Production

More traditional or established areas of design, especially those dedicated to the combination of elements for visual communication, have constituted a solid set of knowledge and modes of action for designers, which are of interest for print interaction.

Graphic design, which is responsible for designing a wide range of materials, including objects produced by printing technologies; editorial design, which has been responsible for the quality of books, newspapers, magazines or catalogues; or visual design and its extensive application in graphic interfaces, on desktop or mobile devices, bring together relevant knowledge for this new space.

The dexterity and organization of media in compositional dynamics, where hierarchy, categorization of information, typographic details, the value and richness of images, the meaning of visual messages, the canvas for exploring semiology, are determining factors to be used for the design of print interaction.

Complementing these visual elements and their communicative ability, in organizing and defining messages, graphic production accumulates procedures arising from various printed reproduction systems, such as the mobile character press, typographic reproduction, lithography, screen printing, offset printing or digital printing. Different printing modes, when combined with different materials (inks, substrates such as paper, post-production materials such as varnishes) and folding, cutting or embossing techniques, contribute to the use of products and the overall experience attributed to them.

The combined management of these elements, techniques and their effects on any experience place them as essential knowledge in the design of interactive print media.

4. Notes for a New Design Space

Based on the mentioned cases, on relevant literature on design and interaction and on material and technological depiction of printed electronics and related possibilities, we can start describing print interaction as a new design-driven space. Print interaction design is a space that combines print media with concepts from interaction design, graphic design and graphic production, enhanced by digital technological augmentation, to create interactive experiences. A few starting notes can help to propel this new design space and clear its future ambitions.

4.1 Tradition

The design of print interaction should consider print media tradition, the long background of visual compositions, and extend its attention to media studies, so it can leverage on media history, consequences, social and cultural interferences as a starting point. Print interaction does not appear from scratch, instead, it owes to common past solutions and tries to improve and update them. A certain emphasis on updating is relevant, particularly in the following aspects:

1. Update print media as cultural and social artifacts with individual and collective significance;
2. Update print media with new or recent materials and technologies that allow data-driven artifacts and inclusion in digital ecosystems;
3. Update print media as design projects, available to be the focus of design processes and methods.

4.2 Cross-Media Design

Print interaction lends itself, out of necessity and out of benefit, to a design-driven approach that emphasizes on cross-media integration, which can be used to create cohesive and consistent experiences across different media channels and for different purposes. Application of printed electronics to print media offers possibilities for creating seamless interactions between digital and physical elements. By incorporating sensors, circuits, and other components directly into printed materials, designers can create interactive print media that responds to users' touch or other inputs, creating immersive experiences. Printed electronics also pave the way for the exposure of print-based messages to the Internet of Things (Janeczek 2020) and consequent information dynamics. Ruotsalainen and Heinonen (2015) already call the internet ‘multimedia’, as it combines the characteristics of different previous media, now articulated. The integration of print media into this constant connectivity is precisely one of the reasons it can be an exciting design space that offers opportunities for creativity, innovation and enhanced experiences. Interactive print media needs to deal with being part of a larger ecosystem of media channels, recognizing the interconnectedness of them all and aiming to develop experiences between them.

4.3 Between Traditional and Emerging Practices

Because it is positioned, even if only in part, as a material achievement and because it is more intended for experiences and relationships with users, than for a unique and restricted physical shape, the design of print interaction appears as an intermediate space, between what are traditional and emerging design practices. Interactive print media fits in a context where several areas of design are dedicated to providing experiences for people, moving away from strictly material needs (Sanders & Stappers 2008). We have witnessed the emergence of 'spaces' in design that seek to address complex (sustainable design, social innovation design) or focused (service design, emotional design) situations, but which separate themselves

from practices now seen as 'traditional' (Sangiorgi 2011) which linked the designer to a know-how and close contact with materials with the purpose of producing something.

Given its observable features, interactive print media aims to reconcile material tradition, especially verifiable in graphic design and graphic arts, in the way information media is dealt with, with the propensity to shape behaviors and consider more holistic experiences, typical of interaction design.

The material tradition to which we allude is not limited only to its tangible side, but rather, it represents diverse contributions to our collective existence, at a cultural, social and educational level.

Instead of limiting itself to being compatible with one side of this comparison, traditional or emerging, print interaction should aim to be a new design space, which, included in a perspective of change, allows:

- the transition from material productions to individual or collective experiences, without giving up physical and tangible contact, but harboring the possibility of dynamic information and adaptation to different situations;
- the possibility of dynamic and updateable information can also avoid a prolonged use of large-scale printing, in the most common model of print media production. This places projects in this design space as contributors to reducing resources and improving the sustainability of the entire process, while simultaneously allowing the renewal of existing products;
- material relationships based on the premise of user participation, transferring control in deciding on the progress or development of products.

4.4 Assessment and Evaluation

Print interaction must focus on testing and evaluating its creations. Concern for people, as well as updating and adapting objects to situations, were largely neglected by print media producers and graphic designers. The necessary investment in reproduction systems forced the maintenance of communication formats. This deprived designers of paying attention to their creations at the moment they were used. An interactive characterization of print media allows for the evaluation of design proposals, particularly in the development phases. This can give rise to better knowledge about usability values, experience metrics, perception of emotions, corrections or adjustments to proposals.

User-centered or human-centered design are key concepts in the development of interactive systems and artifacts. By understanding people's needs and behaviors, designers can create interactive print media that can be intuitive, easy to use, and provide meaningful experiences.

5. Discussion

Like its main contributing areas, a designation and deepening of print interaction is justified, due to the evidence of projects that are characterized in their own way and point us towards a specific direction. Both interaction design and graphic design emerged as terms after one of their practitioners realized the uniqueness of what he was doing. Therefore, this is a first tentative explanation of what can constitute a new design space, because there are observable cases. The majority of these cases can still be referred to as experimental or at prototype level. This fact alone implies the need to collect their findings and aggregate them into contributions and meanings.

Such cases are experimental, and this seems like an admission by those who develop them. The experimentation, at first, seems to be restricted to materials and technologies, although it is not. It appears to be an experimentation with areas of knowledge, with the management of combined elements and with an impact yet to be determined.

The domain of interaction, like design, is expanding. This is positive because we feed practices that can present multiple proposals and that have implications for the socio-economic fabric, but also because we acquire greater knowledge about what we do and what we can do. From here we derive a second reason to recognize this design space, the fact that it can be someone else's scope of action. The need to explain, define and elaborate on print interaction is not only due to what is observable but also as an aid to all those who may want to fit their activity within this framework.

As this is a first attempt at explaining it, the way it is presented may be debatable. Likewise, the initial characterization, included elements, identified areas and mentioned restrictions are debatable. Two of the main starting points that can be questioned are the visual and material overvaluation of print media.

a) Visual Overvaluation

The interpretation followed here is of print media as communication material, whatever its content. This formal levelling may be at odds with positions in media studies or in the printing tradition and the multiple and rich examples it has given rise to. Print media, as assumed here, has been traditionally subjected to design in a visual perspective. Most print materials are thought by ways of visual layout, combining elements such as typography, imagery, colors, shapes and their interpretation of meaning can derive from these elements combined. There are, however, factors that are not considered in this generalization, such as context, culture and geography, which interfere in the production, distribution and perception of meaning and values of print media.

b) Material Overvaluation

Also, as a generalization, all print media is supposed to have material and haptic proprieties, it is distributed and portable through print-sensitive surfaces – from which paper might be the best known and used –, and in some cases are prepared to be handled and allow several gestures. Gesture and handling of print media are fundamental in this appreciation.

Isolating natural gestures that we already have in print media or creating ‘gesture grammars’ close to the physical and recognizable properties in common use, such as in books or magazines, can be an initial advantage. This makes it possible to identify these media as tangible interfaces, a physical material existence to which dynamic graphic information is added. The potential of information flow to be physical and the handling that arises from it places objects that were considered outdated, on the verge of reinvention, transformation, updating, with ramifications for cultural, learning, production and business contexts.

Interactive print-based media proposals present themselves as a manifestation of tangible interaction, expressing limits and understanding of the physical side and its relationship with the transmission of information through digital technologies. These possibilities of physical contact act as motivators for the interactive experience. This description of print media as interactive tangible interfaces can, however, be reductive, immediate and does not ensure, in itself, the correct and complete characterization of the possibilities of physical interaction, for which these media can be made available.

5.1 Tradition vs Future, or How to Begin?

There are two trends, which occur in parallel and which seem to contribute to the explanation of print interaction, or whose influence may be felt in the short term.

The development of systems, services and products, largely based on experiences through screens, sometimes for Web environments, sometimes for physical environments, has been reoriented towards concerns with tangibility, shape-changing interfaces, and interaction beyond human agents, with an attention towards sustainability and a measured use of resources. This development, more comprehensive with social and environmental concerns, with a hybrid propensity, as it occupies places united by the ubiquity of information, has been accompanied by a prevalence of incorporating automatism and 'intelligent' modes in the functioning and use of systems, where interaction emerges as a possible or optimizable way for relationships with people.

Therefore, how does interaction deriving from tangibility intersect with ubiquitous information and intelligent systems, in media arising from or related to print? The temporal connection appears to be difficult. If print interaction needs to respect its tradition, how can we already be looking at future constraints or even risk distorting its benefits due to more technological possibilities? Especially because, in this consideration, the speed of access and use of updatable technological systems can be noted.

Interaction can firstly be introduced in print media by ways of knowledge acquired by designers in dealing with screen layout. Although efforts towards GUI (either on desktop computer operating systems, Web-based applications or smartphone apps), have been to understand them in space and time, designers dealing with print media have tried to mimic them as 2D flat surfaces, ready for visual layouts. So one can expect, as soon as print surfaces become electronic conductors with affordable production systems, designers will try to entangle paper sheets with user interface elements and replicate usability-wise interactions. But from then on, there is already a considerable set of possibilities, to extend the actions of designers, in thinking about printing and its interactive capacity, beyond the two-dimensional.

5.2 A Confusing Technology-Driven Stand

Interactive print media may refer to printed materials that are combined with or incorporate digital elements or a digital connection to create interactive experiences. This print-digital Integration is set to create a seamless user experience, where both print and digital elements can be integrated in a way that may feel natural and intuitive.

Lately, we are able to look at how AR and QR codes are connecting print and digital artifacts and position themselves as ways to contribute to the physical/digital understanding of interaction design. In this sense, print interaction design can focuses on the integration of AR and QR codes with print media. The expected combination creates new possibilities for engagement and interactivity in print materials. By incorporating animations, videos, and infographics, print media may come to life and capture users' attention.

AR is a technology that can be used to enhance print media by overlaying digital content on top of printed materials. Although Yaoyuneyong et al. (2016) present it as more effective than print, AR benefit is to create a sense of immersion and interactivity, making more engaging or memorable experiences that blend digital and physical interactions. By overlaying digital content on top of printed materials, designers can further explore immersive and exciting outcomes. QR codes are a type of barcode that can be scanned using a smartphone camera to access digital content, such as a website or video. QR codes can be incorporated into print media, providing users with easy access to digital content and a simple way to bridge the gap between physical and digital media (Trivedi, Teichert & Hardeck 2020). By incorporating QR codes into printed materials, designers can create experiences that link users to digital content, such as videos, websites, or social media profiles.

Both AR and QR codes can be possibilities related to printed materials. Mainly because they allow movements or additions of information, based on reading or recognizing a printed surface. Still, we can discuss the contribution, enhancement and limitations of AR and QR codes on print media. It may be interesting to clarify what promotes interaction and what enables interaction. AR and QR codes promote interaction, inviting users to use media other than print to shift the focus of action and interact in digital systems. In the case of AR, through a layer of digital information; in the case of the QR code, through the

use of a digital device, which accesses information on a network. However, in both cases, they do not seem to allow print media to be interactive.

When explaining and defining what print interaction is and what makes it possible, we must be particularly attentive to what makes the printed medium interactive and what adds interaction, without necessarily resorting to the printed medium. I argue interaction in print media can have its own combined characteristics given all elements and contributing disciplines and practices. It may be easy to mistake that this initial explanation includes any technological possibility, or that it depends on it. This detail has implications for the design of interactive print media and especially for its future study.

6. Conclusions

An early blueprint is presented to help explain and define print interaction, in what can be a new design space. The main hints and notes were systematized, which could lead us to a definition of a design space for interactive print media. A new design space based on observed design experiments and knowledge collected from crossing areas with a design-led view towards hybrid (physical and digital) interactions, combined with low technology and material resources to maintain the haptic and cognitive benefits of print media.

Print interaction proposes the development of a future vision for objects and techniques that are falling into disuse, based on a dynamic combination, but aware of the material and experimental limitations on which it is based.

Results from this research endeavor will be mainly relevant for interaction designers. Considering print media as interactive provides designers with a new canvas to create engaging experiences, complementing or extending digital services or artifacts. Still, it can also be relevant for research on media studies, graphic design, human-computer interaction and related areas. The great impact can be expected on design projects involving print media and on future research about the materiality of interactive systems. Outcomes will be important to maintain various print media as objects of knowledge communication, for stimulation and preservation of concentration levels when accessing diversified information, to help decrease misinformation and the spread of fake news, for cognitive abilities, especially of younger generations and to help consolidate sectors of economic activity, such as the printing industry.

As it is a first tentative explanation, it paves the way for a set of future research, where several questions may arise. To understand this phenomenon we must then elaborate on:

- how can traditional print media be complemented or reversed through interaction possibilities;
- how can interactive systems, subject to design practice, welcome the presence of print media with interactive capacity in digital ecosystems;
- what are the basic concepts that underpin this design space and how to explain them properly. Above all, those that can be grouped, even initially, from bordering areas, such as graphic design, interaction design, interface design, or user experience;
- how to observe, categorize and study more deeply examples that fit into a design practice where interaction and print media merge;
- how to enable an informed and optimized design practice that contributes to proposals that make the best possible use of this articulation of areas.

To pursue such elaboration, these hints and notes may be of some use.

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P/REFERENCES OF DESIGN

INSTALLATION "MISUNDERSTANDING OF THE FACADE" — BREAKING AWAY FROM TRADITIONAL VISUAL IMMERSION INSTALLATIONS FOR BODILY IMMERSION.

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KEYWORDS | SPATIALITY, BODILY PERCEPTION, ARCHITECTURE, INSTALLATION, VISUAL CENTRISM

ABSTRACT | Human activity has taken place in a space where the real and the virtual merge, yet our perception of space is still limited by the geometric thinking of traditional architecture. In the real world, space is often viewed simply as the existence of a geometric container, and in the virtual world, space is constructed as a visual spectacle based on XYZ axes. In the media landscape under visual hegemony, the body begins to be absent. We gradually abandon our connection with physical space and turn our perception to the virtual world.

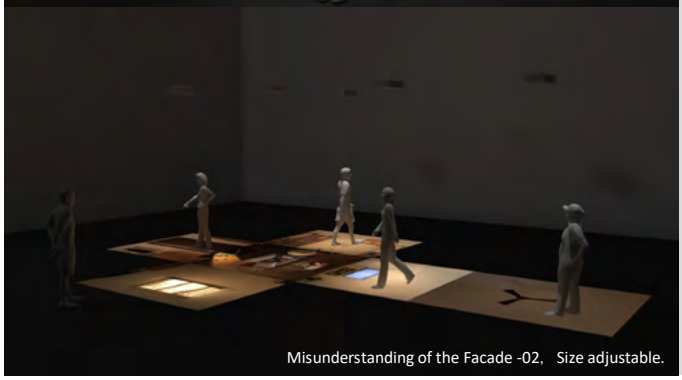
Architectural thinking is reflected in many fields of contemporary art, particularly in its close and profound relationship with installation art. Among these, “Cinematic Architecture” emerges as a new approach in the field of architecture, first proposed by architect Pascal Schöning in the “Manifesto for a Cinematic Architecture” in 2005. Architects no longer perceive architecture solely as physical entities but instead, begin to understand architecture through a cinematic way of thinking. Meanwhile, installation art, as a leading form of contemporary art, utilizes space itself as its material carrier. Therefore, the concept of “Cinematic Architecture” inspires exploration of the potentialities of space in this creative endeavor.

This installation is dedicated to removing the visual centrality and re-conceptualizing the spatiality of everyday architecture from the dimension of the body. It attempts to break the traditional perception of architectural space as a backdrop and create an imaginary space that is constantly reinvented and about memory and emotion. The body is no longer sheltered by the building but becomes an active participant. The term “ facade “ usually refers to the wall of a building. Therefore, the word “Misunderstanding of the facade” is to break the traditional construction of the facade in space, to realise the body’s perceptual wandering through the dissolution of the solid, and to form the individual’s cognition of the space in the path. Through the presentation of the installation, it tries to emphasise the power of bodily immersion rather than visual immersion. No longer creating an object to be viewed, but providing a field, a relationship between the body and space, i.e., space is not a number in numerical measure, nor a form in visual measure, but a perceptual process in bodily measure.

Introduction



Misunderstanding of the Facade -01, 300*250.



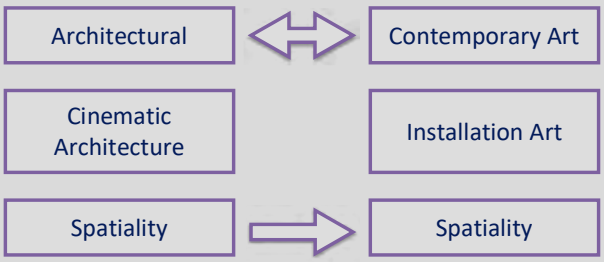
Misunderstanding of the Facade -02, Size adjustable.

This installation artwork comprises **two forms**. The first form (01) reconstructs space by presenting partial architectural elements, while the second form (02) reconstructs space by presenting complete architectural facades. Departing from mainstream art gallery formats, such as screen-based exhibitions and white cube spaces, this artwork transforms "form and construction" into "**events and movements**". By manipulating image content and arranging viewing paths, it engages the viewer's body in a roaming, participatory experience, emphasizing bodily immersion over visual immersion.

The term "facade" typically refers to the walls of a building. The artwork removes physical facades and uses images to construct space, resulting in the building appearing fully transparent. Here, the relationship between architecture and people ceases to be shared in physical space and becomes **co-temporal**, thus dispelling misunderstanding of the facade.

Project Focus and Objectives

Conceptual Inspiration



In 2006, architect Pascal Schöning first proposed the concept of "**Cinematic Architecture**" in his article "Manifesto for a Cinematic Architecture," defining it as: "**Space exists through the absence of presence.**"

This aims to understand architecture through a **cinematic way** of thinking.

Text	Objective	Space	Time	Body	Final form
Traditional architecture	The process of constructing entities	Numerical and visual measurements	Linear	Absent, kinematic displacement	A container
Cinematic architecture	The dual process of entity dissolution and reconstruction	Bodily measurements	Fluid and overlapping	Perceptual, participatory	Projection of memory experience

Project Focus and Objectives

Experiential Inspiration



All these imaginations of everyday spaces are based on an incompleteness of space—whether it's a demolished architectural ruin, the beginnings of a construction site, or a glimpse through the doorway of an unfamiliar space. **So, when you construct a complete space, how do you retain this imaginative aspect derived from incompleteness?** This became the starting point of my creative thinking, shaping the design of 01.

Methodology and Tools

Misunderstanding of the Facade -01

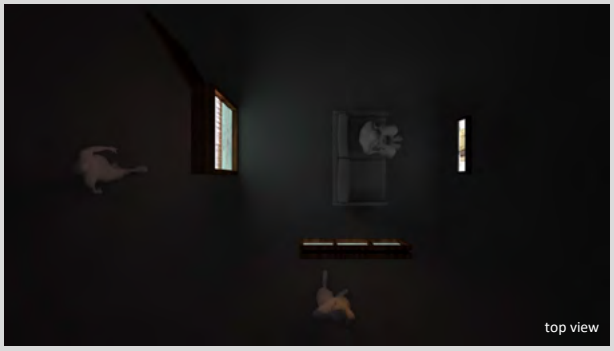
The artwork constructs the entire spatial form through partial images. By combining existing architectural elements like doors and windows with visual content, it approaches tangible spatial places from the dimensions of virtual space. It breaks away from traditional architectural façade thinking, replacing the physical construction of space with the partial representation of space through imagery. Consequently, the spatial form becomes fluid, a result that continuously evolves with the viewer's imagination, achieving visual segmentation and perceptual reconfiguration.



https://youtu.be/LwqvXlX6KVQ

Methodology and Tools

Misunderstanding of the Facade -01

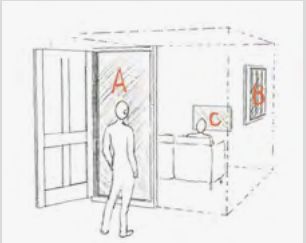


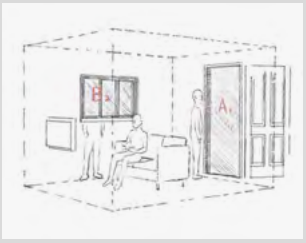


The arrangement of spatial structures on-site guides the movement path of the body, turning the installation space into not just an object of gaze or a mere vessel of service, but a subject to be interpreted and a field supporting dialogue between individuals. As a result, reality and virtuality cease to be attributes firmly attached to specific spaces; they become relative concepts, reliant on real-time frames of reference. The space itself gains existence through human experience.

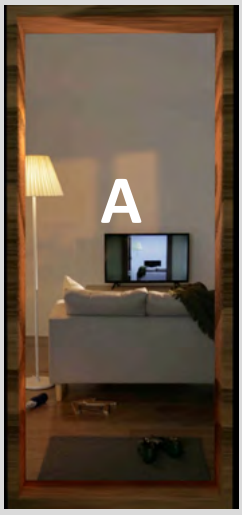
Creative Process

Misunderstanding of the Facade -01





Spatial Design



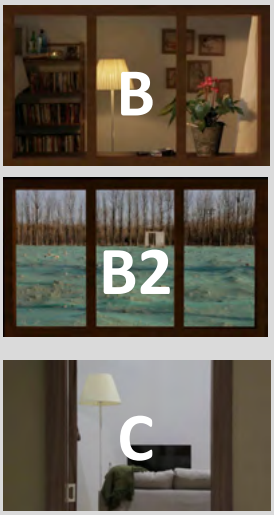


Image Design





Creative Process

Misunderstanding of the Facade -01







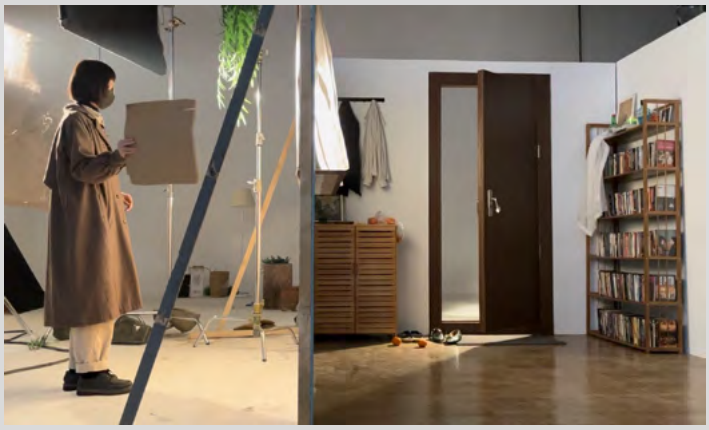




Creative Process

Misunderstanding of the Facade -02

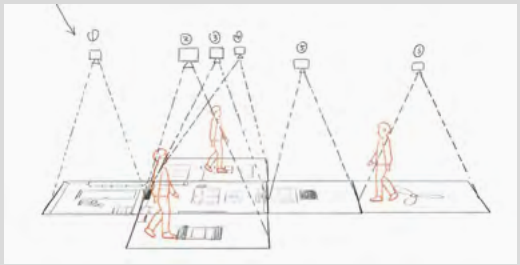




The familiar everyday space being dismantled can evoke a sense of distancing effect, thus giving rise to the second proposal. By breaking the architectural conventions, yet still relying on them to forge new imaginations.

Creative Process

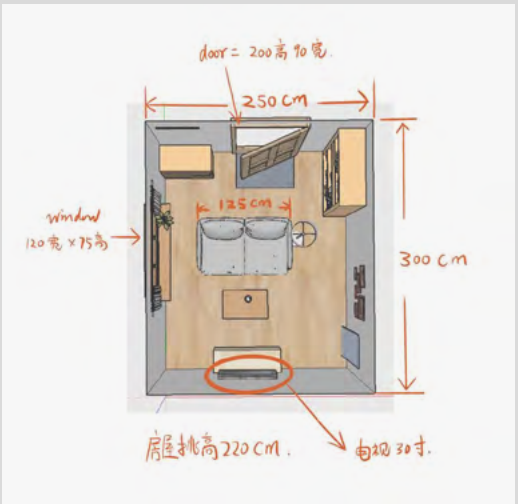
Misunderstanding of the Facade -02





Spatial Design

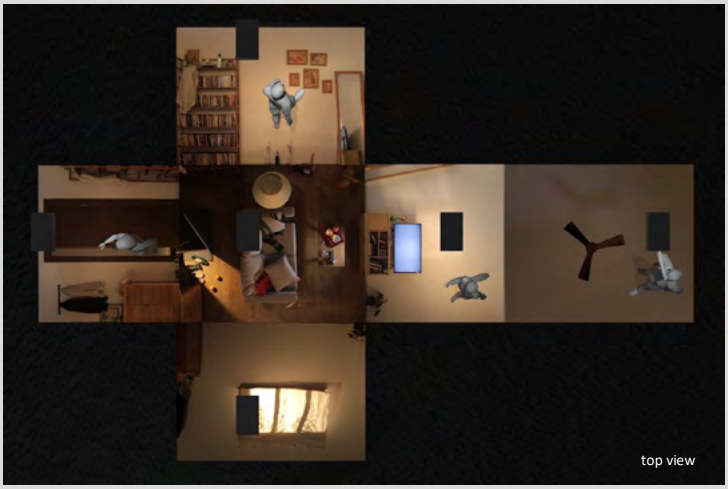
Image Design



Methodology and Tools

Misunderstanding of the Facade -02

This work is based on an architectural stereotype, a residential specification. It disrupts a tangible spatial entity from within, flattening a three-dimensional structure into a two-dimensional plane. The geometric spaces constructed under rationalism are rigorously unfolded through rationalistic methods. The panoramic perspective implies authority and identity. Thus, the viewer's real-life identity and emotions are temporarily replaced by the identities and emotions defined by the visual presentation, allowing a momentary detachment from inherent identities to re-experience everyday architecture.



Methodology and Tools

Misunderstanding of the Facade -02

Completely abandoning the notion of architecture as an enclosure, it allows the viewer's own coordinates to become the sole point of departure. As the viewer enters the projection area, the corresponding images undergo localized changes from a static state. Different facade images are interconnected, and through the collaboration and triggering of various observers, they collectively construct a complete narrative content.



https://youtu.be/4Sxeg5II8dg

Obtained Results

Installation View





Misunderstanding of the Facade -01

Misunderstanding of the Facade -02





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P/REFERENCES OF DESIGN

EMBRACING UNCERTAINTY IN EXHIBITION DESIGN: A PARADIGM SHIFT TO CHALLENGE DIGITAL HOMOGENIZATION — THE EXHIBITION DESIGN OF LU HONG'S ART ARCHIVES: 1978-2022.

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b Hubei Institute of Fine Arts, China
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DOI: 10.63442/YFEK2874

KEYWORDS | DIGITAL HOMOGENIZATION, CONTEMPORARY EXHIBITION, EXHIBITION DESIGN, DESIGN APPROACH, UNCERTAINTY

ABSTRACT | In the rapidly evolving digital landscape, the digitization of exhibitions has led to a pervasive homogenization of diverse displays. Traditional exhibitions, meticulously planned to present information, often prioritize eliminating randomness and uncertainty, resulting in standardized layouts and silk-screen prints. Mechanized and orderly process, while ensuring the seamless execution of events, have unintentionally eliminated the inherent "uncertainty" that exhibitions, as artistic expressions, should embody. This case study involving a Chinese contemporary art critic's archival exhibition adds a practical dimension to the theoretical exploration, reimagines the contemporary exhibition scene by addressing these issues and highlights the pivotal role of uncertainty in fostering diversity and creativity. Examining common forms of expression in contemporary art—namely "writing," "posting," and "found objects"—the paper draws parallels with the exhibition design process. "Writing" and "posting" correspond to printing and hanging, representing subjective and random acts influenced by the curatorial subject, ultimately shaping the final appearance of the exhibit. The use of "found objects" as exhibition props not only saves time and costs but also introduces an element of unpredictability.

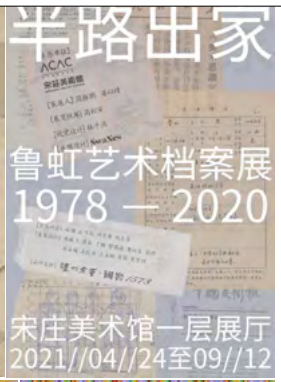
Uncertainty, in this context, becomes a catalyst for exploration and experimentation. Designers are encouraged to embrace the unknown, challenging conventional design paradigms, questioning established norms, and cultivating a mindset that values the process as much as the outcome. This departure from cookie-cutter exhibitions allows each design to become a unique journey reflecting the distinct identity of the content it showcases.

By leveraging the inherently random nature of "writing," "posting," and "found objects," this study seeks to turn contingency and uncertainty into the highlights of the exhibition. The intention is to disrupt the monotonous presentation styles of mainstream refined exhibitions and restore the diversity that exhibitions were meant to embody. This paradigm shift aims to redefine contemporary exhibition strategies as a type of contemporary artwork, emphasizing the need to reconsider and redefine the role of uncertainty in curatorial practices. By embracing the unpredictability inherent in these artistic expressions, this paper advocates for a departure from the assembly-line mentality that characterizes many contemporary exhibitions. It encourages a return to the fundamental, diverse, and uncertain nature of artistic expression, urging curators to embrace uncertainty as an integral part of the creative process.

In conclusion, this design research contributes to the discourse on contemporary curatorial practices, highlighting the importance of a more dynamic, inclusive, and unpredictable approach to exhibition curation in the evolving landscape of the art world. It also invites designers and audiences to reconsider the fundamental nature of artistic expression, encouraging a return to the diverse and uncertain roots that define the essence of exhibitions as powerful forms of creative expression in the digital age.











Lu Hong's Art Archives: 1978-2022

Type / **Exhibition Design**

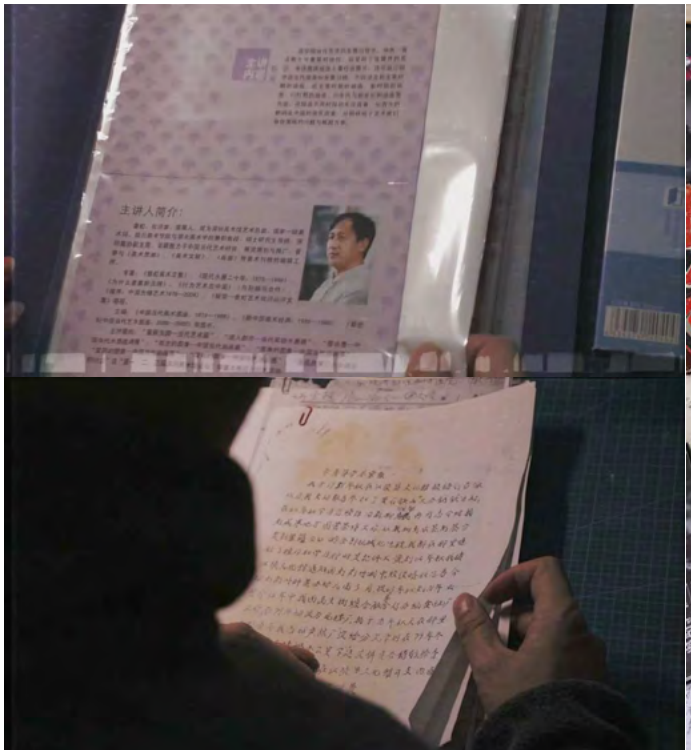
Floor Area / **1520m²**

Location / **Art Museum of Sichuan Fine Arts Institute, Chongqing, China**

Project Year / **2023**

Itinerant Exhibition / **2019 - Guangzhou**
2021 - Beijing & Wuhan
2023 - Chongqing


Lu Hong
&
His Works




水墨进行时
Ink Painting on Going:
2000-2019
中国当代艺术史
HISTORY OF CHINESE CONTEMPORARY ART

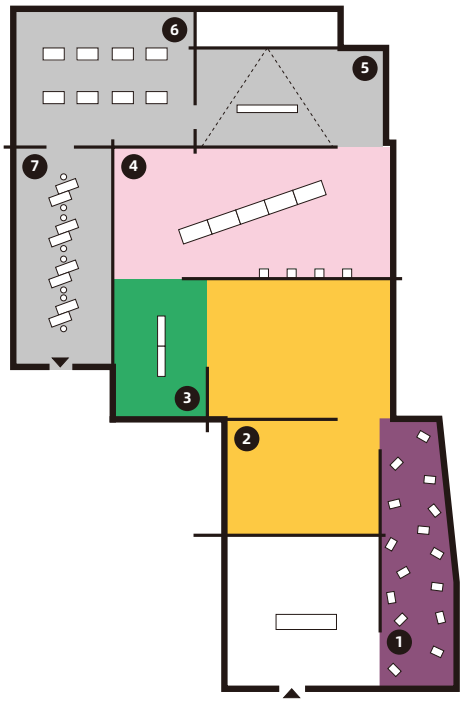
Lu Hong's Multiple Roles:

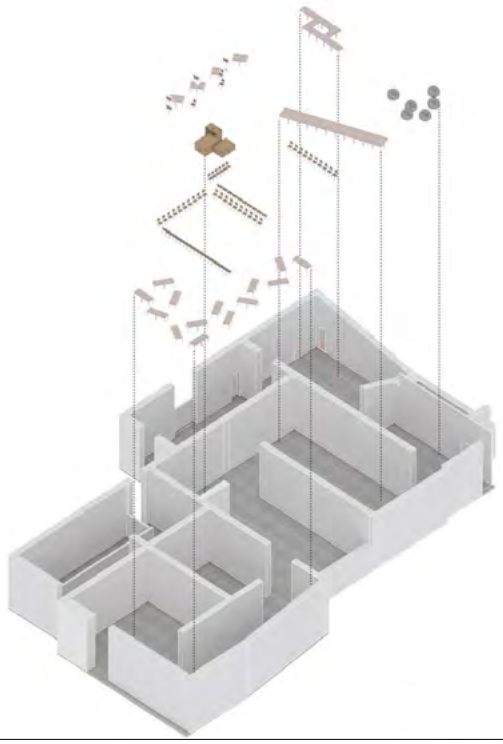
Part 1 **Lu Hong as a Writer**

Part 2 **Lu Hong as a Curator**

Part 3 **Lu Hong as a Gallery Director**

Part 4 **Lu Hong as a Learner & Researcher**





Exhibition Plan:

Part 1 **Writing & Publishing**

Part 2 **Curating & Publishing**

Part 3 **Gallery Work**

Part 4 **Daily Life**

Part 5 **Videos**

Part 6 **Itinerant Exhibition**

Part 7 **Audience Reading Area**


WRITING



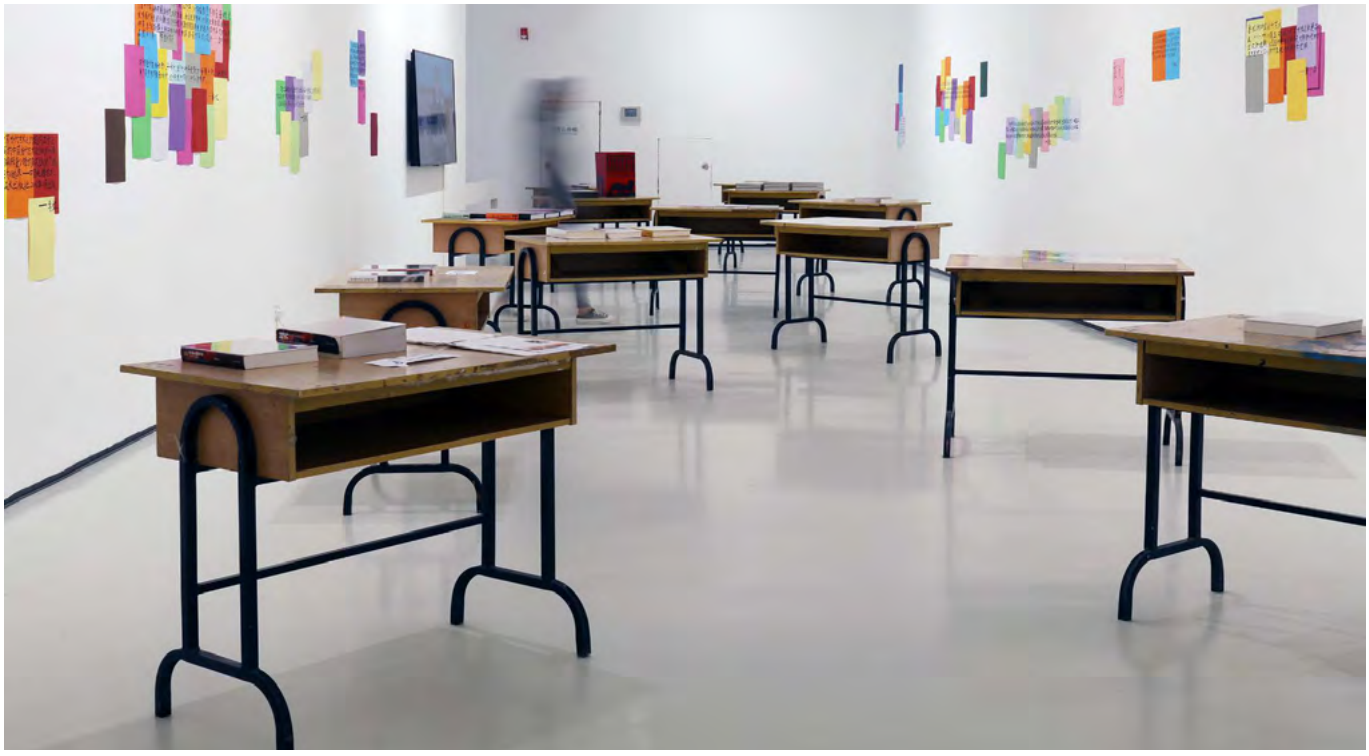

Forward
Titles/Headlines
Quotations
Floor Plans
Labels

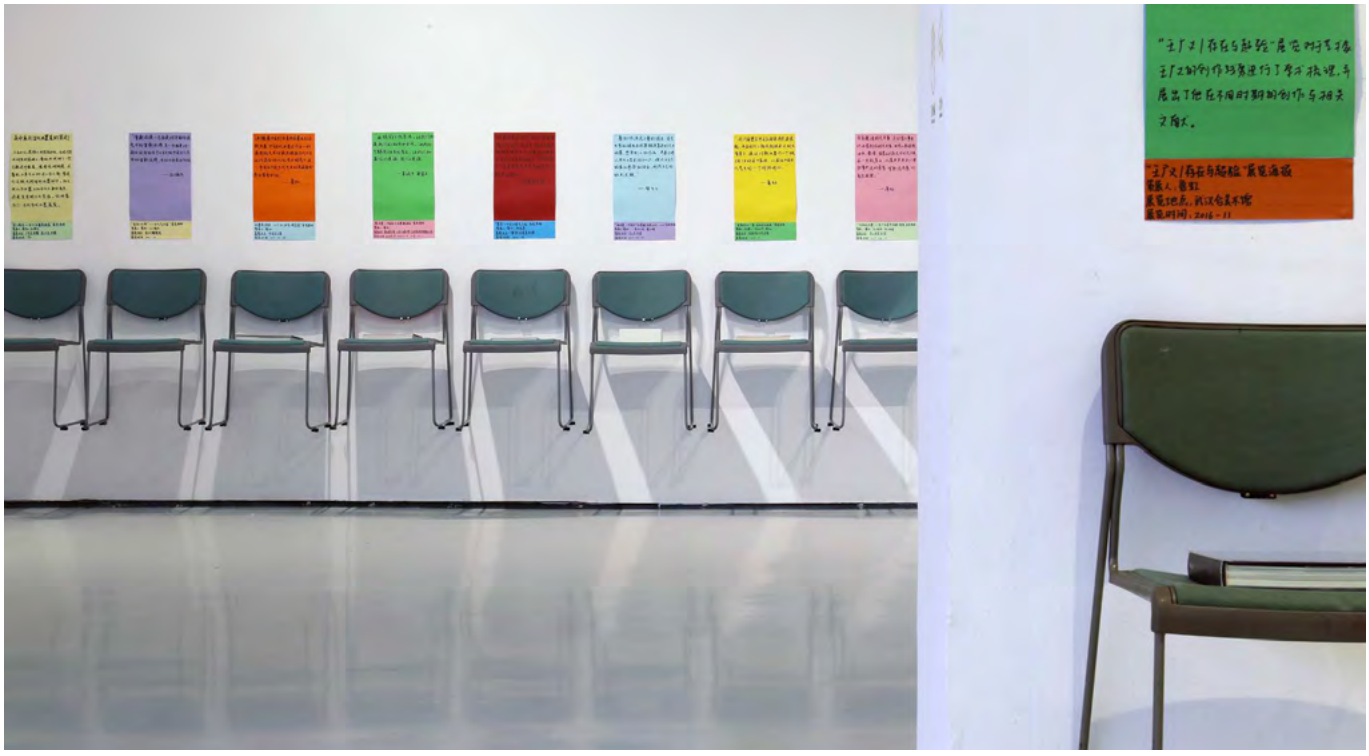

POSTING


FOUND OBJECTS


Embracing Uncertainty by
"WRITING"
"POSTING"
"FOUND OBJECTS"
1994
1983








798
Virtual Landscape
SLASH!!
Undefined Future




鲁虹使用的部分日历
OCTOBER
中国当代艺术史



P/REFERENCES OF DESIGN

THE MEANING OF VIRTUAL ARCHITECTURE.

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* g.aroni@mmu.ac.uk

DOI: 10.63442/KIHI1800

KEYWORDS | DIGITAL GAMES, ARCHITECTURE, SEMIOTICS, NARRATIVE, VIRTUAL, VIDEOGAMES

ABSTRACT | Billions of people spend billions of hours in virtual spaces, which are conceived to entertain, move, or even scare. Much of the attention regarding architecture in digital games approaches the topic from a level design perspective, but architectural design can be used in digital games to establish a narration, tell a story, and create specific aesthetic impressions, as well as gameplay situations (Aroni, 2022). Architecture in digital games can also foretell the unfolding of upcoming events rather than simply adding background information on the game setting, a phenomenon that Brian Upton calls "anticipatory play" (2015). This presentation will investigate virtual architecture as it influences and constructs narration – in this context, architecture is understood as the virtual buildings, cities, and interiors present within the games. What are the architectural elements and techniques that create a setting and enhance narration and immersion for players? How do players understand architectural signs?

This presentation will answer these questions by semiotically analyzing virtual architecture as a central signifier in digital games, based on Umberto Eco's architectural semiotic theory, where architectural objects denote a primary function and connote a secondary "certain ideology of the function" (Eco, 1997). The denotative function is the utilitarian function of architectural objects by their forms and material properties. Similarly, virtual architecture has a denotative function as well, related to gameplay. The secondary connotative function of architecture, which can be incidental or absent in real architecture, is even more present in virtual architecture, as every architectural element is deliberately created and placed in the game by the designers. It is the connotative function that communicates to players through architectural signs information about the gameplay, the narrative, and the context of the virtual world.

As space is one of the defining elements of digital games (Aarseth, 2001, p. 154), thus understating how the virtual environment communicates is of paramount importance for the development of effective digital game environments, but also for a deeper understanding of how we perceive the space around us, virtual or otherwise.

AS MUCH AS PAINTING AND OTHER "VIRTUAL" REPRESENTATIONS OF SPACE, DIGITAL GAMES BOTH RECONSTRUCT AND CONSTRUCT EX-NOVO WORLDS, USING SIGNS FROM THE REAL-WORLD ARCHITECTURE AS WELL AS THEIR OWN VOCABULARY.



Antonio Canaletto, *Capriccio with Palladian buildings*
Galleria Nazionale di Parma (1750-1760)



Final Fantasy XV © Square Enix 2016

The Semiotics of Architecture

Umberto Eco, *Function and Sign: The Semiotics of Architecture* (1973)

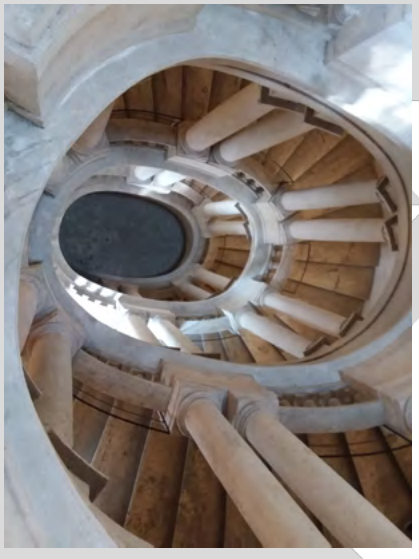
DENOTATION OF FUNCTION
The form of architecture denotes a function



An emergency staircase in a high-rise condo.

Toronto, Canada
(2013)

CONNOTATION OF MEANING
Architecture connotes an ideology of the function

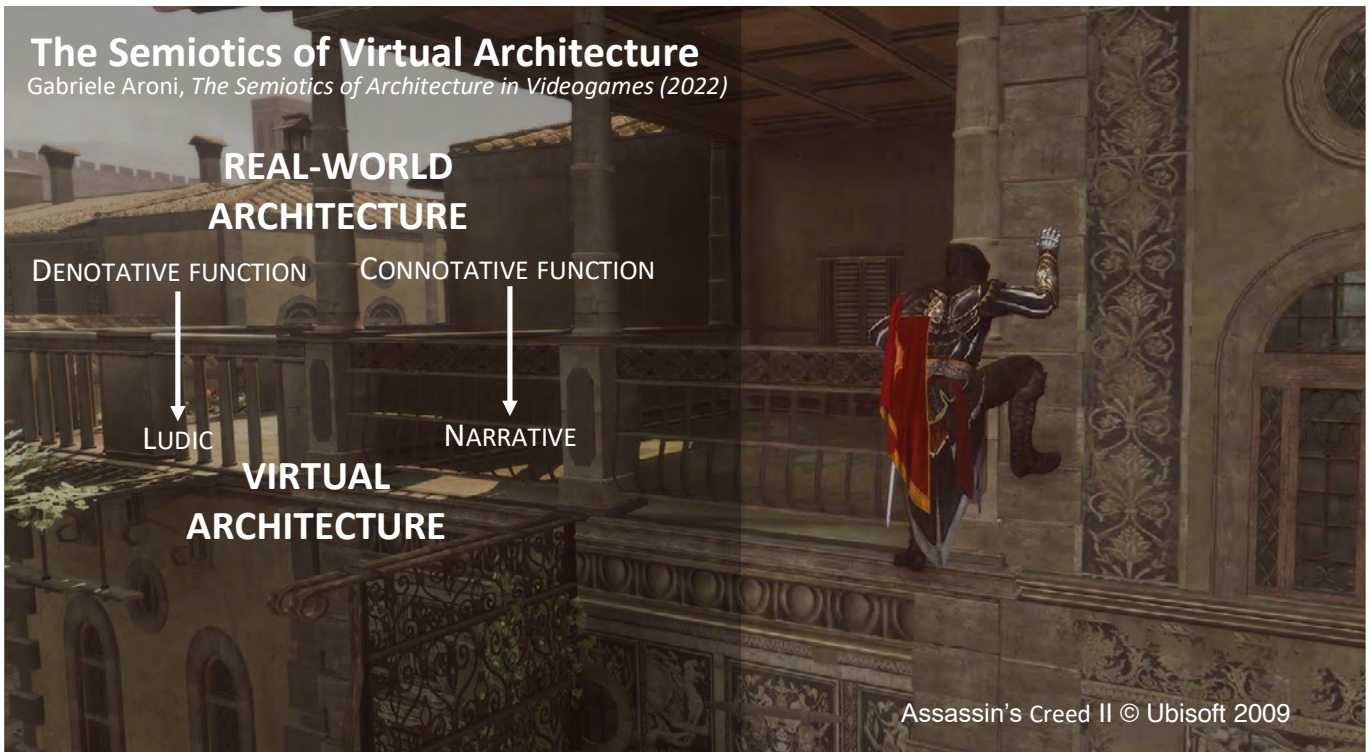


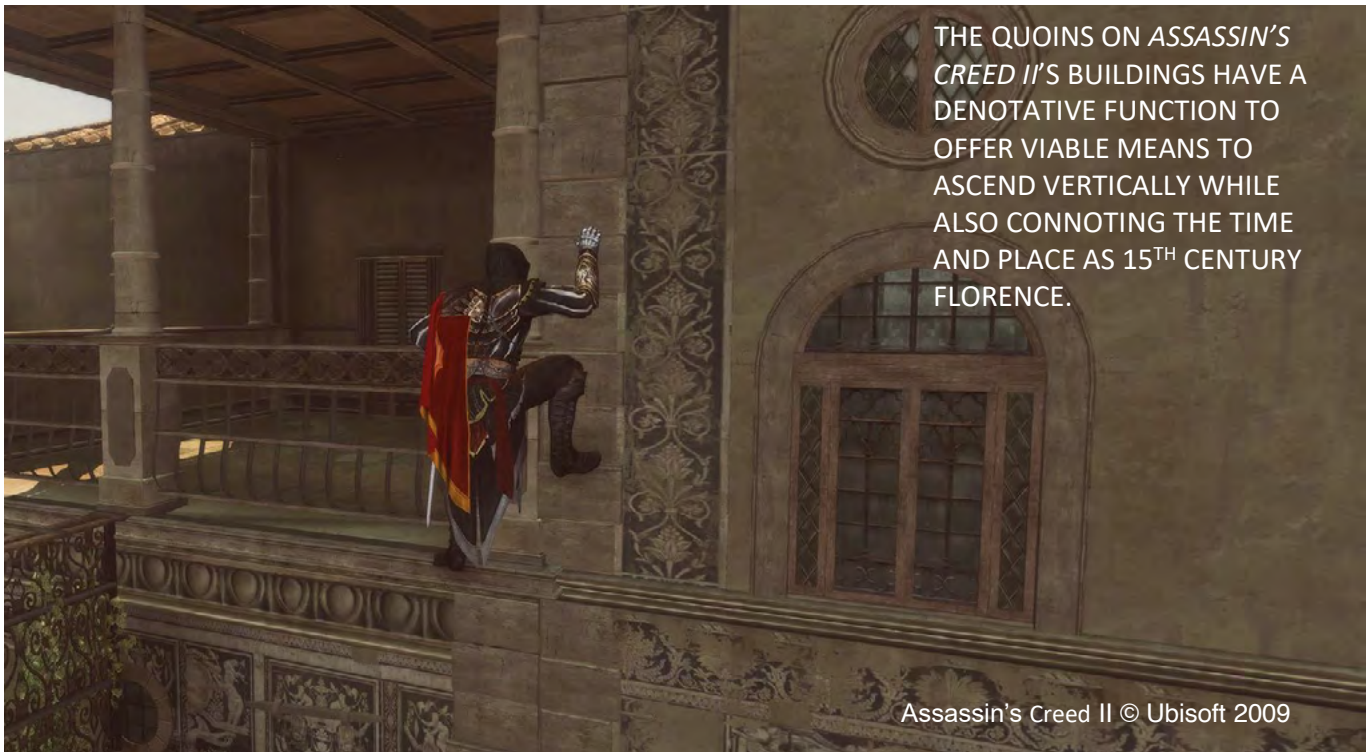
Francesco Borromini

Staircase in Palazzo Barberini

Rome, Italy
(1633)

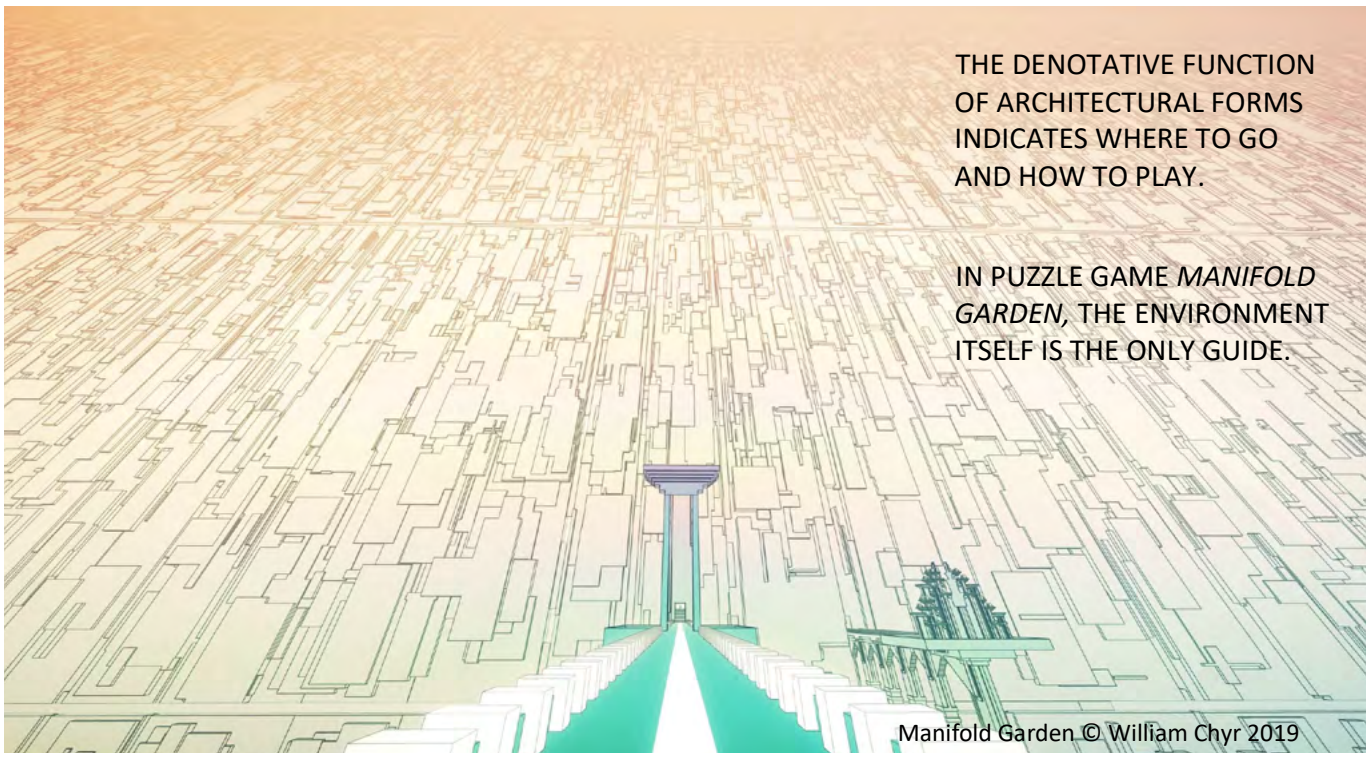

The Semiotics of Digital Games
ARCHITECTURAL SIGNS IN DIGITAL GAMES FULFILL TWO MAIN FUNCTIONS:
1) LUDIC: FUNCTIONAL TO GAMEPLAY
2) NARRATIVE: FUNCTIONAL TO STORYTELLING AND WORLDBUILDING
RiME © TequilaWorks 2017


The Semiotics of Virtual Architecture
Gabriele Aroni, The Semiotics of Architecture in Videogames (2022)
REAL-WORLD ARCHITECTURE
DENOTATIVE FUNCTION
CONNOTATIVE FUNCTION
LUDIC
NARRATIVE
VIRTUAL ARCHITECTURE
Assassin's Creed II © Ubisoft 2009



THE QUOINS ON *ASSASSIN'S CREED II*'S BUILDINGS HAVE A DENOTATIVE FUNCTION TO OFFER VIABLE MEANS TO ASCEND VERTICALLY WHILE ALSO CONNOTING THE TIME AND PLACE AS 15TH CENTURY FLORENCE.

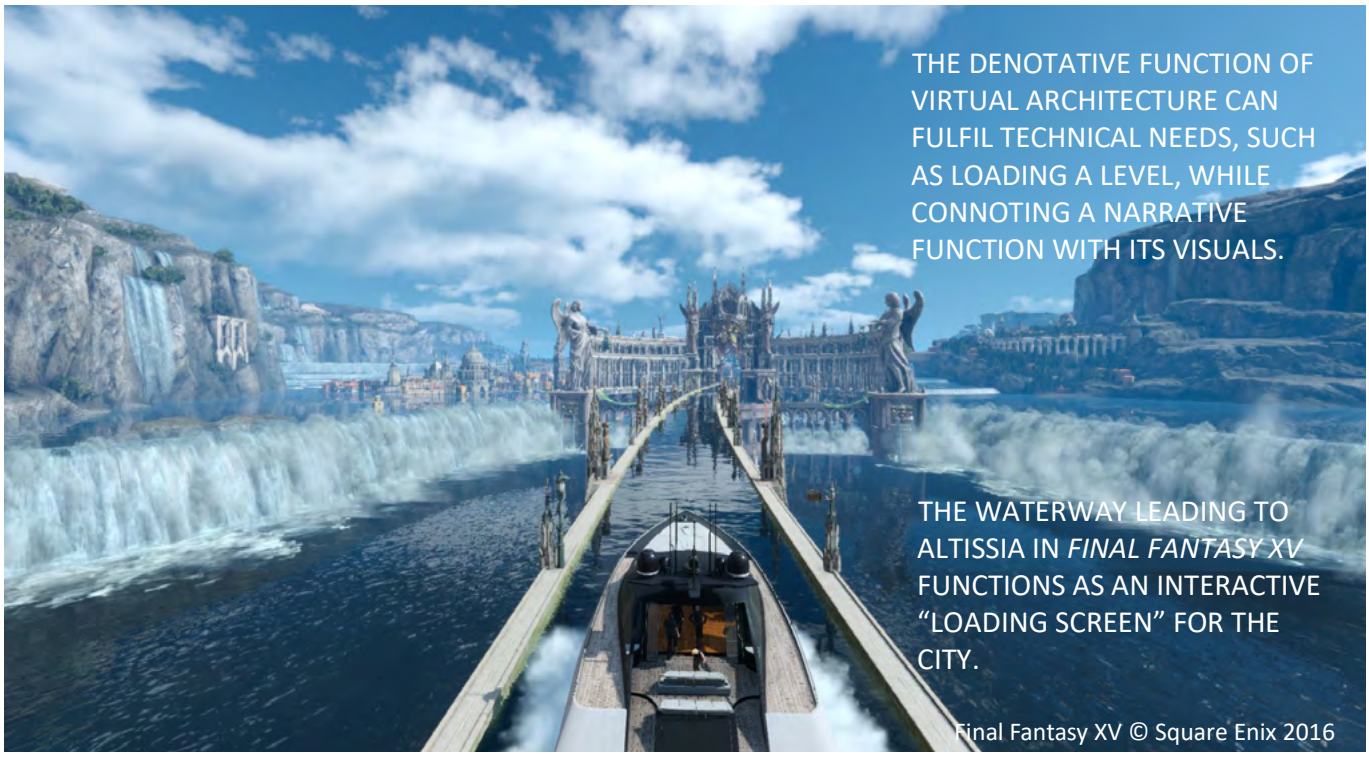
Assassin's Creed II © Ubisoft 2009



THE DENOTATIVE FUNCTION OF ARCHITECTURAL FORMS INDICATES WHERE TO GO AND HOW TO PLAY.

IN PUZZLE GAME *MANIFOLD GARDEN,* THE ENVIRONMENT ITSELF IS THE ONLY GUIDE.

Manifold Garden © William Chyr 2019



THE DENOTATIVE FUNCTION OF VIRTUAL ARCHITECTURE CAN FULFIL TECHNICAL NEEDS, SUCH AS LOADING A LEVEL, WHILE CONNOTING A NARRATIVE FUNCTION WITH ITS VISUALS.

THE WATERWAY LEADING TO ALTISSIA IN *FINAL FANTASY XV* FUNCTIONS AS AN INTERACTIVE "LOADING SCREEN" FOR THE CITY.

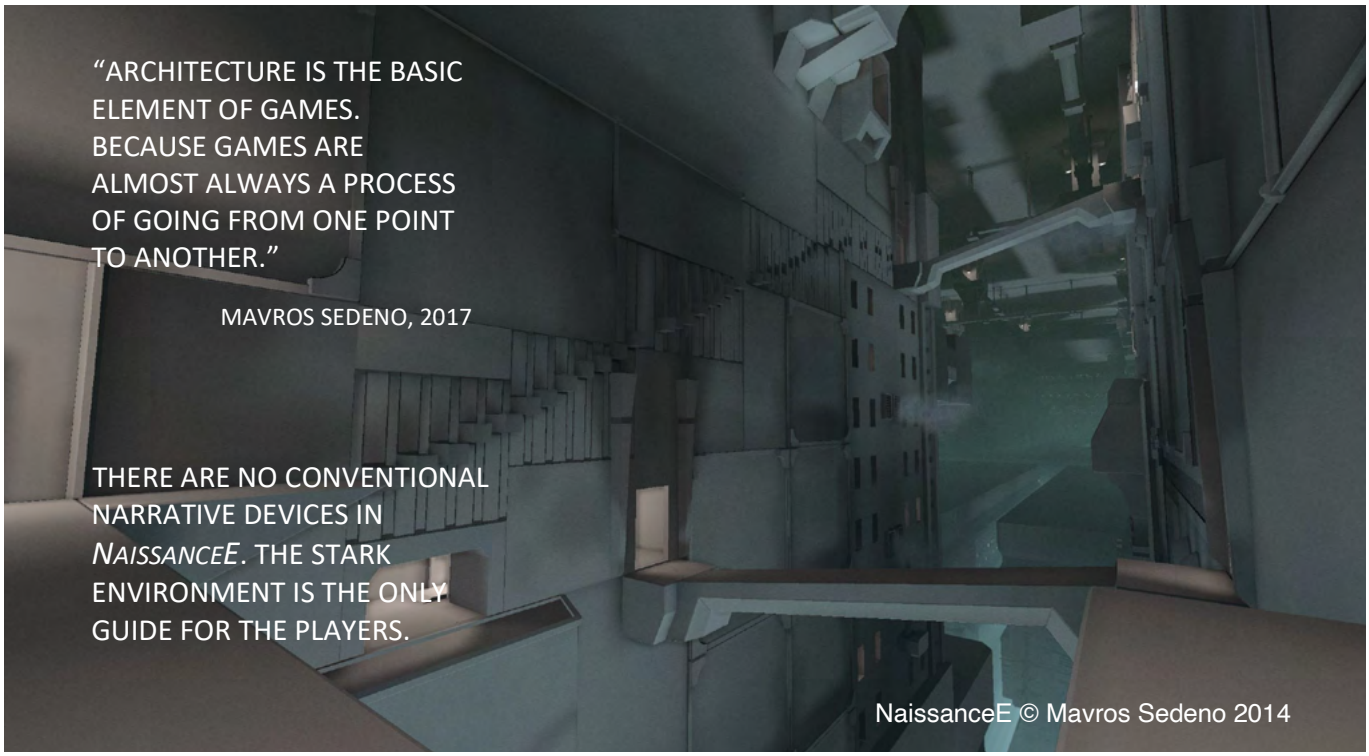
Final Fantasy XV © Square Enix 2016

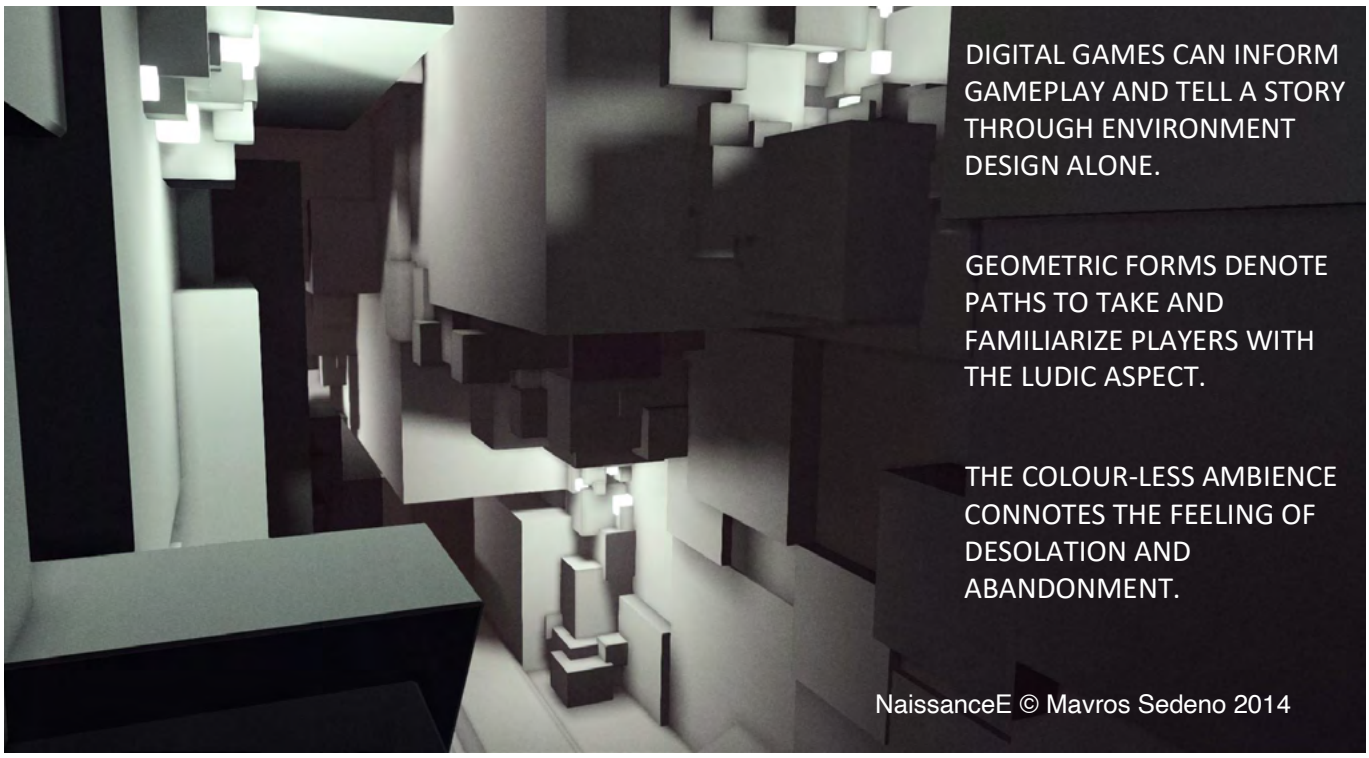


THE CONNOTATIVE FUNCTION ALLOWS FOR ENVIRONMENTAL STORYTELLING AND WORLDBUILDING.

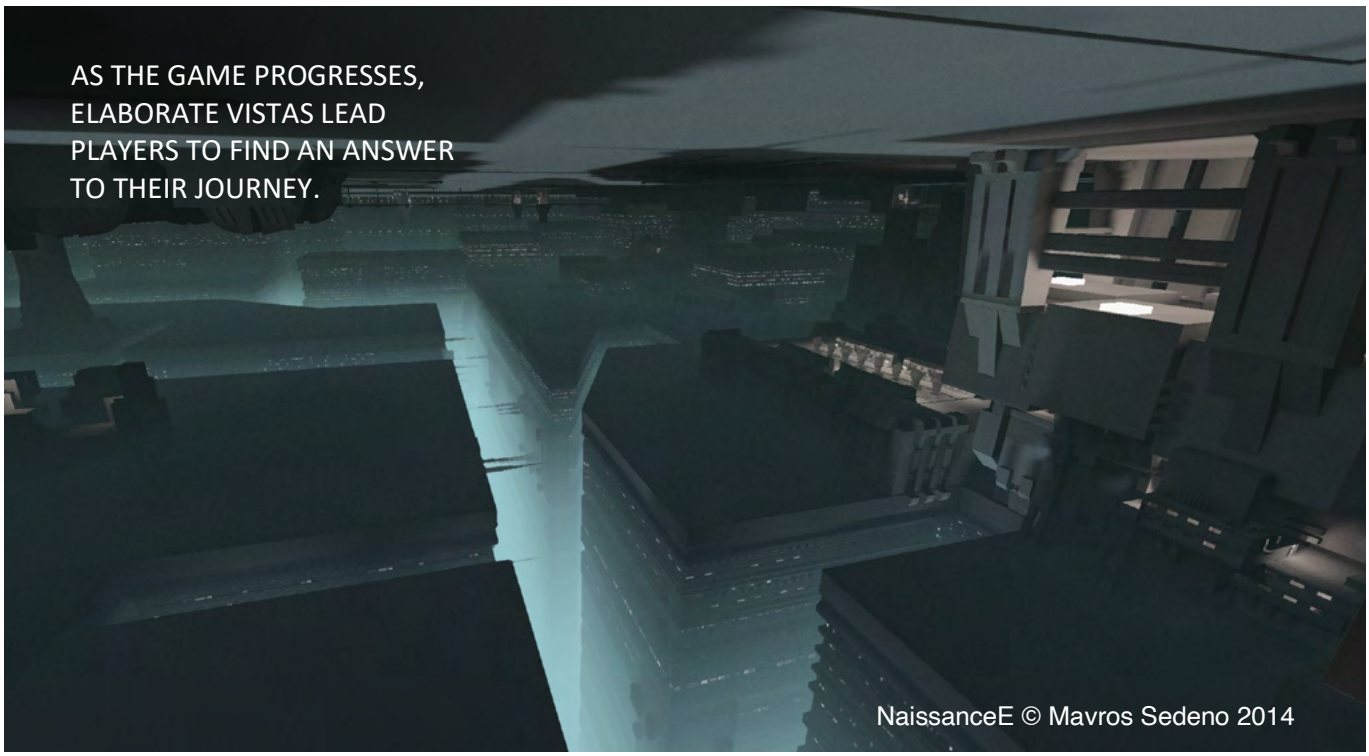
THE VISIONARY PALISADE BLADES BUILDING IN *DEUS EX* LOOMS OVER THE SKYLINE OF PRAGUE, MUCH LIKE THE FICTIONAL COMPANY IT REPRESENTS.

Deus Ex: Mankind Divided © Eidos-Montréal 2016


"ARCHITECTURE IS THE BASIC ELEMENT OF GAMES. BECAUSE GAMES ARE ALMOST ALWAYS A PROCESS OF GOING FROM ONE POINT TO ANOTHER."
MAVROS SEDENO, 2017
THERE ARE NO CONVENTIONAL NARRATIVE DEVICES IN *NAISSANCEE*. THE STARK ENVIRONMENT IS THE ONLY GUIDE FOR THE PLAYERS.
NaissanceE © Mavros Sedeno 2014


DIGITAL GAMES CAN INFORM GAMEPLAY AND TELL A STORY THROUGH ENVIRONMENT DESIGN ALONE.
GEOMETRIC FORMS DENOTE PATHS TO TAKE AND FAMILIARIZE PLAYERS WITH THE LUDIC ASPECT.
THE COLOUR-LESS AMBIENCE CONNOTES THE FEELING OF DESOLATION AND ABANDONMENT.
NaissanceE © Mavros Sedeno 2014


Étienne-Louis Boullée, *Cénotaphe de Newton*
Bibliothèque Nationale de France (1784)
"I FIND IT IMPOSSIBLE TO CONCEIVE SOMETHING SADDER THAN A MONUMENT CONSISTING OF A SMOOTH, BARE AND PLAIN SURFACE, MADE WITH A LIGHT-ABSORBING MATERIAL, COMPLETELY DEVOID OF DETAILS AND WHOSE DECORATION IS AN ASSEMBLAGE OF SHADOWS DELINEATED BY EVEN DARKER SHADOWS"
ÉTIENNE-LOUIS BOULLÉE
ARCHITECTURE, ESSAI SUR L'ART
(1790)


AS THE GAME PROGRESSES, ELABORATE VISTAS LEAD PLAYERS TO FIND AN ANSWER TO THEIR JOURNEY.
NaissanceE © Mavros Sedeno 2014

THE FUTURE OF WELL-BEING

P/REFERENCES OF DESIGN

CUMULUS BUDAPEST 2024

P/REFERENCES OF DESIGN

THE FUTURE OF WELL-BEING: IN A WORLD THAT AGES.

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DOI: 10.63442/SMFM5032

Cura sui – this phrase pops up today as a recurring name for beauty salons, aesthetic clinics, diet counseling, and the like. Two thousand years ago, however, it was used as a philosophical watchword: 'Take care of yourself' that is take care that your existence, taken in both physical and spiritual sense, is aligned with the cosmos as a whole, with its all-pervading order (since the Greek term of *kósmos* means precisely order), or meet some higher level of (divine) design (Hadot 1995). And it also involved that you ought to take the steps needed to achieve that harmony. Your well-being cannot be conceived as an individual state, only as a partaking in something bigger, an engaging in good in itself.

Well, that is the past of how well-being as an existential state can be apprehended, at least how its understanding went on in the most radical part of its history, in which it has been connected to a philosophical approach and art of living. This attitude has been transmitted through modified forms in the Middle Ages, especially in monastic life: well-being was meant of being close to God. Today, by turn, we are at an interstellar distance from this ancient heritage of the *cura sui,* and much closer to the way of life that Foucault (1986) characterized by the term, "aesthetics of existence". Instead of *cura sui* we have had new and different watchwords for long that have a common feature of each being formulated in a possessive grammatical structure: our Earth, the blue planet; our age, the times of modern life; our design, which is aligned to the human scale.

Our planet – our age – our design: such wonderfully obsolete terms, although still in heavy use! This planet got wounded and is ageing. We, as a society and as individuals, are ageing as well, and disintegrating in many different ways. Our design practices, Papanek warned as early as the 1970s, have proven to be harmful

and dangerous, or ignorant as for planetary and natural conditions (including our very ageing). From this perspective, the last thing we need is even more design. Rather we need care and carefulness.
But can we give and take good care in an all-spontaneous way? Might one conceive carefulness without the implication of prudence, circumspect, foresight, and coordination? Since more often than not there arises a great and multiplied need for care, simultaneously for multiple, both human and other living or nonliving entities, and this leads in itself toward the necessity to assess, organize, and institutionalize what is at stake, the act of design per se, be it product development or policy making, seems inevitable even against their apparent overdriving.

The contributors to this section are testifying their deep understanding and experience of the above tensions. Some of them responded to our call by focusing on specific, intersectional, and institutionally underrated or blindspotted issues: like the situation of the gynecological inspection (V. Juretko), or complex problems of period poverty (Z. de Meillon), HPV detection devices seen from the point of view of the user experience (M. Maldonado et alii). Others approached more directly institutional malfunctions: that of hospitalized children healthcare (C. Akoglu and K. Dankl), burial protocols (M. Kuronen), and urban revitalization (S. Qin et alii). Still others provided examples of careful design in multiple fields highlighting how mindsets are the most important aspects as opposed to technologies (I. Caruso and V. Cristallo; L. Christiansen).

A full panel came together from thought-provoking submissions about how to deal designerly with emerging issues in an ageing society. This was by far the most recurring theme among all the 70+ initial submissions we got on our call, and those that made it until this publication phase are not coincidentally those that put an emphasis on service and technology aspects (A. Giambattista et alii; P. Veske-Lepp et alii; A. Pollini et alii). Their underlying issues are the same as the ones we inherited from the modern design tradition: how can we avoid that our ‘solutions’ lead to ever-increasing alienation?

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UNHURRIED POST-MORTEM.

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ABSTRACT | This study investigates the changing landscape of funeral practices, studying the transition from community-involved rituals to professionalized, streamlined funeral processes. Modern funerals have become more privatized, distancing relatives from active involvement and shifting responsibilities to professionals. This shift has led to a lack of personalized rituals and distancing relatives from death, potentially leaving bereaved individuals with unprocessed grief.

Utilizing a service design approach alongside arts-based research methods uncovered nuanced insights into the funeral landscape. This approach facilitated a deeper understanding of the bereaved's needs and shed light on the value of involving slowness in funeral services. Arts-based methods, while emphasizing credibility over conventional validity, provided richer, multidimensional insights into the subject matter. Moreover, reflexive research played an essential role, helping researchers to critically reflect on their assumptions and social constructs.

A key finding of this study lies in the increasing diversity of demands in funeral services and processes, reflecting individualistic desires and varied life-views among the Finnish population. The longing for slowness, a deeper connection with nature, and personalized mourning experiences were the most distinctive themes. Slowness in this context refers not to delaying burial but rather to providing relatives with a considered and deliberate mourning process.

The study's findings highlights the significance of incorporating personalized rituals into the mourning process, challenging the prevalent quest for efficiency and our avoidance of mortality. Slowness in funeral rituals offers a means to confront loss, demystify death, and facilitate healthier grieving processes, ultimately enabling individuals to confront mortality with greater understanding and acceptance.

1. Introduction

In Finland, many people are not familiar with what goes into planning a funeral until they are faced with doing it themselves. Talking about funerals is not common until it becomes necessary, often leading to avoidance until the last minute. As a result, most funeral-related tasks are handled by professionals, leaving grieving relatives feeling sidelined during their loved one's farewell. The post-mortem process has, in various respects, become efficient and effective, yet frequently lacks significance for relatives. However, deliberate and unhurried process is essential to ritualzse, process and comprehend the loss of a loved one. Otherwise, the relatives may feel that they have been left out: *"It felt like a conveyer belt experience, blunt staff who didn't know how to deal with a grieving next-of-kin"* (Participant in web survey, 2017).

The rituals tied to death play a vital role, helping family members cope with their grief and emotions. But these days, funerals are mostly handled by professionals, taking away the family's traditional role. This shift can make relatives feel distant and less involved in the grieving process. Plus, there is still a lot of secrecy and taboo around death in society, even though art and culture often openly explore themes of mortality.

Exploring the issue and taking a developmental approach for the benefit of the family member's experience is important to ensure that everyone has the opportunity to face and deal with the loss. By putting the experience of the relative at the centre and exploring the feelings related to the burial, it is also possible through self-reflection to identify needs and areas for development that cannot be achieved through other methods. Thus, in this study we draw on both service design and arts-based method approaches.

The research questions are:

1. What insights do arts-based research and human-centered design bring to the burial experience? and
2. How can service design contribute to better experiences of loss for the relatives?

Depending on the context, funerals can be understood either as enveloping the entire journey from the moment of death to the burial, or more narrowly as a memorial service. Throughout this article, the term "funeral" refers the entirety of the process.

2. Literature Review

2.1 Finnish Funeral Culture

Finnish funeral culture has become more professionalized over the last 100 years and the involvement of relatives has decreased (Pajari 2014, 64–65; Pentikäinen 1990, 197). Funeral-related services and providers, such as florists, funeral homes, and the church, play a crucial role in facilitating rituals associated with death. Numerous service providers and professionals are indirectly engaged in the process making burial also an economically important factor in Finland.

Rituals aid relatives in confronting their loss and managing their emotions, making them essential for coping with grief. Funerals serve as a means for the community to come together and reorganize following a loss. Often, the rituals surrounding death are influenced by religious practices. (Hakola, Kivistö, & Mäkinen, 2014, pp. 16–17; Pentikäinen, 1990, p. 93). However, the rituals themselves are in the process of changing. For a bereaved, the relevance of rituals to their lifestyle is significant. In contemporary times, internet technology and social media communities provide avenues for individuals experiencing grief to engage in ritualistic mourning and satisfy their need for companionship. (Haverinen, 2014, p. 206).

Art and popular culture frequently draw inspiration from death. However, in our society, aspects such as corpses, mourning, and certain elements of the funeral process are often kept hidden. Unlike birth, which is often openly discussed, death tends to occur behind closed doors metaphorically. Studying this sensitive topic makes death more visible, shedding light on this phenomenon and fostering opportunities for change.

Kimmo Räisänen, a photographer who has captured images of the terminally ill and their families, expressed that "I understand, that it feels horrible that I have taken the photo in this critical hour. However, I think that such pictures must be taken. Death must be made powerless" [authors' translation] (Peltola, 2017). According to Kallinen, Pirskanen, and Rautio (2015, p. 195), research serves as a platform for strengthen the voices of individuals grappling with sensitive topics, providing them with an opportunity to express themselves. By attentively considering these perspectives, it becomes feasible to gain insights on how to develop the funeral services and processes to serve relatives better.

As previously discussed, death often remains a silent and concealed subject within our society, save for its expression in art and cultural mediums like music. Consequently, when individuals are faced with the death of a loved one and require assistance with funeral arrangements, they may find themselves at a loss. In such intimate moments of grief, the significance of rituals becomes heightened as individuals seek guidance from others on appropriate conduct (Poijula, 2002, pp. 92–93). Frequently, the desires of the deceased are ambiguous, necessitating negotiations among relatives regarding the most fitting way to honor their wishes. Molander (2009, p. 40) highlights how death taboos are evident, particularly in the treatment of bodies within hospital settings, where deceased individuals are discreetly transported through back entrances to avoid the gaze of visitors. Nonetheless, there are emerging signs that discussions surrounding death may be gradually shedding their taboo status. Notably, heightened discourse concerning end-of-life care and the legal dimensions of death has drawn increased attention to this significant topic (Ministry of Social Affairs and Health, 2018).

2.2 Service Design as a Human-Centered Approach

The experience of relatives with funeral services and processes can be improved through human-centered methods such as service design. A human-centered approach can be embedded into a design process by examining and considering the viewpoint of the user. Using multiple touchpoints throughout user experiences to create enjoyable and valuable service journeys (Zomerdijk & Voss, 2010; Halvorsrud et al., 2016; Maechler et al., 2016; Miettinen, 2016), service design is a human-centered, multidisciplinary, and transformative design methodology (Sangiorgi et al., 2019; Prestes Joly et al., 2019; Lin et al., 2011). Especially when developing complex services like funerals, it must be understood that the relative is dealing with dozens of different service providers and touchpoints when organizing the affairs of the deceased.

By incorporating people into mapping processes of service user journeys, service design proactively drives value co-creation for continual improvement, an essential component of service design (Yu & Sangiorgi, 2018), for providing services that satisfy functional needs and emotionally connect with users to ensure their satisfaction and the fulfilment of the purpose of the service.

2.3 Arts-Based Research

The arts-based method used was photography, creative notetaking and storytelling. The photos and notes were analyzed by drawing on narrative approaches to visual analysis (Bal, 2001; 2006). In arts-based research (ABR), artistic methods are systematically used as part of the research. Artistic methods can be used in the data collection phase, the operational phase, including analysis, and in the presentation of research results (Barone & Eisner, 2011). The use of artistic methods can achieve the values that designing services commonly require: empathy and change. Empathy makes it easier for us to understand each other's needs and thus enables change. Through art, it is possible to obtain collected material that would not be possible using other methods. Using arts processes in research enables different ways for research

participants and researchers to connect. In addition, the material may be more vivid and nuanced than if the material were collected by other means (Barone & Eisner, 2011, pp. 20–21).

ABR methods focus on credibility rather than validity (Barone & Eisner, 2011, p. 22). Research can potentially gain deeper meanings when utilising other than the so-called clean research methods that supposedly achieve the highest possible validity. However, the use of arts-based methods does not preclude other methods, but the best result is obtained by utilising various ABR methods in the phases of data collection, analysis, interpretation and dissemination of the research (Leavy, 2014, p. 20; 2017). Thus, ABR offers ways for knowing differently as it enables tapping into 'what would otherwise be inaccessible … or out of reach' (Leavy, 2014, p. 21).

Reflexive research (Weber, 2003, p. v) includes the step of taking an intentional break in our activities as researchers for the purpose of reflection, drawing on our ability to reflect on and enhance our understanding by seeing 'the interrelationships among the deep assumptions that underlie our work'. Weber (p. vi) calls on researchers as social beings to 'come to grips with the ways we construct our understanding'. Critical reflection (Fook, 2011, p. 56) can serve as a valuable method in the various stages of reflexive research. The first stage, Fook (2011) suggests, seeks to unearth our fundamental assumptions about social structures and power relationships, to name a few, which enables exploration and enquiry through the recognition of values and beliefs. The second stage draws on new awareness to frame and 'devise new (and better) approaches to practise' that are more suited to our social environments and practices (p. 56).

3. Methods

The research was conducted mostly with qualitative methods: interviews, online survey, photography/visual analysis and creative notetaking as arts-based method, and co-design workshops (Table 1). The studies were conducted between the years 2017 and 2019.

Table 1. DATA COLLECTION METHODS.

Interviews with relatives	n= 13	13 people from all over Finland, aged 34 to 70 years who had organized a funeral sometime in the past
Other informants	n=2	2 persons visiting the cemetery and giving their comments on their visit
Interviews with professionals	n=8	an entrepreneur, a florist, an end-of-life caregiver, a pastor, a senior advisor, an employee of a funeral home, crematorium workers (2)
Co-design with relatives	n=7	1 workshop online, 2 workshops in person
Online survey	n=91	quantitative data with 304 qualitative answers
Observation and self-reflection	n=1	The first author's self-reflection and photos when visiting the crematorium
Creative notetaking	n=5	Creative notetaking with the Mustarinda residency residents
Total of data informants	**n=127**	

The themed interviews were guided by questions, but the focus was placed on the important cues of the participants by encouraging them to continue their stories about their experiences and feelings at the time of dealing with the funeral process. Interviews were carried out with 13 relatives who had organized a funeral sometime in the past. They were from all over Finland, aged 34 to 70 years. In addition 2 informants gave their comments about their visit to the cemetery. It was also vital to understand the service provider's point of view. To accomplish this, an entrepreneur, a florist, an end-of-life caregiver, a pastor, a senior advisor, an employee of a funeral agency and crematorium workers, who also were chapel workers, were interviewed. The objective was to determine what factors affect the experience of those who are arranging funerals from their professional perspective. During the interviews, we discussed the funeral industry and changes in it in general.

The aim of the workshops was to gather ideas from relatives on how to improve burial customs and services. Participants had either organized funerals themselves or had attended a funeral. During the workshops, ideas were collected around four different themes and participants were also given the opportunity to comment on and elaborate on ideas previously collected by other participants. The first workshop was held online and others were held in person. There were in total 7 participants in the workshops.

The web survey's goal was to increase understanding of the funeral industry, generally, and the customer's experiences related to funeral service providers, specifically. There were 92 respondents to the web survey. In every phase, respondents were given the opportunity to respond with an open format reply in addition to a numeric option. This resulted in 304 open replies.

The first author was a resident at artist and researcher residency Mustarinda House in 2019 and collected data during her visit. The thoughts of other residents about funeral rituals and what kinds of rituals they would want to organize for others or would like for themselves were collected by the researcher, supplementing her previous research data. Information was collected from the wall where artists and scholars were encouraged to write and draw pictures of their thoughts. A total of five residents took part in the study. Arts-based methods such as sketching on the walls (Figure 1), instead of only note-taking, were used to collect data, thus supporting different avenues of expression for the participants. Additionally, this approach enabled the participants to process their thoughts differently and enabled us to understand and see differently the assumptions and social structures that underlay the topic of the study.

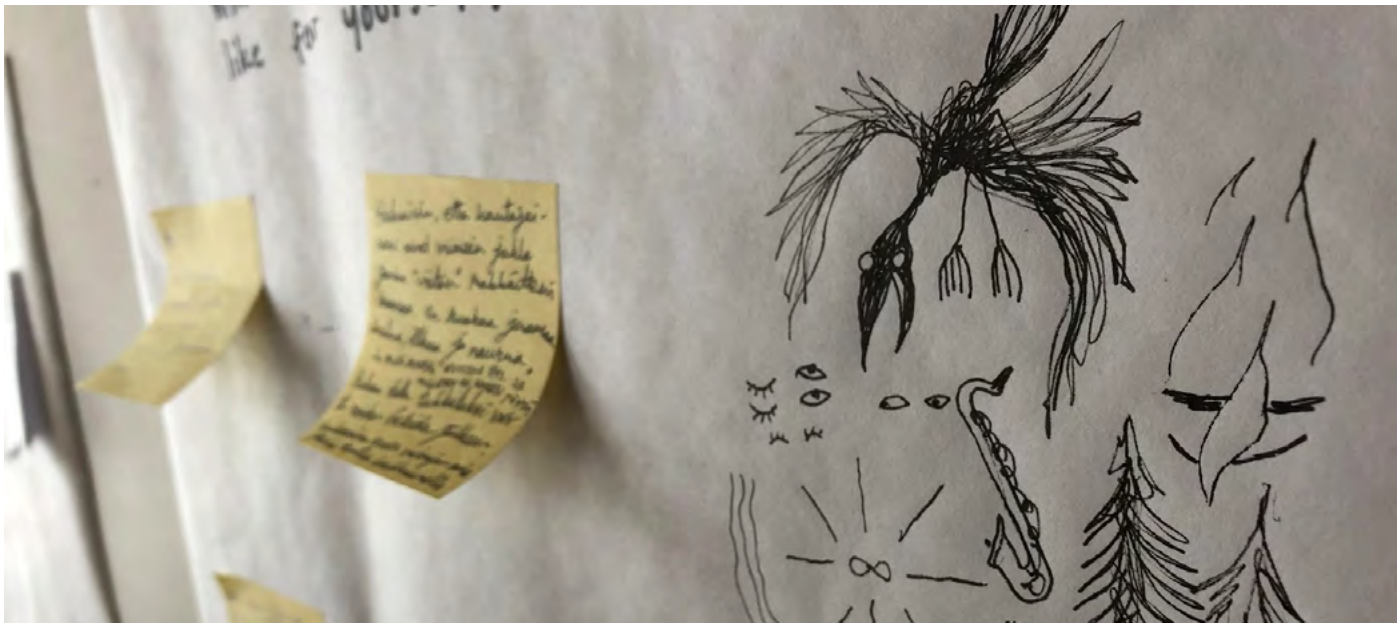


Figure 1. Drawing at Mustarinda House data collection wall.

The analytical approach selected for this study, which was enabled through the reflexive research approaches, was informed by the writings of Bal (2001, 2006) on visual culture and the analysis of visual images as narratives. Bal's approach is based on the logic that visual works contain 'traces' that present clues of how 'the work becomes narrativized' (Bal, 2001, p. 63). These traces are the signs and visual texts in visual images that, once read and interpreted, have the ability to narrate and transfer stories. Such narrativization, once combined with reflexivity, is underpinned by the concept of intertextuality, which 'implies that the adopted sign necessarily comes imbued with meaning' (Bal, 2001, p. 69). Thus, the interpretations coming from the images in this study were 'intertextual' as they transferred meanings across different contexts.

4. Results

4.1 Results of the Data Collecting with Participants

According to the funeral officer we interviewed, fewer people are dealing with death and traditions related to it; for example, fewer are now attending funerals. Obviously, inexperience increases stress and anxiety when the first funeral is to be arranged. In addition to the actual work, funeral officers can potentially play a role in untangling the mysteries and complications that are associated with death. In the interviews with relatives, many stressed the need for slower service experiences and clear instructions as well as a transparent and well communicated process. Funerals are often organized without prior experience, which is why the family members who assume the role of organizers do not always know how to proceed, and they may, and probably do, feel overwhelmed. Funeral officers have recognized this need, and the relatives' role in organizing funerals is usually relatively small. Thus, individualistic choices or one's own rituals are not commonly included. Cultural and religious customs as well as laws also limit self-determined rituals. Relatives often have no information about the deceased's wishes, and this increases the stress. They have a real need for clear, simple and scheduled directions. Practical arrangements such as paperwork should go smoothly for relatives, but dealing with the actual loss often also requires first-hand participation in the burial process. This situation was clearly described by a participant:

> "It would be great if the next of kin had more real-time information about things. As it is, death is hidden behind the funeral home; the idea is that they take care of everything. I think not being able to participate is also stressful for the next of kin." (Participant in web survey, 2017)

In the study, some practiced their own rituals, some in a slightly undisciplined way. For example, one interviewee put keys in a coffin:

> "He lay there quite nicely, the coffin was open and I put the keys of the home in Carelia where he grew up. Even though you're not allowed to put metal inside the coffin, I said 'the hell with it' and did anyway. So it was like he could get home now. He had kept them all his life." (Interviewee, 2018)

Employees of the crematorium also said that they try to fulfil the wishes of relatives as often as possible, not all of which are necessarily in accordance with the instructions. Today, customers desire individualistic choices for funeral artefacts, ceremonies and rituals. Church customs and guidelines, or the views of an individual employee of the church, sometimes limit the options for the rituals of relatives. One of the web survey respondents wrote that they wanted to put a lumberjack's helmet on the coffin at the ceremony, but the pastor had forbidden it.

Some of the participants had also developed their own ways to mourn the loss after the funeral. For example, sisters have a picnic in the cemetery annually and even pour sparkling wine on the grave to the 'delight' of the deceased (Figure 2).



Figure 2. Woman pours sparkling wine on the grave (Picture: Maija-Liisa Kuronen).

Based on the responses from the web survey, it was evident that family members responsible for organizing funerals encountered varying levels of professionalism throughout the service process. Many respondents expressed feelings of stress due to encountering ignorance and unprofessional conduct during the entire journey of organizing the service. For instance, limited resources in terms of space and time in hospitals led to difficulties for relatives and organizers. However, the professionalism displayed by individuals in such situations could significantly impact the experience. An illustrative example of this was an employee who attempted to transform a linen room into a space for relatives to bid farewell to their loved one when no other suitable area was available. Funeral workers emphasized their sensitivity to service experiences and monitored their own behavior to avoid appearing busy. For example, one interviewee mentioned that they never check the time in front of the customer.

The study participants, especially the participants in workshops, expressed a desire for more tangible actions to aid them in coping with their loss, such as shoveling sand onto the coffin, accompanying the ashes, and placing the urn. In many cases the answers reflected the respondents' strong relationship with nature instead of the church. They also explored avenues of self-expression and co-creation, such as utilizing natural stone as a memorial from a meaningful location, planting trees, and crafting coffins. One interviewee even expressed a wish to bake buns and store them in the freezer to be served at their funeral. The data collected through the creative notetaking method also highlighted people's desire for active participation and the importance of nature values. However, the interviewed pastor expressed skepticism towards newer rituals like tree planting, questioning their significance in the absence of established tradition or historical context. They pondered the role of the funeral speaker in such rituals. Nevertheless, they indicated that if such new rituals were not expected to be led by the church, she would not object to relatives partaking in their own farewell ceremonies, emphasizing the importance of allowing individuals to bid farewell in their own way. Interviewed professionals acknowledged the potential for developing new rituals without forsaking established traditions.

4.2 Results of the Self-Reflection and Image Analysis

In this section, the first author of this paper shares reflections from her experience at the crematorium, employing the first-person perspective ('I'). She applied the two steps suggested by Fook (2011) to identify and define the meanings that she saw in the pictures, while also reflecting on, processing and channelling the experiences and thoughts that the participants of the study shared with her.

When I arrived at the crematorium, I was surprised at how harsh, almost cold and extremely simplistic the interior was and the presence of so much concrete. The upper floor was very beautiful, but in an austere way. First, I felt the place was somehow – not sacred – but sensitive, and I was fearing that any misstep, even in the placement of my jacket, could be deemed inappropriate. During the visit, I realized that the crematorium was quite an everyday place. There was no mysticism or spirituality evident, and the cold room was full of human shells, not people. I would not feel comfortable staying alone in the cold room, but I am not afraid of the coffins anymore. I even saw a burning skeleton and felt that the experience made death less awful. The skeleton was no longer complete but a few burning bones. Imaginations of a burning skeleton are much more distressing than witnessing the reality of a burning skeleton in a crematorium.

Burning a body in a crematorium is a very mundane and practical event. Figure 3 shows a coffin ready to be burned in an oven. The coffin is lifted onto the rolling cart. Behind the furnace is a workspace in which the crematory workers supervise the burning of the corpses. The most important thing for workers is to ensure their own safety near the hot ovens and to keep to the schedule given to them. Some relatives ask if they can monitor the burning of the body. The crematorium worker told me that it reduces the mystery of death as the client is introduced to the process without the mysticism, and continued: “And they won’t keep searching for it (the body) anywhere, when they’ve seen it with their own eyes that it’s gone, reduced to dust. It has helped a lot of people”.



Figure 3. Coffin ready to be burnt.

The body disappears into a black hole after one’s life. It even appears like a reverse birth. The atmosphere in the crematorium is unemotional and calm. Steel and tiles give an appearance of efficiency and clinicality. Together with the cart, they form an efficient, clean conveyor belt that efficiently disposes of bodies, the discarded shells of human beings: the viewer may get the impression that it is possible to sweep the dead out of our sight and thus perpetuate the illusion that we have control over our own lives. The coffin is very simple, it is made of unprocessed wood and has cross-shaped screws. The coffin is chosen by relatives and is the only natural object in the picture.



Figure 4. Bones are collected and crushed after cremation.

Figure 4 shows the bones taken out of the oven and three stone balls with which the bones are crushed into ashes. One could easily see something brutal in the picture, but I think crushing the bones is an artisanal stage, even if it is done by machine. At this point, the conveyor belt of the burning of the body seems to slow down, and the crematorium worker picks out foreign objects that are amongst the bones, such as artificial knees and hips made of titanium, porcelain and glass.



Figure 5. A cart in front of a steel desk.

Figure 5 shows a cart that is used to transfer coffins. The cart is empty and is positioned in front of the steel desk that is brightly lit by fluorescent lamps, almost like a spotlight, highlighting the emptiness of the cart. In the middle of the photograph is a black door. This was the first space that I visited when I came to the crematorium. Its coldness felt oppressive at first. Quickly, however, I became accustomed to the facilities, and when I was told that the steel desk was originally meant to be a flower shop I realised my own preconceptions about the premises. Time seems to stand still in the picture. The body no longer exists, but the cart and steel accessories remind us that the body has been eliminated systematically and effectively. Time has stalled, but has the loss been dealt with at the level of mind and body or just swept away? The efficiency of the burial process was also questioned by one of the participants in the web survey (2017):

> "Arranging things went quickly and professionally, but in the middle of grieving, I would have needed a slow service. So I would have had time to think things through."



Figure 6. Room for the farewell to the deceased.

In Figure 6, two metal supports mounted on the wall are depicted, serving as the resting place for the coffin. Additionally, a candlestick holding a lit candle is positioned on the floor, located towards the right side of the image. The room is dim and the walls are made of concrete. The lighting creates patterns on the walls and emphasises its emptiness. There is no coffin, no people and no symbolism related to culture or religion. The word "absence" describes this picture best. It is free from everything; all that remains is a hollow emptiness. However, the areas of light and shadow created by the light bring vibrancy and rhythm to the image.

The images above easily evoke unpleasant emotions, even aversion, in the viewer. This kind of emotion arises from our cultural heritage where anything related to death is both foreign and avoided. We learn in our childhood to fear the things related to death, even cemeteries. Based on these culturally implanted reactions to death, we interpret any images related to it as potentially distressing and intrusive. However, a visit to the crematorium, at the very least, helped me to demystify my thoughts about things related to the deceased. The atmosphere in the crematorium was very different from the image the pictures convey. The employees were nice, and they had highly developed interpersonal skills; after all, they encounter grieving people every day. We drank coffee, and they generously, even proudly, shared information about the important work they were doing.

5. Analysis and Discussion

Death is often unexpected, and relatives need rituals to deal with grief. Many rely on rituals offered by the church because there is nothing else available. However, for processing the loss, it is essential to deal with it through rituals that are personally relevant. The findings from the study indicate that customers will need more opportunities for individualistic choices when organizing funerals and coping with loss.

The first research question asked was, what insights do arts-based research and human-centered design bring to the burial experience. Arts-based research and human-centerd design can be used to identify needs related to burial that support both the smooth running of processes and the emotional experiences of the bereaved. While there is a general desire for services to be efficient, these approaches can be used to identify different needs in relation to burial. Relatives need time and slowness to absorb and understand both the loss they have experienced and the existential, alien, taboo and possibly religious aspects of death. This understanding was gathered in the study, in particular through interviews with relatives and self-reflection and image analysis of the cremation visit. Arts-based research and human-centered design approaches bring out unspoken experiences like preconceptions, the evolution of the bereaved's experience during the process or, for example, the impact of social norms on the relative's experience.

The second research question asked, How can service design contribute to better experiences of loss for the relatives. Service design can improve the carer's experience by putting the bereaved's experience and needs as a starting point, rather than organisational policies and processes. In addition, service design involves understanding the various stages and emotions that relatives go through during the grieving process and customer journey during the entire period. This improves the situation of relatives during a difficult time in their lives. Service design can also be used to identify future needs that service providers can respond to, thus ensuring the future relevance of their services.

According to the current study, relatives need unhurried service when it comes to dealing with a new and unfamiliar matter for them in a situation where they are consumed with grief, not thinking or acting as they normally would. This does not mean procrastination or delaying the burial, but experiencing it without rushing or having time constraints. However, many respondents hoped that the deceased would be buried quickly after their demise because for many the actual mourning began only after the burial. Bereaved needs clear advice, unhurried service, ready-made alternatives and transparency in the burial process.

Involving a relative in various stages of burial, such as preparing the body, make the process more mindfull for the bereaved, and at the same time makes it more humane. If relatives actually take some control of the process of burying their relatives, they can also take the time and actions they need to deal with their loss. The examples in the study showed that, when relatives actively participate in the rituals of death, for example, by being present at the burning of the body, they feel the rituals are more personally meaningful. When one takes the time to fully encounter a loss, for example, by arranging one's own rituals, making something by oneself or even monitoring the burning of the body, it helps to eliminate the mystification associated with death and thus facilitates dealing with the loss. However, it should be noted that each funeral and family experience is unique and the key is to enable everyone to have an experience that suits their needs.

6. Conclusion

The arts-based research used the methods of photography, creative note-taking, and storytelling, enabling slow processes of documentation in reflection by the participants and the researcher. Slowness challenges both our society's quest for maximum efficiency and our delusion that we are immortal. We easily understand our mortality as an abstraction that can be used as an inspiration for art and culture. However, when we have to actually face the death of a loved one, we turn the body over to professionals to take care of and remove it from our sight. Slowness matters when it is time to understand and process the great loss that has taken place.

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P/REFERENCES OF DESIGN

E-TEXTILES IN THE FUTURE OF WELL-BEING AND CARE OF ELDERLY.

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ABSTRACT | In Europe, the ageing population demands innovative solutions to enhance elderly well-being. In the European Union, long-term care services are most often needed by elderly people with health problems. Smart textiles, including electronic textiles (e-textiles), offer holistic care solutions, monitoring vital signs, providing real-time feedback, and supporting cognitive abilities. This paper explores e-textiles' role in addressing elderly care challenges, including physical health, and cognitive performance. The aim is to map the available technology, research, and products already on the market. The challenges, such as privacy concerns, costs, and end-user acceptance, are also discussed. The paper outlines the potential of e-textiles to create innovative solutions for elderly care, and the potential impact of these solutions on society.

1. Introduction

Innovative solutions are increasingly needed to enhance the well-being of elderly populations as communities in Europe age. Elderly people with health problems make up the largest part of those in need of long-term care services (Eurostat, 2020). For example, by 2050, it is predicted that almost 30% of the population in the European Union (EU) will be older than 65 (Eurostat, 2020). In 2020 around 75% of people aged 85 years or more had a long-standing illness or health problem that needed constant monitoring (Eurostat, 2020). More specifically, approximately a quarter of people aged 65 and older in Estonia will be aged 65 by 2030 and 30% by 2060, a significant leap from the 19% recorded in 2016 (Republic of Estonia - Ministry of Social Affairs, 2020). Estonia is a small country with several strong e-services and systems, demonstrating that technology can be seamlessly integrated into daily life. Despite its technology-driven environment, continuous care options supported by technology remain conspicuously absent, yet Estonia's small size can make it an ideal testbed. European care strategy states how the provision of long-term care services (home care, community-based care, and care in residential facilities) should be increased together with adopting quality criteria and standards for long-term care services and supervising their implementation (European Commission, 2022, 2023). In care institutions, elderly care presents a complex landscape of challenges that requires tailored and responsive solutions. Addressing the diverse needs of seniors, electronic textiles (e-textiles) can provide a holistic solution by combining sensory feedback with physical and mental care without losing bodily comfort.

E-textiles are made interactive by incorporating electronics, such as sensors, actuators and soft conductive materials in the textile structure (Hertenberger et al., 2014). Items with e-textiles can provide personalized real-time feedback, for example, support in monitoring vital signs, such as the respiration rate (Guay et al., 2017). Changes in physiological parameters can also be correlated with emotional states. Smart textiles embedded with biometric sensors can measure physiological signals associated with emotions, such as appeasement blanket (SENIORACTU, 2019; STUDIO TWINS PARIS, 2024), heart rate variability (HRV) (Amitrano et al., 2020), skin conductance (Healey, 2011), and temperature (Komolafe et al., 2019) similarly to a smart-watch or a smart ring (Ōura Health Oy, 2024). By detecting changes in residents' emotional states, smart textiles act as empathetic companions. They can improve the mental and emotional well-being of seniors who are isolated or are experiencing cognitive decline. For example, Jiang et al. (2021) developed a smart shawl to visualize physiological data and help regulate emotions. E-textiles can also be highly supportive of communication through tactile and haptic feedback (Schelle et al., 2015). Those solutions can improve the quality of elderly care services, as the care institutions are often short-staffed.

Many e-textile products are available on the market (Levi's et al., 2017; Sensoria, 2022; WearableX, 2022), however, several challenges need addressing to integrate e-textiles into elderly care, particularly in care institutions. To this day, it is customary for innovation and new technologies to reach social care with considerable delay. Many technological solutions that are completely commonplace in the private sector are still little known in the social sector (Republic of Estonia - Ministry of Social Affairs, 2020). The awareness and ability of social workers of different generations to use technical solutions varies greatly, and results in difficulties in introducing innovative solutions in the social sector.

E-textiles offer significant advantages over traditional wearables in healthcare settings, including improved comfort, continuous monitoring, customization, and integration with clothing without limiting movement or adding rigidness, ultimately leading to better patient outcomes and experiences. Thus, this paper explores how e-textiles might be shaping the future of well-being in elderly care, focusing on solutions designed for individual use, and nursing care in hospitals and care institutions. The paper examines the possible role of e-textiles in the well-being and comfort of elderly care in addressing: (1) challenges in physical health together with rehabilitation possibilities; and (2) support of mental and emotional health. The main goal of the work is to analyze current technologies and solutions together with the under-investigated aspects, such as producibility, privacy concerns, high cost, maintenance complexity, and market acceptance. The authors will discuss each of these aspects in the article and demonstrate their importance.

Literature was sourced through Google Scholar (including IEEE Xplore; PubMed; ScienceDirect; ACM Digital Library), Web of Science, and general Google searches (including the European Commission website), encompassing global products. Inclusion criteria emphasized English-language works focusing on technology-supported care, including prototypes, products, services, or studies targeting elderly or long-term care. Exclusions comprised studies not centred on elder well-being or continuous care.

2. Results

This section presents the results driven by the conducted analysis. The authors divided the projects into two umbrella topics: physical and cognitive health support for the elderly with e-textiles.
Figure 1 shows the overview of the division of the result. The physical health topics covered vital signs and movement monitoring, rehabilitation, and safety applications. Providing support for cognitive performance monitoring, assessment, and stimulus as well as emotional well-being was the focus of the cognitive health topics.

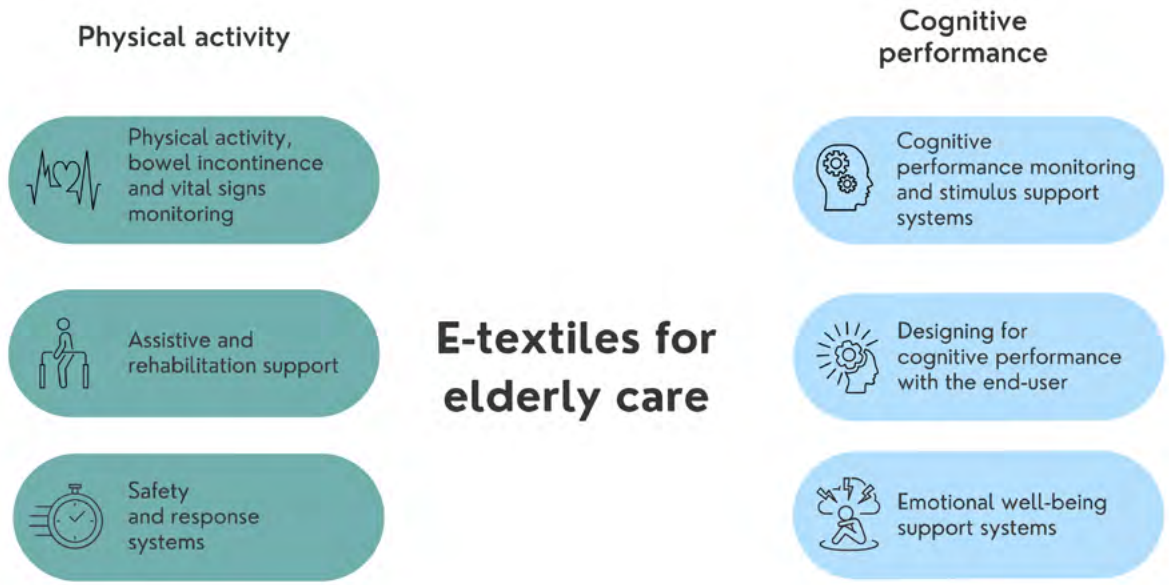


Figure 1. Overview of the results division which consists of two larger topics: Physical activity and Cognitive performance. Physical activity topics are divided into 3 areas: Physical activity, bowel incontinence and vital signs monitoring; Assistive and rehabilitation support; Safety and response systems. Cognitive performance topics are divided into 3 areas: Cognitive performance monitoring and stimulus support systems; Designing for cognitive performance with the end-user (subtopic of previous); Emotional well-being support systems.

1.1 Physical Health with E-Textiles

E-textiles can support comfortable continuous or short-term monitoring of elderly populations with minimal bulkiness and interference with the user's everyday life (Boehm et al., 2016). People's lives can be minimally impacted while supporting healthy ageing and healthcare.

Physical Activity, Bowel Incontinence and Vital Signs Monitoring

Health professionals and caregivers can use movement and vital sign monitoring to assess and manage the health and well-being of their patients. Chronic conditions can be managed more effectively and with lower loss of independence by using continuous vital sign monitoring. Regular monitoring helps healthcare professionals assess the effectiveness of medications and interventions. As a result, individual care plans can be developed more reliably and with fewer resources involved, such as staff involvement, patients' time, etc.

In care institutions, incontinence monitoring is often essential but time-consuming. There are several smart bed systems to monitor incontinence and movement from the bed (Health Quality Ontario, 2018). Fischer et al. (2019) described the development of a sensor mat for detecting urinary incontinence and bed occupancy that can be placed under the bed sheet. Martínez-Estrada et al. (2020), developed a wearable textile system to detect urine leakage. However, these studies were lacking end-user studies, thus, constructive feedback about the comfort and usability of the textile materials.

Electrodermal Activity (EDA) and Galvanic Skin Response (GSR) have emerged as valuable indicators of emotional stress and arousal levels (Healey, 2011; Poh et al., 2010). Electrodermal Activity (EDA) and Galvanic Skin Response (GSR) serve as vital indicators of emotional stress and autonomic nervous system activity, offering insights into overall health and physiological responses. Fluctuations in EDA and GSR patterns may signal changes in sympathetic nervous system activity, potentially indicating pain, discomfort, or medical conditions like urinary incontinence. By integrating these sensors into wearable devices, remote patient monitoring and proactive healthcare management become feasible. Healthcare providers can access collected data remotely, enabling trend tracking, pattern identification, and personalized interventions.

The use of textile electrodes for acquiring biomedical signals to monitor personal and vital functions long-term is one of the most researched e-textile applications (Kubicek et al., 2022). There are several methods of applying, processing and making applications to utilize them. Nigusse et al. (2021) reviewed textile electrodes for the monitoring of ECGs from fundamentals to advancements. In this work, we have emphasized the ones that have been researched for long-term use, more specifically for healthcare and the elderly.

For example, a textronics shirt can show the health status of the monitored person on a mobile device, together with the current date and time of their movements indoors (IPS - Indoor Positioning Systems) and outdoors (GPS - Global Positioning System) (Frydrysiak et al., 2016; Rambausek, 2014). This type of system can support monitoring physical activity and movement in general. However, no end-user tests were described in the reviewed papers. Moreover, using e-textiles with a multi-channel mechanocardiogram (MCG), a wearable system was developed to predict the left ventricular ejection fraction (LVEF) function and provide early warnings about cardiac risk (Lin et al., 2018). Lin et al. (2018) showed an e-textile-based health monitoring system consisting of sensing components, a control platform for the care institution, and a mobile device. The prototype collects electrocardiography signals and monitors heart rates. A fast empirical mode decomposition algorithm was integrated with a hidden Markov model-based algorithm for fall detection for electrocardiography denoising. Wang et al. (2017) and Esfahani (2021) give a comprehensive overview of similar developments and technologies, including body temperature measurements, blood pressure and pulse.

Hexoskin has several products on the market for precise and continuous cardiac, respiratory, and activity monitoring (Hexoskin, 2024). Emglare and Sensoria offer several similar products but only for sports applications (Emglare Inc, 2024; Sensoria, 2022). Sensoria also has Sensoria® Mat to support wheelchair-related in-seat movement and pressure (Sensoria Health, 2024). In general, while the technology seems readily available, it has not reached the elderly care community (Jordan et al., 2023). This lack of access can be attributed to several factors, such as limited financial resources, lack of digital literacy, and lack of government support.

Assistive and Rehabilitation Support

Clothing with embedded electronics can motivate movement and offer location-based real-time simulation feedback for rehabilitation. For example, Vigour “a knitted cardigan with integrated stretch sensors monitors the movements of the upper body to give tailored feedback to the patient’s movement exercises in real-time utilizing sound“ (Ten Bhömer et al., 2013a; Ten Bhömer et al., 2014). Ten Bhömer et al. (2013a) introduced Vibe-ing - a vibration therapy garment that invites the body to feel, move, and heal using electronic circuits in knitted pockets. The prototype with embedded electronics motivated movement and

offered location-based stimulation for rehabilitation. However, no end-user study was introduced. Raad et al. (2019) presented a smart glove for rheumatoid arthritis rehabilitation support. Remotely analyzing a patient's finger flexions while performing various home activities can make an otherwise labour-intensive process more efficient. Yves Béhar's studio, in collaboration with robotics company Superflex, took a step further with The Aura Powered Clothing collection (Morby, 2017). They designed clothes for the ageing population to hold a higher level of physical strength through a series of motors embedded in hexagonal pods. Sensors were placed on the torso, hips, legs, and back. In each "pod," artificial intelligence reacts to the body's natural movements and adds muscle power to help the wearer get up, sit down, or remain upright. The robotics partner Superflex is now a company Seismic which produces similar products but is branded as workwear (Seismic ©, 2022).

Vibroacoustic therapy in e-textiles (blankets, vests etc) can improve well-being and support physical and mental health. In rehabilitation and physical health aspects, vibroacoustic therapy with low-frequency pure sound is found beneficial for muscle tension, chronic pain, insomnia, anxiety and many other mental and physical disorders (Ernst, 2022). However, it is also important to be careful with the vibroacoustic hazards and keep in mind the intensity and frequencies used (Koradecka, 2010).

Phototherapy uses light to treat certain medical conditions. It is most commonly used to treat skin abnormalities, but it can also help with pain management, depression, and anxiety (Seidel et al., 2021). Low-Level Laser Therapy (LLLT) and Ultraviolet light therapy (UV) are commonly used examples of light therapy. Biological response in tissue can be induced by UV therapy by using the electromagnetic wavelength between X-rays and visible light, as opposed to LLLT, which uses a low-powered laser light (Seidel et al., 2021). For example, a conformable blue light therapy device was demonstrated by Jablonski et al. (2014). Shen (2013) and Quandt et al. (2017) demonstrated how luminous polymer optical fibre (POF) fabrics can be used for phototherapy.

Physiotherapy requires a lot of one-on-one time from the therapists. K. Yang et al. (2018) developed a sleeve with electrodes to do seamless muscle stimulation on the upper limb for stroke patients to achieve functional tasks, like hand opening. Liu et al. (2023) described an e-textile-based functional electrical stimulation system for post-stroke upper limb rehabilitation with a small end/user test group. The authors concluded that the fabric electrode offered similar stimulation compared to commercial hydrogel electrodes' performance with the advantage of being suitable for wearable applications and having a long service life.

Moreover, Grimm et al. (2016) described how wearable sensors can benefit the elderly as clinometric tools by counting specific events, such as stairs, or analyzing qualitative parameters, such as step frequency. The article also highlighted that popular consumer activity monitors, such as Fitbit, did not provide the accuracy needed, especially for elderly or disabled patients. Error rates for hip and wrist sensors were more than 60% for both.

Safety and Response Systems

Safety and response systems are essential components of elderly care. However, these systems often lack context-based sensors. Thus, they need activation to work, or have not been developed with user comfort in mind, e.g. materials are not breathable (Medi.ee, 2024; RehabMart.com LLC, 2023, 2024a, 2024b). Movement monitoring technology is evolving rapidly. For example, different IoT (Internet of Things) technologies are available to help monitor remotely and support caregivers - either monitoring the movement with set-up sensors in the room or wearable technology (Ianzito, 2020; Stack Labs, 2023). However, it is still often rejected by the end user due to not trusting the technology or uncomfortable wear (Sung et al., 2022; Tan et al., 2022).

Movement monitoring for safety reasons can have many aspects, like monitoring for wandering or fall (risk) detection. For example, the BalanceBelt is an assistive device that uses haptic feedback to help patients with severe balance disorders overcome their problems and regain their independence (Elitac Wearables,

2024). Using vibrational feedback, the belt detects the direction the wearer is leaning in and alerts them. Moreover, there are several use cases for movement monitoring with e-textiles (Edmison et al., 2004; Elo et al., 2022; Li et al., 2020; Veske et al., 2022). Yu et al. (2020) presented an integrated carpet for self-powered fall detection, using textile-triboelectric nanogenerators (t-TENGs). While the prototype showed excellent first results, there were no end-user tests mentioned.

Furthermore, fall detection is an essential component of elderly care. Similarly to BalanceBelt, (Rahemtulla et al., 2023) investigated near-fall with e-textile socks. The work focused on identifying near-falls, such as tumbles, and more specifically, distinguishing them from falls. USA-based company Palarum offers socks "developed by nurses for nurses to prevent patient falls" (PUP® socks) (Palarum, 2024). Ning et al. (2021) showcased technology for wearable hip-protection airbags to protect the elderly during the fall. One example from the market is TangoBelt (Tango Technologies®, 2022; Tarbert et al., 2021). The belt is equipped with an IMU (inertial measurement unit) that detects falls through an algorithm and deploys an airbag before the user touches the ground. With several examples, Buffagni (2019) gives an extensive overview of this type of research.

Movement monitoring for wandering can be essential in private and care institutions for the elderly due to dementia. While the market offers many remote tracking devices for homes, it can be difficult in care institutions (Just Checking, 2024). Constant supervision requires high staffing numbers. To have quality care with minimal invasion of independence, e-textiles can provide alternative support systems. Fong et al. (2018) proposed how smart clothing can be used in nursing care. The work showed how an emergency can be managed with location tracking by computing the relative position of residents from wireless access points. Sung et al. (2022) made a study with a smart vest that was worn by dementia patients in nursing care. The vest had sensors integrated into them and communicated with movement detectors in the room. However, the authors highlighted that patients were reluctant to wear the vest which is an important note for the product developers.

1.2 Cognitive Performance with E-Textiles

Cognitive assistance technologies, including both textile and non-textile solutions, are being studied alongside passive materials like regular textiles. These innovations aim to offer reminders for medication, appointments, and daily tasks, providing support for seniors facing memory-related challenges (Jiang et al., 2021; Oatley et al., 2021). It is possible to send these reminders through voice, text, or even haptic feedback. As a result, seniors can stay organized and on track with their daily activities, improving their overall quality of life (Motti, 2019).

Cognitive Performance Monitoring and Stimulus Support Systems

Cognitive performance can be assessed and improved through gamification or playful methods. One concept study aimed to both entertain and monitor together with an assessment of the behaviour of people with dementia or its precursor of Mild Cognitive Impairment (MCI) (Oatley et al., 2021). The study used light-emitting diodes (LEDs) and capacitive touch sensors woven into a fabric to augment the traditional activity apron by incorporating light and sound effects as feedback when people interact with different regions of the textile.

Communication can be or feel inhibited by the elderly due to different diseases, loneliness, staying in long-term care institutions or other factors (Comiotto et al., 2016). Vihriälä et al. (2023) highlight the term "complex communication needs". It refers to natural communication methods, such as speech, writing, and gestures, being inadequate to fulfil the person's functional communication needs. Tactile Dialogues are designed to stimulate movement and communication for patients in the late stages of dementia, their family members, and their caregivers (Schelle et al., 2015; Ten Bhömer, 2016, 2022). Through using vibrotactile stimulus patterns and haptic sensations, the developed pillow encourages patients to move and develop conversations in a more alternative yet bodily manner. The project was evaluated in different sessions together with the end-users. Family members were given space and inspiration to encourage their

loved ones with dementia to talk and move more through the prototype. The activity also served as a conversation starter.

A smart shawl developed by Jiang et al. (2021) visualized physiological data and regulates emotions. Based on the wearer's emotional arousal, the prototype captured emotion data using the EDA (electrodermal activity) sensor. Then the emotional state was visualized through light and vibration. Morrison et al. (2018) presented vibrotactile vests that interacted with a vibroacoustic wall in an urban space. This wall was designed to exchange vibrational and physiological information with the wearable vest. In pairs, people interacted with a friend, family member, social friend, romantic partner, or colleague. In two areas of the wall, participants heard and felt their heartbeat and breath rate while performing actions on the wall (such as knocking and swiping). The work reported that in response to the patterns, the participants reported feeling peaceful, therapeutic, and good.

The “Joy, Peace, Grace and Life” project developed a sensory wall (Tan et al., 2022). The polymeric optical fibre fabric was woven with different motifs, and touch-sensitive e-textile embellishments were created using conductive yarn through knitting, embroidery, and other textile constructions. To provide different textures, conductive yarn was combined with textural yarns, feathers, and sequins. Different stakeholders evaluated the prototype: 13 people with early-stage dementia, 9 caregivers, 4 family members, 6 social workers, 1 occupational therapist and the care institution director. Overall, the reception was good, but the authors highlighted that better customization would benefit the prototype.

Designing for Cognitive Performance with the End-User

Literature for elderly care with e-textiles showcased studies that focused on co-designing with caregivers and the elderly. Loss of communication skills can be one of the most significant and detrimental psycho-social characteristics and can have a dehumanizing effect thus creating psychological and emotional distress (Gowans et al., 2007).

Nevay et al. (2015) describe workshops in which older adults living in care institutions designed their own wearables. Design activities focused on craft enabled residents and designers to have new conversations and gain a deeper understanding of residents' real-life experiences, ideas, and skills. Furthermore, Elo et al. (2022) highlighted how diverse studies are focusing on individual applications of assistive e-textiles, few involve a diverse range of stakeholders in the design process. Therefore, the authors organized five multidisciplinary ideation workshops with 50 participants from different backgrounds and roles to gain stakeholder-oriented knowledge on the development of assistive e-textiles. Yang et al. (2022) conducted qualitative research and co-creation workshops to bring together older adults and a multidisciplinary team to develop smart assistive technology solutions. For example, they aimed to identify the critical factors affecting technology acceptability among older adults and how the products should look and feel to be accepted.

Mann et al. (2017) showcased a positive design method involving caregivers in the process of producing customized solutions that are meaningful and helpful. Authors came up with several prototypes, such as a Memory Game to tackle cognitive decline where LEDs were used to interact. Another example is from Jakob et al. (2017), where interdisciplinary research on “Multi-Sensory Environments” for elderly care started by identifying the challenges in the healthcare system and then using a user-centred design approach. The authors also highlighted how textiles have several benefits, such as “creating a warm, comfortable and calm atmosphere reducing negative sensory stimuli such as glares and noise”. Also, members of the general public were invited to participate in Hand i Pocket “funshops” to create sensory textile pockets for those with late-stage dementia (Cardiff Metropolitan University - CARIAD - LAUGH, 2017). The workshops created awareness around dementia and allowed the caregivers and family members to share knowledge and experiences and lose stigma around the topic.

Emotional Well-Being Support Systems

Emotional well-being is essential for any age. However, elderly people can feel loneliness more due to moving to care institutions, lack of everyday contact with loved ones, and other factors. This can cause feelings of isolation and depression, leading to a decrease in quality of life. Different e-textile solutions can support well-being providing comfort, warmth, and a sense of security due to their nice tactile feel.

Treadaway et al. (2015) showcased with several small prototypes that interactive textiles have assisted patients with late-stage dementia in communication and connection with others. Moreover, the results showed they have provided a means of relaxation and distraction and stimulated interest in general (Treadaway & Kenning, 2015). Moreover, Kristin Neidlinger from the Sensoree designed several wearables prototypes to monitor physiological states and translate feelings into auditory, visual, and or tactile displays. Ger Mood Sweater, for example, uses an illuminated collar to read emotion and show excitement levels instantly (Sensoree, 2013). Furthermore, the FleXo prototype acts as a remote physiotherapist by detecting mood and adjusting inflatable acupressure points based on biosensors (Sensoree, 2018).

Multisensory blanket from Maase utilizes non-heat generating LED lights and plush materials to induce a calming effect to aid those dealing with anxiety, autism and sensory processing disorders (SENIORACTU, 2019; STUDIO TWINS PARIS, 2024). The soft glow from the LED lights promotes relaxation, and the plush texture of the blanket provides a soothing tactile experience. Multisensory blankets have the flexibility to integrate various textures and colours, engaging different senses such as touch and sight. This active stimulation can help revive forgotten memories from earlier years by triggering sensory associations and connections. Beyond memory enhancement, these blankets contribute to the overall well-being and safety of elderly individuals. Another study presented a reactive undershirt with embedded textile-based pneumatic actuators that deliver tactile stimulation in response to a change in emotional state to calm anxiety (Goncu-Berk et al., 2020). The prototype has not been validated by end-users yet but such testing is planned (Goncu-Berk et al., 2020; Goncu-Berk et al., 2021).

1.3 Overview

Table 1 shows an overview of tested prototypes and products highlighted in the text. The table overview excluded pure research and proofs-of-concept because they were too far away from the user.

Table 1. Overview of tested prototypes and products highlighted in text.

Category	Sub-category	Solution	Materials	Author	Goal
Physical	Assistive/ Rehabilitation	Vigour	Stretch sensors are made of conductive yarn, electronics, and wool.	(Ten Bhömer et al., 2013b; Ten Bhömer & Van Dongen, 2014)	Measure movement of the arms and lower back, thus, improving the rehabilitation service by keeping the exercises challenging
Physical	Assistive/ Rehabilitation	Smart glove for rheumatoid arthritis	Flex sensor and BLE Nano.	(Raad et al., 2019)	Assist physiotherapists in remotely analysing patients' finger flexions when performing diverse activities at home

Category	Sub-category	Solution	Materials	Author	Goal
Physical	Assistive/ Rehabilitation	Seismic suits	IMUs, sensors, CPU (central processing unit). Materials described: lightweight, breathable	(Seismic ©, 2022)	Reduce muscle strain and fatigue by providing your core with extra power and stability.
Physical	Assistive/ Rehabilitation	Electrode sleeve	IMUs, conductive wires, non/woven fabric with carbon material layers.	(K. Yang et al., 2018)	Training system for stroke rehabilitation
Physical	Physical activity	Balance-Belt	Vibration motors, accelerometer.	(Elitac Wearables, 2024; Kingma et al., 2019)	Correction of body position and improving balance based on haptic feedback.
Physical	Physical activity	MCG shirt	Accelerometers.	(Lin et al., 2018)	Predict the left ventricular ejection fraction (LVEF) function and provide early warnings about cardiac risk
Physical	Physical activity	Hexoskin	ECG & Respiratory sensors and a precise Activity sensor. Textile: 73% Polyamide Micro/27% Elastane.	(Hexoskin, 2024)	Monitoring continuous cardiac, respiratory, and activity
Physical	Physical activity	Sensoria® Mat	Four pressure sensors, Bluetooth-enabled box with electronics.	(Sensoria Health, 2024)	Wheelchair cushion to remind to do pressure relief activities; tracks and monitors the quality of each repetition.
Physical	Safety	Near-fall socks	Microcontroller, IMU, “e-yarns” braided with polyester yarns, knitted sock using Stretchline and Nylon yarns	(Rahemtulla, 2023)	Senses near-fall situations and sends alerts.

Category	Sub-category	Solution	Materials	Author	Goal
Physical	Safety	Palarum - fall prevention socks	Electroconductive fibre with pressure sensors on the bottom	(Palarum, 2024)	Senses fall and send alerts.
Physical	Safety	TangoBelt	IMU, airbags.	(Tango Technologies®, 2022)	Protects the users during a fall by using airbags on hips.
Physical	Safety	Smart vest for dementia patients	Movement sensors.	(Sung et al., 2022)	Tracks movements and sends alerts when needed.
Cognitive	Emotional well-being	Smart sock	Fabric electrodes, electronics.	(Healey, 2011)	Psycho-physiological monitoring system and a wearable sensing unit for emotional reactions
Cognitive	Emotional well-being	Maase	LEDs, speakers.	(STUDIO TWINS PARIS, 2024)	Create a calming effect through music and sound.
Cognitive	Emotional well-being	Different textile artefacts	Electronics, sensors, LEDs.	(Treadaway et al., 2016)	Assisting patients with late-stage dementia in communication and connection with others.
Cognitive	Performance and/or assistance	E-motion-Wear prototype	LEDs, vibration motors, conductive wires, electronics jersey fabric	(Jiang et al., 2021)	Emotional data sensing and visualization through light and vibration.
Cognitive	Performance and/or assistance	Smart textile apron prototype	Electronics, sensors, LEDs.	(Oatley et al., 2021)	Gamification of cognitive tests.
Cognitive	Performance and/or assistance	Tactile Dialogues	Vibration motors, conductive yarn, electronics, cotton.	(Schelle et al., 2015; Ten Bhömer, 2022)	Stimulate movement and communication for patients in the late stages of dementia, their family members, and their caregivers.
Cognitive	Performance and/or assistance	Vibrotactile Wearable Vest and Wall	Vest: 32 vibration actuators, The Zephyr BioHarness 3.	(Morrison et al., 2018)	Wall and vest were to exchange vibrational and physiological information together with people using them.

Category	Sub-category	Solution	Materials	Author	Goal
Cognitive	Performance and/or assistance	Sensory wall	Polymeric optical fibre, conductive yarn.	(Tan et al., 2022)	Support sensory activities to increase social engagement for people with dementia.

3. Discussion

Wearable devices like smartwatches and rings have gained widespread popularity, especially among people keen on monitoring and enhancing their health, sleep, and overall well-being. However, criticisms have been raised regarding their suitability for elderly care, citing issues such as forgetfulness to wear them, discomfort with prolonged use, and difficulty in wearing them (Sung et al., 2022). Despite these drawbacks, they offer durability, reliability, and easy maintenance. On the other hand, e-textile-based clothing shows promise for addressing these concerns, offering comfortable materials and seamless integration of technology. It allows for the collection of movement and other relevant data for personalized care, blending seamlessly into everyday clothing and providing a comfortable touch to the body. However, challenges remain in terms of cleaning and longevity.

This work examined available or researched solutions designed for elderly care for individual use, and nursing care in hospitals and care institutions. The focus was the challenges in physical health together with rehabilitation possibilities and the support of mental and emotional health. The found works are now analyzed based on different aspects, such as end-users (elderly and caregivers) validation, producibility and cost, privacy concerns, materials information, sustainability, and standardization.

However, despite the potential benefits of e-textile-based items, the end-user validations appeared to be lacking. Thus, to make use of the potential benefits of e-textile-based care, there is a critical need for end-user validation and further research and development (Bryson, 2015; Yang et al., 2019). Moreover, research shows that fear of innovation can be a significant barrier to change in social care (Bryson, 2015; Nevay & Lim, 2015; Nevay et al., 2017). Social scientists are essential to such studies and should be part of the future development of e-textile applications for care and their evaluation. Incorporating e-textile technology into care institutions may present integration challenges. Innovative technologies might not always be welcomed, and optimizing the benefits of these tools requires ongoing education. In addition to being comfortable, easy-to-use, and aesthetically pleasing, e-textiles should also support people with varied vision, hearing, physical, and cognitive abilities. Authors believe that as the younger generation enters the field, it may alleviate barriers to integrating new technologies and drive innovation in elderly care. This also prompts reflection on the attractiveness of the caregiving profession, necessitating upgrades to compensation packages and fostering a culture of learning.

Launching new digital solutions can be a significant source of stress for caregivers and other employees, leading to burnout or resistance to work if there is insufficient leadership and support. Thus, caring for caregivers is essential, as evidenced by initiatives like MVO Caring workwear (by-wire.net, 2014), which addresses issues such as posture and air quality to support nurses in their demanding roles. Research by Han et al. (2022) highlights the significant impact of assistive smart textiles in reducing caregiver anxiety, further emphasizing the potential of e-textiles in enhancing the overall well-being of both seniors and those who care for them. To reduce stress during the transition period to technology, the authors emphasize that caregivers must be fully informed of these changes.

The absence of standardized regulations poses challenges in ensuring the quality and safety of e-textiles in elderly care. Social workers, dedicated to the well-being of their clients and communities, may fear unintended consequences or ethical dilemmas that could arise from implementing innovative

technologies. Furthermore, gathering sensitive health data through wearable technology raises privacy and ethical concerns (European Union, 2016a). Authors highlight that striking a balance between safety monitoring and respecting residents' privacy and personal autonomy is essential (European Union, 2016b). Monitoring a vulnerable person requires special attention - if the person can understand their situation, intervention is always based on personal informed consent. Ethical rules are essential and may vary based on the culture, country, and end-user. Furthermore, any type of data collection, analysis and exchange between products is considered confidential data. This can include product sizes, medical data, frequency of use, etc. Additionally, e-textiles require regular maintenance and software upgrades. Ensuring a sustainable, long-term strategy for maintenance and keeping the technology up to date is essential for continued success. They might work better in a service system rather than standalone products. All these aspects were not addressed in the reviewed work and need very strong future developments.

As a result of the regulations and the need for medical documentation, the subject of cost needs to be discussed. E-textile solutions are expensive to implement. Ensuring accessibility for all residents, regardless of financial means, is a challenge that needs to be addressed for widespread adoption. Thus, different smart solutions are often late in the social field and that is caused by several factors (Yang et al., 2019). Social work and related fields are often very distant and unfamiliar to technology developers. Research finds that the market does not seem appealing, because there are often few financial resources and there is no formulated client - often the user and the owner are different (respectively, for example, elderly service user and local municipality). For instance, currently, the social sector and technology-based entrepreneurship in Estonia are still practically separate. Universal terminology, compatible systems, and consensus on data protection and ethical issues are seriously lacking. Any inaccuracies or malfunctions could lead to incorrect health assessments compromise the safety of residents and hinder future technological support system integrations. Materials used must prioritize durability, antibacterial properties, and comfort, including tactile feel and breathability, to maximize user acceptance and adherence. Interestingly, acceptance of such solutions may be higher among individuals accustomed to wearing technology, suggesting the importance of designing for future elderly populations who grew up with digital advancements. Most studies and products in this work did not expand on the textile materials. However, this might be one of the main arguments in user acceptance and, thus, would need to be a part of future developments.

Moreover, our contributions to the world today must meet sustainability regulations and consider beyond human needs to have a positive effect. From the screened literature, only a few highlighted the topic. As an example, Elo et al. (2022) found that sustainability was not a topic raised by different stakeholders in elderly and healthcare workshops. However, Van der Velden et al. (2015) discuss the importance of material selection in developing e-textiles.

4. Conclusions

As the elderly population in Europe is ageing, innovating solutions for care is essential to their well-being, especially for those with long-term health issues. This article provided an overview of how personalized real-time feedback can be provided by e-textiles to address both physical (activity, incontinence, and vital signs monitoring) and mental (cognitive performance and emotional well-being) care needs. This interdisciplinary approach not only benefits the elderly but also shares similarities with designing for individuals with various cognitive abilities (Kuusk et al., 2019) and children (Kubinyi et al., 2021), as demonstrated in educational initiatives. E-textiles promote independence and health in the elderly by utilizing close-to-body technology. Overall, e-textiles can provide feedback to healthcare professionals, allowing them to give continuous support and tailor different rehabilitation programs to each patient's individual needs. This can help to reduce healthcare costs, and accessibility and improve patient outcomes together with early intervention or even prevention.

There are still challenges in using e-textiles in elderly care settings. External factors play a key role – such as the priorities in the society related to a particular problem and the political, economic, and cultural

context. Overcoming these challenges requires addressing issues, such as awareness amongst social workers, producibility, privacy concerns, cost, complexity of maintenance, and end-user acceptance. Despite this, the potential of e-textiles to improve elderly care, particularly when it comes to addressing physical and emotional challenges, demonstrates the need for continued research and development. To have a system that is supported by the social system, these products and practices must be developed closely with the end-users (caregivers and the elderly) to be fully implemented later. Estonia, as a small, technology-driven country can serve as a testbed where e-textiles as part of the care system could be implemented via its lively start-up scene.

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P/REFERENCES OF DESIGN

UTILISING CLOTHING WASTE TO ALLEVIATE PERIOD POVERTY IN SOUTH AFRICA.

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ABSTRACT | Period poverty is a problem affecting schoolgirls in South Africa and often results in them missing school during menstrual cycles. Concomitantly, discarded clothing is contributing to a growing landfill crisis. To mitigate the effect of these problems, the 'Sustain Her' voluntary community-based project, an initiative by a South African non-profit organisation aimed to utilise discarded clothing to create reusable sanitary pads that could be gifted to schoolgirls. This paper aims to answer the research question: How can clothing waste be utilised to create reusable sanitary pads and empower communities? This aim is pursued by first contextualising the 'Sustain Her' project and secondly by contextualising the opportunities and challenges of the 'Sustain Her' project. The research methodology employed is qualitative autoethnography because the author facilitated and participated in the 'Sustain Her' voluntary community-based project, and the findings of the paper are based on the author's personal experience and observations recorded in personal reflective notes. The 'Sustain Her' project showed that it is possible to recycle discarded clothing to create reusable sanitary pads for schoolgirls, to mitigate period poverty. To that end, community volunteers appeared eager to be involved in the 'Sustain Her' project, and seemed empowered to sort clothing, and perform basic cutting and hand sewing operations. The volunteers' machine sewing skills varied which made achieving a consistent quality of sanitary pad challenging. Several volunteers appeared eager to develop their machine sewing skills but due to various challenges, training was not possible.

1. Introduction

"Period poverty" is a term that refers to the lack of financial means to obtain menstrual products, such as sanitary pads (Department of Women, Youth and Persons with Disabilities, 2019; Michel et al., 2022; United Nations Population Fund (UNFPA), 2022; Vardapetyan, 2021). Period poverty is a global problem that affects millions of women and girls (Michel et al., 2022; The World Bank, 2023). It is estimated that seven million South African schoolgirls suffer from period poverty which results in them missing up to five days of school every month (Ekane, et al., 2014; I_Menstruate, 2023; Kgware, 2016; Khamisa et al., 2022; Modise, 2013). The implication is that period poverty is a potential barrier that may inhibit girls from attaining essential education.

Menstrual products can be disposable or reusable. Disposable menstrual products are only used once for a few hours and are therefore not environmentally sustainable because they result in large amounts of waste (The World Bank, 2023; United Nations (International) Children's (Emergency) Fund (UNICEF), 2019). Disposable menstrual products are often discarded in landfills, flushed down the toilet, which causes sewerage blockages, or burned, resulting in toxic air pollution (Khamisa et al., 2022; UNICEF, 2019). Reusable menstrual products, however, such as sanitary pads made from fabric and silicon menstrual cups, provide a more sustainable alternative because they can be used multiple times and therefore greatly reduce waste (UNFPA, 2022; UNICEF, 2019).

Reusable sanitary pads have the potential to provide a long-term solution to period poverty because they require less financial investment in the long term than disposable menstrual products and can be constructed from fabrics that are easy to obtain, such as from clothing waste. Large volumes of clothing are disposed of annually, with two-thirds discarded within one year of purchase (Dean, 2020; Santi, 2023; Zurich, 2023). Excessive clothing consumption and disposal, coupled with a lack of textile recycling programmes in South Africa, has resulted in an ever-growing landfill crisis (Dean, 2020; Jenkin & Hattingh, 2022; Nkosi, 2022; Qukula, 2022; Rewoven, 2023; Santi, 2023; Wadula, 2022; Zurich, 2023). To mitigate the effect of these problems, discarded clothing could be utilised to create reusable menstrual products and potentially empower communities. This was the goal of the 'Sustain Her' project, an initiative by a South African non-profit organisation (NPO), which aimed to utilise discarded clothing to create reusable sanitary pads that could be gifted to schoolgirls to alleviate the effect of period poverty.

This paper embeds itself in the research question: How can clothing waste be utilised to create reusable sanitary pads and empower communities? To align with the research question, this paper has a two-part aim. Firstly, to contextualise the 'Sustain Her' voluntary community-based project and, secondly, to contextualise the opportunities and challenges of the 'Sustain Her' voluntary community-based project.

2. Literature Review

Menstruation is a normal monthly occurrence for women and girls from the age of puberty to menopause (National Health Service (NHS), 2023; UNICEF, 2018). However, due to lack of accurate menstruation knowledge, the menstrual experience is often accompanied by feelings of shame and secrecy perpetuated by social myths such as ideas that girls are unable to perform everyday activities such as cook food, bathe, or sleep in their own beds during their periods (Barrington et al., 2021; Davis et al., 2018; ElGilany et al., 2005; Hennegan et al., 2021; McMahon et al., 2011; Miiro et al., 2018; Montgomery et al., 2016; Thomson et al., 2019; UNICEF, 2019). As a result of these misconceptions and negative attitudes towards menstruation, and the embarrassment associated with not being able to afford menstrual products, girls are often reluctant to discuss their period-related challenges (Boosey et al., 2014; Dolan et al., 2013; Mason et al., 2013; McMahon et al., 2011; Montgomery et al., 2016; Sommer & Kirk, 2008). As such, despite much research being conducted with regard to the effects of period poverty on schoolgirls, it is possible that the effects of period poverty are worse than currently reflected in the literature. However, the literature suggests that period poverty has a negative effect on the physical, mental, and socio-economic wellbeing of schoolgirls (Department of Women, 2017; Rodriguez, 2021).

Studies indicate that, to overcome the effects of period poverty, some schoolgirls may engage in transactional sex or use inappropriate alternative menstrual products, which can negatively impact their health (Chinyama et al., 2019; I_Menstruate, 2023; Khamisa et al., 2022; Malusu & Zani, 2014; Mason et al., 2013; Montgomery et al., 2016; Nobelius et al., 2010; Ssewanyana & Bitanihirwe, 2019; Tegegne & Sisay, 2014; UNFPA, 2022; Phillips-Howard et al., 2015). Transactional sex in the context of period poverty is the act of trading sexual relations for menstrual products or for money to purchase menstrual products (Tegegne & Sisay, 2014; Tellier & Hyttel, 2018). This behaviour increases the risk of teen pregnancy, early marriage and contracting sexually transmitted diseases such as the Human Immunodeficiency Virus (HIV) (Mason et al., 2013; Tellier & Hyttel, 2018). Despite these risks, studies indicate that sex in exchange for menstrual products is socially acceptable in many countries (Mason et al., 2013; Tegegne & Sisay, 2014).

Alternative menstrual products such as leaves, newspaper, cotton wool and old rags are utilised by many schoolgirls when they cannot obtain menstrual products (Chinyama et al., 2019; I_Menstruate, 2023; Khamisa et al., 2022; Montgomery et al., 2016; Ssewanyana & Bitanihirwe, 2019; Tegegne & Sisay, 2014; UNFPA, 2022). These alternatives are often unhygienic because they disintegrate during use or cannot be thoroughly cleaned, which can cause reproductive tract infections and even infertility (Baker et al., 2017; I_Menstruate, 2023; Mishra, 2015; Montgomery et al., 2012; Ssewanyana & Bitanihirwe, 2019; The World Bank, 2023).

Alternative menstrual products are often ineffective at absorbing menstrual fluid, resulting in leaking and staining on girls' clothing (Chinyama et al., 2019; Montgomery et al., 2016). Studies indicate that visible leaks cause shame and embarrassment for schoolgirls and are often the focus of derogatory comments from classmates (Boosey et al., 2014; Mason et al., 2013; Miiro et al., 2022; Montgomery et al. 2016). Bullying by peers, coupled with the shame of not being able to access menstrual products, causes psychological distress and decreased self-confidence in schoolgirls (Department of Women, 2017; Ssewanyana & Bitanihirwe, 2019; Tegegne & Sisay, 2014).

The fear of embarrassment and bullying increases the likelihood of girls being absent from school during their periods (Boosey et al., 2014; Davis et al., 2018; International Federation of Red Cross and Red Crescent Societies (IFRC), 2013; I_Menstruate, 2023; Mansoori et al., 2020; Mason et al., 2013; Mason et al., 2015; Miiro et al., 2018; Montgomery et al., 2016). Studies further indicate that the fear of menstrual leaking decreases girls' ability to concentrate during lessons and reduces their willingness to participate in classroom activities (Jewitt & Ryley, 2014; Mason et al., 2013; McMahon et al., 2011; Tegegne & Sisay, 2014; Van Biljon & Burger, 2019). Frequent absenteeism and the inability to concentrate in class because of menstrual period associated fears, results in gaps in knowledge, decreases academic performance and increases the likelihood that girls will leave school before completing their education (Boosey et al., 2014; I_Menstruate, 2023; Tamiru, 2014; United Nations Educational, Scientific and Cultural Organization (UNESCO), 2015; UNFPA, 2022). Lack of education diminishes a girl's employment options and increases the probability that she will remain in poverty (Department of Women, 2017; The World Bank, 2023).

In 2017 the Department of Women, a ministry of the South African government, published the Sanitary Dignity Policy Framework (Department of Women, 2017). The aim of this framework was "to promote sanitary dignity" and to set out standards for providing menstrual products to those affected by period poverty (Department of Women, 2017, p. 3). According to this framework, access to menstrual products to ensure dignity during menstruation is a fundamental human right that must be provided for by the government (Department of Women, 2017). Since this framework was published the South African government, in partnership with the private sector, has launched several campaigns to distribute disposable sanitary pads to schoolgirls in low-income areas across South Africa (I_Menstruate, 2023; Parliamentary Monitoring Group, 2018a, 2018b; Van Biljon & Burger, 2019). However, the distribution of these disposable sanitary pads has allegedly been sporadic and unreliable (I_Menstruate, 2023; Parliamentary Monitoring Group, 2018a, 2018b; Van Biljon & Burger, 2019).

Distributing disposable sanitary pads to schoolgirls regularly requires consistent financial investment, which makes this type of campaign challenging (Tegegne & Sisay, 2014), whereas reusable sanitary pads

require a once-off investment because they can be used multiple times, thereby providing a long-term solution to period poverty. Studies indicate that the distribution of reusable menstrual products to schoolgirls, such as silicon menstrual cups and reusable sanitary pads, significantly reduces incidences of school absenteeism amongst girls (Hennegan & Montgomery, 2016; Montgomery et al., 2016; Tegegne & Sisay, 2014; Wilson et al., 2014). As such, it is argued that providing reusable menstrual products to girls affected by period poverty is likely to improve their school attendance and improve their chances of completing their education and escaping poverty.

Menstrual cups are made from medical grade silicon and require specialised knowledge and technology to construct (UNICEF, 2019), whereas reusable sanitary pads are constructed from a combination of absorbent and waterproof fabrics, that are stitched together by hand or with a sewing machine (Tegegne & Sisay, 2014; UNICEF, 2019). This means that reusable sanitary pads can be created by anyone with basic sewing skills and access to the appropriate fabrics. Appropriate fabrics are easy to obtain because large volumes of clothing are disposed of annually (Dean, 2020; Santi, 2023; Zurich, 2023). It is estimated that the rate of fabric and clothing production and the rate at which consumers dispose of their clothing has doubled in the past 20 years (Dean, 2020; Santi, 2023; Zurich, 2023). This is projected to increase in the future, with approximately 148 tonnes of fabric waste being produced by the fashion industry by 2030 (Bailey et al., 2022; Dean, 2020; Stanescu, 2021). It is estimated that at the end of their perceived useful lives, 85% of clothing will be discarded into landfills and 15% will be donated for reuse or recycling (Bailey et al., 2022; Burns, 2019; DeVoy et al., 2021; Ellen MacArthur Foundation (EMF), 2017; United States Environmental Protection Agency (EPA), 2023; Fletcher & Grose, 2012; Kadolph, 2011; Zurich, 2023).

Clothing discarded in landfills decomposes vastly differently (Fletcher, 2000). Natural fabrics such as cotton, silk, wool, and linen decompose relatively quickly, within two weeks to five years (Fletcher & Grose, 2012; Manteco, 2023). This process is, however, retarded by the application of synthetic dyes and chemical finishes during production and if natural fibres have been blended with synthetic fibres (Fletcher, 1997; Manteco, 2023). Synthetic or manmade fabrics such as spandex and polyester decompose over a much longer period, between 20 and 200 years (Fletcher & Grose, 2012; Uren, 2015).[1] As synthetic fabrics decompose, they break down into microplastics and flow out of the landfill in the leachate (Silva et al., 2021; Svedin, 2020; Weinstein, et al., 2016).[2] Despite leachate being treated before it is released into the environment, microplastics are not readily removed during this treatment (Silva et al., 2021; Weinstein et al., 2016). This is problematic because, if consumed, microplastics can cause damage to the cells, inflammation, and oxidative stress (Danopolous et al., 2022; Gerretsen, 2023; Huang et al., 2021). But since synthetic fabrics take a long time to decompose, they contribute to landfills becoming full and being prematurely closed (Fletcher & Grose, 2012; Uren, 2015). This is a problem that South Africa is currently facing. Large metropolitan areas such as Johannesburg and Cape Town are rapidly running out of landfill space (Nkosi, 2022; Qukula, 2022; Wadula, 2022). New landfills could be constructed, but this is a long, expensive process, and requires large areas of land, which is in short supply (Wadula, 2022).

In terms of the 15% of used clothing that is donated for resale or recycling, only 20% is suitable for resale (Schumacher & Forster, 2022). The remaining 80% is donated to the second-hand market in developing countries, recycled into lower-grade fabric goods such as insulation, or discarded into landfills (Schumacher & Forster, 2022). Less than 1% is recycled into new fibres for use in clothing (Schumacher & Forster, 2022). South African statistics are not available, but since fabric recycling programmes are limited in South Africa (Jenkin & Hattingh, 2022; Rewoven, 2023), it is likely that most donated clothing is not fit for resale or donation to the underprivileged and is thus discarded into a landfill.

Creating reusable sanitary pads from clothing waste is not only environmentally sustainable, but it also has the potential to empower communities. The literature documents several programmes in Africa in which schoolgirls and disadvantaged members of the community are taught how to create reusable sanitary pads (Ssewanyana & Bitanihirwe, 2019; Tegegne & Sisay, 2014). These programmes empower schoolgirls to

[1] Synthetic fabrics are derived from petroleum through chemical processing (Kadolph, 2011).
[2] Microplastics are pieces of synthetic fibres that are smaller than five millimetres (Costa et al., 2010; De Falco et al., 2018).

overcome the challenges of period poverty whilst simultaneously equipping community members with skills and knowledge for future employment (Jenkin & Hattingh, 2022; Ssewanyana & Bitanihirwe, 2019).

3. Methodology

The research methodology employed was qualitative autoethnography. Ethnography is the examination and description of social phenomena (Babbie, 2021; Lichtman, 2023; Silverman, 2004). Data is gathered by researchers primarily through observation of the social phenomenon, which is recorded in field notes (Lichtman, 2023; Silverman, 2004). Autoethnography is a class of ethnography in which the researcher records, examines and describes their own experience of a social phenomenon (Çayır, 2020; Poulos, 2021). As such, researchers fulfil the dual role of participant and observer in autoethnographic studies (Çayır, 2020; Poulos, 2021). Autoethnographic methodology was applied in this paper, because the author facilitated and participated in the 'Sustain Her' voluntary community-based project, and the findings are based on the author's personal experience and observations, which were recorded in personal reflective notes.

The 'Sustain Her' project is an initiative of a Johannesburg-based NPO. The project participants included the author, the director of the NPO and community volunteers, including student volunteers from a Johannesburg-based higher education institution. The director of the NPO granted permission for the names of the project and of the NPO to be included in this paper. However, to avoid any possible negative effects because of this paper, and to protect the privacy and integrity of the NPO director, community volunteers, the higher education institution and the schoolgirls who benefitted from this project, all identifying names of people and associated organisations have been omitted.

4. Contextualising the 'Sustain Her' Voluntary Community-Based Project

The 'Sustain Her' voluntary community-based project aimed at creating reusable sanitary pads from clothing waste to reduce waste discarded into landfills. At the same time, gifting these reusable sanitary pads to schoolgirls could potentially reduce the likelihood of absenteeism from school, thereby sustaining their educational journey.

4.1 Clothing Sorting Event

The first phase of the 'Sustain Her' project was to sort through clothing donations and determine what could be used for the reusable sanitary pads. The clothing sorting event was held on Mandela Day, 18 July 2023, at a school in Johannesburg. Volunteers were invited to participate in the clothing waste sorting event via online groups and social media pages. Three types of fabric were required to create the reusable sanitary pads, namely, T-shirting, towelling and waterproof fabric. Volunteers were verbally briefed on the types of clothing to sort. Volunteers were advised not to gather light-coloured T-shirts, such as white or pastel colours, that could be easily stained by menstrual fluid. Once all the T-shirting, towelling and waterproof fabric had been sorted, a large volume of clothing remained. It was then decided by the author and the NPO director that these clothing items could be used to create bags in which to carry the reusable sanitary pads.

4.2 The Development of the Reusable Sanitary Pad

The author developed the reusable sanitary pad design, which consisted of four layers; two outer layers, an absorbent layer, and a waterproof layer. The outside layers were cut from clothing made from cotton T-shirting. The outside T-shirting layers of the reusable sanitary pad were oval shaped for easy sewing, and also provided 'wings' on the sides to wrap around the underwear gusset and were clipped together with snap fasteners. Cotton T-shirting was utilised for the outer layers because of its absorbency, ease of laundering and comfortability.

The absorbent layer was cut from cotton towels and face cloths because the double-knit structure of towelling makes it ideal for absorbing menstrual fluid, laundering and comfortability. The absorbent towelling layer was cut in a rectangular shape, of the same length as the outer layers, and the approximate width of an underwear gusset. This shape ensured that the top and bottom edges of the absorbent towelling layer were attached to the outer layers, with minimal bulk at the width to ensure comfortable fastening around the underwear gusset.

The waterproof layer was cut from faux leather or raincoat fabric in the same oval shape as the outer T-shirting layers. However, few raincoats and faux leather clothing were donated to the NPO, so faux leather fabric was purchased for the reusable sanitary pads to improve their waterproof properties. Pads made with a double layer of raincoat fabric were recommended for light flow days. However, the aim was to make most pads with a faux leather waterproof layer.

The reusable sanitary pad was assembled by first stitching the absorbent towelling rectangle onto the oval waterproof layer. The oval T-shirting layers were then pinned in place on top of the towelling layer and underneath the waterproof layer, and then stitched together. Stitching the edges of the three oval layers together ensured that the waterproof layer could not shift inside the pad during wear or laundering and that the whole pad was waterproof, to prevent leaks. Once the layers had been stitched together, the outer raw edges were overlocked to prevent fraying, provide strength, and promote longevity.[3] Thereafter, snap fasteners were stitched on either side of the oval 'wings' so that the reusable sanitary pad could be secured around the underwear gusset.

Since the outer layers looked the same, a mark was embroidered on the top T-shirting layer, above the absorbent towelling layer. This was done to identify the absorbent side to be placed against the body, and the waterproof side to be placed onto the underwear gusset. To distinguish between the raincoat and faux leather reusable sanitary pads, those with two raincoat layers were embroidered with "L" to indicate use for light flow days, and those with a faux leather layer were embroidered with "H" for heavy flow days.

Schoolgirls were gifted three light flow pads and three heavy flow pads in a fabric carrier bag as part of a reusable menstrual kit. The kit included a small waterproof purse to store soiled pads until laundering. A pamphlet with important menstruation and laundering instructions was also included in the kit, accompanied by soap and vinegar for washing the pads. The components were packed into a small plastic bucket with a lid, to enable discreet washing and storing of reusable sanitary pads.

4.3 Construction Events

The NPO hosted several reusable sanitary pad construction events, during which volunteers cut the fabric layers out of the clothing waste, pinned the layers together, used sewing machines to assemble the reusable sanitary pads and applied hand sewing techniques to embroider 'L' or 'H' on the pads and attach the snap fasteners. Large construction events took place every three months on Saturday mornings at a Johannesburg school. Workstations were set up where cutting, pinning, machine sewing and hand sewing operations were performed by volunteers, in an informal production line. In addition, smaller construction events were hosted on weekday mornings, where unemployed parents and pensioners from the community volunteered to cut out the fabric layers and complete hand sewing operations on already assembled reusable sanitary pads.

In addition to these events, the 'Sustain Her' community-based project partnered with the fashion department at a Johannesburg-based higher education institution to host machine sewing sessions. These sessions took place every Friday morning for a month. In these sessions third-year student volunteers utilised their machine sewing skills and clothing construction experience to assemble the reusable sanitary pads.

[3] Overlocking is a special stitch created with four or five threads which wrap around and enclose the raw edges of fabric to prevent fraying.

As soon as enough reusable sanitary pads had been completed, the NPO hosted a kit packaging event where high school learners volunteered to pack the reusable menstrual kit components into buckets.

5. Findings: Autoethnographic Reflections

At the beginning of this project, the author and the NPO director explored options to create awareness of the aim of the 'Sustain Her' project to provide reusable sanitary pads for schoolgirls. It was determined that the project would be promoted through a poster shared on social media pages, online groups and at community gatherings. The author and NPO director were aware of the culture of secrecy and shame associated with menstruation and grappled with word choice and colour selection for posters, to present the topic of menstruation and the aim of 'Sustain Her' gently to the community. For example, deciding between words such as 'sanitary' versus 'menstrual' and 'towels' versus 'pads' and using pink rather than red in the posters to avoid associations with blood. The project was promoted by the NPO director and community leaders at community gatherings. However, when male community leaders promoted the project, they appeared uncomfortable and often did not share all the necessary information with the community.

Despite this, the 'Sustain Her' project was well supported by the community, with approximately 20 to 30 people at a time attending the various sorting, construction, and packaging events. Most volunteers were women, but there were several young boys and men who participated in the project. Most of the men who participated were fathers of daughters. Over time the culture of secrecy surrounding menstruation appeared to shift in the community as more women and girls began discussing their menstrual difficulties at the 'Sustain Her' construction events. Noticeably more men without children began participating in the construction events and expressed that this was because they wanted to support their female friends who volunteered in the project.

Overall, the sorting, construction and packaging events yielded positive experiences because many volunteers appeared eager to get involved and contribute to the project. It was further observed that bringing a group of volunteers together to work towards a common goal encouraged a jovial atmosphere where people appeared to enjoy the opportunity to meet new people and build relationships in communities. In some cases, such as with adolescents, volunteers seemed to enjoy the social atmosphere to such an extent that the quality and pace of their work decreased, as the construction event progressed. One young man began cutting fabric in the air, because there was no space on the table where he was sitting, as it was surrounded by volunteers. He appeared reluctant to move away from the other volunteers to another available table, despite encouragement from the author and the NPO director.

However, at the sorting events, volunteers initially appeared to struggle to identify and distinguish between the types of fabric. This may be because the author did not show them an example of the reusable sanitary pad that was going to be created, to provide visual context of the fabric required. Additionally, most of these volunteers had not previously made their own clothes, so this may explain their lack of fabric knowledge. To remedy this, the author engaged in a discussion with the volunteers and demonstrated which fabrics and related clothing items were required. Thereafter the volunteers appeared to be better able to identify and sort the clothing correctly.

A few volunteers expressed apprehension because they lacked sewing skills and were not sure how they could contribute to the project. Such volunteers were encouraged and coached to identify and sort the different types of fabric, cut fabric, pin the pieces together, iron the components where necessary and perform basic hand sewing operations. Most volunteers appeared to acquire these skills relatively quickly. However, a large portion of the construction process required machine sewing skills.
A few volunteers, including the higher education fashion students, had extensive machine sewing experience, which was valuable in this project. A notable volunteer was an elderly gentleman in his seventies. His mother had taught him how to sew as a young man and he had been creating and tailoring his own clothing for decades. This gentleman sat for several hours sewing reusable sanitary pads of excellent quality before he asked the author, "What are we making?" The author then explained the goal

of the 'Sustain Her' project to him and he expressed delight at being involved, as he had three adult daughters and seemed to empathise with girls affected by period poverty.

A few volunteers had their own sewing machines, but their experience was limited to making basic clothing items and home soft furnishings such as children's dresses, curtains, and pillowcases. The author assumed that since the reusable sanitary pad consisted of basic shapes, it would be easy for volunteers with limited sewing experience to sew. However, the inexperienced volunteers appeared challenged by having to sew multiple layers of fabric of different thickness and stretch properties together, which resulted in untidy puckering and gathers at the edges. Over time the author found that allocating a few people to pin the pieces together for an inexperienced machine sewer improved the quality of the sewing. This appeared to allow the inexperienced machine sewer to focus on sewing without needing to break concentration to pin pieces together. The author further found that requiring volunteers to pin two layers together with at least ten pins in a radial manner improved the quality of the sewing because the pieces were easier to handle during sewing.

The various levels of sewing experience of the volunteers resulted in large quality variations of the reusable sanitary pads. For this reason, the author checked that all the pads met a minimum quality standard before they were passed on to volunteers for the final hand sewing operations. In some cases, the assembled reusable sanitary pad had a few errors, which required the stitches to be unpicked and the pad to be reassembled. However, in other cases the pads were poorly assembled and could not be repaired and were discarded.

Volunteers attended these construction events when they were able and arrived and left of their own accord. It was therefore not possible to ensure that everyone received the same information and training at the same time. This meant that despite attempts to oversee all sorting, cutting, pinning, machine, and hand sewing operations, volunteers made errors such as cutting T-shirt layers from white fabric, pinning the pieces in the wrong order, not stitching all the layers together, or embroidering the pad on the wrong side. In some cases, these errors could be quickly remedied, but in other cases the errors were only identified when the reusable sanitary pad was almost complete. In these instances, the reusable sanitary pads had to be discarded because they were not fit for purpose. Overall, it appeared as though the sorting, cutting, pinning, machine, and hand sewing skills of the volunteers improved as the project progressed because over time fewer assembled reusable sanitary pads were discarded.

However, a few volunteers, despite coaching from the author, lacked the machine sewing skills necessary to assemble a reusable sanitary pad of sufficient quality that it could be gifted to a schoolgirl. To make the most of their machine sewing skills, these volunteers were redirected to assemble the fabric carrier bags, which were much easier to sew than the reusable sanitary pads. Constructing these bags appeared to be less stressful for the volunteers and they constructed good quality bags at a rapid pace. The construction of bags was led by an older woman in the community who, from the beginning of the project, elected to sew bags rather than reusable sanitary pads. This woman assumed the role of a leader and mentor, by guiding and supporting volunteers in the construction of bags. This enabled the author and NPO director to focus on the sanitary pad construction process.

Several volunteers, particularly school learners, expressed a desire to learn how to use a sewing machine. It was the intention of the author and the NPO director to encourage this desire to acquire new skills and to teach community members to sew. However, time was limited and the primary aim of the 'Sustain Her' community-based project was to create reusable sanitary pads for schoolgirls. For this reason, instead of training volunteers to use sewing machines, such volunteers were trained to identify and sort fabric, cut and pin fabric and perform hand sewing operations.

6. Discussion and Recommendations

The literature suggests that menstruation education for all people plays a vital role in removing shame and secrecy, as well as breaking down myths associated with menstruation (Khamisa et al., 2022; UNICEF, 2019). As such there is potential for the 'Sustain Her' voluntary community-based project to partner with a menstruation education programme as a two-pronged approach to alleviating period poverty in South Africa. Perhaps a representative from a menstruation education programme could accompany the NPO when the reusable sanitary pad kits are delivered to schools.

The 'Sustain Her' project relied on volunteers to create these reusable sanitary pads. As such, the production of reusable sanitary pads can be slow and, ultimately, the schoolgirls are dependent on the volunteers to elevate them out of period poverty. The opportunity exists to teach schoolgirls how to create their own reusable sanitary pads so that they are empowered to elevate themselves out of period poverty. However, this would require the provision of the fabric and sewing equipment, in addition to providing schoolgirls with sewing lessons. This requires a greater resource investment than is currently available. The author is exploring possibilities of creating reusable sanitary pads that can be constructed exclusively through hand sewing operations from clothing waste, to overcome the challenges of providing sewing machines to schoolgirls.

The literature indicates that several reusable sanitary pad programmes employ community members and train them to create reusable menstrual products (Jenkin & Hattingh, 2022; Ssewanyana & Bitanihirwe, 2019). The possibility therefore exists that the skills acquired by volunteers during their participation in the 'Sustain Her' project will enable them to gain employment in clothing production or to start their own businesses creating reusable sanitary pads.

The author and the NPO are further exploring the possibility of creating a social media instructional video to provide step-by-step instructions on how to construct a reusable sanitary pad from clothing waste. This endeavour may inspire people who possess machine sewing skills to initiate similar projects to reduce the effects of period poverty in their communities.

However, it is noted that schoolgirls affected by period poverty likely also lack underwear. Lack of underwear makes the use of reusable sanitary pads difficult. As such the author and the NPO director are exploring campaigns that can be initiated to obtain funds to purchase underwear so that a pack of underwear can be included in each reusable sanitary pad kit.

The potential further exists for researchers to explore and quantify the amount of clothing that is diverted from landfill through the creation of reusable sanitary pads, as well as to examine the long-term effects of the 'Sustain Her' community-based project on breaking down menstruation myths and alleviating the effects of period poverty on school absenteeism.

7. Conclusion

Period poverty is a global problem affecting millions of schoolgirls. Not only is period poverty a barrier to accessing education, but it also has a negative impact on the physical and emotional well-being of schoolgirls. Provision of disposable menstrual products by state and privately funded campaigns is often sporadic and unreliable. Additionally, disposable menstrual products produce large amounts of waste, which is environmentally unsustainable. Reusable sanitary pads made from clothing waste are a potential long-term solution that overcomes the challenges of period poverty faced by schoolgirls and simultaneously prevents clothing waste from being discarded. As such, reusable sanitary pads made from clothing waste are a sustainable alternative to disposable menstrual products.

This paper set out to answer the research question: How can clothing waste be utilised to create reusable sanitary pads and empower communities? This was pursued by contextualising the 'Sustain Her' voluntary community-based project, as well as contextualising the opportunities and challenges encountered during the 'Sustain Her' project. The 'Sustain Her' project showed that it is possible that the design and making of sustainable solutions can be used as a strategy to recycle clothing that would otherwise be discarded into landfills, whilst at the same time empowering communities to develop new skills and potentially support the wellbeing of schoolgirls affected by period poverty.



Figure 1. Reusable menstrual kit including a bucket, instruction pamphlet, bottle of vinegar, soap and soap dish, waterproof purse, six reusable sanitary pads and a fabric carrier bag (underneath the reusable sanitary pads).

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P/REFERENCES OF DESIGN

HOW CAN SOCIAL DESIGN FOSTER BETTER EXPERIENCES FOR PATIENTS IN THE FORM OF SERVICES, PRODUCTS AND SPACES?: THREE CASE STUDIES FROM HEALTHCARE FOR/WITH CHILDREN IN DENMARK.

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KEYWORDS | SOCIAL DESIGN, HEALTHCARE, CHILDREN, PARTICIPATORY DESIGN, AGENCY AND CITIZENSHIP

ABSTRACT | Social designers' involvement in healthcare and well-being has been steadily growing. Their roles have expanded to encompass various facets well beyond products and services towards seeking to make an impact on a holistic level aiming to enhance the overall patient experience. However, there is a lack of research into overarching objectives and qualities that social design can add to healthcare. As a response to this gap, the study aims to delve into and explore potential areas where social design can make contributions within healthcare for/with children. As a response to this gap, this study explores three case studies from a master's programme focusing on social design and participatory design in Denmark. The three case studies cover various aspects of healthcare involving the creation of environments and experiences that promote healing, comfort, and a sense of safety for patients. The analysis of these three case studies point out to four qualities that were added by social design: encouraging patients' and parents' agency, increasing engagement, fostering a sense of wellbeing and enhancing patient satisfaction. These provide insights that can guide future initiatives, strategies, and collaborations aimed at integrating social design principles to enhance healthcare delivery and improve outcomes for patients and communities. This paper suggests that a social design-led approach to healthcare for children working closely and continuously with patients throughout the project, could assist in creating value-driven services and thus increase the overall quality of care.

1. Introduction

This paper's overall perspective is social design which inherently bases its work on participatory and co-design methods to ensure a people-centric approach throughout a project.

Social design contributes to the concepts that inform the creation and organization of social systems, structures, and interactions to achieve positive outcomes for individuals and communities (Armstrong et al, 2014). These concepts are often applied in fields such as urban planning, technology design, community development, organizational management, health, and social care. While specific points may vary depending on the context, social design consists of the following fundamental aspects: a) inclusivity and diversity, b) participation and co-creation, c) empathy and equity, d) accessibility, e) resilience f) cultural sensitivity, g) continuous feedback and iteration, g) transparency and accountability (Nold et al.,2022). Markussen (2017) argues that social design is created out of a collaborative design process where designers involve a specific group of citizens, public and private partners to achieve social change, with the aim to improve life conditions for a disadvantaged and confined social group or community. Markussen sees micro-scale effects that may reach a meso-level, but stresses that these effects rarely break out of their limited frame, meaning that the social value is conceived of as a small, but decisive qualitative change in the form of a re-distribution of identities or interpersonal relations. (Markussen, 2017:169).

Studies show an increasing focus on children's psychosocial well-being in healthcare environments (Lambert et al., 2013; Bishop, 2014), in healthcare technology design (Iversen and Brodersen, 2007; Sims 2018), and in healthcare services (Miettinen and Alhonsuo, 2019; Russell et al., 2014). This increasing focus resonates with social design referring to the intentional and collaborative process of creating, shaping, or improving healthcare services, products, and spaces with a primary focus on enhancing the well-being and experiences of individuals and communities within the broader social context. Focusing on patients - in this scope, children's - experiences in the design of healthcare services, products, and spaces is of paramount importance for several compelling reasons. This does not only enhance the quality of care but also contributes to improved health outcomes, increased patient satisfaction, and gradually a more efficient and effective healthcare system (Harris et al., 2015).

This paper aims at bringing up what future social designers should be cautious about when designing healthcare with/for children as well as showing and discussing why social design is especially suited to contribute to the healthcare design with/for children.

Unlike traditional design approaches that may prioritize aesthetics and functionality, social design in healthcare places a strong emphasis on understanding and addressing the social, cultural, economic, and emotional aspects of patients' lives as well as the aesthetics and functionality. In this domain, social design emphasizes a people-centric approach, fostering collaboration, empathy, and inclusivity to create services, products, and spaces that contribute to the overall patient experience by following an empathic, co-creative, inclusive approach with continuous feedback and iteration. However, there is a lack of research into overarching objectives and qualities that social design can add to healthcare. As a response to this gap, this study aims to delve into and explore potential areas where social design can make contributions within healthcare by presenting three case studies from a master's programme focusing on social design and co-design in Denmark. The three case studies cover various aspects of healthcare involving the creation of environments and experiences that promote calmness, comfort, and a sense of safety for patients.

Existing research in healthcare with a focus on children reveals three main areas that are covered: (1) healthcare technology design with children and its respective methods, (2) interior design of hospitals with an eye on children's needs and (3) the service design of healthcare and children's needs.

In the following sections, first, a portrait of existing relevant research is presented; this is followed by elaborating on the three case studies via going deeper into the approaches taken and methods used. With

these in mind, a set of values that social design practice brings into the domain of healthcare are proposed towards the end of the paper.

2. Healthcare Technology Design with Children and its Respective Methods

Traditionally technology design with children focused on human–computer interaction (HCI), emphasizing on acquiring information from mediators such as teachers and parents, with scarce involvement of children themselves (Druin 2002). It seems to be common ground that working with children in a technology design process is more challenging than working with adults for several reasons: Hanna et al (1999) argue that children have more difficulty in vocalizing their thoughts, so techniques such as thinking aloud tend to be more challenging to use. The interval during which children can concentrate, as on a single object, idea, or activity is more limited (Markopoulos and Bekker 2003). And finally, methods need to address and acknowledge the power relation between children and adults (Punch 2002).

However, suggestions and frameworks for children's involvement that address these challenges have been made (Druin 1999; Harvard and Løvind 2002; Isomursu et al.2004). These focus on analysing children's joint interactions with a particular design proposal- ideally with a 'fun' factor - rather than focusing on solicitating direct feedback. Methods like peer tutoring following these suggestions: children form a peer group for testing and rehearsing a design. A researcher introduces the first child to the design solution and shows the child how to use it. After a few minutes of practice, the child becomes a tutor to the second child; again after 15 minutes the second child, the tutee, becomes a tutor to a third child and so forth. Observations of the interaction between design proposal and children's up-take of it can be used for design iterations (Druin 2002). The BRIDGE method, developed by Iversen and Brodersen, stresses that it is the designer's and design researcher's duty to enable equal contribution to design from children and adults by adapting language, materials and environment accordingly rather than focussing on children being considered as cognitively incomplete (Iversen and Brodersen, 2007).

Those projects that do engage in healthcare technology design typically include informal and formal user-centred design methods. As an example, Weightman et al (2010) worked with children with cerebral palsy to design engaging, playful hardware and software devices for upper limb rehabilitation. The methods they used in their iterative design include questionnaires, interviews, peer tutoring inspired by Druin (2002) and a comparative method. Studies highlighting methods available for children with special needs include Allsop et al (2010). They analyse available methods such as co-inquiry, cooperative evaluation or the above-described peer tutoring and their potential barriers for children with special needs and call for an inclusive adoption of methods to give a voice to these children. Sims (2018) involved kids in co-designing children's upper limb prostheses by applying the conversational BRIDGE method (see above). The researcher also stresses children's "opportunities to develop social, academic and design skills and to develop autonomy, which can be further enhanced by ensuring children are afforded equal rights as adults when deciding whether to participate in research." (Sims, 2018:25).

Thabrew et al (2018) offer an interesting review of eHealth interventions that were developed via co-design with children and young people. A computer game for treating anxiety in children with long-term physical conditions, a self-monitoring app for use during treatment of depression in young people, and HABITS, the development of an emotional health and substance use app, and eHealth platform for young people, are used to discuss the value and challenges of co-design processes. (see Thabrew et al, 2018:1) Projects used probing, toolkits and workshops adapted to their specific contexts and authors concluded: "Co-design can successfully be undertaken with children and young people. However, additional thought needs to be given to settings and techniques to ensure meaningful engagement and participation from these groups." (Thabrew et al, 2018:5).

3. Interior Design of Hospitals with an Eye on Children's Needs

Hospitals are usually seen as environments that provoke the feeling of fear, sadness, anger, anxiety, loneliness, and homesickness for children; studies show that all these emotions have an impact on children's physical and psychosocial well-being (Lambert et al., 2013; Bishop, 2014) while some additionally point out to how those also impact parents' stress levels (Cartland et al., 2018). To overcome these emotions and create child-friendly healthcare environments, literature emphasizes the importance of involving children directly or children's parents in the design and development of such spaces (Coad and Coad, 2008; Lambert et al., 2013). Among those, Li et al (2016) emphasized the importance of play in reducing anxiety and negative emotions in hospitalized children.

Studies that were presented in literature mostly use observations and interviews with children (accompanied by parents) or sometimes only with children's parents, while a few uses art-based activities to actively engage with children. For instance, Coad and Coad (2008) investigated the viewpoints of young children regarding social spaces within hospitals to guide the design of the built environment of a new children's hospital through one-to-one semi-structured interviews and workshops accompanied by art-based activities. They found that children desire a variety of age-appropriate entertainment options that are easily accessible throughout the hospital. These activities not only combat boredom but also empower children with choices and reduce feelings of isolation by fostering social connections within the hospital community and beyond. Belver and Ullan (2011) presented a case study from a children's hospital in Spain focusing also on using art to improve the hospital environment as well as the emotional experiences of children; they conducted interviews with parents and other relevant healthcare professionals working in the hospital; however, no children were engaged in this one.

In another example by Lambert et al (2016) about social spaces for young children in hospital, the importance of using art to positively impact the children's emotional status was emphasized; additional to that, the authors brought up that technology can assist in expanding children's social connectivity during their hospital stay, bridging connections to home, school, and the larger world.

In respect to comparative studies, Cartland et al (2018) conducted research about the experiences of children (aged 3-17) admitted to a recently established facility tailored to promote child-centred care and equipped with family-friendly amenities, and those admitted to a prior facility lacking such accommodations through interviews. The newly constructed facility served as a replacement for the older establishment. In this example, the findings show that children in the new facility experienced less anxiety than in the old one; parents and children identified distinct aspects of the hospital that they deemed restorative.

4. The Service Design of Healthcare and Children's Needs

In the past ten years, there has been a growing focus on encouraging children and young individuals to actively engage and participate in decision-making processes and services that impact them regarding their health (Cartland et al., 2018; Coad et al., 2008). Even though literature points to the importance of involving children in the development such processes and services, practices vary. For instance, in a rehabilitation examination study by Miettinen and Alhansuo (2019), the participants of the study were mainly children's parents and healthcare professionals. In another study, Alhansuo et al (2023) discuss how children can be engaged in shaping hospital services through creative storytelling, how service design can be used to create innovative materials; data from these creative processes were analyzed to develop a fiction-based storytelling approach and visual service journey mapping tool for children's service design process in Finnish hospitals. Aldiss et al (2009) wrote about exploring children's experiences and views of cancer care services by using play and puppets for collecting data rather than interviews or observations. Using play and puppets could be connected to using storytelling as a method as in Alhansuo et al (2023).

What this literature research shows is, that in healthcare projects addressing children, parents are often still the main collaborators and if children are involved interviews are used more often than co-design activities, however there are increasing efforts specifically in service design projects, that emphasize play and storytelling as promising participatory design approaches. There is a lack of research into overarching objectives and qualities that social design can add to healthcare for and with children. As a response to this gap, the following research questions are explored in this study: What are the specific qualities and what is the value that social design can add to healthcare for and with children?

5. Research Methodology

This study uses case study as the methodological approach. Case study research entails a thorough and focused examination of a specific event, situation, organization, or social group (Yin, 2014).

Case study research offers the advantage of providing detailed data from various sources. However, opinions vary on the generalizability of case study outputs across different settings (George et al., 2005). By employing a qualitative case study approach, George et al (2005) emphasize the potential for a thorough examination of specific cases. From a design research perspective, Breslin and Buchanan (2008) describe case studies as exploratory and descriptive tools that not only construct phenomena but also contextualize them within relevant literature and discourse.

In this study three cases from healthcare design with and for children, developed in a social design master programme, MA Design for People, at Design School Kolding in Denmark are presented. The empirical data was acquired through various methods in each three cases: a) closely monitoring, and guiding student projects over five months, b) MA project reports, c) scrutinizing final presentations and design proposals of the student projects. The MA project reports consist of a relevant literature review, research methodology and methods used, as well as the final presentations which encompass both design proposals/solutions and comprehensive process mapping, highlighting different types of engagements, tools used, and findings for each project.

The methodology for analysing the three projects for distinct social design qualities is based on and inspired by Markussen's (2017) framework of social design. The framework defines aim, modus operandi, social value, locus of innovation and effect to clarify social design's main qualities. We use the three aspects modus operandi, social value and effect which we deem relevant for our case analysis. In regards to modus operandi, which translates to tools and methods, the framework states: "Co-design processes and material aesthetic practices take centre stage in the form of infra-structuring contradictory interests and resources"; with respect to social value it states: "Social value is conceived of as a small, but decisive qualitative change in the form of a re-distribution of identities or interpersonal relations."; in relation to effect it states: "Micro-scale effects that may reach a meso-level, but these effects rarely 'break out of their limited frame". (Markussen, 2017:169)

6. The Three Cases

The study explores three case studies from a master's programme focusing on social design and codesign in Denmark. The three case studies are covering various aspects of healthcare involving the creation of environments and experiences that promote healing, comfort, and a sense of safety for children and parents (Table 1). Case study 1 is the design of a set of sensory products to assist parents and nurses/bioanalysts in calming and reassuring their child during a blood test experience and reduce the child's needle phobia. Case study 2 is the design of a safe and playful spacious experience to reduce the level of anxiety in children before having a surgery. Case study 3 is the design of a dialogue tool and a peer-to-peer support service for parents of premature babies.

Table 1. An overview of the projects, analysis lens and the images from the design outcomes.

The case studies	Modus operandi/ Methods	Social value	The design outcome
A set of sensory products for calming children	Observations, sensory ethnography, semi-structured interviews, probes, workshops	More active roles for parents, Expanded roles for healthcare staff, fresh hospital identity	
A safe and playful spacious experience before having a surgery	Semi-structured interviews, digital workshops with children and parents	Advanced interpersonal relations between parents and children, Playful interaction between children in the same situation	
A dialogue tool and a peer-to-peer support service for parents of premature babies	Observations, Interviews Dialogue tools (Timeline, Privacy Mapping, Relationship Activity Chart)	New interpersonal relations between veterans and parents in the same situation	

Case study 1: the design of a set of sensory products to reduce the child's needle phobia for blood test

The first case we explore in this paper focuses on designing a set of sensory products to support parents and nurses/bioanalysts in calming and reducing the child's needle phobia for blood tests. It aims to address the issue of children's fear of needles during blood tests. It begins by observing blood tests in the children's ward of a Danish hospital to understand the child's perspective. Expert insights are gathered from various stakeholders including children, parents, pediatric nurses, bioanalysts, a play therapist, hospital clowns, design specialists, and a healthcare anthropologist. These first-hand experiences inform the project, guiding the development of supportive tools to enhance the pediatric blood test experience. The background of this project is rooted in the fact that needle pro-cedures are among the most feared experiences children have in healthcare (Kortesluoma & Nikkonen, 2004) and the importance of child-centred care as an approach within pediatric medicine that emphasizes the significance of placing the child's experience at the forefront of their care (Ford et al., 2018).



Figure 1. The different elements of the project, which translates to calmness and safety. Image credits: Roseanne Marie Kimber.

The outcome of the project was a set of sensory producs that parents and nurses/bioanalysts to prepare and support children for blood tests. These producst help to communicate psychological care through the senses. The products come in a kit with 3 tools and an infor-mation leaflet with images. The set of products can be used for preparation, sensory comparison, calming or hypnoanalgesia, a recognised technique for relaxation; they can be used in the waiting room in the time before the blood test when the child needs to wait 30minutes for the numbing cream to work as well as in the test room with the nurse/bio-analyst. (see:https://www.roseannekimber.com/work/sensorytoolsforreducingneedlefear).

Case study 2: The design of a safe and playful spacious experience to reduce the level of anxiety in children before having a surgery

The objective of the second case is to enhance the hospital experience for children by infusing with elements of playfulness and relaxation, thereby mitigating pre-operative anxiety. The study context was awaiting room in the children's department at a Danish hospital before children are taken to surgery. This initiative is rooted in the prevalence of perioperative anxiety and physical discomfort among children undergoing surgery, as documented in numerous studies; research indicates that preoperative anxiety can exacerbate postoperative pain, negative behaviours, and complications like delayed wound healing, delirium, and nightmares (Baghele et al, 2019). Factors contributing to this anxiety include fear of surgery,

separation from parents, unfamiliar surroundings, and loss of autonomy; the stress typically begins upon scheduling the operation and peaks upon admission to the hospital (ibid).



Figure 2. The different elements of the project which translates to playfulness and calmness. Image credits: Christina Sapounidou.

Recognizing the significance of addressing preoperative anxiety, this project seeks to leverage design strategies to create a more soothing and familiar environment for paediatrics patients. By incorporating elements that evoke feelings of calmness, comfort, and control, the aim is to alleviate stress and foster a sense of acceptance and security in an otherwise unfamiliar setting. Techniques such as non-pharmacological interventions, information dissemination, and distraction are explored as potential means to minimize preoperative anxiety and promote a safer and more positive surgical experience for children (Charana et al,2018).

The outcome of the project was an installation for children in a hospital's waiting area, which can be considered as an individual preparation for children; it is supposed to provide bodily physical calmness before children undergo an operation. It can be used by one child, siblings, children waiting for an operation at the same time or children and their parents. This spacious design consists of a seating area, a soft playful wall to lean on, touch or immerse the body into, another seating / laying on piece, and an interactive part to light up the space in different colours (Figure 2).

Case study 3: The design of a dialogue tool and a peer-to-peer support service for parents of premature babies

The third case study we explore in this paper focuses on designing for peer-to-peer support among parents of premature babies. The study context was a Neonatal Intensive Care Unit at a Danish hospital. The background of this project is the fact that in Denmark, around 4000 children are born each year prematurely (Dansk Præmatur Forening, 2020). Clottey and Dillard (2013) assert that these parents often experience a long and hard period of insecurity, not knowing whether their child or children will survive and whether it will be with or without a disability. This emotional distress can lead to parents feeling hopeless and powerless to a larger degree than parents of full-term babies' experience.



Figure 3. The different elements of the kit Samvær, which translates to socialising. Image credits: Marie Kremer.

The outcome of the project was a product-service solution, a kit that works hand in hand with peer-to-peer support led by so called veterans. These parents went through the experience of having a premature baby in the past and could therefore empathize with parents in the same situation. The kit includes a card congratulating the parents on the arrival of their child, activity cards that give the parents the option to choose what they would like to do during the meetings with the veterans, emotion objects, and a map and memory cards, which allow one to document and keep fond memories made in the hospital (see https://www.mariekremer.com/samvaer) (Figure 3). Introducing a kit with various tactile and material objects helps veterans and novices to structure and moderate their meetings and perhaps touch on what is close to the parents' hearts but not so easy to talk about.

7. Analysis

7.1 Modus Operandi/Methods: How the Projects Used a People-Centric/Patient-Centred Approach in the Process

In the first case, the focus was set on child-centred care (Ford et al, 2018) by investigating how to best support children to have less-anxious blood test experiences based on a participatory design approach. The research design consisted of the following steps: visits to the hospital, observations at the children's department in terms of blood test experiences, semi-structured interviews with several healthcare professionals and designers working in healthcare and focusing on children and a play therapist, participant observations as a clown, probes and an online 'Play Doctor Workshop'. The engagements with children (except for observations) were based on different joint actions such as dreaming, performing (dressing up and acting), imagining/dreaming, making, and reflecting (Figure 4).

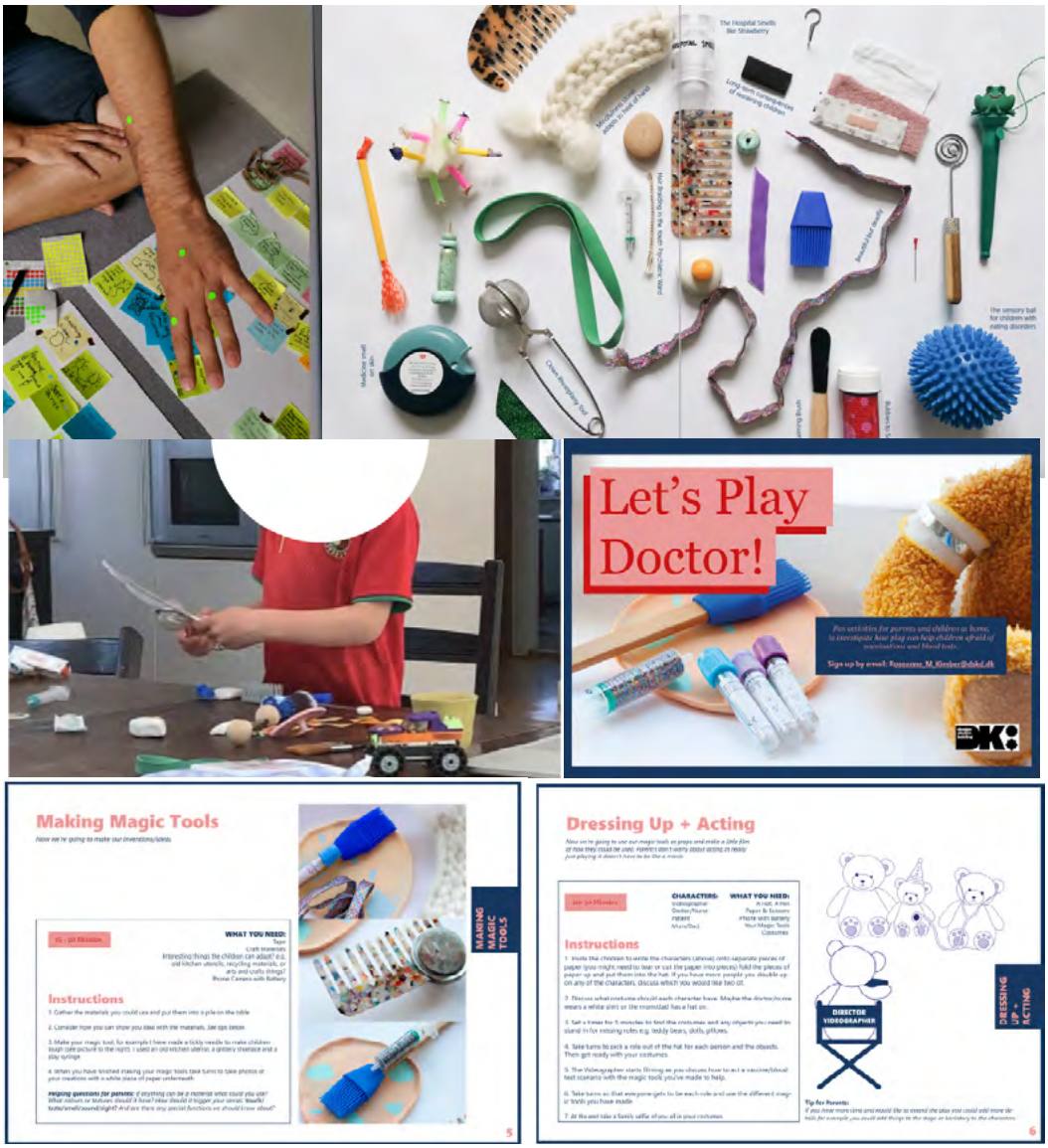


Figure 4. The different elements of the project, which translates to calmness and safety. Image credits: Roseanne Marie Kimber.

In the second case, the focus was on the anxiety levels of children in the pre-operative period at the hospital. The research design consisted of the following steps: visits to the hospital, interviews with nurses working in the children's department in different hospitals, one physical and three online workshops with children (together with a parent if the child was at an age that required adult companionship).

As depicted in the images below, in these workshops the design researcher used drawing as a a means to imagine what children would pack in a fictional suitcase to be as well prepared as possible for their hospital stay and surgery as well as what made them feel calmer and which character lived there among the provided images. In another workshop, different materials were used to involve children (and their parents) in co-designing the actual design proposal.



Figure 5. The different elements of the project which translates to playfulness and codesigning. Image credits: Christina Sapounidou.

In the third case, throughout the project, a focus was set on emotions and feelings of the parents, which shaped the participatory design approach. The research design consisted of the following steps: Observations at the neonatal intensive care unit (NICU), interviews with medical staff that were carried out to draw on the staff's expertise on how to support parents and to help place the individual parents' stories in a broader framework. Interviews with parents explored their challenges and feelings in the NICU and to provide a platform to share their stories. Based on these insights the designer worked with online workshops, using dialogue tools to generate knowledge and insights together.

The three tools (Figure 6) featured timeline (below) in which participants were asked to map out both the timeline of how their friendships developed and the progress of their hospital stay. The goal was to see if there were similarities between the two; a map of the ward where participants were asked to mark to where they felt safe and had privacy and where they did not. And lastly an activity chart in which participants were asked to outline the relationship they have with their friends, their activities, and

conversational topics and opinions that connect them. Here the designer wanted to find out whether there was a difference between friends inside and outside the hospital.



Figure 6. The different elements of the kit Samvær, which translates to socialising. Image credits: Marie Kremer.

7.2 Social Value: How the Projects Fostered a Re-Distribution of Identities or Interpersonal Relations

The set of sensory products for blood tests supports children in going through the pro-cedures that are among the most feared experiences they have in healthcare. Focusing on what is most feared and easing this experience ideally has dripple-down effects on the overall feelings that children have towards healthcare and thus can change the identity of the hospital as such. The set of tools also offer chances for a circulation of roles: parents can become a more active character when using the tool and thus support the healthcare staff in performing their procedures they have to do. Healthcare staff on the other hand can shift their role from a purely technical, medical one to a more child-centred caretaker act. In that way parents and healthcare form a new team and new interpersonal relations.

The playful installation introduced in case study two, suggests an alternative to common pre-operative waiting areas, not designed for children's needs in mind. By offering convivial, joyful materials, tactile structures and elements that spark curiosity, interpersonal relations between different parties are advanced. First and foremost, between parents and their children, which are given autonomy and choices between relaxation, withdrawal, or physical activity; and second it gives room for playful interactions between children in the same situation. Finally, also here, the hospital gains new options for a child-centred care identity.

Shared experience and an understanding of what others encounter are the foundation of peer-to-peer support (Hall et al. 2015). The suggested Veteran Parent System from case study 3 builds upon this finding and uses the principle of sharing for common good. New interpersonal relations can grow between those who went through the often-traumatizing process of being at the NICU with a premature baby and those in

the same situation. The reciprocal nature of the service implies that parents can take on different roles and thus re-distribute their identities – recipients of the service can become veterans with the possibility to give back and pass on their experience.

The system introduced in case study 3 creates a protected space for parents with the hospital as the distributor of the new service. In this sense also the hospital changes its identity by offering a service that goes beyond the purely medical one, acknowledging that feeling safe and understood supports the wellbeing of the parents and thus in return their premature baby.

8. Discussion and Conclusion

Based on the analysis of the modus operandi of the case studies and their social values we would like to discuss the specific qualities and values that social design can add to healthcare for and with children. What future social designers should be cautious about when designing healthcare with/for children are the following points:

Encourage young patients' and their parents' agency: Designers endeavour to encourage young patients' and their parents' agency by designing experiences that foster engagement, education, and pro-active participation in their own well-being. This includes creating tools, interfaces, and environments that facilitate a better understanding of health information and encourage proactive health management with a special eye on the needs of children and their parents. Social designers work in this way by working with tactile qualities, understanding through bodily experiences and performances, through touch, sound, and different materiality.

Increased engagement: The analysis of the cases suggests that social design leads to engaging young patients actively in their own care by designing experiences that encourage and educate them. This might involve user-friendly interfaces for medical devices, clear communication of health information, and tools that encourage participation in treatment plans as well as spacious experiences and overall services. Having an empathic approach, working closely and continuously with patients throughout a project process increases engagement, tends to create commitment and ownership for patients and their parents as well as related healthcare professionals.

Foster a sense of well-being: Social designers aim to create environments that promote a sense of calm, comfort, and well-being for young patients and their parents. Factors like lighting, colours, furniture, and overall spatial design can significantly impact the emotional state of patients during their healthcare journey.

Enhance patient satisfaction: Social designers aim to elevate patient satisfaction by addressing not just the medical treatment but the entire journey within healthcare facilities. This includes considering aspects such as waiting times, ease of navigation, and emotional support during the healthcare process.

For social designers and healthcare designers, this paper contributes a set of three examples, detailing four design objectives that might enhance the agency of children when navigating through healthcare systems. To conclude, this paper suggests that a social design-led approach to healthcare for children working closely and continuously with patients throughout the project, could assist in creating value-driven services and thus increase the overall quality of care.

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P/REFERENCES OF DESIGN

COMFORT, SHAME, AND INNOVATION: THE CHALLENGES OF REINVENTING THE GYNECOLOGICAL SPECULUM IN THE 21ST CENTURY: A CONTRIBUTION TO A FEMINIST-INSPIRED REDEFINITION OF MEDTECH.

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ABSTRACT | The history of the speculum is primarily characterized by the stigmatization of the female body and unethical behavior towards people with vaginas. Despite its long history of use in gynaecology, routine examination with this instrument remains uncomfortable for many patients. This paper takes a feminist perspective to open up new approaches to design in medical settings. It examines the influence of social gender on the perception of individuals and the role of gender stereotypes. Through an analysis of medical, sociological and bioethical texts as well as surveys and interviews with patients and professionals, the need for a redesign of the speculum is highlighted. A market analysis and comparison with other concepts show realistic possibilities for a redesign. The results emphasize the increasing importance of comfort for patients in medical examinations and also show that changes in this area must be achieved not only through new products, but also through structural changes.

1. Introduction

The speculum is an instrument that is known and used by almost every person with a vagina. It is used as an examination instrument in gynaecology and is utilized in every routine examination to take a swab of the vaginal tissue as well as that of the cervix (Wright et al., 2004). From the first penetrative sexual intercourse until after menopause, this instrument is typically used once a year for every person with a vagina (Barad, 2021).

The speculum is one of the earliest instruments used in gynaecology and has thus shaped the development of this medical specialty (Baker, 1999). However, the instrument not only reflects developments in medicine but also society's attitudes, values, and perceptions of the female body. In addition to analysing the product, this thesis also considers the speculum as a symbol that reflects and questions social, gender-specific, and cultural dynamics.

The current state of medical research primarily involves identifying issues with the speculum's usage and exploring how these can be addressed by increasing awareness among healthcare providers. This work draws on studies such as “Improving women's experience during speculum examinations at routine gynaecological visits: randomized clinical trial” (Seehusen et al., 2006), and “A comparison of two techniques for vaginal speculum placement to reduce patient pain” (Pérez et al., 2021). Both studies highlight an awareness of the needs of those undergoing examination, yet they also reveal persistent comfort issues. It seems that raising the awareness of those providing treatment is the only way to better meet the needs of the people being treated.

As the speculum is to be analysed from multiple perspectives, contributions from the social sciences, the book “Unbehagen der Geschlechter. Gender Studies” (Butler, 1991) and other contributions to gender studies are consulted. These are essential for understanding the social, societal and cultural background of the instrument. This literature elucidates social constructs and concepts that continue to influence us today. While the speculum has proven its efficacy as a gynaecological instrument, it is noteworthy that there has been surprisingly little innovation in its design, considering its central role in medical examinations.

Papers and articles that reflect a redesign of the instrument, such as “An Innovative Design for the Vaginal Speculum” (Bouquet et al., 2023), are also considered. These show what possibilities exist for a redesign. At the same time, they highlight the limitations of developing a new tool. Those limits are primarily characterized by competition from existing products on the market, due to their price efficiency and longevity.

To clarify the significance of the speculum, it is necessary to analyse its historical evidence and archaeological finds. The historical analysis illustrates the relevance of the topic, but also shows the stigmatization of the speculum by sources such as (Heinesohn, Steiger, 1987). Other historical sources, like (Ojanuga, 1993), delve into the intersection of medicine and the social sciences, examining the ethics of instrument development and questioning its impact on the modern instrument.

Addressing the issue of sensitive design, particularly concerning the speculum, implies an awareness of the needs of the individuals undergoing treatment. A plausible conclusion should be that there is a wide range of different tools available for the treatment. However, this is not the case. That's where this paper picks up by analysing the approaches from different fields, bringing them together and designing an interface where a new instrument can emerge.

In particular, the position of the person undergoing examination hardly seems to be addressed as a factor for a redesign. The following question is therefore used as a guiding research question to identify those aspects that are useful for a redesign:

How can the need for comfort be reconciled with the practicalities of everyday examinations? Is this even feasible?

The summary of the state of research places the development and current status of vaginal speculum in the context of gender studies, the social sciences and medicine. A historical analysis clarifies the emergence of the speculum and helps to understand its impact on modern gynaecology. This analysis highlights the urgency of redesigning the instrument to respond to the changing needs of patients.

Another methodological approach is the application of the theory of the symbol (Hülst, 1999), which abstracts the speculum as a symbolic object. It represents both the problems and challenges in the development of the instrument due to historical, cultural and social structures as well as the possibilities for change and redesign.

In addition to these theoretical approaches, practical methods were applied. These include interviews with gynaecologists to gain insights into their perspectives and experiences. Furthermore, surveys were conducted among people with vaginas of different age groups (18- 54) to capture their perceptions of the examination experience and the instrument and to collect potential suggestions for improvement. Moreover, shape analyses are conducted to elucidate the shape and function of both the speculum and the vagina. An integral aspect of the argumentation involves the prototype currently under development. This is aimed at enhancing the examination experience for all patients, with particular emphasis on addressing special needs of patients. Additionally, the prototype should serve educational purposes to bridge the gap between specialists and non-specialists, as well as to combat the stigmatization of the female body.

The aim of the redesign is to develop an instrument that not only enhances comfort for patients but also provides relief for medical personnel. By prioritizing increased comfort, additional specific objectives that cannot be fully achieved with the current state can be pursued. Integration of technologies can facilitate quicker detection and documentation of diseases and abnormalities. Furthermore, the redesign can lead to patients having fewer concerns about the examination, attending appointments more regularly and diseases being diagnosed more efficiently. This contributes to both patient well-being and potential relief for the healthcare system. Through a needs-oriented redesign of the product, accessibility for individuals with specific needs can be enhanced.

This paper is part of my ongoing master's thesis, that’s why it’s not always mentioned as a paper.

This paper is structured as follows: An excursus into gynaecology and the anatomy of the female body clarifies the topic and locates the speculum as an examination instrument in gynaecology. The design of the current specula is derived from the historical development of this examination instrument.

The following chapter deals with gender-specific perception and the role it plays in the development of specula. The design is strongly influenced by social and cultural dynamics from the time the instrument was created. This imprint still strongly influences the perception of the speculum during the examination. The following section discusses how the speculum's design can influence its perception on a deeper level and how this can be steered in a more positive direction.

Finally, a “requirements profile” is developed through comparisons with new approaches to different specula and other medical fields, which provides a framework for redefining this instrument.

The challenges encountered when redefining and reinterpreting a product in this manner are addressed.

2. The Speculum as an Instrument in Gynaecology

The speculum is a medical instrument that provides insight into various body orifices through its spreading function. The vaginal speculum opens the vagina by insertion and provides a view of the cervix (lowest point of the uterus). Vaginal specula are used in gynaecological examinations to take sterile swabs from the vagina and cervical tissue. In some cases, the speculum is used to insert other instruments sterilely through the vagina into the uterus (Speculum, n.d.).

Specula are available in metal, which are cleaned and sterilized after use, and plastic, which are designed for single use. The latter are primarily used in hospitals. The speculum is also available in various sizes and designs, depending on the preference of the person performing the procedure and the circumstances in which the speculum is used.

2.1 Form and Function

The shape of the speculum has been developed in close relation to the anatomy of the vagina. The vagina is a hollow organ (Jung, 2023). It is a hollow, muscular tube that connects the external genitalia to the uterus. The anatomy of the vagina dictates the construction of the speculum, requiring it to be elongated and narrow to adequately open the entire length of the vagina. Due to the elasticity of the vagina, it can expand and contract to many times its own size, which is necessary for childbirth. In its contracted state, often considered the initial position, the vagina exhibits numerous invaginations and indentations. Certain factors influence the shape of the vagina and the resulting functions of the speculum. Very young patients are often more sensitive to the pressure of the instrument, which is why smaller specula are particularly advantageous. Shortly after giving birth, the tissue is still very stretched, which means that more tissue has to be displaced during subsequent vaginal examinations. As soon as menopause occurs, the vagina changes again and becomes less flexible and therefore more sensitive again due to the absence of oestrogen (Falco, 2021).

The examples of organic changes in the vagina influence both the choice of material and the shape of the speculum.

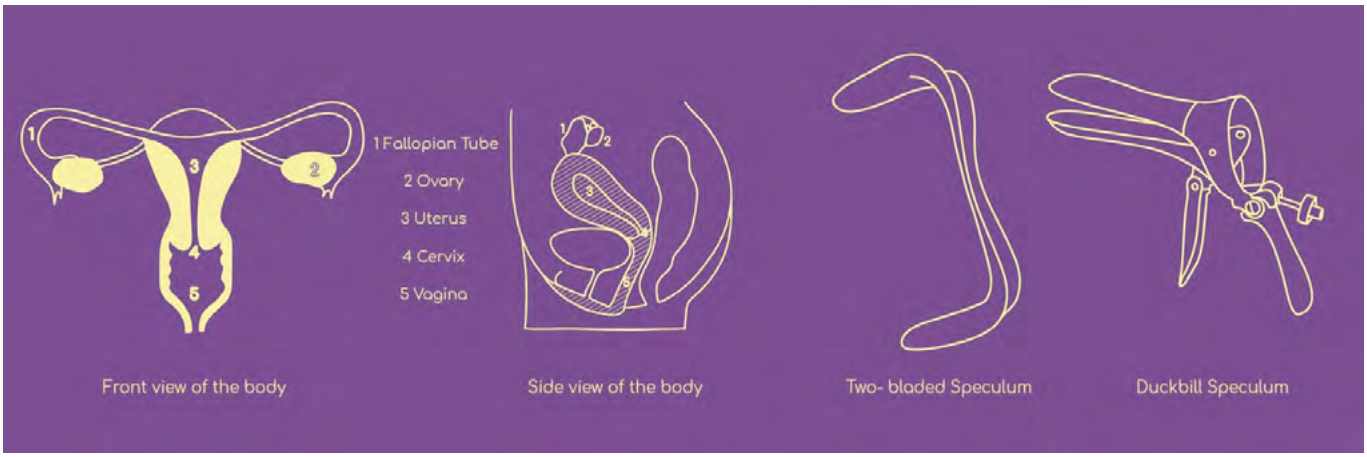


Figure 1. Shows the vaginal structure from the front and side and the gynaecological Speculum in the most common variations nowadays.

The instrument must be able to displace tissue (Pardes, 2017). How much and how strongly depends on the anatomical conditions. For example, obesity exerts particularly high external pressure on the vagina (Palsgaard et al., 2022). This functional requirement, as well as the necessary sterilizability, led to steel being preferred over wood as a material over time (Spekulum aus Holz, n.d.). Steel is not only robust, but it's also easy to clean and, with the right care, durable.

There are different variants of the shape of the speculum (Spekulum aus Holz, n.d.). There are specula with one, two or more blades. Typically, the speculum we are most familiar with is the duckbill speculum, which has two blades (see Illustration). The duckbill speculum is available for one-handed operation, which makes it particularly suitable for use in everyday practice. The instrument can be secured with a screw after opening and sits securely in the vagina so that the practitioner can carry out the examination and swabs. Another variant of the speculum is also used in everyday practice, but more frequently during surgical procedures. This speculum consists of two individual parts (more likely to the two- bladed speculum in the Illustration) and must be held in place throughout the procedure, which requires the presence of another person.

2.2 Procedure of Examination with the Speculum

During a gynaecological initial examination, an informative discussion is initially conducted with the patients to inform them about the procedure. Subsequently, the actual examination takes place. Patients are requested to undress from the waist down, which is often feasible in a cubicle or a designated area for this purpose. Following this, patients take a seat on the gynaecological chair, an adjustable chair equipped with footrests to elevate the feet. In this position, the physician explains the procedure of the examination. The speculum is announced and inserted. In some practices, the speculum is stored in a pre-warmed drawer and subsequently lubricated to facilitate insertion and increase comfort. The speculum is inserted in its closed state and then opened within the vagina. During a routine examination, the instrument is utilized to provide a view of the cervix as well as the vaginal walls. The tip of the speculum can be used to stabilize the cervix portio for conducting a cell smear. For this purpose, a swab or brush is guided through the speculum. Following the smear, the vaginal walls are examined to check for any changes. Subsequently, the speculum is carefully removed from the vagina. It's important to mention here that most physicians don't close the speculum inside the vagina completely due to pinching the tissue if they do. Additional palpation examinations may be conducted if necessary, for which the speculum is no longer required. Typically, throughout the entire examination, the patient, the physician, and a medical professional are present in the room (Barad, 2021).

2.3 Historical Development of the Speculum up to the Present Day (2024)

Bioethics, medical ethics and archaeology have developed different perspectives on the speculum. Accordingly, the speculum is presented as the most important invention of the time, which had a positive effect on the role of women in society. In other sources, however, nothing good is said about the development of the speculum, especially when it comes to its ethical justifiability (Sardesai, 2023). Depending on whether the first specula, i.e. the finds from Pompeii (Baker, 1999) are analyzed, or the use and significance of the specula in the 19th century, when the speculum was invented for the “second time” (Heinsohn, Steiger, 1987), the assessments vary. There are some records from the 19th century on the use of the speculum in Great Britain (Kennan, 2019) and on the development of new fields with the instrument in the United States of America (Ojanuga, 1993). The analyses are often related to fields beyond medicine, such as the social sciences, shedding light on the historical context and critically examining it for the reader.



Figure 2. Shows a Vaginal speculum, bronze, said to be from Pompeii, Roman, 199BC-79AD, possibly 20th century copy (https://collection.sciencemuseumgroup.org.uk/objects/co88417/vaginal-speculum-vaginal-speculum).



Figure 3. Shows a variation of vaginal specula from around the 14th, 15th and 16th century. Source: https://theconversation.com/speculum-the-creepy-history-of-this-ancient-gynaecological-device-and-why-its-still-feared-today-196977.



Figure 4. Shows a wooden speculum, which could have been used as a template, to model metal specula, but also could have been used as a speculum itself. The exact usage is unknown. Source: https://collection.sciencemuseumgroup.org.uk/objects/co88417/vaginal-speculum-vaginal-speculum.



Figure 5. Shows Sims speculum from around 1860- 1890. Source: https://collections.countway.harvard.edu/onview/files/original/a3e1e0d16c537860278047fe44428357.jpg.

At the beginning of the development and shaping of the speculum at the end of the 19th century, pronounced role models and gender stereotypes prevailed. Men had almost the sole privilege of higher education (Heinsohn, 2000). In Germany at this time, women were taught the naturalness of the role of mother and the unnaturalness of girls' education:

> "In general, however, it cannot be emphasized strongly enough that nature itself has prescribed to woman her profession as mother and housewife, and that natural laws cannot be ignored under any circumstances without serious damage, which in the present case would be particularly evident in the offspring." (Kirchhoff 1897, 257, quoted from Heinsohn, 2000, p. 62; translated from German)

> "And if the same demands were to be made on girls, in whom female sexual development is added at the age of about 15, they would be brought up as cripples who would be ruined for life. In my opinion, the establishment of female grammar schools should be banned once and for all for health reasons." (Kirchhoff 1897, 274, quoted from Heinsohn, 2000, p. 55-62; translated from German)

Higher education and the associated opportunities to rethink, develop and invent products were male dominated. The focus was on innovation and convenience for the treating physician. The needs and feelings of the people being treated, especially women, were ignored.

The first clinical specula, developed by Dr. J. Marion Sims in the United States at the end of the 19th century, served diagnostic, treatment, and research purposes (Ojanuga, 1993). It should be noted that Sims was not the only one to "rediscover" the speculum. During the period of witch-hunts, all knowledge about female care by midwives (referred to as "witches") was lost and had to be discovered a second time (Heinsohn, Steiger, 1987).

This work primarily focuses on the redesign and development initiated by Sims. This further or new development of the speculum was experimentally introduced and tested under reprehensible conditions (Sardesai, 2023). Accordingly, the ethical justifiability of Sims' further development must be criticized. Sims used his speculum to perform experimental operations on enslaved African women, without their consent and anaesthesia (Ojanuga, 1993). While many subsequent revisions of the instrument have been made, they often retained the material and basic shape of the original speculum (see Illustration).

The most obvious change over time is the range of applications. Not much is known about the initial use of the speculum, but the design of the form suggests that the female anatomy was explored and there is even evidence that the comfort of the subjects examined played a role (Baker, 1999). Between 1864 and 1869, the speculum came into widespread use in the United Kingdom. There was a surge in syphilis cases at the time, and the speculum was used to screen sex workers - or women who appeared to fit the profile- for venereal disease. Legislation for control purposes was enacted, mandating examination for those who fell within the criteria (Kennan, 2019).

During this period, and likely earlier, the only other patients that got treated with the speculum been among the wealthy classes to monitor pregnancy and childbirth, based on the few archaeological findings. Unlike sex workers, patients in the wealthier classes had the possibility to deny the exam (Baker, 1999). Today, the main field of application of the specula is diagnostics during gynaecological examinations (Schollmeyer, Schollmeyer, n.d.) and is, therefore, part of every check-up. The shape has been revised in certain areas. The design has been refined, with rounded edges and various sizes available to accommodate individual anatomical variations. Medical practices may conduct differing numbers of examinations depending on their size, with the majority of patients visiting for preventive measures, including cervical cancer screenings performed with the speculum (Speculum, n.d.). Depending on the handling, metal or plastic specula are used. Disposable plastic specula are discarded after use, while metal ones may be cleaned on-site or by external providers. In any case, sufficient instruments must be available to prevent bottlenecks (Interview, 28.10.2022). However, hospitals often lack the resources to reprocess all instruments, leading to a shift towards disposable plastic specula (Interview, 28.10.2022).

The time required for reprocessing is eliminated with plastic specula, but so is the longevity, which was once a key feature. It is debatable which is more practical for use. In some cases, it is argued (A better speculum, a better practice, a better world., n.d.) that plastic specula are more comfortable to insert because plastic is warmer than steel at room temperature.

The changes that have taken place in the design (pictures of various specula over the course of time, see above) and use of the speculum have arisen out of necessity, due to medical laws and overall development in the medical field and not out of an orientation towards the needs of the person being treated:

The speculum has rounded edges to avoid bruising the tissue (Palsgaard et al., 2022). In addition, the speculum was developed in different sizes to minimize any discomfort for the person being examined and to adapt to different individual circumstances (see also Chapter 3.1.1). In addition, it is now possible to use disposable specula, which rationalize procedures, especially in everyday clinical practice. These are the most important changes that have taken place historically. These are changes that had to take place in order for the instrument to comply with today's medical guidelines and be used in everyday medical practice. The emphasis on this is important at this point because the changes are so marginal, but there is so much potential for improvement in the design and enhancement. The lack of attention to such a sensitive area over a prolonged period (150-200 years) will be further explored in subsequent chapters (Pardes, 2017).

3. Gender-Specific Perception Regarding the Design of the Speculum

The design of medical instruments plays a crucial role in everyday treatment processes, as improvements in efficiency and comfort positively impact care (Bouquet et al., 2023). Specialist areas such as gynaecology in particular benefit from sensitive design. Sensitive design makes the person being examined feel more comfortable, which simplifies the examination for the person providing treatment. However, sensitive design also has effects beyond the actual examination. If the person being treated feels comfortable, they are less reluctant to attend regular appointments and potential illnesses can be detected at an early stage, which reduces the burden on the healthcare system (Bouquet et al., 2023). In addition to the formal aspects of speculum which were highlighted in the previous chapter, other factors such as cultural circumstances, social structures and gender-specific characteristics and traits also play a role.

Considering the social and cultural conditions at the time of its inception (as discussed in Chapter 2.2), it can be inferred that the design of the gynaecological speculum was heavily influenced by male perceptions. In addition to the historically predominantly male power of definition in the medical field of gynaecology (see subchapter 2.3), the parallels between the design and the role models prevalent at the time of development and the associated different perceptions of the sexes must be explained with methodological recourse to gender studies.

3.1 Social Gender and Gender-Specific Perception of Pain

Social gender is part of the sex-gender model. This model states that biological sex and gender identity are to be considered separately. Biological sex is defined by certain anatomical characteristics (Gildemeister, 1992) (Butler, 1991), whereas gender identity is not predetermined but develops through social interactions and is influenced by upbringing and cultural factors (Gildemeister, 1992). According to Butler, no gender identity can be automatically assigned to a biological sex (Butler, 1991).

According to the gender studies explanatory model, the tendency for biologically male individuals to identify as “men” and biologically female individuals as “women” is attributed to societal gender roles imposed from an early age (Blackstone, 2003). Biologically female children are often exposed to caregiving roles, through books or toys while biologically male children are discouraged from certain behaviours deemed unmasculine. Such statements and behavioural patterns shape gender roles and identity formation (Pauli, Hornberg, 2008).

These roles, which are shaped by the social environment, influence individual perception. By favouring or suppressing emotions, the perception of certain feelings, such as pain, can be retrained or expressed less clearly. (Pauli, Hornberg, 2008) The expression of pain has traditionally been stigmatized as stereotypically

female (Pauli, Hornberg, 2008). Gender-specific stigmatization, especially of female socialized persons with vaginas, tends to decrease nowadays.

Sims' first speculum, which was inspired by a tin spoon, was an example of the neglect of the needs of people with vaginas. With this instrument, the gynaecologist performed the first experimental operations on enslaved African women, without anaesthesia (Ojanuga, 1993). The existing disproportionate social power imbalance made it impossible to make room for women's needs.

Studies have shown that empathy for pain is most effective when the other person has experienced the same pain and can empathize by putting themselves in the position of the affected individual Jackson et al., 2005). In the case of the speculum, the anatomical characteristics of men make this direct empathy impossible. With regard to male-dominated gynaecology (see Chapter 2.2), one could speak of unfortunate factors that have not necessarily had a positive influence on the design and further development of the speculum.

However, as more interest in patients and their comfort in this area has developed over time, research has been and continues to be conducted into ways of making the examination more comfortable for those undergoing treatment and reducing pain (Seehusen et al., 2006).

3.2 Impact on the Development of the Specula

The discussion here regarding the impact on development is an interpretation of the preceding analysis of temporal conditions and circumstances.

The one-sided perspective, tied to the stereotypical notion of women, both female and male socialized persons and their roles, are reflected in the form and function of the instrument. Sims did not incorporate the needs of women into his development process of the speculum, and since then, the needs of patients with vagina have not been truly integrated into the product's further development process.

Another point that may have affected the design was the lack of sensitivity to the female gender. As alluded to earlier, this was probably less malicious intent than ignorance and the circumstances that prevailed at the time. Questions that might arise at this point are: “Didn't all instruments originate in such experimental forms? Why is there such an emphasis on the fact that the speculum was designed by men? Does perception have anything at all to do with the design?”.

These questions are justified and can now be summarized once again. Most products have an experimental origin. However, it is important to pay attention to the context of these products. Most products are developed either for men as well as women, or only for men. Here, the focus was on the needs of male practitioners, which was difficult to achieve when developing the speculum, or led to an unpleasant design for women.

The emphasis on male design is important because women were strongly underrepresented in decisive and co-determining positions at the end of the 19th century. This does not mean that the needs of women were not seen, but that male needs and perceptions were considered decisive.

It is important to draw a connection between design and perception, as these stereotypes and social circumstances has strongly influenced the priorities and decisions of developers. If women are not valued, or less valued, in society, it is very likely that their needs will not be considered in the development process either.

But hasn't our society moved a long way away from this and developed further? Yes, it has, at least that's what one might think. But if one looks at how the speculum developed until today, one cannot be quite so sure.

The factors that play a role in the fact that nothing has really changed regarding the further development of the instrument are analysed and discussed below.

4. The Speculum as a Symbol

The previous chapter showed how the social dynamics of the time affected the design of the speculum. These gender-related dynamics continue to shape society and culture to this day. The following chapter addresses the associated issues of stigmatization of the female body and shame. However, it also demonstrates how social upheavals and movements toward a more equal society can open up new paths.

4.1 Social Stigmatization of the Female Body and the Resulting Shame

Stigmatization occurs when cultural factors, stereotypes, and prejudices in a society lead to biologically female individuals being associated negatively or inferiorly compared to biologically male individuals, resulting in shame for their biological conditions (Reasons for Stigmatization, n.d.). We find the stigmatization of the female body in everyday situations that have become established and normalized in our society through centuries of tabooing and judging. This normalization implies that the evaluation is accepted and, furthermore, that many individuals socialized as females orient themselves toward and adapt to the lived and demonstrated norms.

The symbolization of the speculum helps to illustrate the complex social dynamics and how these can be perceived in an instrument such as the speculum. The speculum is not only a product of medicine, but also a symbol of the prevailing power structures and gender dynamics, both then and now. The fact that the design of the speculum is almost the same as it was at the time of its development is underpinned by the following readings of the speculum as a symbol.

The power imbalance between the sexes and control over the female body: Because the speculum is inserted into the vagina by a second person, the speculum symbolically becomes an instrument of loss of control, or the relinquishment of control, as the person being examined must completely trust the second person. The person being examined takes on a passive role here - also physically - a role that is reminiscent of social dynamics and power imbalances from the development of the speculum.

The right over one's own body: In many cultures and countries, the development and role of biologically female individuals are determined at birth. Being a woman often means being a mother, staying at home, and caring for children. The right to decide over one's own body, such as whether or not to use contraception, historically falls under the responsibility of men and has long been a taboo subject.
The speculum, developed by men to monitor bodily functions, thus symbolizes the ongoing control over the female body and its functions and rights, especially considering the history of the instrument's origins.

4.2 Social Upheavals and Enlightenment

The metaphors of the speculum considered in the previous chapter carry a negative connotation. How might the instrument be perceived if designed with feminist approaches and contextualized differently? The speculum could then metaphorically stand for values such as self-determination, enlightenment, inclusion and democratization.

By taking into account the needs of people undergoing treatment in the design process, the self-determination of the people being examined can be improved. The safety and autonomy that such an enlightened and sensitive scenario could foster would lead to an improvement in the examination experience and signify the disruption of historic dynamics.

A redesign can likewise stand for education and enlightenment in the area of gender stigmatization. The redesigned speculum would symbolize and reinforce the growing awareness of the needs and rights of biologically female individuals.

Diversity and inclusion could also be conveyed through the redesign of the instrument. The perception and consideration of diverse groups of people, regardless of age, sexuality and other identity characteristics, can be reflected in the design of the speculum.

Rethinking and redesigning the speculum can also stand for an upheaval and a redefinition of the power relations and dynamics of our society. Old hierarchical structures are broken up and people with vaginas can influence and shape the design themselves.

The following chapter will analyse what such a redefinition of the speculum could entail and explore the realistic possibilities.

5. The Speculum from a Design Perspective and in Comparison

During the research on the speculum, one fact stood out: problems in the use of the instrument and their possible origins have been identified. There are studies investigating how the use of the speculum can be improved and how the pain - which a large proportion of women experience - can be minimized (Seehusen et al., 2006). Furthermore, as already discussed in Chapter 2, some studies critically analyse the context of the second invention of the speculum and question its ethical justifiability (Sardesai, 2003).

This reveals the urgency of the redesign, which is discussed in this chapter from a design perspective. This is followed by market analyses, surveys and interviews. It is discussed how realistically a redesign of the speculum would be received and maintained in today's market, with the help of a comparison from another medical field.

5.1 Positive and Negative Characteristics of the Speculum in its Current Form

The characteristics of the speculum are better or worse, depending on the perspective from which they are viewed. The perspective that is still in focus today is that of the treating persons. Since this work deals with the perspective of the person being examined, particular attention will be paid to this in the following section.

Positive characteristics in the design are expressed above all in the handling of the specialist staff, as confirmed in the interview conducted with a gynaecologist (Interview, 28.10.2022). The material used, which in many cases is stainless steel, has little to no wear if it is properly cared for. Due to its longevity and the fact that it does not require the installation of special technology, the speculum as it is used today is a cost-effective product, even if it has to be cleaned and sterilised after each use. The handiness of the instrument has improved insofar as the two-bladed speculum, the “duckbill” is used for most examinations. This allows the practitioner to use both hands freely during the examination. There are also some improvements for the person being examined with regard to the perception of the product and the associated pain sensation. These are manifested by rounded edges and improvements to the spreading mechanism. Unfortunately, these upgrades are minimal and are mostly expressed by sensitized staff and less by improvements to the instrument itself (Interview, 28.10.2022).

A clear pattern emerged through discussions with people who have also had the speculum examination experience, as well as an anonymized survey on the topic of the speculum examination with regard to well-being.

Due to the fact that steel was used for the speculum, the temperature of the instrument is always colder than the body temperature of the person being examined, despite prior warming. Little can be done about this, as rapid thermal conductivity is a fixed property of the material. The survey showed that 26 of the 32 people questioned found this property very uncomfortable and tended to cramp up as a result). Before the speculum is inserted for the examination and smear test, the first uncomfortable feeling for some people undergoing

treatment arises as soon as they see the instrument or just think about it .For most people, the instrument does not look like what it is intended for. The feel qualities are described as tool-like, rough and hard. The survey and paper show that there is potential for improvement, particularly in the shape and material.

5.2 Realistic Possibilities and Challenges of Redesigning the Speculum

The survey of patients showed that for almost all respondents, adapting the material would significantly improve the examination experience. Accordingly, there is a lot of potential in aredesign.

What was not asked in the survey was whether the current instrument could be used in a different way to create a more pleasant experience. People have already dealt explicitly with these questions before and conducted studies. The result was that the comfort of the person being examined can be increased by offering them the opportunity to insert the speculum themselves. The improvement in the examination experience increased significantly (Wright et al., 2004). That study has shown that it's not just the insertion itself that impacts the overall examination experience; the way the examination is explained is decisive for many patients. For instance, one participant mentioned:

> “Everything was explained very well to me... so I understood. I was more involved in the process; it took the mystery out of it for me.” (Wright et al., 2004)

Regarding self-insertion, participants were informed about how the instrument should be inserted, after which they were given a moment to do it themselves. According to Table 9 of the study, 95% (126 out of 132 individuals) of the participants successfully inserted the speculum on their own. Additionally, 54% of them positioned the speculum in such a way that the doctor didn't need to make any adjustments. This aspect is significant as efficient time management is often crucial in medical settings. Concerns from some practices regarding the potential for self-insertion to prolong the examination were alleviated by the evaluation of the collected data post-study (Wright et al., 2004).

Another study examined in detail what constitutes sensitive language in the examination environment. Statements such as “watch out, it might hurt soon” or “it might pinch a little” are familiar to most people during examinations with the speculum. This study investigated what this response and “forewarning” does to the people examined. The conclusion was that the announcement exacerbates the perception and is therefore counterproductive (Carugno et al., 2020). The possibilities for redesigning the speculum seem obvious, but what challenges might be hidden here? The need for more sensitive instruments must be seen by the “right” people, i.e. doctors and the industry. This will only happen if there is an awareness of this issue and it is addressed.

Not only the instrument is supposed to be redesigned, but there also has to be a rethinking and listening process in the specialist areas concerned. Without rethinking and recognizing the need, it will seem unnecessary to many to replace an instrument that works “so well” (for the treating specialist staff).

Factors that also influence a redesign are the cost, the reprocessing of the instrument and the handling for the practitioners, as the current speculum is very efficient in this aspect. In addition, there are strict requirements that must be adhered to and provide a very strong framework for the design.

In order to get an overview of what instruments are currently available and on what is worked on, what competing factors need to be included and what the market has and has not accepted, the following section analyses the market and shows three directions of the market's state of the art.

Some deal with a redesign and reinterpretation of the experience for the person being treated, like Yona Care. They experiment with silicone to cover the metal surface (see table below). In addition to the redesign, Yona Care sets their focus on communication and education. Yona Care, as a comprehensive concept, seeks to enhance the examination experience for both patients and doctors. An accompanying

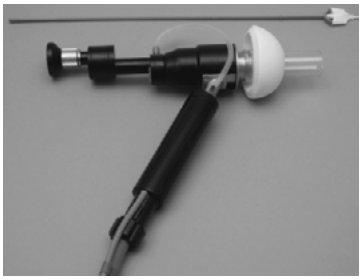
app facilitates preparation for the examination and enables the recording of essential information required beforehand. This data is then transmitted to the attending practice, allowing to increase interpersonal interaction during the examination.

The primary focus lies in adequately preparing patients to ensure their experience is as comfortable as possible. It's worth noting that Yona Care is still in its early stages of development and is not yet available on the market.

Some other speculums are made entirely of plastic. The plastic version is intended as a disposable product, which means lower costs for clinics and large practices, this is what the Orchid Speculum is made for (see table below).

However, these variants are still strongly oriented towards the shape of the speculum. The only new design, by Veda Scope is highly technologized, so the product is still in its infancy, as it is very cost-intensive to manufacture and purchase (see table below).

Table 1. Market Analysis of three different Approaches for a Redesign.

Product	Design/ Look/Source	Improvement (compared to the recently used tool)
Bridea Medical Orchid Speculum	 (https://www.brideamedical.com) (10.01.2024)	Disposable, which leads to cost efficiency compared to the metal speculum, plastic is less cold than metal (more comfortable for patients), rounding edges to not pinch the tissue
Yona Care	 (https://yonacare.com/) (10.01.2024)	Metal covered with silicone to make it less cold, this product deals more with the education and preparation before the exam happens, an App is available that guides through the exam
Veda Scope	 (https://doi.org/10.1111/j.1479-828X.2004.00180.x) (https://www.vedascope.com.au/) (10.01.2024)	Completely different look, it's supposed to be inflated inside the vagina which makes the spreading mechanism more comfortable, it's made from plastics so it's less cold, it's very cost- intensive, due to the technology

To put the development of the speculum in perspective, we compare its development with that of a medical instrument from another field. The compared instrument originates from dentistry and orthodontics and is used to take imprints of teeth. This instrument was chosen for the comparison because the basic design of the instrument is similarly simple to that of the speculum. A steel splint and alginate impression compound (dough-like mass) are used for the imprint. This method is inexpensive to use and prepare and is also durable and efficient due to the material, similar to the speculum. In contrast to the speculum, this splint is used neutrally for all people; there is no gender-specific design. This neutrality of the instrument and the field of dentistry, in general, means that it is a much less intimate and stigmatized environment in which the instrument is used. Another point of differentiation is that the speculum is used on everyone with a vagina as it is part of the check-up. In contrast, the splint is only used in dentistry when necessary and is not part of the regular examination equipment. The development that has taken place here over the last 10 years is the biggest difference. The instrument has been completely renewed in its design and equipped with new technology to optimize the examination experience for patients. The new instrument, the "3D intraoral scanner," makes it possible to take images of the teeth directly in the oral cavity and assemble them three-dimensionally on a screen in real time.

A discussion with an orthodontist revealed that the introduction of this scanner was initially associated with some challenges - such as learning how to use it and transfer the images to the corresponding program, as well as the frequent need for replacement parts. Despite this, the feedback was largely positive. The greater complexity and higher acquisition costs compared to the traditional method were justified by the increased comfort for the people examined.

This comparison should make us think. If innovative solutions can be used successfully in other areas, such as dentistry, why are there not similar advances in gynaecology? This question led to a critical reflection on the differences between medical specialties and the underlying social dynamics. The stigmatization and taboo of gynaecological examination were identified as potential barriers to innovation in this field. However, the comparison also encouraged breaking the stigma and developing new solutions that could not only improve comfort but also help to overcome outdated ways of thinking. Given these findings, the aim of this work was more clearly defined: The need to promote innovative solutions in gynaecology that not only improve comfort but could also help to overcome stigma and promote a more sensitive approach to the topic. This could help people with vaginas feel better understood and heard in the healthcare system.

6. Conclusion

6.1 Summary of the Results

The analysis showed that a redesign of the speculum should be characterized by the need to improve the examination experience, which was elaborated in chapter 5.2 with the help of studies. On the other hand, the design should be characterized by the destigmatization of the female body. This can happen at the level of the examination itself, through sensitization of the staff, but should also be achieved through a new and improved design. This frees itself from its ethically difficult background and thus demonstrates an openness and awareness of the needs of the persons to be treated.

6.2 Possible Implications for the Design and Application of the Speculum

These findings should be reflected in some way in the redefinition of the instrument. The form of the speculum should be designed inclusively, drawing inspiration from outside design fields where comfort and people's needs are more central to the design process. In order to improve the comfort of the investigation and to satisfy any autonomy needs, the study: "Speculum 'self-insertion': a pilot study" on the self-insertion of the speculum can be taken into account and elements from it incorporated into the redesign. The redesign should take place as a co-creation and be based heavily on user feedback to meet the needs of the people who will ultimately be affected.

New methods can be devised to eliminate the need for the opening of the instrument. Various technical options, such as cameras, can be included at this point. The materiality of the product should also be reconsidered and, at best, be replaced. There are many aspects that should be emphasized in the design process, but above all, there is still a lot that needs to be researched in this area of the healthcare sector.

6.3 Outlook

In the subsequent practical part of the work, a concept will be developed that meets many of the identified needs. There will be further surveys and own studies in which the first prototypes of a new instrument will be tested. The feasibility and regulations for products in the healthcare sector will be addressed and the design of the product will be finalized on this basis. In addition to the tool, a guide to gender-sensitive and gender-specific design will be developed to raise awareness on this topic. This guide is intended to help identify insensitive design more quickly and adapt it efficiently.

Attachment

Interview (German):

Survey (German):

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About the Author:

Victoria Juretko completed her Master's degree in Industrial Design with the development of the product discussed in this paper. The product is intended to be further developed to enhance patient well-being. Her primary interest lies in female healthcare, particularly in stigmatized areas.

P/REFERENCES OF DESIGN

WHEN THE PARK INTERWEAVES THE OLD NEIGHBOURHOOD: FUTURE SCENES PLANNED FOR LIVING UNDER THE URBAN RENEWAL.

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KEYWORDS | URBAN RENEWAL, OLD NEIGHBORHOODS, PARK CITY, LIFE SCENE PLANNING, SUSTAINABLE DEVELOP-MENT

ABSTRACT | With the continuous advancement of global urbanization, the problems presented by old communities have gradually become a major obstacle to urban development, and the gap in the living environment has become a symbol of the status of the rich and the poor. The main contradiction in China is the contradic-tion between the people's growing need for a better life and unbalanced and inadequate development, so the renewal design of old communities has become an important focus of urban development. In response to such problems, China has proposed the concept of a park city, which optimizes and integrates the spa-tial structure of the city and improves the quality of old communities by introducing the concept of parks. This paper discusses the design principles and strategies of the spatial, functional, and cultural relation-ships between parks and communities, answers the question of how to balance the development of park cities and old communities, and expounds on the importance of introducing the renewal mode of old urban communities into parks. It aims to seek a new urban development model, a new perspective of urban re-newal, which can not only meet the functions and efficiency of the city but also protect and restore the ecology and culture of the city, realize the high-quality development of the city and the people's better life, and provide a practical example for sustainable urban development.

1. Park City: Park in the City or City in the Park?

Park City is a composite system that organically integrates the form of the park with the urban space and is a new model of urban construction in the new era. The park city is not an image symbol. It is not a park built in the city, nor is it a simple sense of "park + city, " but the city and the park are integrated. Under the premise of following the historical evolution of the city, the transformation from the traditional city to the park city is to break the independent "island" model based on the past city park and integrate the leisure, entertainment, and tourism of citizens.

The essence of the park city is the home, so to meet the needs of the people as the priority. "People-oriented" is the starting point and foothold of the construction of the park city, but ecological protection and restoration is the basic premise, with the city's high-quality and resilient, healthy and sustainable development and social and economical green and efficient development as the guarantee, and finally to achieve a beautiful ecology, production development, and a happy life.

Therefore, in the process of urban renewal, how to effectively integrate parks and old communities to create a more humanistic and ecologically sustainable future life scene has become an important task in contemporary urban planning. Parks are intertwined with old communities, and ecological resources such as urban green space systems and park systems, which are most closely related to residents' lives, are regarded as the basic configuration elements of urban construction and residents' lives (Zhang & Li, 2021, pp. 1292-1301), to find a Chinese model of future communities, to build and create a new scene of future life under urban renewal, and to realize the park city expectation proposed by General Secretary Xi Jinping that "the whole city is a big park, and people go out as if they walked from home to their garden."



Figure 1. Chengdu Yulin Road old community into the park city concept renewal design project (image credit: www.archdaily.cn).

2. Renewal of Old Neighborhoods in Park City: The Link Between Urban History and Ecological Future

The construction of park cities is not only to beautify the urban environment but also to improve the quality of life of urban residents, and the transformation and development of old communities, as an important component of urban functional areas, is of great significance to improve the overall image of the city and the living standards of residents. At present, there is a certain contradiction between the construction of park cities and the development of old communities in China.

2.1 Unbalanced Resource Allocation

In the process of urban renewal and development, the construction of park cities often becomes the focus of urban planners and social capital because of its green ecological characteristics and leisure and entertainment functions, attracting more resources and investment. However, the development of old

communities is often neglected, and there is a lack of sufficient resources and attention, resulting in the uneven allocation of resources, the gradual deterioration of the infrastructure, environment, and living conditions of the communities, and the roads, drainage systems and power supply facilities of the old communities are inadequate and gradually aging due to disrepair; green space is scarce, public activity space is insufficient, environmental problems are becoming more and more obvious, and the community style and the quality of life of residents is seriously affected. This unbalanced development trend not only leads to the unfair allocation of social resources but also aggravates the uncoordinated internal structure of the city.

2.2 Land Use Conflicts

The growth of cities often comes with a large demand for land resources, especially in the process of creating park cities, which can mean that some existing land must be expropriated. At the same time, historic neighborhoods are often located in the heart of the city or in easily accessible locations where the value of land speaks for itself. Therefore, how to ensure that there is no conflict between the construction of park cities and the development of old communities while making efficient use of land resources has become an urgent problem to be solved. This requires not only the foresight of urban planners to balance the two with innovative perspectives but also to find a delicate balance between preserving the historical context and promoting urban regeneration. Only in this way will we be able to modernize our cities while preserving the communities that carry our historical memories and cultures and allowing them to coexist in harmony with the modern urban landscape.

2.3 Cultural Inheritance and Urban Renewal

The old town is often a place where the history and culture of the city are accumulated, where every brick, tile, street, and alley bears the stories of the past and the imprint of the times. However, in the process of rapid urban development, these old communities full of charm have unfortunately been marginalized and even faced the fate of abandonment or destruction. Such a situation not only results in the loss of many precious cultural heritages but also threatens to cut off historical continuity and weaken the diversity and richness of urban culture. Therefore, in urban planning and construction, we should pay more attention to the protection and rational use of old communities so that the historical context can be continued and the soul of the city can be inherited.

Therefore, how to balance the development of park cities and old communities and realize the rational allocation and utilization of resources is an important issue that every city must face and solve in the process of pursuing modernization. In the park city, the "park" is no longer a public green space dotted with urban and community spaces in the traditional sense, but a global, continuous, and accessible blue-green space system is established as the basis for the construction of the park city, forming a networked group layout of urban and green space integration (Dai, 2020). This means strengthening the greening, beautification, and purification of the community, paying attention to the fine design of the street space, and promoting the overall landscape construction of the community so that community residents can feel the existence of natural beauty everywhere in their lives. The construction of park cities and the renewal design of old communities should coordinate and cooperate to form a planning and construction model of park communities, realize the full coverage and sharing of park cities, and build a better living space that people yearn for.

3. Case Studies: Integration and Renewal of Park Cities and Old Communities

A good community park can meet the diverse needs of residents, and it will bring something to the residents spiritually. It may be about natural ecology, or it may be about regional culture, which requires us to explore and create (Table 1).

Table 1. Comparative analysis of design cases related to the integration and renewal of parks and old communities in China.

Case Name	Xinhua Road pocket park	Meifeng Community Park	Caoyang Centennial Park	Micro-landscape design of Xiaobao Village, Songzhuang Town
Case location	Shanghai	Shenzhen, Guangdong	Shanghai	Beijing
Design concept	Through the power of space, people can be separated from busy urban life and immersed in a quiet natural garden where they can stroll, sit, watch exhibitions, and enjoy flowers.	Based on the principles of "openness, ecology, and diversity," the site and surrounding areas are systematically sorted out place.	A multi-level, complex pedestrian experience community park, introducing the concept of a "3K" gallery to integrate art into daily life.	Serve the community, integrate art, and face the future.
Design method	1)Mirror stainless steel system. 2)weathering steel entrance. 3)plant system.	1) "Open" – removing walls opens up the boundaries of the park and establishes accessibility to city streets and neighborhoods. 2) "Ecology" - destroy the existing reinforced concrete floors, let the land breathe again, and establish an ecological landscape base. 3)"Diversification" - improve the park road network and basic service facilities, consider the surrounding users to set up children's play venues, terraced squares, Cultural exhibition corridors and jogging trails, and other diverse leisure and entertainment facilities (Zizu Studio, 2021, pp. 62-67).	1)excavating the site context. 2)constructing spatial scenes. 3)reshaping the street green network.	1)The main element of the design is a perforated gray brick wall with concentrated seating in designated areas, alternating with perforated weathering steel. 2)To the rear is a green area filled with pine trees and shrubbery, which form a natural buffer into the car park and can be accessed through various hidden passages.
Design highlights	The mirror system is rotatable; it is full of natural wildness; the weathering steel material is historic; through the reflection of the mirror, it forms a	Use low-cost landscape; design rich vertical aspects to create diverse activity spaces.	Reuse of remaining space; three-dimensional extension of the narrow site; random combination of ten sets of scenes.	There is a "living room" node every 100 steps to create a space for people to stay. Each node has a theme, and pedestrian trails connect the nodes to form a pleasant

	certain reminder to avoid becoming an urban crime space.			walking experience.
Comparison diagram				
	Before updating design			
	 	 	 	 
	After updating the design			

The above pictures are all from www.archdaily.cn.

Based on the above case analysis, it can be seen that China's old communities currently have clear boundaries between parks and communities, which are separated from the urban environment; functional supporting facilities are incomplete and lack maintenance; environmental problems ignore the connotation of ecological nature; cultural loss and lack of "place spirit," the residents' participation level is low, and their enthusiasm for participation is not high. In the context of population aging, there is an insufficient supply of age-appropriate services, and the renewal of age-appropriate services has just started. But at the same time, China has begun to adopt diversified practices in urban community renewal design, such as introducing mass participation, protecting historical features, paying attention to biodiversity, etc., aiming to create a more harmonious and livable urban space.

In terms of audience, community parks mainly serve community residents, the elderly, and children. At the same time, it can also attract residents of other age groups, such as young and middle-aged people, families, etc., who can relax and enhance relationships by engaging in sports, picnics, photography, and other entertainment activities in the community park.

In terms of spatial layout, most of the existing cases have chosen to remove the walls, thereby opening up the boundaries of the park and establishing accessibility between the park and urban streets and communities. The spatial layout within the park agrees that functional zoning and landscape effects need to be considered, and various activity venues, leisure facilities, green vegetation, etc., need to be reasonably arranged to meet the needs and preferences of residents of different ages and hobbies, and to reflect the principles of humanization and aesthetics, creating a comfortable and beautiful public space.

In terms of functional zoning, according to the needs of the audience, it is divided into quiet rest areas, recreational activity areas, sports and fitness areas, recreation areas for the elderly and children, etc. The setting of functional zoning needs to fully consider the diverse and individual needs of residents, making the park a comprehensive space that satisfies different functions and emotions.

In terms of landscape design, eco-friendly, green, sustainable, site-memory materials or unique local geological landscapes are used as the entry point, and measures are adapted to local conditions. For example, local rocks, rivers, lakes, vegetation, etc., are used to create a natural and harmonious landscape, which not only retains the regional characteristics but also increases the beauty of the park and improves the ecological value of the park. The selection of materials should be consistent with the theme and function of the park, reflect the park's innovation and responsibility, and create a green and sustainable public space.

In terms of ecological construction, technologies such as sponge cities, rain gardens, and bioretention are used to collect, purify, and utilize rainwater in the park, reduce runoff and pollution in the park, and improve the water circulation capacity of the park, pay attention to the seasonal changes and plant configuration of the park, create a rich level and change of the landscape effect, enhance the park's ornamental value and interest.

In terms of social culture, different combinations of urban space and entertainment and leisure facilities will form unique urban "scenes," and these different urban scenes contain specific value orientations (Silver, Clark, & Navarro Yanez, 2010, pp. 2293-2324). This value orientation attracts different urban groups to participate in activities and consumption practices, thereby injecting new vitality into the place and promoting regional development. Therefore, scenes are not only consumption, practice, and activity symbols of cultural value in urban space but also an important part of urban space (Deng & Liu,2021, pp.452-467). It fully explores and displays the park's historical culture and community characteristics, enhances the park's cultural connotation and place spirit, and enhances the park's sense of identity and belonging (Zheng, 2023, pp. 286-287). For example, combining the functions and landscape of the park, and setting up some cultural elements that can educate, inspire, and inherit, such as historical and cultural displays, folk activities, etc., make the park a platform for disseminating culture and knowledge. This will increase the participation of community residents, the vitality and interaction of the park, and make the park a platform that promotes community harmony and development.

4. Evolving Design Thinking: Integrating and Updating Park Cities and Old Communities

Integrating and updating the park city and the old community is to introduce the concepts and methods of the park city based on retaining the history, culture, and community characteristics of the old community and carrying out all-around space, function, landscape, ecology, and social development. Through transformation and other aspects, we can realize the transformation and upgrading of old communities and improve the quality of life and happiness of community residents (Figure 2).

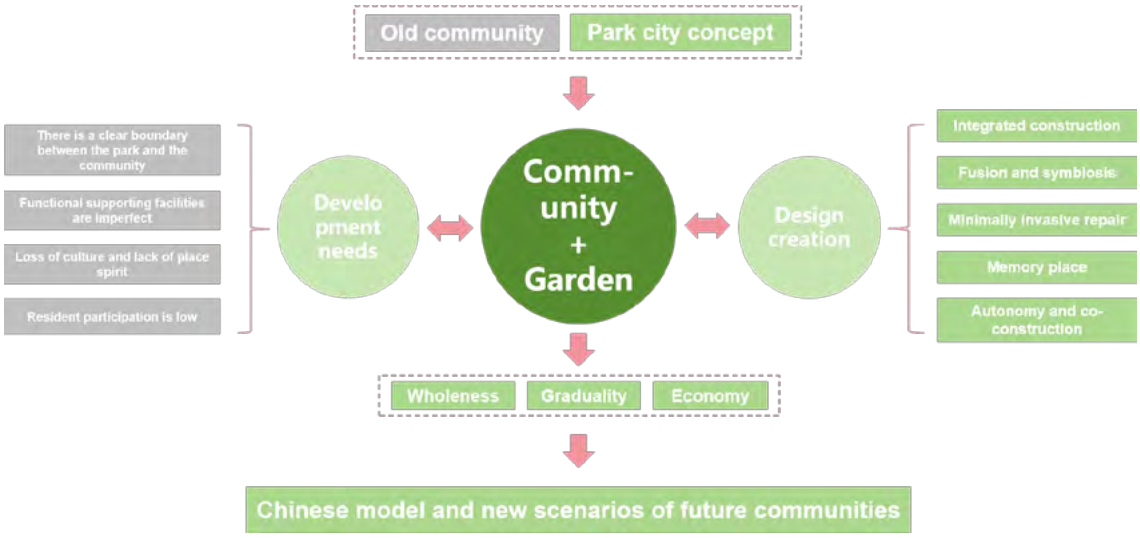


Figure 2. “Park + Community” design thinking (drawn by the author).

With the old community as the core, multi-level and multi-type community parks are organically connected, and around the spatial layout of park green space, community public service facilities, and community centers, an innovative "park +" spatial layout model is constructed, following the principles of integrity, progressiveness, and Economic design principles promote the organic integration of park form and community space, break the rigid functional separation of the community, innovatively use park green space to sew and penetrate the functional space of the community, amplify the landscape effect of the park community, and actively create urban green and An organic blend of landscapes for community spaces.

5. Design Strategies and Experiences: Integrating and Renewing Park Cities and Old Communities

Old communities are important witnesses of urban historical development and one of the main manifestations of urban historical context. Its spatial structure, street texture, history and culture, and other aspects of the form are all products of the development of the times (Zhu, 2023, pp. 102-104).
The foundation of the old community renewal strategy is to follow the concept of "people-oriented," which means returning to humanistic participatory and temperature governance. In the renewal of old urban communities, the subjective initiative of residents, the subject of renewal, must be given full play. Based on this, an operating mechanism of "co-construction, co-governance, and sharing" was established (Zhang, Wu, Yang, & Yan, 2023, pp. 95-103). Therefore, the renewal design of old communities requires the cooperation of governments, planners, residents, and other parties. All parties need to use a careful attitude to preserve the historical context of the old community as much as possible. At the same time, the occupied public spaces and abandoned spaces are designed through consultation to eliminate potential safety hazards, increase available landscape space, and create a good living environment for community residents.

5.1 Integrated Construction

1) Expand the area of green space by demolishing illegal buildings, using gaps to plant greenery, and opening fences. According to the provisions of the Property Law of the People's Republic of China, the public green space of the residential community belongs to the owners of the common ownership. Private encroachment on green space destroys the sharing of public green space and affects the quality of public space in the community. Therefore, legal demolition measures should be taken to restore the original green space. In addition, small green belts and miniature landscapes can be set up in the fragmented gray space at the corners of the community to transform and upgrade the inefficient and negative hard landscape.

2) Construction of roof gardens and the addition of vertical greening (Tan & Ma, 2021, pp. 360-369). Low-rise community buildings or roofs that can be roofs of people, retain the original function, improve the efficiency of roof space utilization, implant drying areas, supplement living facilities, implant activity areas and rest areas, and provide public communication spaces. Flexible reserve activity space to meet the diverse needs of residents, guide residents' activity space to the roof of the building, guide community residents to build a rooftop environment, give vitality to the space, and refresh the city's "air appearance." At the same time, by planting climbing plants, hanging flower pots, setting up green walls, etc., the three-dimensional greening effect of the city is increased, the urban landscape is beautified, the urban climate is regulated, the noise Is Isolated, the dust is”abso’bed, the quality of life of urban residents is improved, and a healthier and more comfortable living environment is created for residents.

3) The global COVID-19 epidemic that broke out in early 2020 caused community residents to pay renewed attention to environmental issues in public spaces. After experiencing a long period of isolation, people are more eager to get closer to nature and socialize with others. Therefore, in the design of park space, the alternative medicine system constructed by Japanese researchers can be combined to integrate exercise therapy, horticulture therapy, and forest bathing therapy (Harper, Fernee, & Gabrielsen, 2021), etc., with community park green spaces to achieve a certain healing effect. On the one hand, park green spaces can cool down and humidify, provide negative oxygen ions, and have the function of purifying air, water, and

soil, which is conducive to enhancing individual immunity, thereby reducing the spread of diseases. On the other hand, park green spaces can shorten the distance between people and nature and between people, calm the mind, and help promote the healthy development of individuals' physical and mental health.

5.2 Integration and Symbiosis

We shall give full consideration to the action care of the audience and employ behavioral scene theory to observe the activity characteristics of community residents in different years. Behavior setting believes that residents' activities have clear and definite spatiality and that specific places and people's behaviors are inseparable ecological integral units (Proshansky, Ittelson, & Rivlin, 1976). To analyze the interactive relationship between non-individual behaviors and environmental characteristics, A theoretical approach is provided. According to the behavioral needs, life needs, activity needs, and spiritual needs of residents of different age groups, reshape the green space with refined design and humanization. Through research, it was found that most of the residents in old communities are elderly and children. Therefore, in the community renewal design, attention should be paid to improving the walking environment, smoothing the road network, enhancing the accessibility of facilities, and adding barrier-free facilities, rest seats, handrails, etc. In age-friendly facilities, the activity spaces for the elderly and children should be arranged adjacently to create an activity venue shared by "elderly + children" intergenerational integration and multiple subjects. Design children's activity facilities with high safety and fun to achieve flexible integration of different types of facilities (Zheng, 2023, pp. 126-128); through active social participation and intergenerational activities, we promote equality and tolerance in the social environment and reflect socialist humanistic care value orientation and institutional advantages.

5.3 Minimally Invasive Restoration

Through field research, it was found that a large number of illegal buildings in the old community have seriously squeezed the public space in the community and infringed on the public rights and interests of residents, so it is necessary to coordinate and communicate with multiple parties for these illegal buildings, and demolish them in time to restore the building texture (Zhu, 2023, pp. 102-104), expand the area of public space, eliminate potential safety hazards, and improve the living environment of residents. Given the aging degree of the building, the roof tile finishing layer, protective layer cracking, waterproof layer, thermal insulation layer, roof structure damage, and other roof problems caused by lack of effective maintenance are repaired and strengthened by necessary engineering measures. At the same time, the original chaotic attachments of the building façade, such as air conditioning, awning, water pipes, etc., should be sorted out, and the scale of the air conditioning unit and awning should be unified to maintain the harmony between the building façade and the overall environmental style.

5.4 Memorable Places

Maurice Halbwachs believes that memory is not personal but is influenced and constituted by the social environment and groups. Memory is social, and "collective" and "society" are the practical subjects of memory. Memory is a social construction and a collective behavior (Cai & He, 2023, pp. 112-116).
A community is such a "memorable place" that can carry the collective and individual memories of community members, linking the cultural history and memory of individuals and society and generating a "spirit of place" in the continuous interaction between community residents and community space. For example, the "Transition Museum" on Dinghai Road, Yangpu District, Shanghai, "presents" old memories through photography, object display, artistic creation, cultural and creative design, etc., leads people through the "memory corridor," and creates a building that belongs to Dinghai residents. "Memory Place" re-experiences the unique charm of the old alley and realizes the continuation of the "memory of the alley."

5.5 Autonomy and Co-Construction

The 19th National Congress of the Communist Party of China pointed out that the people's demand for "a better life" should be placed at the core of socialist construction in the new era, a new social governance pattern of "co-construction, co-governance, and sharing" should be created, and the construction of community governance systems should be strengthened. Including community public spaces, urban public space micro-renewal is a continuous and progressive process from planning and design to maintenance and management, and its core is public participation (Su, 2021).

Implement participatory renewal in which residents co-construct, share, and promote community co-governance. Through an organizational model that combines "top-down" and "bottom-up" and balances the interest demands of all parties, a new social governance pattern of "co-construction, co-governance, and sharing" can be achieved (Zhang et al., 2023, pp. 95-103). Coordinated by planners and with the participation of governments, social organizations, and residents (Figure 3), participatory green spaces such as community parks and pocket parks are constructed. For example, in Shanghai's long-term series of micro-renewal activities for old community parks, community parks are designed, constructed, managed, and maintained through government funding guidance, professional guidance from social organization planners and designers, and residents' voluntary organizational participation, not only promotes communication and interaction between neighbors but also improves residents' active participation in community public affairs. The positive interaction of residents' autonomy promotes the sustainable renewal of the community (Kuang, Huang, & Lu, 2021, pp. 14-19).



Figure 3. Multi-party collaborative governance relationship diagram (drawn by the author).

6. Conclusion

In the process of urban renewal in the current stock era, how to stimulate the spontaneity and participation of social and community residents through space creation and social governance is an important part of community construction (Hou, 2019, pp. 23-27). This paper provides a comprehensive perspective on urban renewal and future life scene planning by delving into the interweaving relationship between parks and old neighborhoods. Through the in-depth understanding of the residents of the site and the cultural characteristics of the site environment, starting from the small space nodes, the design exploration is carried out according to local conditions, and finally, the overall vitality of the old community is stimulated, and the public space environment with cultural characteristics, economic rationality, and humanistic care is created.

The construction of park cities and the renewal design of old communities should coordinate and cooperate to form a planning and construction model of park communities, realize the full coverage and sharing of park cities, and build a better living space that people yearn for.

We hope that these findings can provide inspiration for urban planners, policymakers, and community residents and promote urban renewal to better meet people's expectations for livability, health, and sustainable development so that people can feel the atmosphere of the park at their "doorstep," further explore the implementation path of urban old community renewal in the new era of sustainable development, and contribute to shaping a more humane and eco-friendly urban future.

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P/REFERENCES OF DESIGN

DESIGN IN SEASIDE CONTEXTS: PRACTICES, MODELS AND EXPERIENCES OF WELLBEING, SOCIALITY AND SUSTAINABILITY.

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KEYWORDS | BEACH WELLBEING, OUTDOOR DESIGN, SEASIDE ENVIRONMENTS, DESIGN FOR SOCIALITY, INTERSPECIES DESIGN

ABSTRACT | This paper proposes the synthesis of an academic research which, starting from 2016, examines projects, products, services and researches considering seaside environments as strategic places to examine in an innovative way how models of social well-being converge and change in relation of tacit, declared and emerging needs. The contribution intends to describe the role of design which, as a project science that integrates skills capable of generating and supporting development actions, offers concrete and unprecedented models of relationships, health, well-being, care of the body and the person when referred to the specific place. These actions are in some way to transform themselves into enabling and multiplying factors of social, community and intercultural connections. On the beach, therefore, the complexity of contemporary living is fully reflected: from the evolution of customs and habits to technological innovation; from economic to social changes; from ideological to cultural transitions. In addition to this, the beach context is notoriously characterized by the combination of natural elements, artefacts and rituals bound to the limits imposed by landscape protections in relation to the benefits of local communities, the beneficiaries of the sea coasts and the economic chains operating in the tourist-seaside sector. And it is precisely in this complex framework that those “devices” endowed with principles of coexistence between territory and people take shape, also in an attempt to balance the degree of anthropization of nature with bathing solutions which are able to consider new priorities and sensitivities. The beach environment also represents the close relationship between typology-service-user and how these changes over time. In this direction, the beach becomes a metaphor for the inhabited space in which man regularly brings together needs and interests. This is why, beyond leisure, well-being, relaxation, contact with nature, the beach reconstructs a multifaceted seasonally inhabited microcosm which draws from the city the idea of an expanded square in which public-private needs converge which welcomes and places for interpersonal, and in which relationships are tested in a dimension of sustainable opening. Among the design topics for the beach, it is possible to cite the continuous search for “models of harmony” between exposure of the body, social acceptance and natural elements; ecosystems sustainability; the appropriate use of inaccessible areas or “submerged beach” strips; spatial and urban regeneration; the relationship of the seaside system with territorial specificities, communities and local heritages; the entry of increasingly digital technologies; the updating and implementation of models of sharing and sociality between natural needs and personal needs; inclusiveness, interculturality and demographic changes; personal well-being and care also as access to the democracy of services; the new global health challenges. The selection of examples that will be described on an international scale will therefore have the task of representing how the beach habitat is a significant place to show the possible coexistence between anthropic activities and ecological emergencies such as to provide a map of good practices exemplifying a progressive culture which has as its objective a concrete regeneration of the seaside environment.

1. Introduction: From Healthcare to Wellness

From a methodological point of view, this contribution proposes a speculative reading carried out through case studies selected as models of good practices and as such representative of some areas of the product-service relationship in which values and solutions can be identified that belong to a kind of "new bathing culture."

These are selected examples of which strengths or weaknesses were not voluntarily analyzed in a strict sense but assumed to outline a kind of phenomenology of merit to which to give the task of outlining an overall frame of reference to represent the complexity of design phenomena that are traced on the beach environment between well-being, sociality and sustainability. Therefore, it was – not of the historical examples – primarily to form a kind of "empirical-speculative mapping" for a subsequent "mapping of practices," that is, to offer "gateways" capable of leading us among some of the most emergent traces of the "Spiaggiaverde" research.

The beach, in the classical tradition, is considered a mystical place, a line of contact between the land and the mysteries of the sea, a boundary between the solid and liquid worlds, and moreover a territory of the 'advent of life', but, moreover, an unpleasant, anxiogenic and dangerous area. The forerunners of this change of perspective are some French poets (e.g., Théophile de Viau, Tristan l'Hermite, Saint-Amant) who, from the beginning of the 17th century, "celebrate the ineffable joys of lurking on cliff tops, walking along the sandy shores and observing the changes in sea water" (Corbin, 1990). In this period, the beach gradually becomes a place of meditation and landscape contemplation; a natural environment - appealing to both Enlightenment and Romanticists - in a "subtle balance" between hermitic retreat and urban hubbub for which it is nevertheless preferable to be attended by "some particular person with whom to communicate in order to avoid the tedious solitude and oppressive multitude" (De la Hoguette, 1648).

Apart from a few exceptions, until the 18th century, the attraction to the properties of bathing did not yet possess the widespread character that we recognize today. However, the useful dimension of the beach comes to the fore and is concretely defined: its 'tranquility' as opposed to the pollution and noise of northern European cities, coupled with the promotion of medical therapies praising the beneficial effects of fresh bathing and salty air, makes coastal resorts 'desirable spaces' within a few decades. In fact, seawater began to be attributed curative properties in the same way as thermal water. In the mid-1700s, British coastal towns such as Scarborough, Brighton, Margate and Weymouth began to structure themselves to attract wealthy people who had the opportunity to indulge in seaside holidays to cure themselves of tuberculosis, asthma or simply regenerate from increasingly crowded and polluted urban environments. There was, in essence, a need to equip the beaches with support services for holidaymakers to make bathing comfortable, safe and, above all, compatible with the sense of decency and social rules of the time. In fact, undressing in public or showing oneself in a swimming costume was considered improper. It was also inappropriate to jump, run along the beach, or 'fool around in the waves' (Spurrier, 2008). Surprisingly, at least until the Victorian age, it was considered permissible to bathe naked, but always with health rather than a recreational or sporting purpose in mind, i.e. to dive briefly in the absence of the opposite sex and preferably in conditions of maximum isolation from potential prying eyes. In order to make this 'medical ritual' (Chase, 2005) adhere to the customary requirements of the Edwardian age, so-called bathing machines were developed: wooden and fabric huts mounted on mobile wagons (privately fitted out or rented) that were pulled into the sea like sedan chairs, often with the help of horses or by means of winches and mooring ropes.



Figure 1. A perspective view of Scarborough, John Setterington, 1735.

The first known representation of cabins on wheels appears in an engraving by John Setterington in 1735, but it was in 1750 that Benjamin Beale developed a model equipped with ladders, a small window and a fan-shaped awning (called a modesty hood) to safeguard the privacy of holidaymakers while bathing. This provided bathers with a means to cross the beach and a space to change and store their belongings (Darcy, 2020).

2. Not Only Leisure

Generally speaking, it is therefore possible to consider modern seaside tourism as an invention 'prototyped' and developed in British coastal cities and then, throughout the 1800s, extended across Europe to Normandy, south-western France, Italy, areas of Scandinavia and northern Germany. A tourist model capable, from time to time, of adapting to the different conditions of the context in which it is welcomed, implemented by the cult of health and sociality, as well as enriched with increasingly complete and complementary services declined in recreational, relaxation and entertainment components. The first architectural structures that were to be the forerunners of modern establishments were called 'kursaal' (treatment rooms), but, despite their name, they are very different spaces from simple places for treatment. Instead, they are large spaces offering, in a general way, both regenerating and socializing activities: social entertainment and various services including dance halls, restaurants, bathing and spa services, reading or relaxation rooms, games rooms, and theatres. Even in their earliest developments, they are primarily mundane and elitist places that involve strolling along walkways (pleasure pier) with the sea as a backdrop, while bathing in the sea is a self-defeating pleasure at first sight due to the 'brutal' immersion envisaged as a kind of shock therapy similar to a spa. Ultimately, "the beach has gone from being a source of food and a place where journeys begin and end, to a place of fun and recreation" (Weaver, Oppermann, 2000) and, over the years, from being a place for simple, practical relaxation to an area organized and spread out over twenty-four hours for an increasingly broader concept of personal 'care' and socialization (La Pietra).
The idea of 'leisure as compensation' (Löfgren, 2001)) developed in the industrial society of the 19th century. A 1903 guidebook for promoting tourism in the Catskill Mountains (USA) supports the following thesis: “We need change, we cannot live by monotony or systematic routine. Each of the five senses needs a new diet and a change of regime. This is not possible in the atmosphere or horizon of one's own city, even if one stops working or doing other activities completely. Everything has to be changed: the air, the environment, the room. The food. The people we meet, the sounds we hear; to detach ourselves from the rest and secure the desired benefits.” (Hendricks, 1903) The desire to possess the beach spread in the European continent from the first decades of the 19th century. Even if timidly: 'bathing still consists of a quick dive, you "catch

the wave", you breathe iodine, but you don't swim. The swimming costume is an invention of the 20th century and only after 1920 did one lie in the sun' (Boyer, 1997). Throughout the 20th century, and especially after the Second World War, innovations were experimented in bathing environments all over the world, capable of solving the various technical contextual criticalities and evolving needs, customs and models of both individual and collective well-being.

3. Individual Wellbeing

Due to the general aggressiveness of seaside environments (sunshine, exposure to winds, salt, strong thermal variations), solutions for individual protection are necessary, understood as a mediation between the pleasantness of exposure to natural and meteorological elements and the possible discomfort caused by them. A historical type of bathing furniture born precisely from the search for this balance is certainly the so-called 'strandkorb' (Potthast, 2024). Such seats, for private use, have been known since the 16th century in Hamburg (1595), Lübeck (1611), Bremen (1648) and Cologne (1773). The first real single-seater strandkorb (literally 'beach basket') did, however, make its appearance in 1882 and was made by Wilhelm Bartelmann, a basket-maker from Rostock, for Elfriede von Maltzahns, a lady suffering from rheumatism (and therefore particularly sensitive to the cold wind) who often went on holiday to Warnemünde. The strandkorb comes in two main variants: the first is in the shape of a chest with a straight cover and drawer footrest, used mainly on North Sea beaches; the second is in the shape of a basket with a rounded wicker cover, used mainly on Baltic Sea beaches. In both cases, the main feature of these bathing chairs is the high canopy back that provides cover and protection from wind, sun and rain. The use of the strandkorb began to spread after Bartelmann's wife, Elisabeth, opened a bathing establishment near the Warnemünde Lighthouse in 1894 where, for the first time, seating was offered for hire. Elisabeth, as well as understanding and publicising the use of these seats/cabins as a bathing service, encourages her husband to develop the project further. Bartelmann then designed the two-seater version with a canopy, footrests and side folding tables. Felix Schneider in 1893 patented a model that could be folded and transported as a kind of large picnic basket. Then, in 1897, Johann Falck, Bartelman's previous collaborator, improved the mechanical system for opening and adjusting the backrest, defining the model that is still in use today.



Figure 2. Strandhotel U. Kaiserhof, Rudolf Jahn, Borkum-Dresden, 1899, postcard.

In 1820, the British surgeon and paleontologist Sir Everard Home conducted the first scientific studies on the effects of sun exposure on skin burns. The first sunscreen with a chemical composition was formulated experimentally in 1891 by the German Friedrich Hammer. The association between skin cancer and prolonged exposure to sunlight was then discovered in 1894 by two separate studies. In Germany, Paul Unna observed degenerative changes on exposed areas of sailors' skin and, in France, William Dubreuilh, Professor of Dermatology at the University of Bordeaux, analyzed the incidence of actinic keratoses and skin cancers in vineyard workers (Ma, Yoo, 2021).

Despite these important discoveries, the invention and clearance of bathing within a few decades 'freed' bodies, making exposure socially accepted in much of the world. After the First World War, summer sunbathing began to be fashionable and, widely, synonymous with affluence, beauty, availability of leisure time and good health, and no longer a symbol of poverty and toil. Until then, in fact, it was mainly fishermen and farmers who had dark skin. In 1935, French chemist Eugène Schueller, founder of the brand L'Oreal, formulated the radiation-filtering lotion 'Ambre Solaire Huile'. In 1956, the German physicist Rudolf Schulz introduced the concept of the sun protection factor (SPF) (Svarc, 2015). Until then, the real effectiveness of sunscreens was only suggested or simply promised by the slogans and images of increasingly uninhibited advertising posters. In essence, however, the first preparations are not very stable, do not resist water and only protect against UVB radiation, the main nuisance of which is erythema.

Today, on the other hand, the common lotions provide protection against UVA rays and, consequently, are indispensable products for conscious and truly careful bathing to prevent skin melanomas. There are some interesting contemporary design projects that deal with sun protection in an alternative way to chemical cosmetics. For example, SUN+ (Rosso, 2018) is a research on shapes, artefacts, production processes and materials designed to protect in a 'physical' way from overexposure to the sun's rays. The Dutch designers Brecht Duijf and Lenneke Langenhuijsen, integrating the theme with a marked eco-environmental and systemic sensitivity, propose a study straddling product and fashion design that tackles the objective of testing possible alternatives to the use of sun creams that are potentially harmful to the skin and, moreover, require polluting production processes and distribution practices. Starting from historical research on traditional cosmetic solutions (such as, for example, the use of ash or natural dyes), Buro Belén subsequently directed its investigation towards different sunscreen solutions, including temporary shelters and, more generally, textiles. This led to the definition of a collection centred on the adoption of filters and fabrics of vegetable origin for the creation of wearable accessories and mobile tents capable of providing adequate sun protection. Unseen Sunglasses, for example, replace ordinary lenses with an ultra-light metal material that is filigree machined and colour-matched to different human phototypes. The particular micro-etching lets in a third of the sunlight; which is sufficient to guarantee adequate protection for the wearer's eyes, without inhibiting their vision. The Vitamin Hat, on the other hand, is a sisal fibre hat characterized by a flap so wide that it is able to shade the wearer's entire body, but without hindering the physiological production of vitamin D. Sun Veils are natural garments that wrap around the body, defining, by layering, different degrees of solar filtering. Prosol D is a beach umbrella with an asymmetrical cover made of a specific biopolymer fabric developed in cooperation with the Institute of Textile Chemistry and Textile Physics at the University of Innsbruck. Finally, the Shadecloth range includes different types of 'textile barriers', designed and treated to provide varying conditions of protection according to the different phases of an outdoor day. These solutions, therefore, experiment with the physicality of sun protection by offering solutions that are at the same time natural, sustainable and healthy.



Figure 3. Sun+, Buro Belén (Brecht Duijf and Lenneke Langenhuijsen), 2016.

One project, on the other hand, that introduces smart technologies for sun protection is the My skin track micro-device designed by Yves Bèhar (Fuseproject) to constantly monitor sun exposure and to promote a model of tanning aesthetics that is not detached from correct dermatological prevention practices. The small sensor, developed by L'Oréal's Technology Incubator in collaboration with La Roche-Posay and presented in 2018 at the Consumer Electronics Show in Las Vegas, measures and records the user's exposure to UVA and UVB rays, environmental pollution, pollen and humidity (McNeill, 2019). The device also provides immediate updates on a person's general health status, storing the collected data for up to three months. The battery-free sensor is activated by sunlight using the NFC (Near Field Communication) technology of the user's smartphone. The aim is to provide bathers with an easy-to-use, discreet and effective accessory for collecting and organizing useful information to increase awareness of their skin's well-being and thus be able to take preventive action against melanomas or other skin diseases. The device is resistant to water and overheating, can be stuck directly onto a fingernail and is equipped with a metal clip that allows it to be clipped onto a bathing suit. In an updated version, the technology of this small digital 'button' is being incorporated into an adhesive patch that can be applied directly to the skin.

4. Social Wellbeing

The second group of case studies collects initiatives capable of acting on the scale of the beach-space with actions capable of imagining for the context shared and, therefore, socializing times, themes and fruitions. The beach thus becomes an 'open square', a place of dialogue between residents and holidaymakers, an ideal and multifunctional space for 'being well together' and for hosting the functions of welcome, dialogue, culture and collaboration.

With the Bibliobeach project, for instance, Matali Crasset creates a pop-up library that transfers free book lending services to a seaside context in a temporary and light format. The structure exploits materials and construction systems typical of outdoor furniture: aluminium profiles, and colored canvas and mechanisms for simple folding. The result is a sort of "cultural isle" consisting of a central location for the operator, delivery desks and three rest areas where one can "immerse" oneself in reading while lying on large mats

and protected by appropriate shade curtains. The Bibliobeach thus decontextualizes and makes the use of common library services more friendly and informal, offering itself as a "satellite" opportunity to share the pleasure of reading.

Another peculiar case study is the Sci-Fi Hot Tub by Zoe Walker and Neil Bromwich (2006). This is an inflatable platform for experimenting with a model of an immersive and contemplative bathing experience in high nature-value lake settings. The inflatable island, shaped like an iceberg, is equipped with a heated pool that accommodates participants in a warm and comfortable condition as they float and 'sail' through sublime, but also potentially hostile environments. The contrast between this shared 'comfort zone' and the vast expanse of nature encourages, in the designers' intentions, confrontation and collaboration between users in an isolated, non-hierarchical context. This defines a playful-conceptual experience capable of fostering dialogue between people and a general state of physical and emotional well-being for users. The artists worked with researchers from the Phase One Drugs Trials Unit at Hammersmith Medicines Research. The medical team led by Dr Mark Down defined a scientific methodology to assess the relationship between the art installations and the audience. The project thus explores the emotional impact of an art experience on the well-being of its users (Walker, Bromwich, 2009).



Figure 4. Sci-fi Hot tub, Zoe Walker & Neil Bromwich, 2006.

The Festival Internacional de Benicàssim, commonly abbreviated simply as FIB, is, since 1995, an annual art and music event that takes place in the city of Benicàssim, in the Comunidad Valenciana, Spain. The program includes mainly pop, rock and electronic artists, as well as short films, fashion shows and art installations for public enjoyment. The festival is held in July and includes performance areas, camping and bathing areas. The beach area, during the days of the event, must therefore be able to fulfil many functions, absorb an exceptional load of users, and provide diversified activities at different times of the day and night. In 2013, a group composed of several Spanish designers united under the name Collectivo Desenfreno, realized a temporary installation on the beach using, with a ready-made approach, transennas, metal fences, lighting bodies and shading fabrics. Specifically, the project stems from the

analysis of certain contrasts and criticalities that occur on the beach of Benicàssim during the days of the event. The designers identified two main types of targets: the holidaymakers, i.e. the ordinary beach vacationers, and the festivalgoers or Fibbers, the music festival tourists who live at night while relaxing on the beach during the day. In order to adhere to the needs and expectations of these two complementary targets, and to create opportunities for socializing between them, the installation has been arranged to be, during the day, a lounge area equipped with hammocks, deckchairs and tables for free use. At night, then, it transforms into a lighthouse; a luminous totem serving as a point of reference and aggregation.

The Weltevree Strandtuin bathing pavilion designed in 2015 by Floris Schoonderbeek explores new ways of recreational enjoyment that are not limited to the passive provision of goods and services, but which, in a general sense of eco-social awareness, invite holidaymakers to play an active role in the functioning of the bathing space (Välk, 2019). The temporary pavilion is designed to be energy self-sufficient and to utilize, in a self-sustainable manner, all that the beach has to offer: the wind barriers are made of dunes, wood collected nearby by the users themselves feeds small ovens for food and stoves for heating the water for the two relaxation pools, solar and wind energy provide the electricity needed for lighting and cooling systems, and a local well provides fresh water. Food and drink are kept cold in the Groundfridge cell, which utilizes the insulating effect of the sand. The Strandtuin, in the designer's intentions, does not put the visitor in "a cottage overlooking the sea", but requires a collaborative effort thus making him feel part of and creator of the place. It brings him into direct contact with the elements of the context, making him a proactive subject in commensurate with them with a non-predatory attitude, but in search of a possible balance between nature and the pleasantness of using the seaside resort. The holidaymaker thus becomes a bit of a bricoleur, a bit of a maker, a bit of a romantic castaway and has fun, collaborating concretely with his peers, to create sufficient conditions of comfort and anthropization.



Figure 5. Slingswing, WMB studio, Winter Stations, Toronto, 2015.

Another unique initiative is the international Winter Stations design competition which has been held annually since 2015 in Toronto, Ontario, Canada. Participants are tasked with designing temporary winter installations that incorporate existing lifeguard towers between Kew and Woodbine city beaches. The structures, disused in the cold period, are considered anchoring and distribution points for installations that have the aim of encouraging the use of the beach even in the cold periods by both local and occasional users and allowing them to experiment with new models of interaction with a normally unwelcoming context.

5. Interspecies Wellbeing

Today, the need for strategies oriented towards introducing models of dialogue and interspecies collaboration is strongly emerging. They are needed solutions useful to redefine the role of the human race in relation to other living species (plants and animals) and, on a broader scale of impact, to face global environmental emergencies. These have to be new models of "pacts" in which human activities connected to bathing or, more generally, to the use of beaches and marine environments, are not in conflict with ecological needs. Human interventions, indeed, can activate processes of environmental regeneration which, at the same time, recover and strengthen habitats and develop new non-predatory and, therefore, sustainable touristic economies. They are interventions, therefore, which do not preclude nature from human enjoyment with the aim of protecting it and which actually are characterized by a high intrinsic level of technical complexity that necessarily has to be managed in a holistic and interdisciplinary manner.
In reference to this eco-social sensitivity, for example, it is possible to mention "Underwater sculpture" (Gocova, 2013), the artistic research conducted since 2006 by Jason deCaires Taylor. In collaboration with some marine biologists, the sculptor, using a neutral pH cement, shaped groups of human figures to give life to submerged installations acting as passive dwellings for the proliferation of several marine species. This project puts art at the service of the sea. These sculptural groups serve as a warning about the ecological duties from which man cannot escape as the guardian of a unique and fragile heritage. The enjoyment of these mutable and hybrid works by tourists equipped with diving masks therefore becomes a metaphor for the relationship between nature and artifice in the suspended grandeur of the depths of the sea; but above all it experiments with new possible ways to conceive a sustainable coexistence between anthropic development, cultural growth and the creation of a model of tourism that is aware and respectful of the environment. Another experience that combines ecological and social practices is the Reef Cells project developed by Christopher Xavier O'hare (USA) since 2005. The research develops modules designed for the maximization of biodiversity in the marine environment through the production of an artificial coral reef characterized by cavities interconnected and internal surfaces that recreate ideal habitats for the taking root of marine species. Thanks to the use of a particular fiber-reinforced cement and a manual manufacturing technique, it is possible to obtain thin surfaces and light blocks in which the ratio between the overall volume and the interconnected internal space compared to the quantity of material used and the minimum area of the occupied seabed is optimized. The dimensions, the irregular and rough shapes and the spatial organization of the internal voids are designed to obtain diversified modules capable of camouflaging and integrating with the ocean floor. The construction of the modules involves the creation of layers of free-form concrete "veneers" around a base with a column which guarantees rigidity and facilitates transport and lifting operations of the final structure. The modules are made manually with a simplified construction technique and are therefore practicable by volunteers from environmental associations. The project, for this reason, is a virtuous example of involvement and balance between local communities, environmental needs, scientific research and systemic development of the economies connected to bathing.

Another unique research in introducing universal priorities to the design of submerged beach use is the Sea Bathing Facility by Carlos Mourão Pereira (2007). It is an inclusive seaside path composed of a system of basins, walkways, seats and landing places designed to accommodate a wide range of users (children, elderly, blind, people with limited mobility) in conditions of safety, comfort and dignity (Ebrahem, Alsaadani, El Sayad, Elseragy, 2018). The direct contact with nature is facilitated and encouraged since the structure protects bathers from wave motion and, at the same time, defines small habitats in which marine life can naturally develop. These biological tanks thus become invitations to discover plant and animal

species in a multisensory and integrated way. Everything is made of recycled concrete, a material that meets functional, economic and ecological needs, as well as requirements for resistance to sea water. Furthermore, the basin system does not require a mechanical water filtering system because, thanks to its position and shape, it exploits the tides as opportunities for water recirculation and purification and "biological exchange" between basins and the ocean. Furthermore, this specific location "on the water's surface" is designed to encourage a seaside experience that is as symbiotic as possible with nature. This “accessible border” space therefore takes on a rich and specific multisensorial character. It is an adaptive place where wind and water interact in a mediated form with the coast, and therefore where anyone can enjoy the pleasant tactile, olfactory, acoustic and material sensations of the marine elements.

Econcrete (Sella, Perkol-Finkel, Rella, 2018), then, is an interdisciplinary macro-research which, since 2012, has involved biologists, ecologists, environmental engineers, designers and specialists in concrete technology for the creation of particular blocks for the stabilization of the seabed and the construction of coastal barriers. The modules, characterized by tube-like surface depressions, are made with a specific mix of chemically balanced concrete which guarantees a level of microporosity that favors the growth of organisms such as algae, oysters, corals or barnacles. These organisms act as an ecosystem nursery and as a biological glue, improving the strength and durability of the structures and, therefore, increasing their stability and longevity. The result is an intervention model and a construction practice that does not damage marine habitats but understands them and acts with them, facilitating the best conditions for the development of healthy and diversified ecosystems that are also capable of contributing to the quality and effectiveness of the infrastructure. The ECOncrete mix is up to 10% stronger than traditional concrete, with a 70% lower carbon footprint when used in combination with slag cement and is designed not to release particles into the marine environment. In recent years, pilot barriers have been installed in different natural and climatic contexts (temperate, tropical and estuaries) and in urban port areas. In few months, in different ecosystems it has been observed that the units manage to develop a high range of native species within them. These "living infrastructures" have now been adopted globally in green architecture projects in Spain, Holland, the United States of America, Israel, England, Germany, France and Hong Kong.



Figure 6. Econcrete, Ido Sella and Shimrit Perkol-Finkel, 2012.

Another international research and innovation center for the marine environment is the Reef Design Lab (since 2013). The Australian multidisciplinary company is specialized in the design of infrastructures for the development or support of marine habitats for commercial or research applications. The company collaborates with different types of marine researchers, including coastal protection experts, eco-engineers

and biologists. The studio was founded by industrial designer Alex Goad who leads a team based in Menton. The research group's overall work focuses on combining experimental materials and digital fabrication technologies with traditional coastal management techniques to create economically and environmentally sustainable solutions that respond to current and future ecological emergencies. The MARS project (2013), for example, addresses the critical issues of coral reefs due, globally, to ocean warming and acidification, destructive fishing practices, and the presence of invasive species. The project, aimed to create a nursery for corals, develops a three-dimensional and modular structure that can be transported by small boats and installed by divers without the aid of heavy machinery (to which many communities do not have access). The system can also be built in reference to local specific needs or recovery objectives. The modules are manufactured through 3D printing using a particular inert ceramic compound. The Living Seawalls project (2018) was developed in partnership with biologists from the Sydney Institute of Marine Science to test the possibility of making ecologically productive artificial coastal walls such as dams and barriers in ports or urban areas (Bishop, Vozzo, Mayer-Pinto, Dafforn, 2022). Normally these vertical surfaces are flat, continuous and free of cracks or surface textures. These conditions make their colonization by native organisms difficult. On the contrary, the project proposes a system of hexagonal concrete panels morphologically designed to encourage the development of a varied plant and animal microecology. The Wave Break project (2022), on the other hand, is aimed at improving a possible balance between marine habitat and tourist activities. Large porous bells, located near the submerged beaches, provide coastal protection, reduce erosion phenomena caused by the force of the waves, enrich the natural habitat, thus constituting a hybrid and dynamic attraction for snorkeling activities during the high tide phases and for naturalistic observations during low tide phases. The first modules were made with a mixture of ecological concrete mixed with fragments of locally sourced marine shells.

Similarly, the X-REEF project (XtreeE - SEABOOST, 2017) applies 3D printing processes for the creation of large concrete products to be used as ecological nurseries and for the restoration of coral reefs. Designed in collaboration with biologists, the dimensions, the shapes and the textures of the cavities were, once again, have been defined to maximize the reproduction of the underwater species. A first prototype was immersed in the Calanques natural park in France. The technology adopted, specifically, made it possible to recreate the morphological complexity typical of the so-called "coralligen". Coralligen is a marine bioconstruction, that is, a permanent structure formed by the stratification of some plant species that grow by accumulating calcium carbonate on the cell wall. This type of growth significantly increases the volume, complexity and heterogeneity of the marine habitat, attracting a large number of other animals and plants. Consequently, the coralligenous is a very biologically rich environment, so much so that it is considered the second most important biodiversity hotspot in the Mediterranean, after the Posidonia meadows. In nature, this peculiar ecosystem can take several hundred years to form and then gives shelter to thousands of living species including fish, crustaceans, corals, algae, plants and mollusks.

Another example of effective and sustainable collaboration between human intervention and biological needs is the Tetrapots project by Sheng-Hung Lee - Wan Kee (2014). Artificial sea defense infrastructures are usually composed of stacked breakwater modules of various shapes. These are considered highly impactful from a landscape point of view and, under certain conditions, not sufficient to counteract the continuous action of wind and waves. Mangroves actually perform the function of protection and mitigation between water and land in nature, but due to the greenhouse effect and global warming, it is estimated that more than 35% of this valuable plant has already disappeared. The Tetrapot cavities are designed to host and develop mangroves, thus generating a symbiotic relationship between nature and artifice. The roots of the mangroves will, over time, strengthen the bond between the modules by holding them in place and thus creating a more effective chain of shoreline protection. they will come together to create a long-lasting sea defence of growing trees and roots that help hold the blocks in place. As the plants continue to grow backwards from Tetrapot, the roots intertwine and gradually form a natural defence from the sea. The product thus not only prevents soil erosion but also helps to protect and create a natural habitat (Salam, Prasad, Noor, 2023).

In 2018, due to the destructive force of Typhoon Mangkhut, the city of Hong Kong lost about 80 per cent of its coral reef. Designers from the Robotic Fabrication Lab, as part of the Fabrication and Material Technologies Lab in the Faculty of Architecture, and marine scientists from the Swire Institute of Marine Science (SWIMS) in the Faculty of Science at HKU jointly developed a new method for reef restoration, using 3D-printed artificial 'tiles' specially designed to promote the rooting and, thus, proliferation of corals (Lange, Ratoi, Co, 2020). In July 2020, the field trial started with the installation of an area of around 40 square metres of terracotta modules prototyped by digital manufacturing. The test was conducted at three selected sites within the Marine Park, including Coral Beach, Moon Island and a sheltered bay near the WWF Marine Life Centre. Specifically, the modules promote the restoration of corals and various forms of marine microhabitat in general by providing a structurally complex and porous mesh for coral attachment and preventing sedimentation, a major threat to corals. The recent 3D-printed artificial reef designs present are site-specific and a universal solution may be difficult to calibrate, as there are various types of underwater conditions. However, a common denominator, pioneered by the Japanese team, can be considered the use of natural materials, i.e. capable of not altering the underwater flora and fauna. To this end, the researchers deemed clay suitable as it is chemically similar to the calcium carbonate found in real coral reefs.



Figure 7. 3D Printed tiles, Robotic Fabrication Lab, University of Hong Kong Faculty of Architecture, University of Hong Kong Swire Institute of Marine Science, 2020.

6. Conclusions

The analysis of these specific case studies demonstrates how much the beach environment is a complex microcosm in which they are experimented with sustainability issues centred on principles of well-being and sociality. These models of sustainability are entirely centred on an equally complex thought of anthropogenic and environmental regeneration that in confronting design culture brings into focus how much design space there is to fulfil and sustain social, economic, and technological needs in addition to those imposed by climate changes. Therefore, by selecting different experiences, objectives and geographies, the examples illustrated to highlight the strong relationship that insists between "natural heritage", "bathing context" and "design role" in different possible product-service combinations. That is to say, whatever design action is developed in the beach-sea relationship, it demands intelligent practices in the mediation between nature and artifice. For this reason, the beach, as a territory, represents a privileged place from which to observe the responsibility of the project in proceeding according to different and possible models of development and of an answer to evolving needs. In other words, a context from which to examine the responsibility of the project and designers in introducing appropriate regenerative actions. In this direction, among the project themes that most interpret these objectives, design culture has to face new challenges for ecosystem sustainability, for the appropriate use of impervious areas or of the "submerged beach" strips, for a renewed relationship of the beach system with territorial specificities, for the adoption of digital technologies, for the updating and the implementation of models of sharing and sociability between natural and personal needs; demographic changes; and personal well-being and care.

All together, these important topics show how the beach as a composite habitat is a significant place to show the possible coexistence between human activities and ecological emergencies. In the end, all that has been said so far spills over in a methodological key into the possibility that for designers the beach environment can be an "objective context" from which to examine the responsibility of the project and therefore of the designers in introducing targeted redevelopment actions. A redevelopment that can - not without risk - test the reconciliation of different objectives also from playful activities capable of dialoguing with the social dimension and environmental sustainability. To be consequently open to experimentation, to the unexpected, to the reversibility of the result in the certainty that design is a "heteronomous" discipline because of the uninterrupted relationship and dependence it has with other knowledge (interdisciplinary vocation). This awareness enables design and designers to move beyond a "simple" problem solving model to a "consciousness of reality" that requires designers to constantly understand that it is never about making products or services but deploying effects in the world.

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P/REFERENCES OF DESIGN

EXPLORING INTERACTION AND CREATIVE PRACTICES FOR RECONFIGURING ACTIVE LIVING IN AGEING COMMUNITIES.

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KEYWORDS | ACTIVE LIVING, WELLBEING, INTERACTION DESIGN, PARTICIPATORY DESIGN, TRANSFORMATIVE PRACTICES

ABSTRACT | The aim of this paper is to describe the collective engagement and design approach adopted inside a European technology-enhanced ambient assisted living project, aimed at supporting the autonomy and self-management of health of the older people, through the use of innovative technological devices. The collective design methodology adopted in the research, including interviews, sharing sessions, co-design workshop and affinity diagrams, aimed at investigating the concept of Active Living with a mixed top-down and bottom-up approach, by combining theoretical definitions with user perspective for deriving scenarios and functionalities to stimulate older people. The following factors of Active Living were identified as the main dimensions of older people's experience: (a) empowerment, (b) perceived self-efficacy, (c) autonomy. This research allowed us to discuss and reconsider these dimensions and to propose novel factors for defining Active Living as an emerging experiential and interactional reality consisting of a balance between the personal sphere and the relational one. Technology acceptance and adoption play a fundamental role in supporting patients with mild cognitive impairment disease (MCI) when technology is designed, and perceived, as a tool that facilitates self-determination.

1. Introduction

The population is gradually ageing, with global life expectancy increasing by more than 6 years between 2000 and 2019, from 66.8 years in 2000 to 73.4 years in 2019. In addition, it is estimated that in 2050 more than 20% of the population will be over 60 years old (World Health Organization, 2015). For these reasons, interest in ageing is growing: despite improved living conditions, increasing life expectancy in fact brings with it challenges, related to physical and cognitive deterioration (Inouye, Studenski & Tinetti, 2007). A particularly problematic cognitive-related expression of ageing is dementia. While not totally disabling in most cases, the various forms of dementia still negatively affect a person's health and quality of life. Dementia sufferers are particularly exposed to social isolation (Hackett, Steptoe, Cadar & Fancourt, 2019), depression (Ong, Uchino & Wethington, 2016) agitation, apathy and anxiety (Cerejeira, Lagarto & Mukaetova-Ladinska, 2012). In addition, dementia is also associated with an increased likelihood of falls, difficulty with self-care and social relationships, and memory problems (Miranda-Castillo, Woods & Orrell, 2010; Wilcox, 2009).

Dementia in older people can be considered as the last step in a slow process, ranging from normal cognitive decline due to aging, to mild cognitive impairment (MCI), to full-blown dementia (Jongsiriyanyong & Limpawattana, 2018). Faced with this scenario, some solutions are needed in order to be able to intervene early, as soon as the first signs of cognitive decline emerge, so that the older person can remain autonomous and independent as long as possible and delay the progression of deterioration, supporting them in all those activities that are impaired (Sosa et al., 2012).

It is in this context that the present research is set. The research aims to ensure the well-being of people with mild cognitive impairment by supporting their autonomy and self-management through the use of an innovative modular mobile App, that delivers coaching services related to nutrition, physical activity, cognitive exercises, and social relationships. The system is thought to help older people with MCI to become more resistant to the changes the old age brings and take better care of themselves.

The technology is designed as an open, modular, and adaptable platform to provide self-management and coaching services to people with MCI, integrating informal and professional assistants as needed, to be used independently or in combination with lifestyle monitoring systems or wearable devices on the market. The approach used in this research is a user-centered one, that is, based on end-user participation at all stages of design in order to adequately address the needs of target users, ethical and cross-cultural dimensions, and to monitor and validate the psychosocial impact of the technology (De Vito Dabbs et al., 2009). Indeed, it has often been noted that people with mild cognitive impairment or other similar diagnoses are often not included in research (Chopra, 2021) and data collection comes from the field of caregiving, while instead “to give voice to people with dementia and increase their level of empowerment even in research processes, it is important to include them as valued participants. Therefore, public and patient involvement (PPI) and co-production, especially in an interdisciplinary health care and design context, is important to bring together, adapt, adopt, amalgamate, and develop appropriate methods to facilitate people with dementia as active partners in every stage of research” (Niedderer et al., 2017).

2. Active Living Framework

In line with the healthy aging definition that focuses on the optimisation of opportunities (Swedish National Institute of Public Health, 2007) a multidimensional concept has been used for the design of the system, based on the meaningful integration of five main elements:

- healthy nutrition;
- daily physical exercise;
- regular cognitive and mental activities;
- maintaining social contacts inside and outside the family;
- keeping an active interest in society.

Such elements are tightly interwoven since maintaining good physical health and functioning plays an important role in facilitating mobility and enables older adults to perform more integrated functional tasks which include activities of daily living, fulfillment of social roles, and recreational activities. Furthermore, good cognitive health is linked to social connectedness, independence, and life activities, and it might be preserved and enhanced by maintaining an intellectually engaged and physically active lifestyle (Halaweh, Dahlin-Ivanoff, Svantesson, & Willén, 2018; Bourassa, Memel, Woolverton, & Sbarra, 2017).
We identified the following factors as main dimensions of older people's experience:

- empowerment;
- perceived self-efficacy;
- autonomy.

2.1 Empowerment

The notion of empowerment (Perkins & Zimmerman, 1995) is foundational in our approach since it does represent the overall scope of an intervention. The empowerment is a multidimensional concept constituted by several components including supporting older people to keep their current levels of mental functioning; by preventing possible decay in cognitive and social skills; by coping with adverse events and negative experiences; and by exploiting latent resources (Mitzner et a, 2010). That is why, in order to empower older people to live independently, designers should make sure that older people can adapt and configure devices according to their personal circumstances in a way that their independence can be supported and be constantly renegotiated (Giaccardi, Kuijerb & Nevenc, 2016; Giaccardi, Nicenboim, 2018). Renegotiation of self-image may support the idea of iterative empowerment pathways as structured, organized and goal-oriented paths for a healthy population integrating multiple levels of skill-support.

2.2 Perceived Self-Efficacy

Self-efficacy can be defined as a personal judgment of ‘how well one can execute courses of action required to deal with prospective situations’ (Bandura, 1982). In general, individuals with high perceived self-efficacy are determined and show more effort across a broader range of tasks than people with a lower level of self-efficacy.

Staying active is reportedly connected to self-efficacy since it implies good physical functioning and the ability to autonomously reach a goal. It has to be noted that decreased levels of self-efficacy, resulting from low levels of exposure to related stimuli, are also associated with higher levels of anxiety and this is particularly relevant in the interaction design for the elderly.

2.3 Autonomy

Staying independent was viewed as a major characteristic of ageing well. Beyond the participants' living status (alone or with family), the importance of being independent was connected with the autonomous status of the older adults. A major concern that was frequently mentioned in the user research was not being or becoming a burden to others. In particular, along with the interactive discussions in all groups, target users involved in the user research reflected on the necessity of staying independent in performing their daily life activities including both personal and instrumental activities.

We have used the Active Living components to analyze, understand and interpret the findings from the empirical research on users by investigating:

- How the users might confirm, integrate and expand the definition?
- How the users’ perspectives might allow the researchers to disentangle this concept?
- How the users’ concerns, motivations and internal experiences might enrich the design of the interactions?

3. Research Methodology

The research and design methodology developed in the project integrates methods and techniques from a broad range of disciplines, from ethnography and psychology to Design research and Participatory design. The research methodology adopted in the research involved 41 participants (both people with and without a diagnosis of MCI) from Italy, Switzerland, the Netherlands and Canada in user research and design materials explorations and 6 expert participants including researchers and scientists from clinical psychology, interaction design, and technology development.

The following table shows participants numbers, divided by the activities carried out in each country, and the paragraph below reports the description of the activities:

Table 1. Participants involved in the study.

Activity	Scope	Italy	The Netherlands	Switzerland	Canada
Interviews	Collect qualitative data about “Active living” meaning	10 participants	10 participants	4 participants	/
Evaluation of Envisioning Scenario in participatory sessions	Define system future User Experience and functionalities	4 participants	5 participants	/	3 participants
Exploration of digital materials in Co-design sessions	Validate task flows and design solutions defined, by using interactive mockups	4 participants	/	/	/
Affinity Diagram	Requirements elicitations	2 experts	1 experts	1 experts	2 experts

3.1 Interviews and Sharing Sessions with the End-Users

Interviews have been carried out by expert partners able to establish a relationship of trust and reciprocity with people of concern, to use an appropriate language, a participatory approach and to keep in mind cultural markers and to manage any vulnerabilities. Through interviews, experts have had the opportunity to collect qualitative data about what “Active living” means for elderly people.

Field data collected in the first part of the research have been used as input for Scenario-based design, addressing the system service and user experience.

3.2 Evaluation of Envisioning Scenario in Participatory Design Sessions

The team has defined 3 main scenarios with a few User eXperience (UX) /User Interface (UI) Statements to be validated together with participants to explore the future system functionalities. These materials were presented to end users in order to identify and understand their perspectives about those affirmations, in terms of acceptance, perceived utility and satisfaction. Here below an example:

Personas: Elizabeth is 74 years old and lives alone since her husband passed away a few years ago. Nevertheless Beth is a determined and dynamic woman. She is constantly on the move. Beth handles all her daily activities, such as grocery shopping and housework. She is also very active in the social field. She likes to do things for others, like getting groceries for her neighbors.

When she gets out, she prefers to walk, but in case of necessity, she uses a bus, which is another opportunity to socialize! She has no relevant age-related physical problem but she recently noticed that her memory is getting worse. She loves meeting up with her friends, especially to play Bridge. Once a month, she goes to the theater. Elizabeth is quite capable with technology. She uses a tablet to search for online recipes and to consult the theater's program. She also uses a smartphone to communicate with her family.

[Extract of] Envisioning Scenario:
Beth heard that tomorrow evening there will be a performance and set the appointment on the calendar. The system checks the events organized in the town and compares the collected data with those recorded by Elizabeth. The system detects a gap in data: a similar event will take place in two days. So the system offers further information on the theater program and asks her: "Are you sure your event is correct? Do you want to check?"

Statement [to validate with participants]: I believe that a tool for checking my calendar and confirming the scheduled event, could be useful.

Participant answer: "This service is like a guardian angel. It could be a great brain aid. If developed well, it could be very useful."

In doing so, Storytelling has been emphasized for the Active Living concept exploration, to elicit intrinsic motivation issues and to explore alternative futures with relation to the 'as-is' experience of MCI and formal/ informal caregivers.

In general, the use of scenarios (Carroll, 1995; Carroll, 1997) allowed to structure data gathered through activity analysis while envisioning the role and functionalities of the system, and the assessing and validating the envisioned solutions from a technical perspective. The validation of these scenarios, allowed to revise the preliminary formulation by enriching and extending them.

The scenarios that came from, represented the starting point used to design and define a set of interactive mockups, useful in the following phase.

3.3 Exploration of Digital Materials in Co-Design Sessions

Starting from the data collected during the previous activity, experts used the revised scenarios to build specific task flows, defining the most effective User Experience. Based on these task flows the team designed the User interface and relative screens to test the UX. These screens were then used to create a first prototype to be submitted to end users, obtaining an interactive mockup. The flow sequences were designed using Sketch. The prototype was animated with Adobe XD creating a mixed interaction in which direct touch interaction was combined with the "Wizard of Oz" technique to allow users to interact with the interface while the application functionalities are simulated. This technique requires the user to interact with the system to be evaluated, while a hidden operator processes the user input and consequently simulates the system response. This method allowed experts to test with end users a few specific flows and stimulate the discussion for generating new ideas. This exploration session has been carried out with 4 participants and allowed the team to elicit and validate the "Active Living" Requirements that emerged during all the previous phases.

3.4 Affinity Diagram

The affinity diagram is a problem-solving technique useful to organize data according to its natural relationships. This tool, also known as affinity chart, thematic analysis and K-J method, was created by the Japanese anthropologist (more specifically the ethnographer) Kawakita Jiro. Over time, multiple variants of this method were elaborated and improved (Plain, 2007).

This technique is considered very useful to manage a large collection of mixed data that is too complex to proceed directly to the requirements stage of the project. Compared to the usage of one of the formal techniques - such as task or workflow analysis - through the affinity diagram activities, the risk of losing the users' context decreases. In fact, it is particularly adopted during the design process, to secure the quality of qualitative data and allow bridging the UX research to the design phase, avoiding the loss of information, significance and conceptual connections among data.

This step-by-step approach (Alänge, 2009) provided the designers with the possibility of using sticky notes with a group of participants. The aim was to group the information in macro thematic categories and identify conceptual links among them to define a set of design recommendations.

The session started from the definition of the main research question.

People involved had to identify what is the problem they want to investigate and figure out. This question formulation facilitated the focus on facts during the data collection. The second step consisted in writing down the insights - collected during the contextual research - on sticky notes. At this point, the sticky notes were grouped by the principle of affinity. The first level grouping allowed gathering information with the same meaning. A headline was added to each group referring to the general theme.

The clustering has been repeated a second time, depending on the complexity of the issue and allows for a higher level of abstraction. As Alänge (2009) confirms this process continues until a shared understanding has been reached. In particular, this process stopped as soon as the panel obtained a few supergroups: they are thematic categories able to contain all the sticky notes with a common significance. These supergroups were then linked to show interrelationships among them. Using the arrows, the team proceeded with the connections between the main topics. The direction of the arrows indicated the consequentiality and allowed us to identify the order of reading of the contents. Defining relationships meant understanding and prioritizing the most important issues influencing the question analyzed. For what concerns the Affinity Diagram related to this project, the session has been carried out remotely, using the Mural visual collaboration online software. The team was made by six participants from consortium countries, Italy, The Netherlands, Switzerland and Canada, following the below questions:

- What does Active Living mean for aging people?
- Which are the main Active Living components?
- How can we design interactive technologies to support Active Living?

Starting from this data, the research group validated all the information currently available. At this point, participants have followed a partially different process compared to the traditional affinity diagram method. The following step consisted of prioritizing the topics and figuring out what the team considered most significant, by voting both main clusters and single items. Each participant had to express his preference for a maximum of 15 votes, (by using a star icon) and once the activity was completed, the team shared opinions and thoughts. Participants were asked to be aware of which values, motives, and priorities they were using as foundation ideas before starting ranking:

- Is this your user’s priorities, your organization’s, the stakeholder’s, or your own? Which ones should you put the most emphasis on?

4. Findings from Design and User Research

This paragraph reports the main findings from the user research activities. All the participants in the engagement sessions have been stimulated to take part with questions and proposals and for exploring the interactions strategies with a coaching service. The participatory sessions allowed us to understand the real needs of users, their motivations, habits, but above all their concerns and frustrations. Users have positively participated at the validation of the scenarios, emphasizing the aspects of the project that are most relevant and useful to them.

4.1 Results from Interviews

Direct interviews with people with mild cognitive impairment (MCI) allowed the researchers to directly explore memory degradation, how do people react to forgetfulness and loss of cognitive abilities. As also reported here below, motivation is crucial to carry out cognitive tasks:

> "I know that it would be important to train memory with reading, crossword puzzles … but these activities bore me. Some years ago, I loved reading a lot of books and sports newspapers." (participant 1 - IT);
>
> "I take care of my mind more than my body. In fact, playing in a theatre company, I often have to learn my lines from the script by memory. This is a good exercise to train my memory. I also read a lot and I like crossword puzzles and rebuses." (participant 3 - IT)

In particular, the majority of respondents reported that they use a variety of strategies including timetables, and crossword puzzles, like:

> "I use different strategies to not forget my appointment. I have a timetable where I put the bills and I mark the expiration dates. I also set the alerts on my smartphone to remind me of my appointments." (participant 3 - IT);
>
> "I also play cards on the computer to maintain my memory training." (participant 5 - IT);
>
> "I think it's very important to keep my mind trained. I do crossword puzzles and I read to exercise my mind." (participant 8 - IT).

Other participants in the research questioned the importance of planning, as reported here:

> "I always plan what to cook the next day and the housework to do. I never write down my plans, but I try to keep them in mind." (participant 8 - IT);
>
> "Planning is not important for me. I will see what tomorrow will bring, everything will be alright. When you plan something, it can turn out very different in the end" (participant 3 - NL).

Cognitive activity has also been related to the ability to use and the acceptability of technology, as reported here:

> "I am not able to use it. I have only a mobile phone. I am not interested in learning the use of the main technological devices (smartphone, laptop …)." (participant 1 - IT) and here "I don't like very much technology but I able to use smartphone, Internet and I have also Facebook profile" (participant 2 - IT).

An increasing number of situations in the daily life of the elderly have been pervasively modified by the use of technology, including storing pictures, monitoring physical activity, and communicating with people, as reported here:

> "I always use my laptop, smartphone, and Internet. I like technology very much and I often store and modify my photos on my computer." (participant 3 - NL);
>
> "I really like technology and I always use the Internet, laptop, social networks, and smartphone. I also use a pedometer that monitors my progress and performances. I can see them through an app on my smartphone." (participant 5 - IT);
>
> "It is important for me to communicate with people by means of my phone" (participant 3 - NL);
>
> "I send emails for the choir, I make photos and copy files for Spanish class. Then I can make the spaces larger and use different colors for the translations. I get emails from the pharmacy". (participant 4 - NL).

As emerged from the interviews, social relationships are a key aspect for older people. In particular, the end users consider social life as an essential aspect of maintaining an active and satisfactory life:

> "Looking at these images I think that the most important is to maintain social relationships because I like to compare my opinions with other people on different topics. It makes me feel alive." (Participant 1 - IT);
>
> "I believe that the lifestyle should be appropriate to the age of the person. For me, social relationships are essential to a healthy life. I take good care of relationships with my family." (Participant 3 - IT);
>
> "I need to have a lot of social relationships to be happy. I need to discuss and spend time with colleagues, friends, family, and grandchildren. I wouldn't know how to live without social relations." (Participant 6 - IT).

This element therefore shows that isolation can lead to worsening the daily life of people suffering from cognitive impairment. Maintaining constant social relationships allows people to have a better attitude and feel more motivated to follow a healthier lifestyle, as reported in the following quotes about personal interests' sharing:

> "I think that to have a healthy life is to stay fit and cultivate hobbies and interests." (Participant 1-IT);
>
> "He likes to cook for the residents of the two flats here. He made soup for Easter and we had brunch. He really enjoys doing that" (wife) (Participant 5 NL);
>
> "Sometimes I call my friend to grab something to eat in the city nearby" (participant 8 NL).

This aspect has been broadly considered by the team during the definition of scenarios.

4.2 Results from Evaluation of Envisioning Scenarios

Among the aspects that emerged during this activity, the use of technology had a relevant importance. Very different points of view have emerged on this issue. As shown below, some users (the ones more capable with the technology) were interested and excited to use the proposed system. On the other hand, users less familiar with the technology were quite frightened. This leads the team to deduce that it is important to design solutions that are particularly suitable for this less convinced target, trying to foster greater trust in technology.

Future scenarios allowed eliciting opposite attitudes towards technology, ranging from personal skepticism towards technology, until very enthusiastic perspectives. These attitudes might be seen in statements like:

> "I am not very much interested in technology." (Participant 11- IT)

> "This service is like a guardian angel. It could be a great brain aid. If developed well, it could be very useful." (Participant 12- IT);

> "I would love to use it! I'm very curious about technology. I think technology could represent a proper aid if it's used in the correct way." (Participant 13- IT).

Some of the participants also highlighted the cognitive aid role that technology might play, such as:

> "With these modern systems we use the brain less than years ago. In the past when you had to call someone you had to remember your phone numbers. Today we are used to pressing a key and calling quickly. On the other hand it is also true that technology simplifies your life." (Participant 12- IT).

Among the most important results of the participatory sessions it has been reported that seniors, their relatives and caregivers need to be aware of the benefits of physical activity. Not only to increase motivation towards physical activity but also towards the use of technology as a motivator. Results also show that lack of competence is the most important barrier to engage in physical activity. Possibilities for social interaction are shown to be the main motivator. However, it should not affect seniors' sense of competence and autonomy. Goals' setting is already widely used in the whole caretaking process. The goals and pop-up notifications should be succinctly, specific and should focus on resolving the critical causes of the lack of hunger. The notifications should stimulate a new and healthier eat/drink rhythm. It is important to create awareness in a positive way. Elderly may get a negative experience with the system because of unreachable goals. The difficulty level of the goals should therefore automatically adjust to the skills of the person. It should not be too confrontational and should stimulate a positive mindset. wasting water for brushing teeth).

4.3 Results from Mockup Exploration

By using the interactive mock-up in co-design sessions, people were allowed to enter into two main components, like Physical Activity and Memory. Regarding the first one, all the participants were aware about the importance of regular physical exercise, and reported to exercise at least once a week. At the same time, when the team proposed the usage of a device, like a smartwatch to monitor physical parameters, not all the people were committed, as reported here:

> "I'm always on the move. It seems interesting, but I don't feel the need to have a smartwatch" (Participant 16- IT);

> “I already have one (she wears it). Instead I am very interested in having additional information about my physical activity, know how many kilometers I have traveled, heart rate, etc. I am a curious person. I do a lot of physical activity, in addition to walking, I go to the gym 3 times a week.” (Participant 17- IT);
>
> “I'm not interested in having a smartwatch. I don't do much physical activity. I usually walk a little and in these moments, I prefer to do it alone." (Participant 18- IT).

This exploration allowed the authors to highlight that people want to maintain their autonomy and independence and not everyone feels the need to monitor their physical activity in such detail. For what concerns memory, people have reported that they need to write down all important appointments and information they have to remember. In general, the system was positively accepted, as reported here:

> “For me it would be very useful to have help to remind me of things. The tablet would be perfect because I sign everything, shopping, visits, appointments and I do it on a calendar or smartphone” (Participant 17- IT).

At the same time, it is essential for people to be able to maintain their autonomy. Designing for this target means providing tools that, according to personal needs, allow them to feel autonomous and able to take care of themselves, as it happens with social relations, materials used as cognitive artifacts, like the post-it, and the use of the personal agenda: as reported here:

> “I prefer to remember things by myself. I don't want to get help from this point of view. If I need, I am asking for some help. My husband always tends to remind me of things." (Participant 18- IT);
>
> “Sometimes I wonder, "Did I do this? Once done, I throw the related post-it” (Participant 18- IT);
>
> “I usually use the agenda to remember things, but I think that the system help could be useful. I would use it.” (Participant 17- IT).

4.4 Results from Affinity Diagram

Keeping in mind the starting questions, the researchers taking part in these sessions were engaged in trying to make sense of the clusters of concepts and creating supergroups in order to answer the question: “What factors are most strongly affecting the starting issue/problem and how these factors are interrelated?”. As reported in Figure 1, the awareness of independent living represents one of the most important themes that the group of participants was discussing.

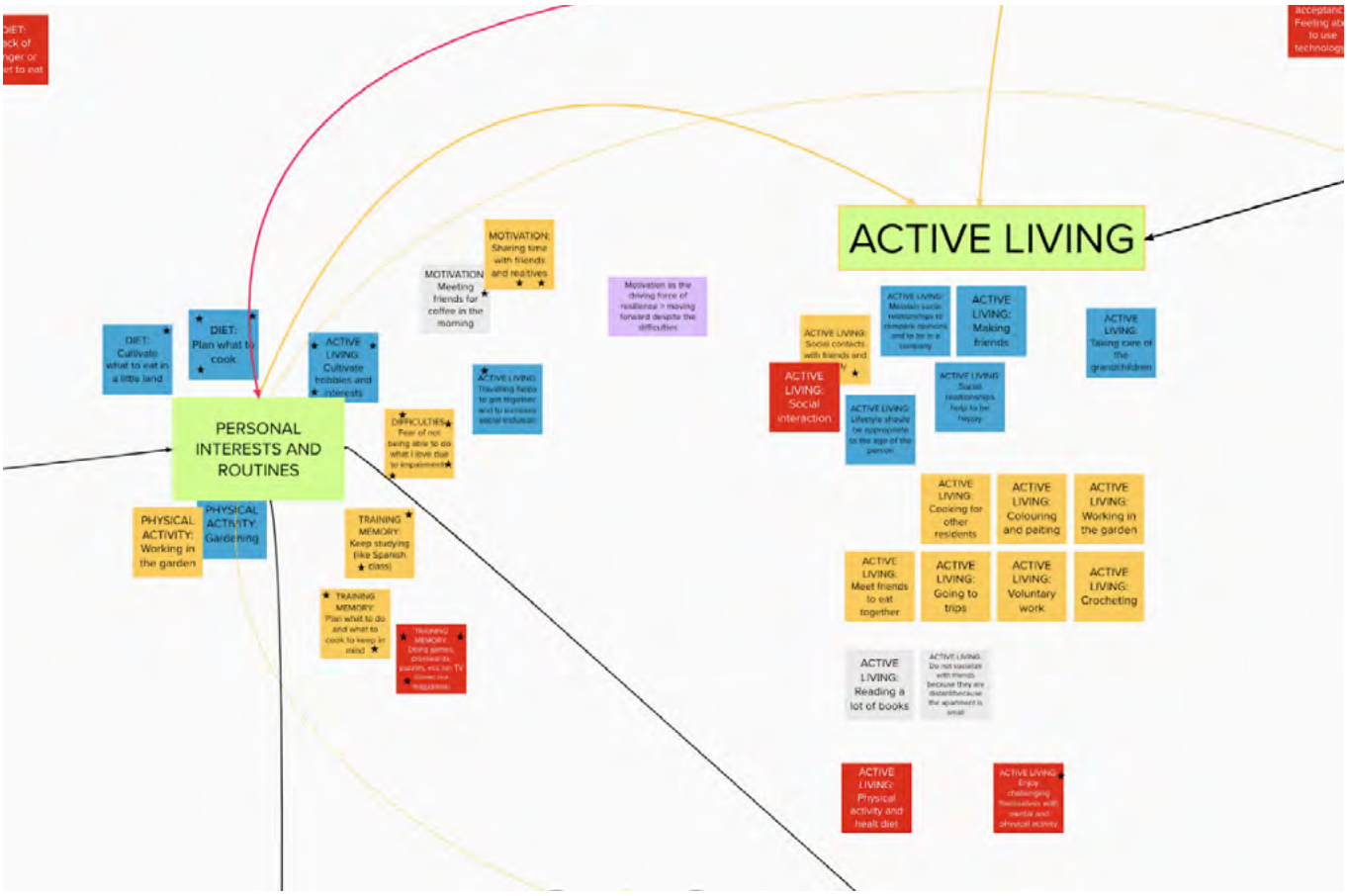


Figure 1. Awareness cluster with the detail of evidence of results from the research.
Some post-its include the preference star as well.

Most interestingly, the Affinity Diagram allowed the experts to create connections among the Active Living components, as reported by the other activities that have been carried out in this research. Figure 2 shows an example of the supergroups of clusters that have been created in the session.

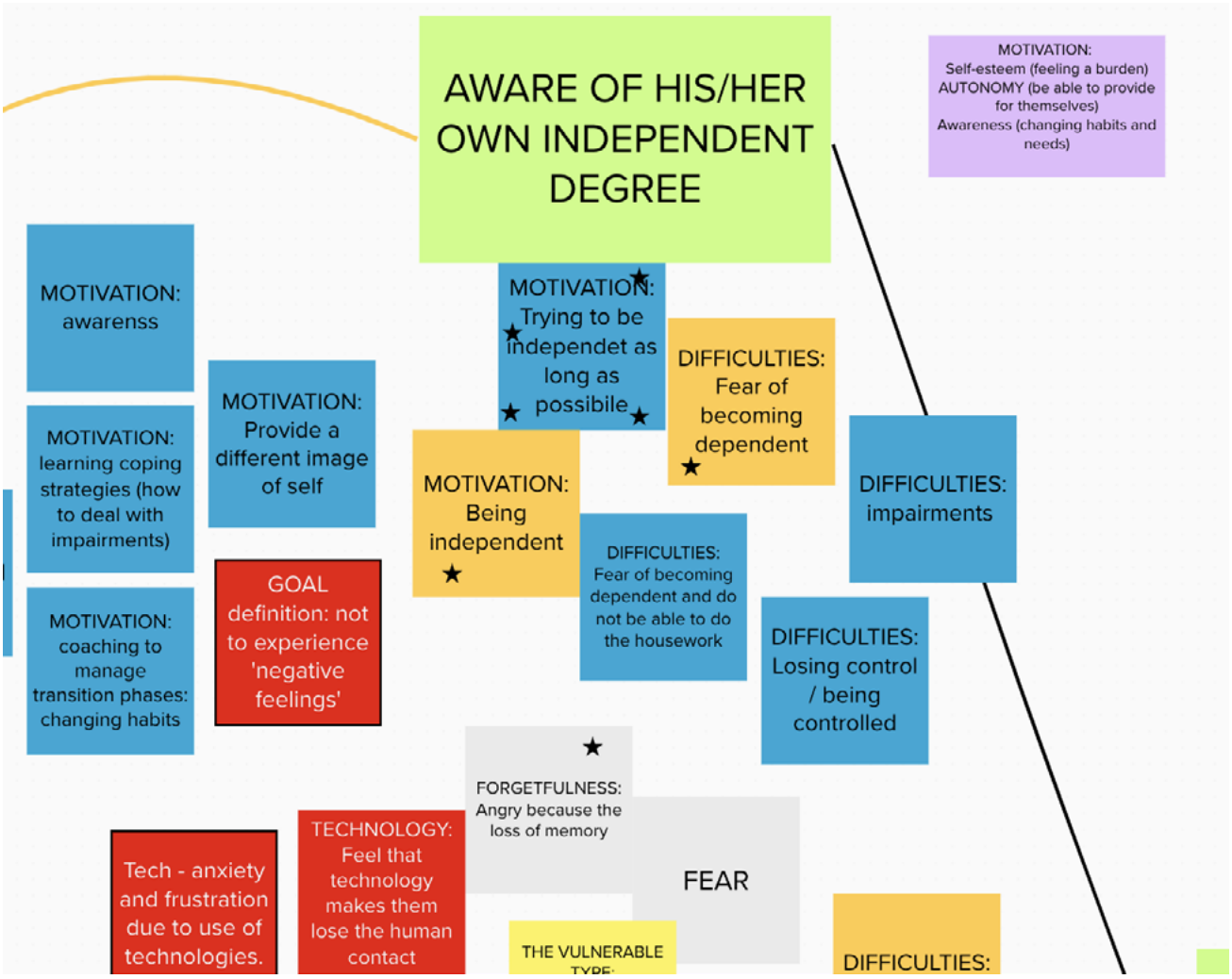


Figure 2. Connections among the clusters to create supergroups.

The Affinity Diagram allowed us to process and elaborate the qualitative data obtained by the user research into a structured knowledge base around the Active Living definition for the intervention. In our framework, Active Living is strongly grounded on the opportunity to stay fit while cultivating personal hobbies, like for example cooking, driving, painting and reading and with sharing personal interests and experiences. Action and interests are thus aimed at maintaining social relationships and contacts: negotiating ideas and values, discussing personal opinions with other people on different topics is considered essential for a healthy life. Social connections in fact may amplify, suggest, trigger a series of novel interests and stimulate people with MCI to live in a more positive way.

Regarding technology, the patients with MCI involved in our design phases have shown a higher level of acceptance if technology is perceived as a tool to facilitate self-determination. Technology is expected to be user-friendly and designed considering the possible visual impairments that can occur in old age and the limited users' skills. Technology should not provide "orders": the user must feel that he can choose and have full control of the activities he is carrying out. Also considering motivational aspects, the recommendations could be linked to the interests and activities that the user prefers: the user appears more favourable to implicitly receiving coaching advice.

5. Conclusion

In order to complement the top-down theoretical definition of Active Living provided in Par. 2, this research allowed the team to consider Active Living as an emerging reality consisting of a balance between the personal sphere and the relational one. In other words, a person is more motivated to live in a healthy way,

when he/she tries to maintain independence, including self-esteem, autonomy in daily activities, acceptance and awareness about the changing habits and needs, and carry on positive and inspiring relationships. In particular, motivation plays a key role in leading a healthy and satisfying life and represents the driving force of resilience that allows us to move forward despite difficulties. Motivation is also achieved through cultivating personal hobbies and interests, like for example cooking, driving, painting and reading.

Older people's participation in the exploration of Active Living allowed the team to verify the hidden assumptions behind research hypotheses and to disclose their actual perspectives about cognitive decline, self-perception and active ageing expectations. Personal life conditions, inner motivation challenges and management of dynamically changing health conditions are all factors that might be considered at the heart of assistive technology research and design through the active participation of people with vulnerabilities. stimulate and support awareness and individual decision-making actively, and promote collective participation to generate common critical thinking that can address the challenges of the climate crisis by contributing to more responsible and sustainable social and cultural progress.

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P/REFERENCES OF DESIGN

DESIGNING DIGITAL PET ADOPTION SERVICES: BARRIERS AND OPPORTUNITIES FOR ITALIAN OLD ADULTS.

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ABSTRACT | Social isolation and loneliness can play an important role in Italian old adults' health. Adopting a pet could help mitigate negative health effects and could at the same time help reduce the number of animals living in shelters. Digital platforms can be a useful instrument to improve pet adoption rates thanks to matchmaking processes; however, little research has been done on verifying if old adults can effectively benefit from their use. This study follows the development of a service concept, afFido, that focuses on applying a matchmaking pattern to pet adoption and support. Nine participants explored their relationships with having pets and five testers were recruited to investigate the usability of an app prototype. The qualitative interviews have highlighted the presence of fear of attachment and loss which can prevent pet adoption in particular among male old adults. The digital platform's usability scored lower than average due to a perceived lack of information as well as conflicts between common matchmaking patterns and the testers' knowledge. To become effective, digital pet adoption services should focus on including emotional issues in their narrative and may benefit from working together with old adults in reinterpreting matchmaking patterns to improve their usability.

1. Introduction

The Italian population is rapidly ageing. As of 2021, 23.5% of its population of 59.2 million people is 65 years and over (Istituto Nazionale di Statistica, 2022), and in 2050 this age group could grow to 33-36.7% (Istituto Nazionale di Statistica, 2022). Old adults are subjected to discrimination rooted in ageism (Krekula, 2009) and can become socially isolated due to their representation as socially useless, determining a negative impact on their health (Kobayashi & Steptoe, 2018). Loneliness, although not determined by isolation (de Jong Gierveld et al., 2006), can still worsen its effects (Pinquart & Sörensen, 2001) and have independent negative effects on cognitive functions (Luchetti et al., 2020) and general health (Luo et al., 2012). In Italy, old adults' social isolation and loneliness rates vary on the basis of the geographical area (Cavallero et al., 2006; Fiordelli et al., 2020).

Loneliness can also be influenced by feelings of uselessness (Aartsen & Jylhä, 2011) which can be heightened by detachment from adult children (Gu et al., 2016) and health issues preventing autonomy and social involvement (Curzio et al., 2017).

Interactions between humans and animals have been shown to be effective against loneliness (Banks & Banks, 2002; Kanamori et al., 2003; Krause-Parello, 2008) and in improving social interactions among groups (Sollami et al., 2017). Having a pet can also be beneficial to socialization as it can help old adults meet new people (Scheibeck et al., 2011) as well as satisfy their need for attachment support (Krause-Parello, 2008) in cases where communities do not exist or are difficult to develop due to physical or social barriers.

Animals in Italy experience a similar state of social abandonment to that of old adults, with an important number of animals spending their lives in shelters (Innocenti, 2019) that also have a strong impact on the economy (Ministero della Salute, 2023). Old adults could play an important role in reducing the population of animals in shelters as they may possess free time paired with high energy levels (World Health Organization, 2021) to support a pet in their lives. In Italy, only 12.1% of couples and 11% of single old adults aged 75 and over have a dog (Istituto Nazionale di Statistica, 2020), and it is unclear what the stance of Italian old adults on pet adoption is. Previous studies analyzed the pets' characteristics influence on adoption (Hawes et al.,2018; Powell et al., 2021) adopters' family status (Mondelli et al., 2004) and adoption return factors (Fatjó et al., 2015; Hawes et al., 2020; Powell et al., 2021). In cases where the adopter's age is mentioned (Shore, 2005) there was no analysis of the correlation between adoption motivation and age.

During the last decade there has been a rise in studies on digital pet adoption services. These services allow their users to put up adoption announcements and choose a pet manually (Santy et al., 2018) or by filtering through position (Magdum et al., 2023) or matchmaking processes (Allison, 2019; Davis et al., 2019). Matchmaking adoption strategies may reduce adoption drop-outs and could be perceived as useful activities if presented as a direct help to shelters (Davis et al., 2019). As of now, no study has focused on testing the usability of a match-making pattern applied to pet adoption.

Digital services may appear useless for old adults, but in Italy 60.4% of people aged 65-74 were reported having access to an internet connection, with lower adoption rates for older adults (Istituto Nazionale di Statistica, 2023). According to the Silver Economy field, old adults are a growing target for the development of new products and services (Laperche et al., 2019), a theory supported by the investment of 1,901,000 euros by Italian old adults in this sector in 2021 (Itinerari previdenziali, 2022). Nevertheless, technological products do not reach their target due to cultural, economic (Klimczuk, 2016) and social issues, as old adults perceive technology to be too difficult to use due to their age and avoid it as it heightens their interiorized ageist beliefs (Caspi et al., 2019). However, old adults navigate lower complexity platforms similarly to younger people (Ziefle & Bay, 2005) and those who use technology present better cognitive and memory functions (Benge et al., 2023; Scullin et al., 2022). One possible solution to the development of successful services could be a focus on low-technology solutions (Lipp & Peine, 2022) integrating digital and physical practices and planned with the involvement of old adults.

2. Research Questions

Based on the current research state, the main goal of this study was to individuate what are the basis for the development of a digital pet adoption service for Italian old adults as of 2023. This problem includes two main variables: Italian old adults' stance on pet adoption and their digitalization skills.

In particular, the study has been focused on these specific issues:

- What are the current trends in pet adoption among Italian old adults?
- What are the discrepancies between Italian old adults' perceived digital skills and their effective ones?
- How would a matchmaking-based adoption service fit with old adults' mental models?

The relevance of this study has been supported by the 2023 animal adoption campaign held by the municipality of Rome and directed towards old adults' communities (Roma Capitale, 2023).

3. Methodology

3.1 Data Collection Methods

The first research step was to understand how having a pet is perceived by old adults. Semi-structured phenomenological interviews were conducted with old adults residing in Rome. Nine old adults above the age of 65 (M=75, SD=4,86, age range 69 – 83), five male and four female, were recruited. Seven were recruited following a consecutive sampling method by visiting two old adults' communities, Centro Giovani Anziani Cornelia (four participants) and Centro Anziani Valcannuta (three participants). Two interviewees were recruited through word of mouth. The median length of the interview was 09:42 minutes (SD=0,23). Four interviews were conducted in an office located in an old adults' centre, with the president being present in the room, three interviews were held in the main hall of the centre, one was held outside a public café and one online on a Teams call, using a personal laptop. At the beginning of the interview, the participants were introduced to the research topic and gave their informed consent, agreeing to have their voice recorded.

The interview was structured to initially obtain an evaluation of the participants' current neighbourhood and a recount of a typical week in order to evaluate their social activity levels and the presence of any external barriers to socialization. After that, the participants were asked to describe their relationship with technology and if they received any help using it to investigate their digital skill levels and whether it influenced their relationships with other people. Lastly, the interviewees were inquired about current or past pets and their thoughts on the implications of having a pet and if and how they would adopt one. These questions were planned to evaluate the current adoption trends among old adults and to collect insights on the possible difficulties faced while having a pet. Additional questions were added according to the context; participants with no pets were invited to explain their refusal, whereas those with pets were asked to share their experiences with them.

The prototype of the service was designed on Figma. The usability test was open to people aged 65 or over who had to currently have a pet or have had one in the last five years and would define themselves as pet lovers. The testing phase involved five people over 65 years old (M=71,6, SD= 6,11), with one being a returning participant from the initial interviews, and the others being recruited through snowballing recruitment. Three tests were conducted in person by using a laptop with a mouse and a trackpad available, while two tests were conducted online via Google Meets. The median length of the test was 43 minutes (SD=0,11).

At the beginning of the test, the participants were asked three questions aimed at assessing their digital skills: “How many hours do you spend surfing the internet or using apps in a typical week?”, “Which websites and/or apps do you use the most?” and “Are there any websites or apps you particularly like or hate, and why?”.

After this phase, the participants interacted with the prototype. The moderator briefly explained the service’s options and introduced the testers to a roleplay scenario in which they had to pretend to be women interested in adopting a pet. The testers were to complete two main tasks, sending an adoption request and subscribing to a support plan while guided by a moderator. After each main task the participants were asked to take a survey hosted on Google Forms based on the Single Ease Question (SEQ) rating scale used to assess the tasks’ difficulty level (Sauro, 2012). The survey consisted of a single question measured on a 7-point Likert scale inquiring on the task execution difficulty (“How easy or difficult was the adoption process?”, “How easy or difficult was the support request process?”). At the end of the usability test the participants were asked to evaluate the prototype’s usability according to the Usability Metric for User Experience Lite (UMUX-Lite) scale, a simplified usability model derived from the UMUX scale (Schrepp et al.,2023) consisting of two statements followed by a 7-point Likert scale (“The platform’s characteristics meet my necessities”, “This platform is easy to use”).

3.2 Analysis Method

The interviews were transcribed in order to conduct a thematic analysis and highlight recurrent themes used by the interviewees. The coding processes were conducted by one author. The initial coding phase was conducted by means of an empathy map, a tool used to summarize visual information, thoughts, actions and positive and negative experiences obtained through interviews (Gibbons, 2018) that has been used as an initial deductive coding frame. The second coding phase was based on inductive coding, and its results were later re-assessed following pattern coding and thematic analysis with the objective of identifying similar experiences, highlighting diverging opinions and understanding deeper motives behind the accounts. The codes were arranged following a focused, hierarchical coding structure, with the first coding level representing the main topic, followed by the interviewee assessment and categorization of the condition (Saldaña, 2013). The information obtained through the interviews was coded individuating three main topics: current pet stance, social activity, and digital skills.

With regards to user testing, the data obtained by the initial interview was coded through a digital assessment scale used by the usability team of the UK government (Hurst, 2015). The scale is based on Go ON UK’s “Basic Digital Skills” definitions and included seven questions measured on a 4-point Likert scale, with 0 identifying no digital skills and 4 representing full control of basic digital skills. The qualitative information obtained through the interviews has been codified following the scale by converting the information into a numerical value. The testers’ digital skills were evaluated by summing together all the points and calculating the average value.

The data from the usability test has been subjected to a descriptive statistical analysis measuring the usability values of the prototype. The usability score of the prototype has been calculated by summing together the scores given by each participant to the two UMUX-Lite items, Ease of Use and Usefulness (Q1+Q2=QA), and then subtracting two from the initial score (QA-1=QB). The result has then been multiplied by 8.33 to bring it on a scale from 0 to 100 (Melissourgos, 2023). The general usability score has been obtained by summing all five UMUX-Lite scores together and calculating the average value.

It is possible to convert the UMUX-Lite score to another usability scale, the System Usability Scale (SUS) (Schrepp et al., 2023) in order to compare the scores to platforms previously analysed. The method used in this research is the one-item interpolation working only with the Ease of Use item and converting its score to a 100-point base by applying the following formula: SUS = (*Ease* – 1) * (100/6).

4. Service Definition

A digital pet adoption service, AfFido, was designed following the information obtained through the interviews. The main functions are adoption and post-adoption support in which the service acts as a mediator between shelters for the former and trained figures for the latter. The user is matched to them through a survey and can choose to select their preferred option. The service is aimed at reducing waiting times and adoption returns thanks to the initial match-making phase, which is autonomously conducted by the user and can result in reduced workload for shelters too. The support figure can call the user or visit them in person; in the second case, the user can also have pet products be delivered to their house or receive basic vet visits at home. Further options also include sponsoring pet-based activities held at old adults' centers as well as promoting interactions between pet-loving old adults by applying once again match-making practices.

Four different personas were designed to summarize specific users for our field of analysis (Stickdorn et al., 2018). The main differentiations between them were based on diverging stances on pet adoption, combining them with compatible habits, needs and pain points.

The personas' experiences in reaching the adoption and support goals and the necessary touchpoints were summarized through means of general (Figure 1) and user-specific (Figure 2) Journeys (Stickdorn et al., 2018). Considering the varied digitalization levels of Italian old adults, a digital pet adoption service seems to benefit from being paired with in-person and call centre touchpoints. For the persona with the highest digitalization skill, the platform could be present in all steps, whereas for personas with a limited usage of technology, the platform could be introduced after the pre-service phase. For the other persona, the digital platform could be the initial touchpoint for one, whereas it could be implemented after a first introduction for the other two personas.

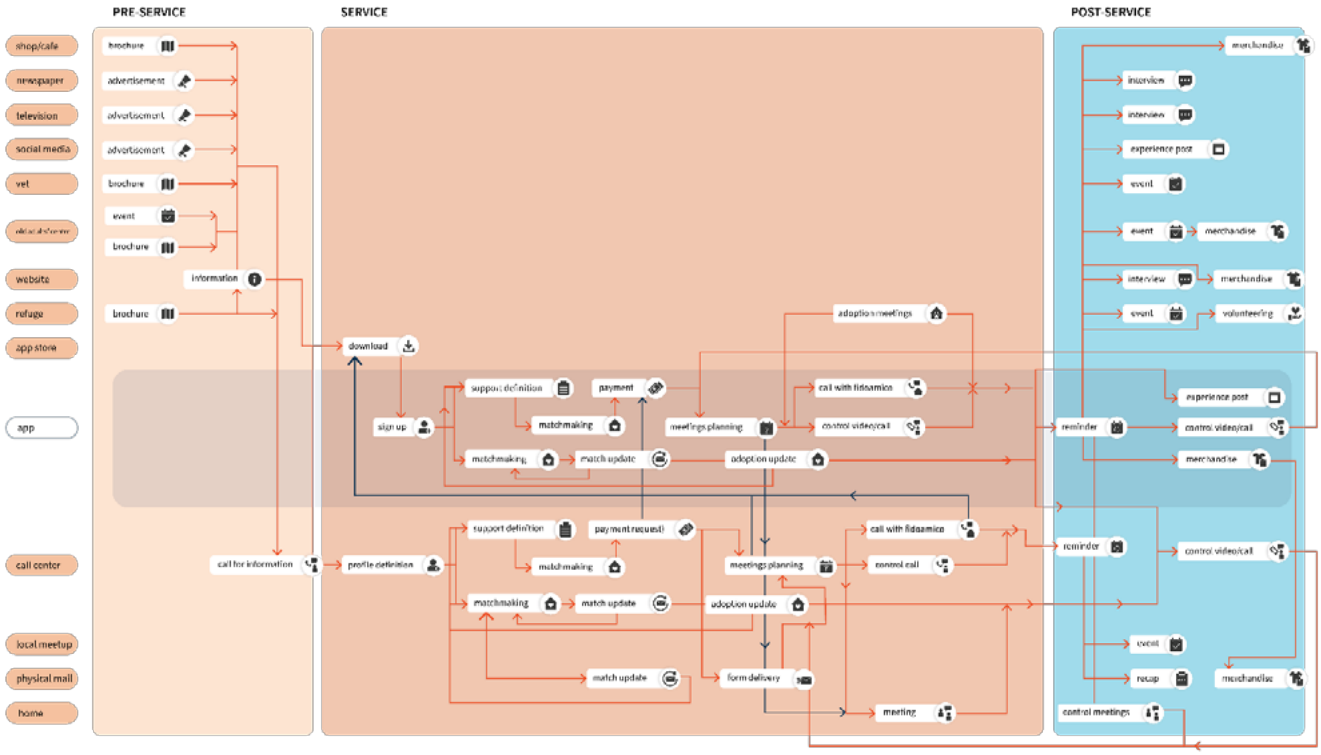


Figure 1. User Journey including all touchpoints, with a focus on digital (app) ones. The arrows in dark blue highlight conversion points from phone-based interactions to app ones.

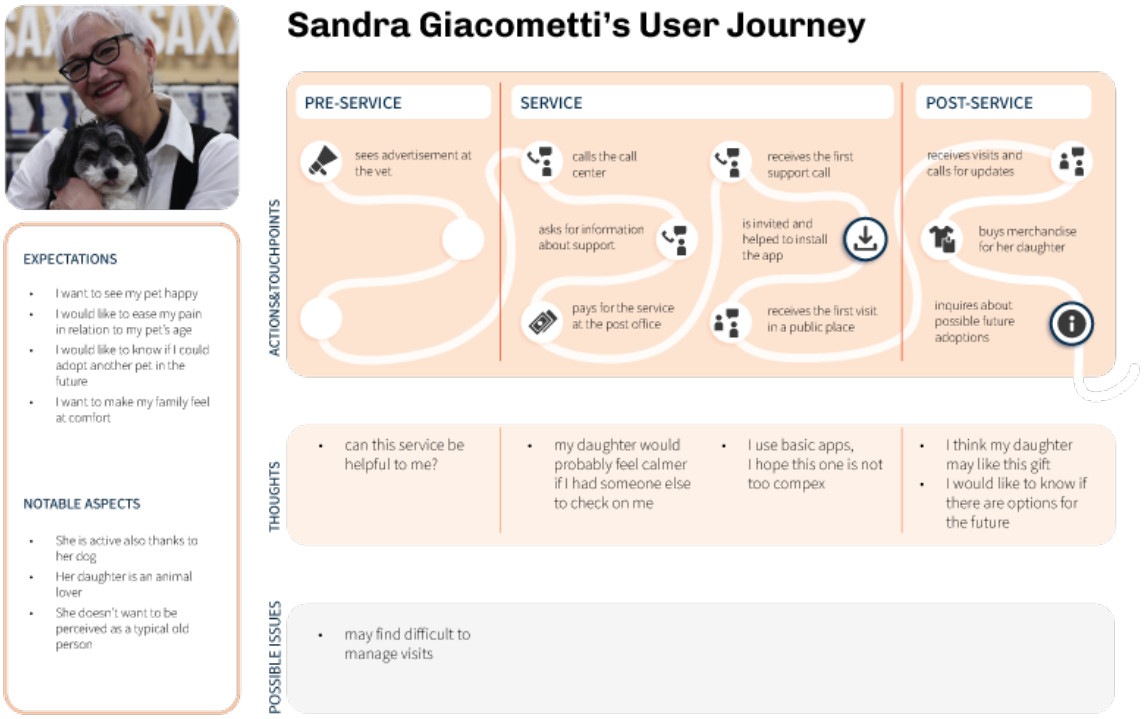


Figure 2. Persona-specific User Journey. The steps highlighted in blue represent digital touchpoints.

At the same time, a Service ecosystem was designed to highlight all the actors involved in digital and in-person interactions (Figure 3). This step was useful to understand the complexity of the general system as well as which interactions to prioritize in the development planning phase. By comparing the information obtained, persona-specific service blueprints were used to investigate the relationships between the service components and the user (Gibbons, 2017).

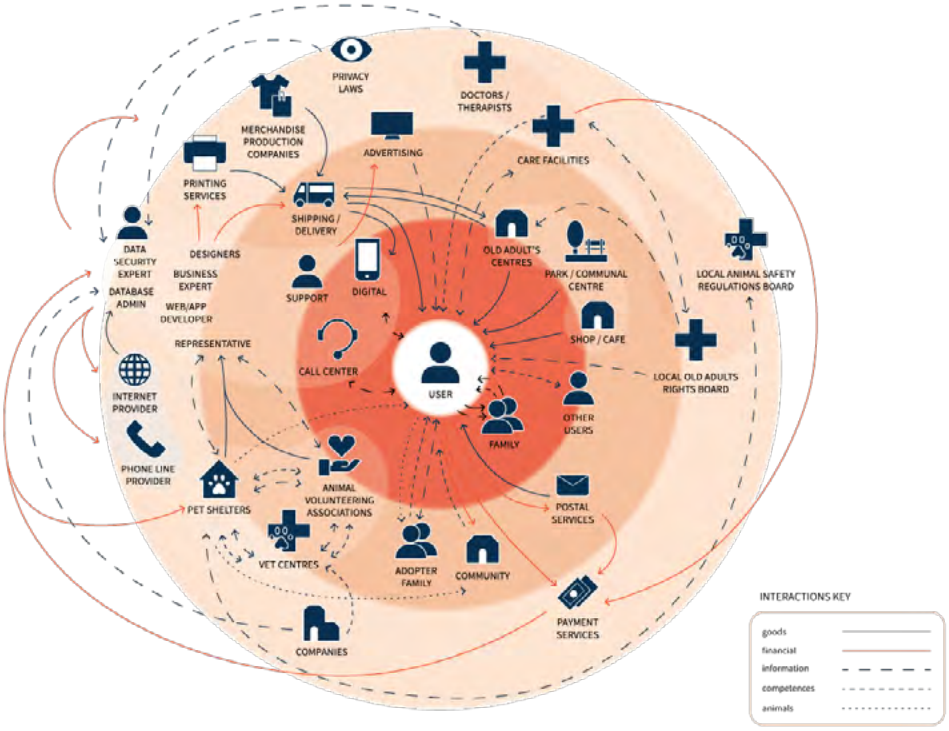


Figure 3. Visual representation of the service ecosystem.

5. Experimental Development: afFido

The service's prototype was based on the analysis of two existing platforms, Petfinder (https://www.petfinder.com) and empethy (https://www.empethy.it), which both offer the possibility to take a test to be matched with compatible pets.

The digital platform was structured as a responsive design (Figure 4) to satisfy all possible device usage. The interactive prototype was presented as a tablet app that included the two matchmaking processes of finding a compatible pet and a suitable support figure; the tablet ratio was chosen as it was hypothesized that any visual issues with this phase could be encountered on smaller screens.



Figure 4. AfFido's digital platform shown on different devices.

The pet matchmaking phase was ideated to include a survey followed by a list of three compatible pets (Figure 5) with the intention of testing if showing three to four items, recommended for better information retainment (Galitz, 2007), would make the process understandable to old adult users.

The prototype was designed following Web Content Accessibility Guidelines (WCAG) in their WCAG 2.0 version (Web Accessibility Initiative, 2023). The colour palette used was compliant with the success criterion 1.4.3 Contrast (Minimum) reporting that "The visual presentation of text and images of text has a contrast ratio of at least 4.5:1" (WAI, 2023). The colour orange (#F04D23) was chosen due to its ambiguous status as an accessible colour determined by worse performance over dark backgrounds (Pereira et al., 2022). The components were designed in order to be bigger than 41 mm, a measure that has defined to be accessible to people with Parkinson's (Nunes et al., 2016).

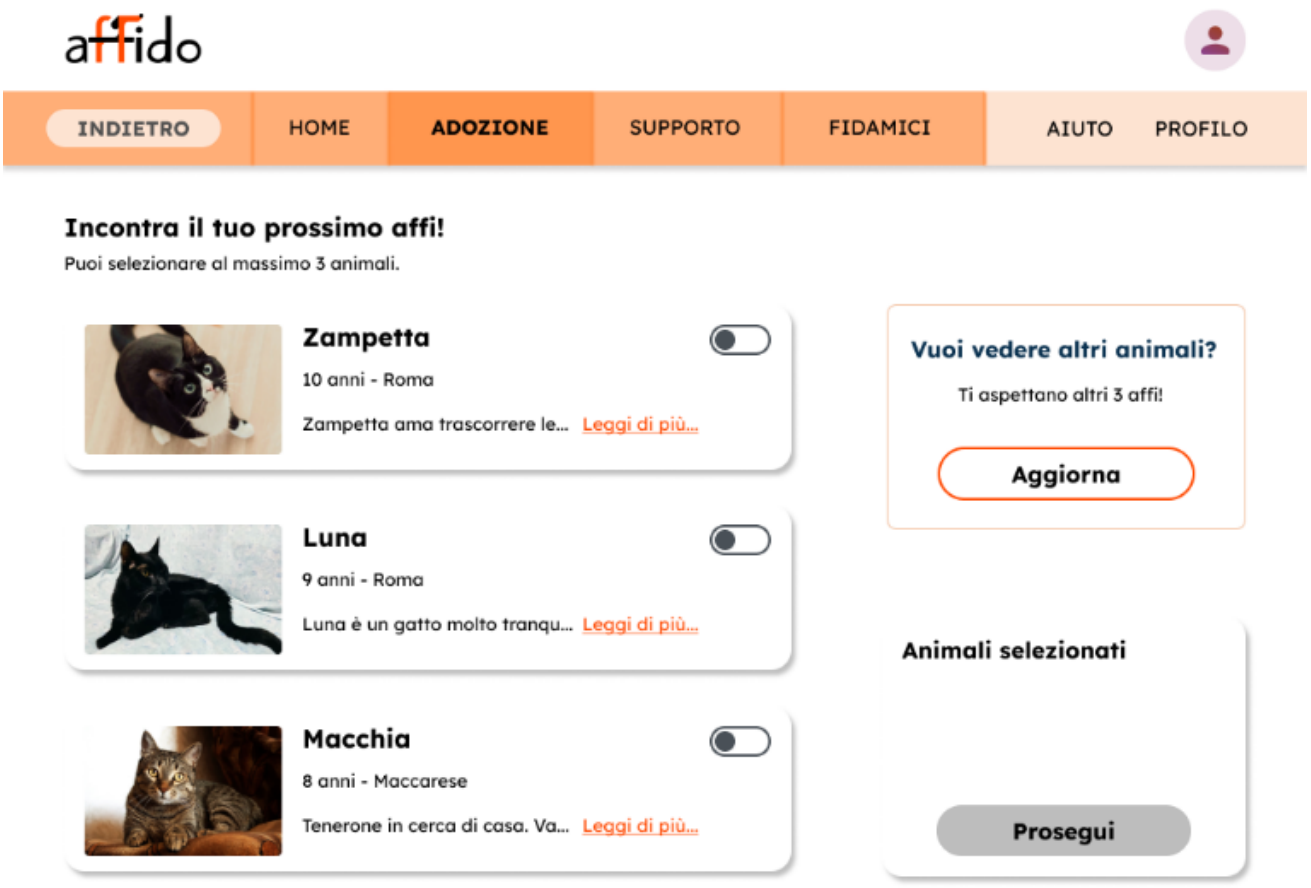


Figure 5. The pet selection page as shown on the prototype. The participants could click on the Update (*Aggiorna)* button on the top right side to show other adoptable pets.

6. Results

6.1 Interview

Four participants reported having at least a pet dog, while five did not have any pets at the moment of the interview and all but one reported not wanting one at the moment. Two interviewees personally got their pet, with one buying them and another adopting it, while the other two had it from their adult children. Seven participants had at least one pet in the past. Six participants would hypothetically adopt a pet in the future, with three expressing an interest in adopting from a pet shelter, one in buying and the other two not expressing preferences. The participants reported four main reasons not to adopt a pet (see Table 1). Three participants referenced the concept of having a pet as a family member, with two of them presenting it as a negative aspect. All male interviewees presented limits in talking about their affection towards animals, with two participants overcoming their initial fear during the interview.

When asked about their digital devices, all nine participants reported using a smartphone at a basic level, and only one used a PC. Eight interviewees indicated using WhatsApp, five Facebook and three Instagram. Two participants interpreted the word “technology” and the concept of using technological device as the usage of specific devices. Five participants made references to their past activities when talking about their relationship with technology. Eight participants admitted receiving help to use technological devices, with six participants receiving help from their adult children, two from their son-in-law, and one did not indicate any specific figure. Five participants held positive views on technology, one negative, and three were indifferent about it.

Seven participants reported attending an old people's centre. Four interviewees are caregivers; all of them help their adult children and one helps with their grandchildren. All nine participants mentioned interacting with their family or friends, with two also reporting going out alone if needed. Two participants mentioned having health issues, although only one reported them having an impact on his social life. Three participants related their physical activity to their pets.

Table 1. Participants' history of pet ownership and negative adoption stances.

Participant	Age	Gender	Past pets	Reasons not to adopt
P1	65	Male	Yes	NA
P2	NA	Male	No	Lack of time, Lack of space, Not interested
P3	75	Male	Yes	NA
P4	70	Male	Yes	Lack of space, Fear of loss
P5	NA	Female	Yes	NA
P6	74	Female	No	Lack of time, Not interested
P7	NA	Female	Yes	Not interested
P8	79	Female	Yes	NA
P9	83	Male	Yes	Health issues

6.2 User Testing

The average digital skill level obtained by the five testers was of 2.93 (SD=0.73), with the minimum value of 2 and the maximum value of 3.85. The average SEQ score has been reported to be around a 5.4 value (SD=0.47) for both questions. All testers were able to complete the main tasks with only brief interruptions that were solved autonomously or with light interventions from the moderator.

For UMUX-Lite scores on the platform's usability, the average usefulness score was of 6 (SD=1) and the average ease of use score presented an average of 4.6 (SD=1.14) (Figure 6). The average UMUX-Lite score was of 71.63 (SD=8.5), with the highest score of 74.97 and the lowest of 58.31. The corresponding average SUS value was 60 (SD=16.99).

All testers encountered issues using the prototype's functions but to different degrees. Three participants mistook text for clickable elements, two struggled with dropdown menus and toggles, one did not know how to use checkboxes and three had trouble understanding written indications.

Three testers did not initially understand how to proceed with selecting the desired pets after the survey phase, but after the intervention of the moderator two of them managed to correctly interact with the prototype.

All users expressed perplexity at the words "*affi*" and "*fidaiuto*" used to identify respectively the pets and the human support figures. Three testers reported perplexity at the drawings used to represent the adoption functions, not understanding their meaning.

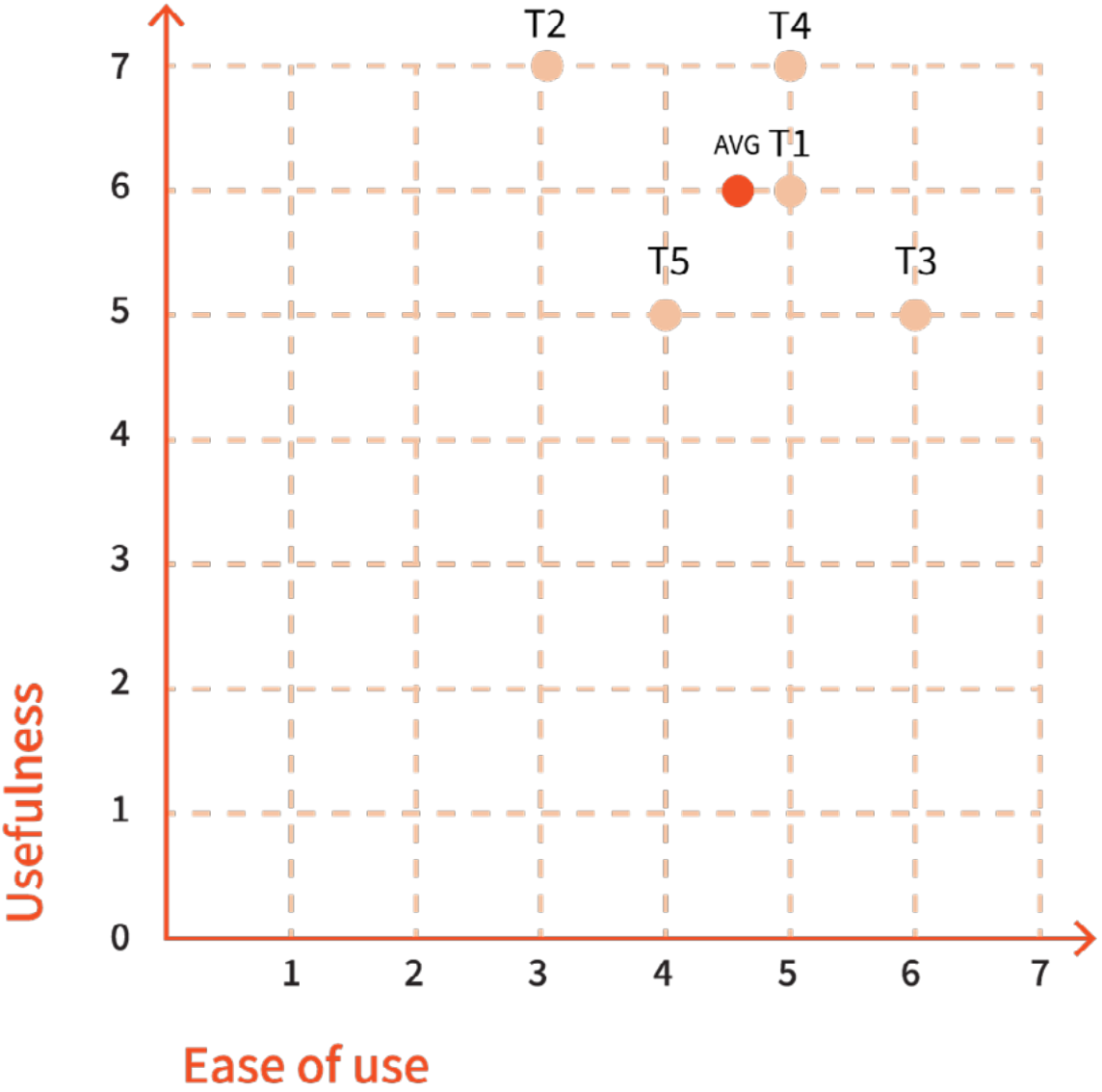


Figure 6. Scatter graph representing the relationship between the Ease of use and Usefulness scores for each test and the average score.

7. Discussion

7.1 Old Adults, Pets and Technology: An Overview

The participants presented three different stances towards pet adoption, with people who were strongly in favour of adopting a dog, people who were in doubt, and people who were against it. When asked about past experiences with animals all participants who had a pet and those who were in doubt about adopting reported having had pets that they cared about. These results are in line with observations on past pet experience being a predictor for future involvement with pets (Banks & Banks, 2002).

When it comes to disinterest in pet adoption, the participants who were strongly against it lamented the lack of space in their house as the main issue, present also among the reasons for returning or abandoning pets (Fatjó et al., 2015; Powell et al., 2021). For two participants becoming attached to the pet was a negative factor as it could interfere with their current lifestyle: “I do not want pets because they become part of the family, and since I am always out, I could not take care of them.” The participants who

expressed this view were also those who reported being active in their old adults' communities. Having a pet was also reported to be a possible source of negative feelings for P4:

> "No, I don't want pets anymore because you get attached to them and you have to take care of them and – I can't do that. […] I feel like I'm missing something, and this isn't right."

This avoidant behaviour could be interpreted as a tendency to avoid negative emotions (Van Assche et al., 2013). It is also possible to notice the presence of underlying pet grief, which had an impact on pet owners too as they feared losing their pets: "I tremble now, as her age is significant, and every day – she's well kept, for God's sake". The data on pet grief is compliant with reports on pet loss and its status as a form of disenfranchised grief (Brown et al., 2023), to which corresponds a difficulty in communicating about pets with other people. In fact, when talking about her pet's story, P8 commented:

> "It is as if they [pets] were a family member. I know that when I say this to someone who doesn't like pets, they look at me as if I were stupid. […] I also say silly things such as 'Come to mom', but if friends of mine who do not share these passions were to hear me, they would think I lost my mind."

These comments are in line with other findings on discretion being a fundamental component to old adults with pets or experiencing pet loss grief (Brown et al., 2023). The difference between pet-havers and people who do not like them was seen as a moral failing by two pet-havers, as one of them commented: "They [people who do not want pets] are egoist […] Taking care of a pet means being inclined to sacrifice yourself."

It was also possible to identify different display of affection towards pets. All pet owners but one, when invited to talk about their animals, voluntarily shared emotional information of them. Participant 5 was immediately invested on talking about her pet dog, and even imitated him, while P8 preferred sharing her pet's adoption story. Participant 3 was initially detached, taking time before talking about his dog; a similar reaction was observed in P9, who waited before deciding not to talk about his late dog.

All participants who presented contradictory feelings towards pets or took time to open up about their relationship with them were male. Participant 1 presented an unexpected behaviour, as he did not report being attached to his hunt dogs, whereas participant 2, vocally against adopting pets, spontaneously recollected a time when he identified his neighbour's dog as being jealous:

> "When my daughter gave me her dog and [the other dog] saw me with him, he was like this [mimicking exaggerated open eyes], he was furious, as he was jealous. I had to throw two, three biscuits to him."

This behaviour seems to be in line with previous research on the impact of gender stereotypes on expressing emotions (Hess et al., 2000; Kelly & Hutson-Comeaux, 2000), which see men expressing sad emotional states less than women and expecting themselves to appear happier when recounting negative events, which may explain the apparent detachment from their pets. This observation is further supported by the comments of P6, who proudly stated that: "I don't have animals and I don't want them […] I have been told 'It's a blessing that you are not like other women'."

One participant reported being physically active also thanks to taking her dog out and confirmed that she liked to walk and was healthy. Participant 3 used to go out with his dog but now stopped due to a leg injury. These observations are in line with former studies on the correlation between dog ownership and physical exercise (Curl et al., 2017).

Family members played a strong role in adopting a pet, as for P8 and P9 the animal had first been adopted by a younger family member and was later left to live with them, as P9 reports "I had the dog in "loan for use" from my daughter's ex-boyfriend". For P9, the lack of in-person support and his health issues made it

impossible for him to adopt a dog: “If I had this safety [having a trusted person to take his dog out], I would obviously pay and I would have no doubts, I would immediately adopt a dog.”

With regards to technology, all but one participant admitted being helped by family members or friends to varying degrees, with most participants expecting to be helped by adult children, a finding in line with previous research (Hunsaker et al., 2019). Participant 6 recounted her smartphone usage improvement story since her son’s observations on her attitude:

> “He once scolded me because I always asked him to solve my issues, and he told me that I had to learn to read instead of randomly tapping on the screen. […] I once encountered an error, I read it and I thought to myself that I could solve it.”

The interview has confirmed the trend on smartphone usage (Itinerari previdenziali, 2022), and surprisingly no participant reported using a tablet device. The only participant who used a PC, P9, believed this skill to have helped him stay active:

> “My peers are left abandoned inside their homes, they spend their time in front of the television, [I see] they aren’t motivated. I respect them but I do not agree with what they do.”

Two participants had an unexpected reaction to being asked about their relationship to technology, as they interpreted it as being able to work with complex machines, thus requiring the moderator to reword the question. More than half of them also believed that you could only possess digital skills if you had a strong interest in technology or were a young person, contradicting their own current experiences. It is possible to identify an expertise-based narrative that is in line with previous research on old adults and negative reactions to technology introduction in later stages of life (Barnard et al.,2013; Morris & Venkatesh, 2000; Selwyn et al., 2003).

7.2 Usability Test

With regards to usability scores, the prototype was classified as on the lower end of the acceptable usability level. It could be hypothesized that the scores would have been lower if the moderator had not been present, as testers commented: “I would have rated this lower if I had been alone”, “I rated it a six due to the necessity of asking for help”.

Being able to ask for help elicited different reactions in the testers, as the presence of a function to directly access the app’s help desk reassured P3, but increased P1’s frustration, leading her to comment “I don’t want to ask for help, I’m not interested in it” in a frustrated tone.

One of the main elements that impacted the usability was the perceived ambiguity of buttons and text, with the latter being mistaken as interactive and buttons being identified only after a second navigation of the interface. The difficulty in using buttons and toggles may also be related to the use of a laptop during the test, which may have been confusing for smartphone users. All five participants did not report having any sightseeing issues, but one tester struggled with reading dark blue text on an orange button; when asked if he had any issues identifying the text, he did not comment on it but was visibly distressed.

The introduction of the fragmented pet list determined mixed results. The pattern had been introduced with the objective of avoiding too many stimuli in a single page; however, the mechanism posed various issues to the testers and appeared complex to understand without a proper introduction, as one tester commented: “Did the other pets disappear?”. Other reactions included feeling upset due to the failed matchmaking, as it was considered to have not been adequately communicated during the survey. The results may be explained by the presence of significant differences in the mental models of old adults with respect to standard user testing participants.

The use of drawings turned out to not be sufficient to convey information, as most testers ignored or did not understand them. The drawings used in the prototype were more akin to flat icons' style, which has been shown to be less effective due to the absence of any references to real objects (Wu et al., 2022). The results of this study do not necessarily correlate to a lack of learning abilities and adaptability in old adults, as most participants were able to interact with unknown elements by the end of the test after receiving verbal or visual feedback. This finding is in line with previous research on the effectiveness of support in digital learning (Martínez-Alcalá et al., 2018; Pirhonen et al., 2020). During the test phase, some users commented on the options, remarking that the choices did not fit with their beliefs: "This is not my birthdate", "I would like to adopt a dog". All users also expressed perplexity at the unusual words used in the prototype, which may be due to changes in guessing abilities for unknown words determined by ageing (Mcginnis & Zelinski, 2003).

8. Recommendations

When working on new services the main research step is directed towards assessing the needs and adoption barriers of potential users or stakeholders. The following recommendations are directed towards the development of services for old adults which can include topics similar to pet adoption.

1. *Hypothesize the presence of hidden emotional barriers*. A social issue can be influenced by complex factors that may go unnoticed in quantitative research. When conducting quantitative or qualitative research, consider interacting with old adults who are apparently not potential users to verify the presence of such factors.
2. *Structure interviews with emotional barriers in mind*. All interviews with male old adults were characterized by a fear of attachment expression. When interacting with old adults, it is suggestible to re-explore emotional topics after having established a safe environment, possibly by indirectly showing positive examples.
3. *Interpret the user's digital skill level*. When planning research involving digital skill evaluation, include questions identifying the extent of external help. It could be useful to identify a scale or an evaluation by specific support situations which could be defined by exploring hypothetical scenarios with the participant.
4. *Investigate the presence of different mental schemes*. When designing digital platforms for old adults it could be useful to test existing conventions by subjecting them to new, older or non-expert users to highlight issues that may have been accepted by habitual users.
5. *Consider polarizing factors in the user testing narrative*. Pretending to adopt a cat when loving dogs can been a distracting element to testers. If it is fundamental to include such elements, collect the participants' preferences through pre-test surveys to plan roleplay activities which accommodate their inclinations.
6. *Design tailored onboarding experiences*. Old adults can be frustrated when offered unneeded support. Future onboarding practices could assess the users' needs through a survey or on-demand help in order to allow old adults to retain their independence and help platforms include multiple user typologies.

9. Limitations and Future Directions

The generalizability of the results has been limited by the restricted pool of testers. Further studies could focus on quantitative research to validate the extension of the reported experiences in Italy.

It is possible to observe how former studies on pet ownership analysed a general population (Albright et al., 2022; Pikhartova et al., 2014), women (Krause-Parello, 2012; Ory & Goldberg, 1983; Watson & Weinstein, 1993; Zasloff & Kidd, 1994) or explicitly admitted not finding many male pet owners (Brown et al., 2023).

Considering the restricted number of participants in this study, future research could explore the relationship between current male pet owners and their pets and investigate any positive or negative patterns to consider in future interventions.

To further support the development of pet adoption interventions with old adults, future research could define the current interest in using digital solutions and receiving in-person and online support among this demographic.

With regards to usability, the findings of this research could be corroborated by quantitative tests defining the incidence of communication issues and pattern incompatibility here reported. The matchmaking pattern could be reinterpreted by finding a compromise between a list and a curated view, without limiting the user's actions. Further research should analyse the discrepancies between younger adults and older adults with high digital skills in order to highlight any usability and accessibility issues that may go overlooked due to mental schemes adapted to existing solutions.

10. Conclusions

Pet adoption from old adults is promoted by evidence of its positive impact on loneliness, but it is not widespread in Italy (ISTAT, 2020). Along with typical issues such as lack of space and free time, Italian old adults may refrain from adopting pets due to fear of loss and, for male old adults in particular, a general fear of emotional attachment. It is also possible to highlight the presence of two distinct groups of old adults, with pet-loving ones feeling detached from people disinterested in pets. The results of this study suggest taking into account the role played by emotional and social issues when designing services aimed at interventions with animals or other polarizing elements.

With regard to digitalization, the majority of participants reported using digital devices and platforms. Regardless of their abilities, all participants considered human support as an essential aspect of their abilities, suggesting the need for a reinterpretation of digital skill assessment in old adults. Matchmaking-based digital services can be an accessible option to find an adoptable pet for old adults if paired with sufficient information and onboarding sessions tailored to different digital skill levels. The interaction with the prototype of a digital pet adoption platform has highlighted the contribution determined by onboarding issues in discouraging old adults in their approach towards technology. Testing established patterns and elements with users from pre-internet generations may help identify areas of improvement and optimization which could simplify their usage for all.

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P/REFERENCES OF DESIGN

ENHANCING WELLBEING: EMPOWERING INDIVIDUAL AND COMMUNITY NEEDS FOR SHARED IMPACT.

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DOI: 10.63442/WMKM6127

ABSTRACT | *How can we ensure that individual and community needs are effectively empowered to generate a shared impact on optimizing wellbeing?*

Today, the health and care sector has technologies and methods at its disposal that could change it for good and improve the quality of life of millions of people with physical and cognitive disabilities, whether temporary or permanent. The integration of new technologies, ranging from digital fabrication to advancements in machine learning and AI, offers unprecedented opportunities to revolutionise how we approach solutions in various domains. Particularly in the realm of affective computing, where machines can interpret and respond to human emotions, the potential for adaptation and personalization is profound.
This intersectionality presents a unique avenue for addressing fragility, embracing pedagogy, accommodating disabilities, and fostering collaborative design. By harnessing these technologies, we can create tailored solutions that cater to individual needs and circumstances, thereby mitigating fragility by providing targeted support.

Moreover, in the realm of pedagogy, personalized learning experiences can enhance educational outcomes by catering to diverse learning styles and abilities. For individuals with disabilities, technology can serve as a powerful tool for empowerment, enabling greater independence and participation in various aspects of life. Additionally, collaborative design processes enriched by technology facilitate inclusive decision-making, ensuring that diverse perspectives are incorporated from the outset.
Thus, by leveraging these technological advancements, we can not only make solutions more efficient but also more inclusive and impactful, addressing the multifaceted challenges of our time.

However, by addressing the multifaceted challenges posed by disabilities and other complex issues, it becomes increasingly evident that technology alone cannot provide comprehensive solutions. Instead, the importance of employing a collaborative approach such as co-design emerges as paramount. Co-design stands as a methodology through which customized solutions are crafted and tailored precisely to meet the unique needs of the stakeholders involved. By bringing together a diverse array of participants, including designers, manufacturers, developers, healthcare professionals, and individuals with disabilities alongside their caregivers, co-design ensures a holistic and inclusive process. This collaborative effort fosters innovation, empathy, and a deep understanding of the nuanced requirements, ultimately leading to more effective and impactful solutions.

The Glifo project exemplifies the convergence of co-design and technology, showcasing both the collective achievements and the potential for collaborative impact. Created in collaboration with the TOG Foundation, Glifo, in English Glyph, is a customized writing aid that helps children with a complex neurological disorder to write and draw.

A purposeful sign, lightweight, adjustable, washable, and, thanks to 3D printing, a customizable writing tool. It was born from the joint planning of makers, designers, therapists, and families of children with disabilities to help children with complex neurological pathologies to write and draw independently.
Today, it is available via open-source 3D printing documentation.

Create positive impact on **real needs** with **empowerment of all actors** through **shared innovation.**



open dot



Fragility, pedagogy, disability and **collaborative design -** it is no longer **'design for all'** but **'each and everyone'.**

How can we ensure that individual and community needs are effectively empowered to generate a shared impact on optimising wellbeing?

An **approach** centred on social good to create real change through shared and open innovation.

A **goal** based on real needs, from macro-level impact to providing effective solutions for individual needs.

A **methodology** based on a human-centred design approach, aiming for relevant and impactful design created by all stakeholders.



open dot **TOG**

Manifesto of co-design for Health & Care

1 Listen and observe

Co-design means creating a space where all opinions, competences and experiences count and are useful, it means to enact a process based on listening.

2 Teach and learn

We are all experts in something and reciprocal training is fundamental: doctors, designers and individuals with disabilities, experts in their condition, sharing knowledge and competences, intersecting them.

3 Speak the same language

Break down the wall of anglicisms and technical jargon, in favor of a common language that everyone can understand.

4 Share the real needs

The goal is to solve a real need, no matter how small or big, what really matters is focusing on the reason. The "how" comes after.

5 Think and design together

Moments of sharing, exchange and collective design guide the group towards the final idea, stimulating everyone's creativity when it comes to devising new and innovative solutions able to address real needs.

6 Materialize the idea

The production of a first prototype allows us, thanks to software, digital fabrication technologies and rapid prototyping, to touch, explore, and test the idea. And last but not least, customize it.

7 Prototype, prototype

The prototyping phase is a spiral process in which projects improve by increasing versions, and through continuous dialogue on how to perfect the object.

8 Replicate, scale, share

A well designed project on its own could be useful and replicated to also respond to others' needs. Here is where the value of the open source philosophy comes into play: sharing the process and the final solution is a way to enrich the project and to amplify its social impact.



The design process is a **laboratory**!

A journey from the realms of **digital fabrication** to the frontiers of **machine learning** and **AI** including the intersections and complexity of **affective computing**.

A lightweight, adjustable, washable and custom-made writing support thanks to **3D printing**.

Born from the **co-planning** between **makers**, **designers**, **therapists** and families of **children** with disabilities, to help children with complex neurological pathologies to write and draw independently.



SayEye

Manuale mobile



Ensuring a domain where fluid communication between **care-receivers, families,** and **children** becomes possible.

An eye tracking-based software that allows people with complex neurological diseases to communicate through eye movement.

TOP! Together to Play is a videogame suite to improve therapy for kids with complex neurological disorders.

The suite offers rehabilitation and **learning sessions** based on videogames and interactive activities, thanks to **eye-tracking technology**.



Empowerment through **Open-Source**



P/REFERENCES OF DESIGN

ARI-TEST: SET THE FOCUS ON THE USER EXPERIENCE IN THE DESIGN OF A SELF-SAMPLING DEVICE FOR HPV DETECTION IN WOMEN.

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DOI: 10.63442/KWLB2766

KEYWORDS | HPV DETECTION, CERVICAL CANCER, HEALTHCARE DESIGN, SELF-SAMPLING, PREVENTION

ABSTRACT | Human Papillomavirus (HPV) is regarded as the main cause of Cervical Cancer (CC), affecting over 440 million people worldwide (UC Christus Healthcare Network, s.f.), diagnosing over 600 thousand women each year, from which half of them die (WHO, 2023). In Chile, this outlook worsens, where 70% of over a thousand women who are diagnosed yearly die (Urrutia, 2015).

It constitutes a global public problem, which has among its causes the inequality of access to healthcare services, refusal on the part of women to attend their gynecological check-ups, and other socioeconomic determinants (WHO, 2023) that complicate the situation. In the research, different critical interactions were raised, the most relevant is the lack of time and the discomfort generated by the PAP test (Papanicolau) experience, which distances women from the examination and, therefore, the early detection as well. These diseases are asymptomatic and don't show obvious signs until they are in an advanced state and treatment becomes limited. However, its effects can be treated when detected in time.

This implies that we're facing a design problem that was not addressed as such. A healthcare and well-being concern that's affecting people's quality of life, so setting the view in the user's experience is something that wasn't being contemplated in these types of exams. The project proceeded considering the multiple aspects of the challenge but taking as priority those that directly influence the promotion of early detection.

The research started as an undergraduate thesis in 2022 at the School of Design of Pontificia Universidad Católica de Chile, and it is currently financed by the National Research and Development Agency, Chile's main funding state institution in research matters.

Ari-test eases vaginal self-sampling for HPV detection, allowing women to regain agency over their gynecological experience and self-care by granting the possibility of access to the exam in a simple way from the comfort and privacy of their homes.

The design process was approached from the iterative methodology of Health Design Thinking, which focuses on the real needs and behaviors of users instead of seeing them as patients defined by illness (Ku and Lupton, 2018). Including users in the process through co-designing tools and considering their gynecological experiences was crucial and challenged us to go beyond designing only for their bodies but working for and with them.

Different self-sampling devices from other parts of the world were reviewed and studied, suggesting a response to medical or laboratory perspectives instead of considering women's experiences. This concept became crucial for the development of the research, passing from a distant and invasive experience to a closer and easier one that promotes self-care, involving women with self-sampling, a technique that can help reach global targets of screening (WHO, 2023). In the following stages of the research, in collaboration with the CancerLab of Universidad Católica del Norte, the Ari-test device will be validated with 60 women from the Coquimbo region, Chile's territory with the highest CC indicators.

HPV

Human Papillomavirus

CC

Cervical Cancer

Research project since 2022

Worldwide

half

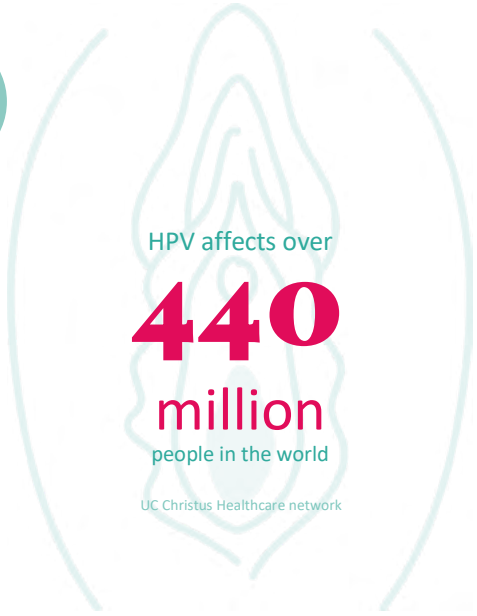


of the women diagnosed
with cervical cancer each year

die



WHO, 2022



HPV affects over

440

million

people in the world

UC Christus Healthcare network

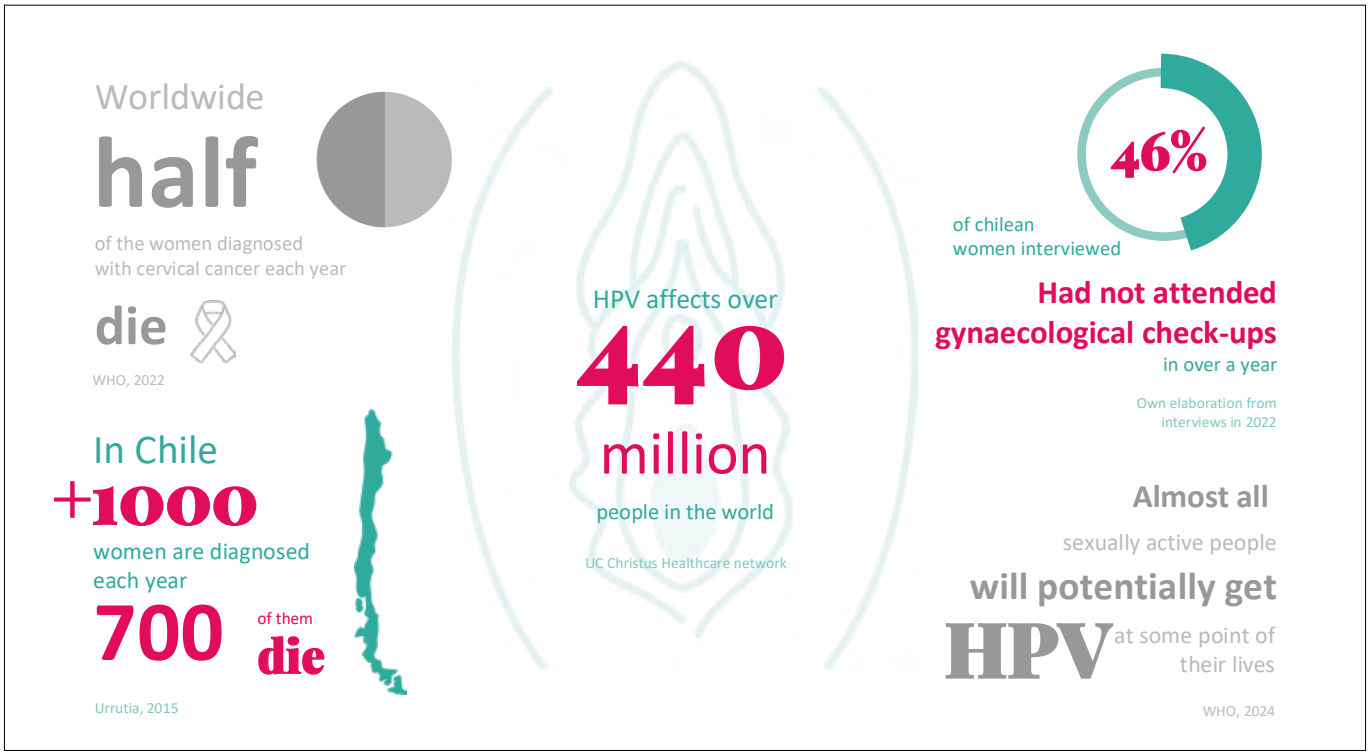
Almost all

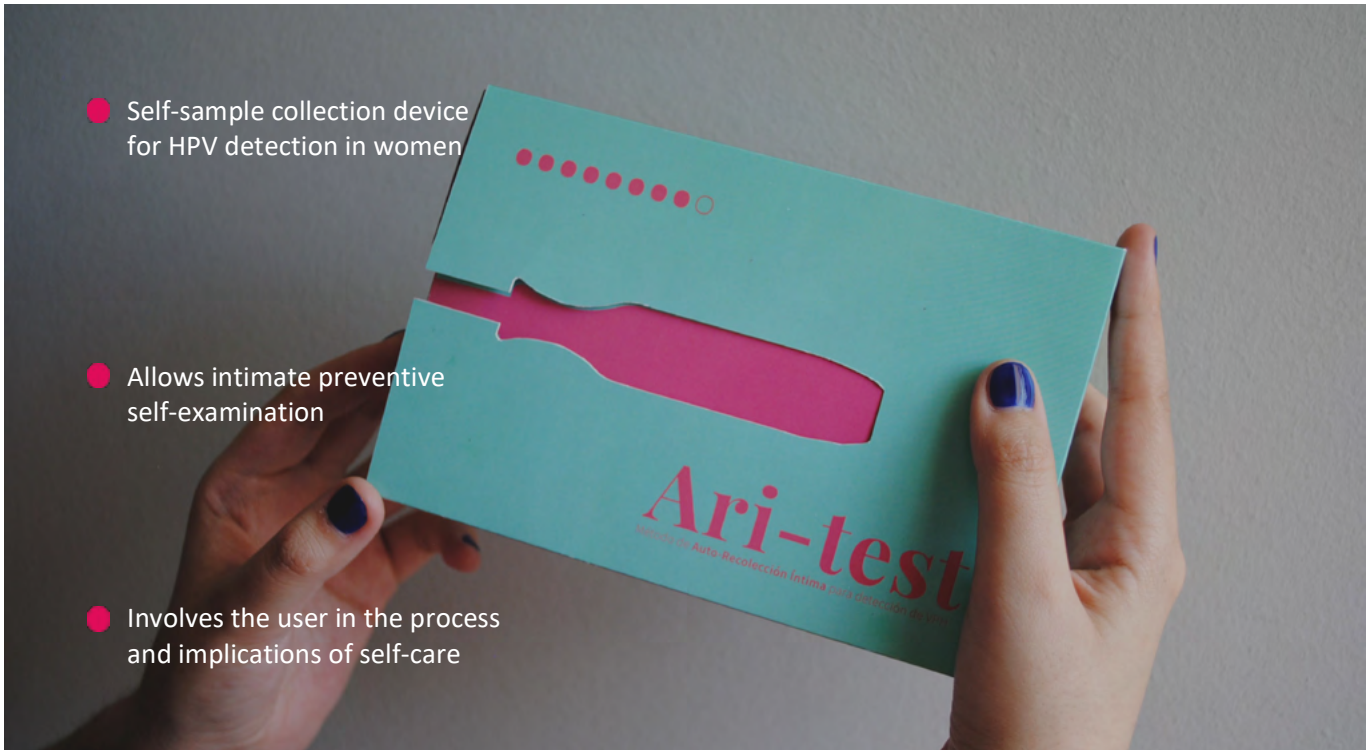
sexually active people

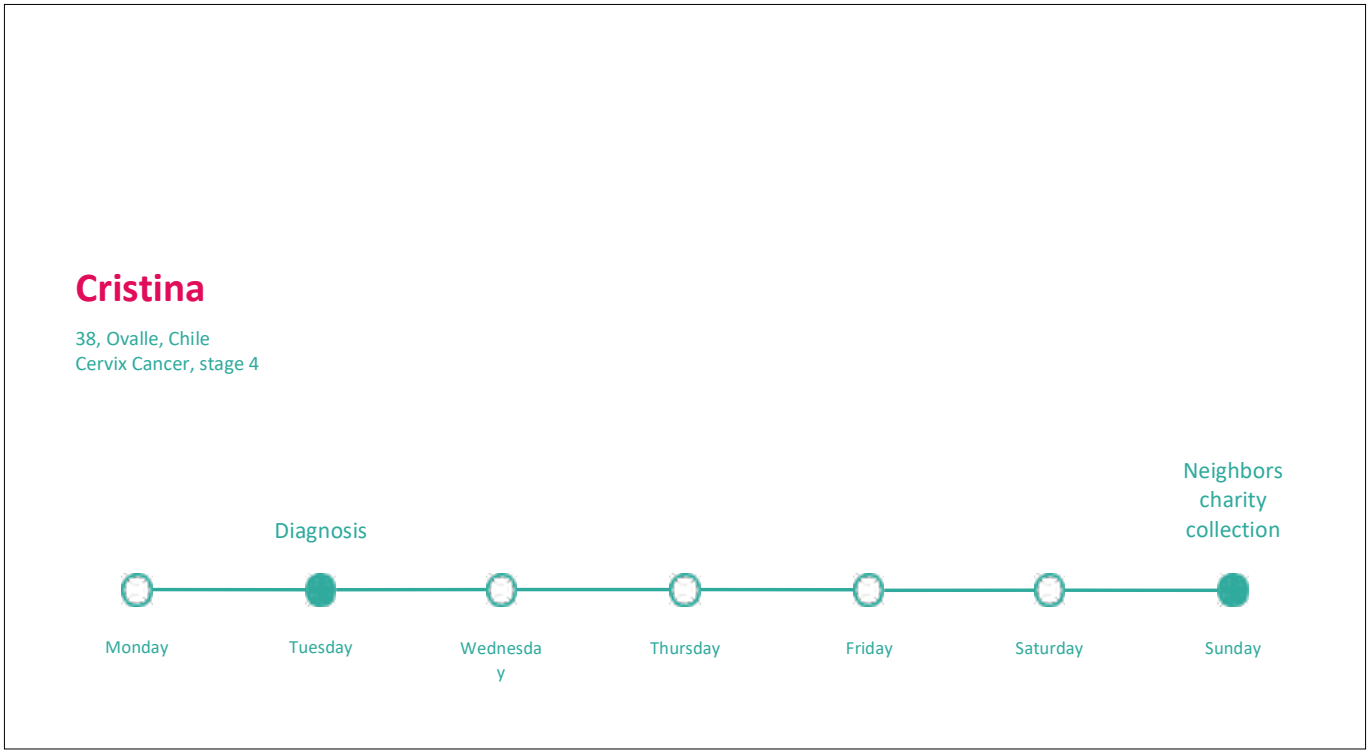
will potentially get

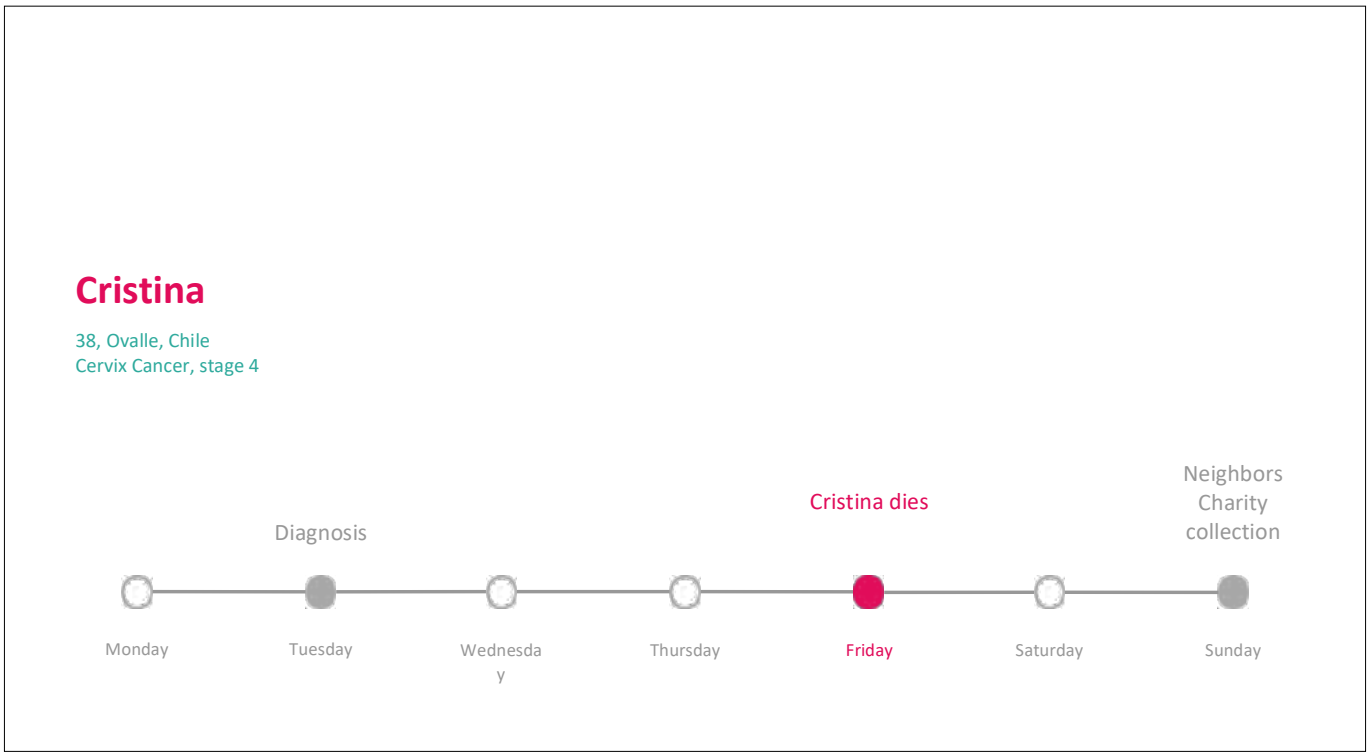
HPV at some point of
their lives

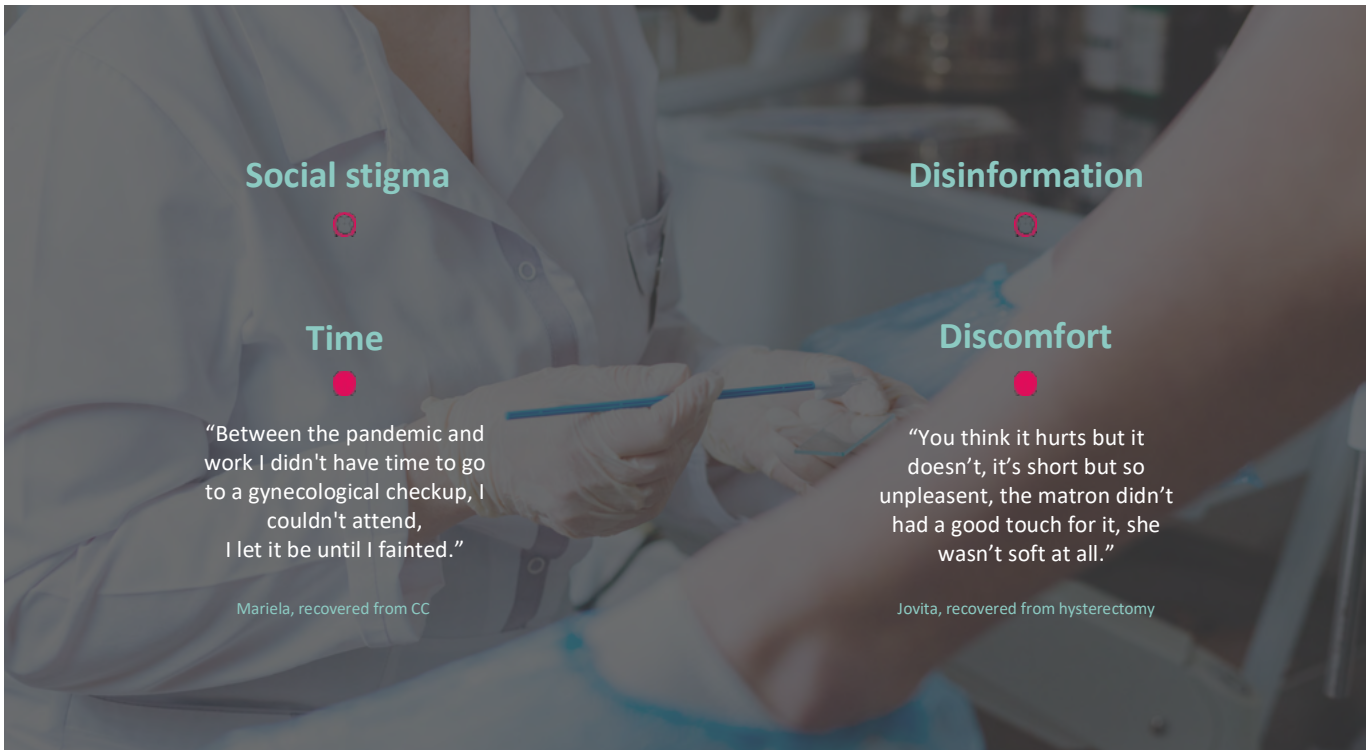
WHO, 2024

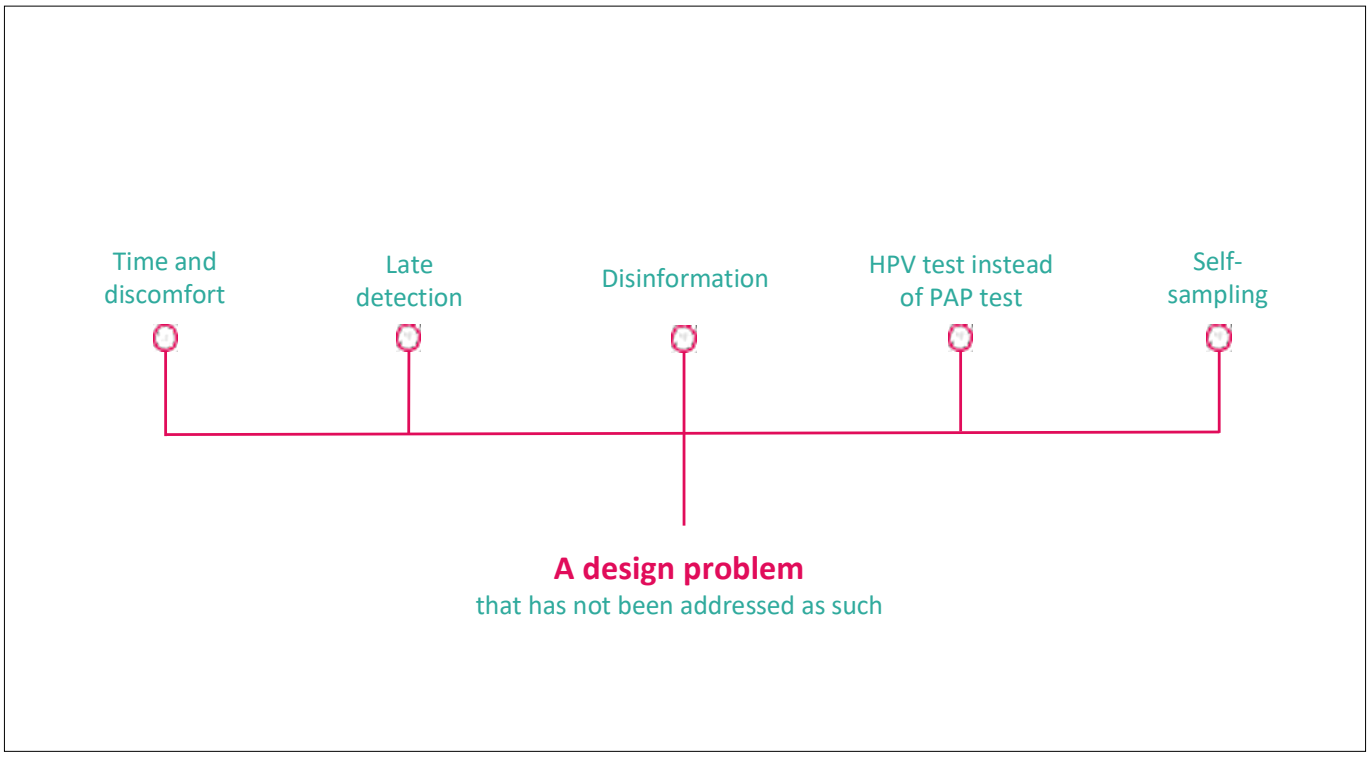

Worldwide
half
of the women diagnosed
with cervical cancer each year
die
WHO, 2022
In Chile
+1000
women are diagnosed
each year
700
of them
die
Urrutia, 2015
HPV affects over
440
million
people in the world
UC Christus Healthcare network
46%
of chilean
women interviewed
Had not attended
gynaecological check-ups
in over a year
Own elaboration from
interviews in 2022
Almost all
sexually active people
will potentially get
HPV
at some point of
their lives
WHO, 2024

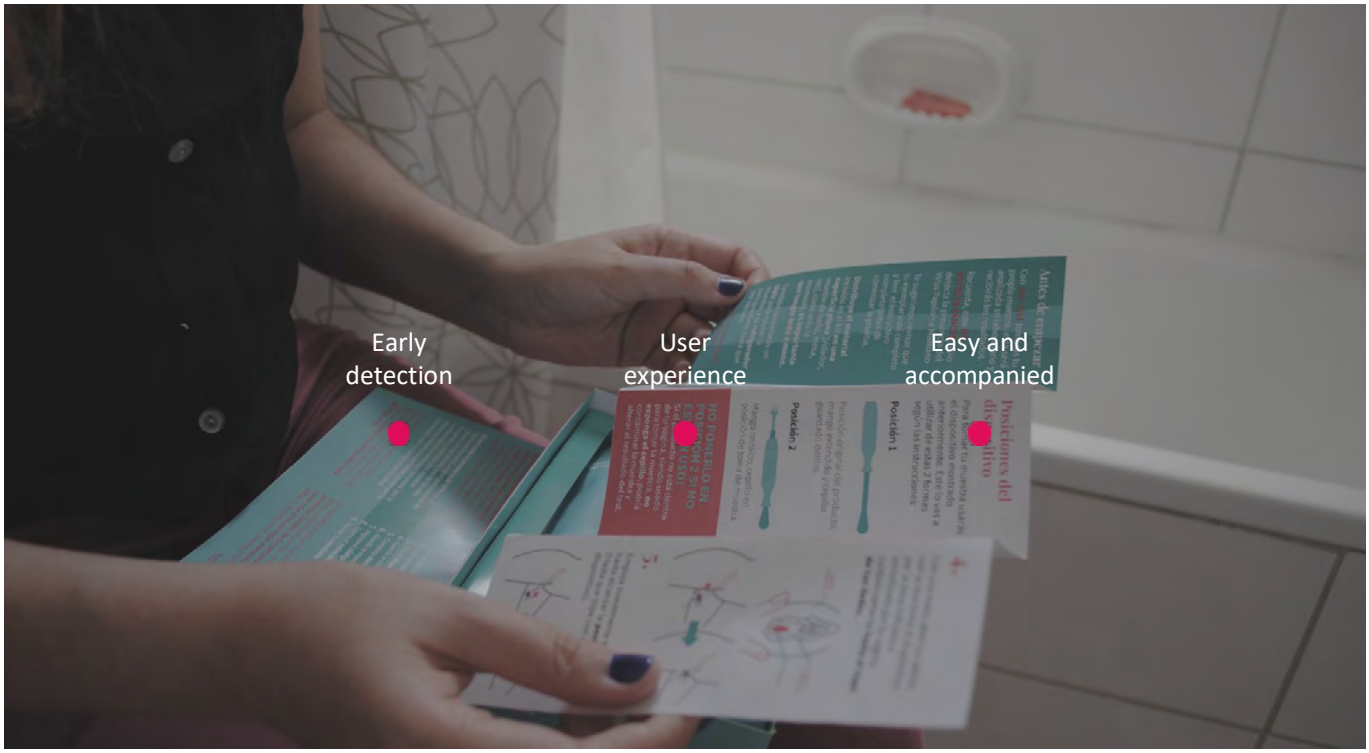

Self-sample collection device
for HPV detection in women
Allows intimate preventive
self-examination
Involves the user in the process
and implications of self-care
Ari-test


Cristina
38, Ovalle, Chile
Cervix Cancer, stage 4
Diagnosis
Neighbors charity collection
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday


Cristina
38, Ovalle, Chile
Cervix Cancer, stage 4
Diagnosis
Cristina dies
Neighbors Charity collection
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday


Social stigma
Disinformation
Time
Discomfort
"Between the pandemic and work I didn't have time to go to a gynecological checkup, I couldn't attend, I let it be until I fainted."
Mariela, recovered from CC
"You think it hurts but it doesn't, it's short but so unpleasent, the matron didn't had a good touch for it, she wasn't soft at all."
Jovita, recovered from hysterectomy


Time and discomfort
Late detection
Disinformation
HPV test instead of PAP test
Self-sampling
A design problem
that has not been addressed as such



Share knowledge and experiences

Involve women in the design process

Gain ownership over preventive healthcare

Keep focus on the user experience



Multiple aspects of the challenge

Multiple areas of development

Self-sampling device and interaction

Packaging, instructions and more

Understanding the challenge through the design process

Connecting through the right language

Translate a distant medical experience into an ownership of the gynechologycal healthcare experience

Looking at what they already do

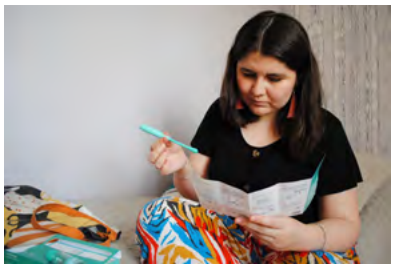
Medical requirements meet users experiences



Iteration process







Co-design

Sharing and
co-creating

Interaction

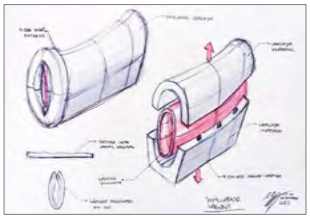
Dearest user
vs patient

Involve

Testing and
re-designing

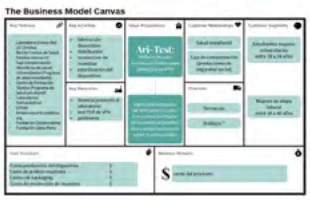
Keep the focus on the users' experiences











Prototyping and manufacturing

Service and experience

Testing simulator

Interdisciplinary team

How to make it happen

What has allowed us to keep it happening

Grounding the project

Funding

Financed by the National Research and Development Agency

Patent

Managed by Transfer and Development Directorate of Pontificia Universidad Católica de Chile

Validation

Colaboration with Cancer Lab at Medicine Faculty of Universidad Católica del Norte (UCN)

Get the idea to the real world



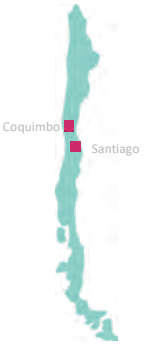
Testing the early versions of Ari-test in the nursing school simulation classroom in 2022

Get the idea to the real world

Validation alliances

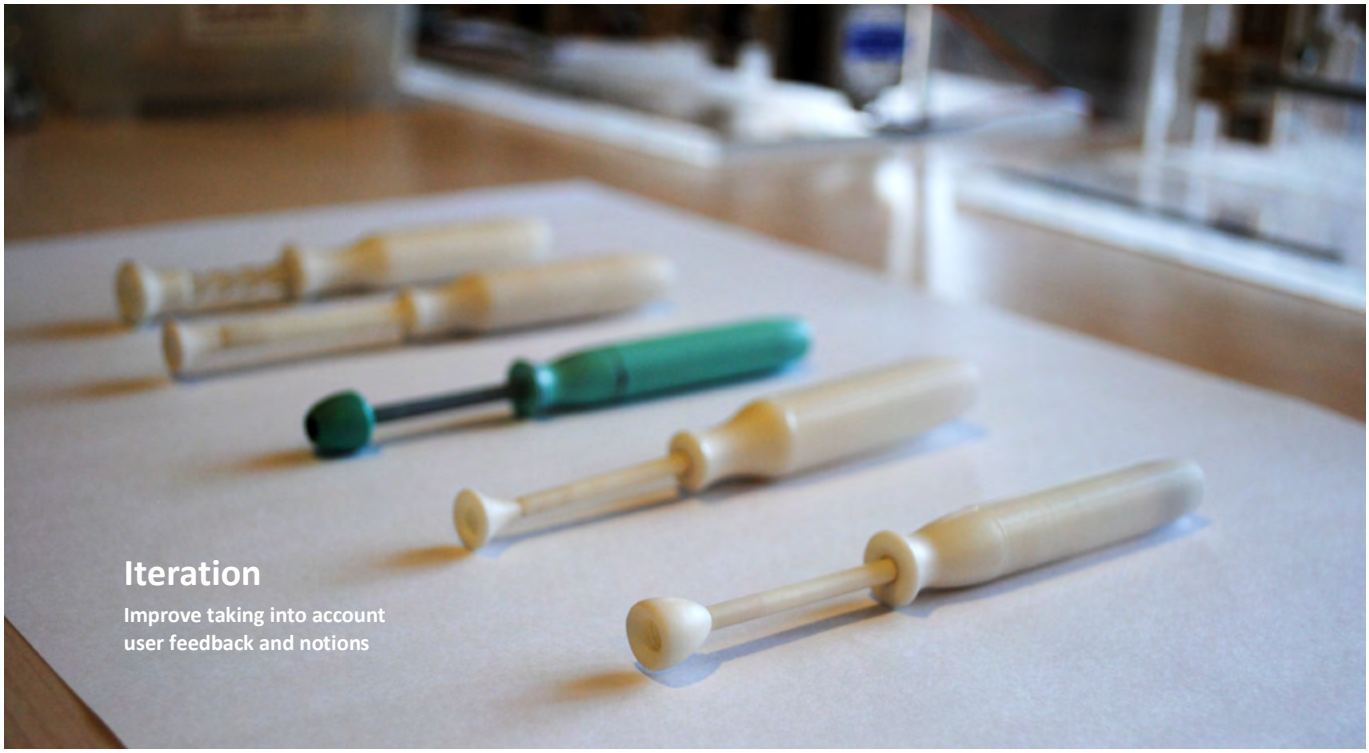


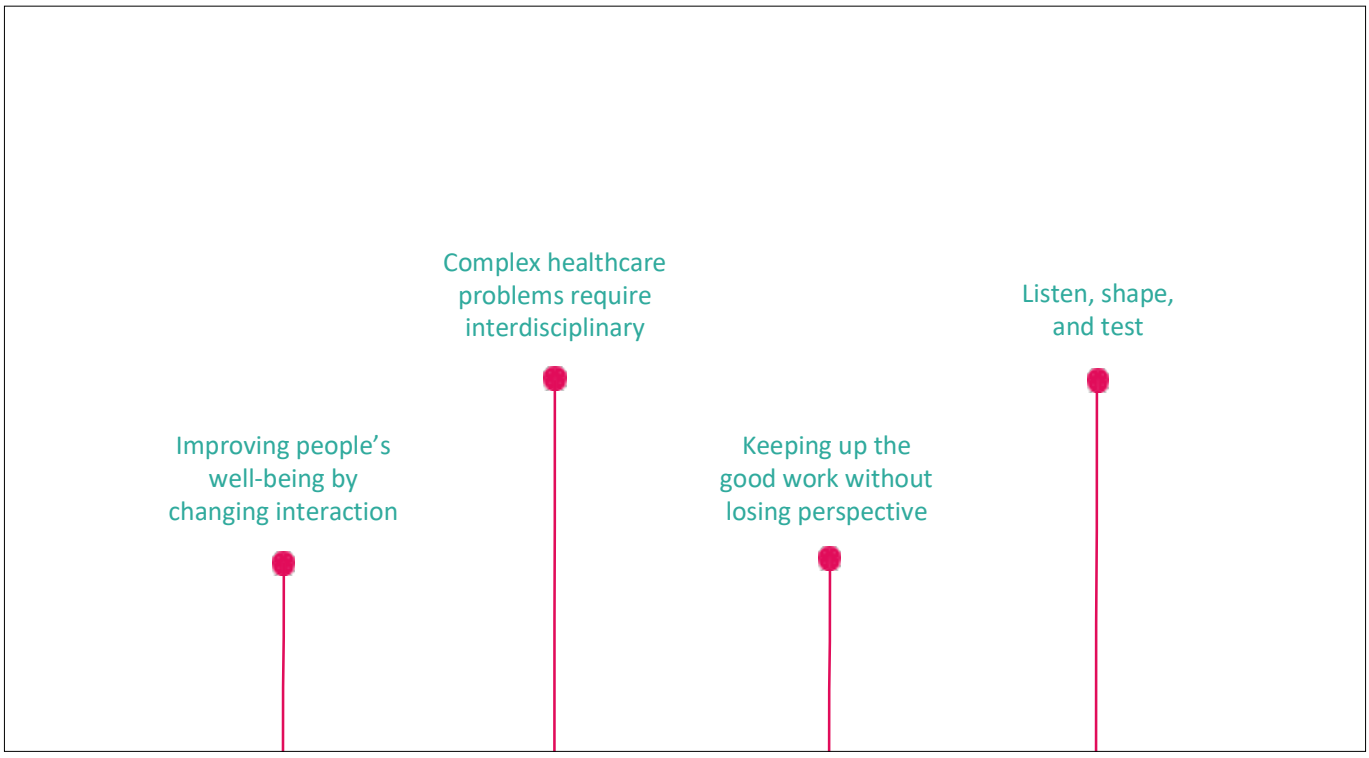
Visit to UCN for collaborative alliance in 2024



100 women of Coquimbo region are going to test Ari-test this year

The area most affected by HPV and CC in the country


Iteration
Improve taking into account
user feedback and notions

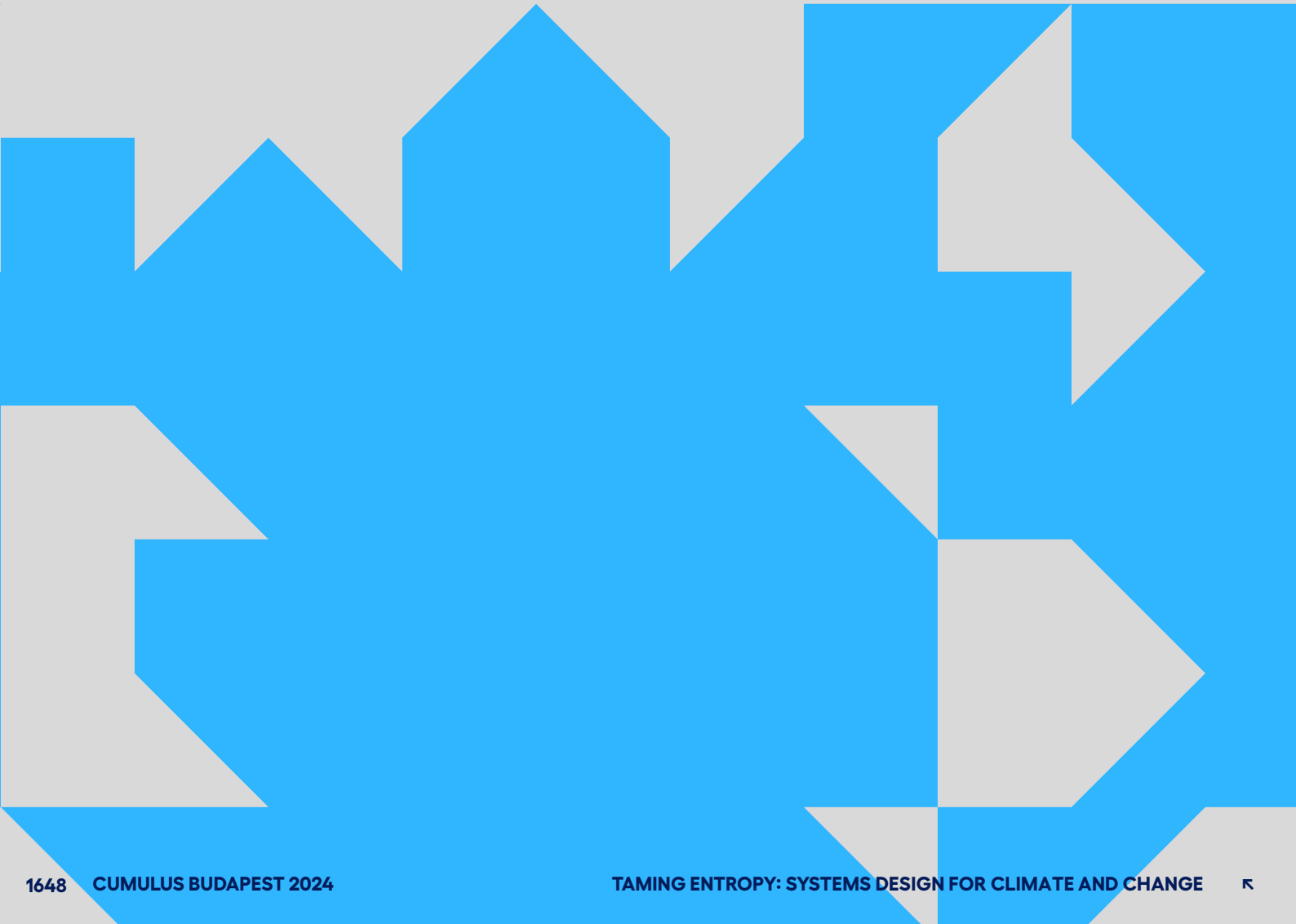

Improving people's well-being by changing interaction
Complex healthcare problems require interdisciplinary
Keeping up the good work without losing perspective
Listen, shape, and test


Ari-te

TAMING ENTROPY: SYSTEMS DESIGN FOR CLIMATE AND CHANGE

P/REFERENCES OF DESIGN

CUMULUS BUDAPEST 2024



P/REFERENCES OF DESIGN

TAMING ENTROPY: SYSTEMS DESIGN FOR CLIMATE AND CHANGE.

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While design, by its very nature and purpose, strives to reduce entropy within artificial environments, entropy is concurrently on the rise, not only within the natural world but also within the realm of human existence. The segmentation of design, driven by increasingly specialized fields, gives rise to new layers of meaning while universal concepts become depleted. Is sustainable design merely another method of shaping commodities, or can it encompass a comprehensive systems perspective? Within this complex domain, the parameters governing its operation can be defined, offering a fertile ground for scholarly exploration. We invite contributions to the track “Taming Entropy: Systems Design for Climate and Change”, where we aim to shed light on the leverage points of high efficiency within the design of sustainable systems.

As outlined in the call for papers, the concept of sustainability is frequently compromised by market-driven logic, resulting in practices of greenwashing and distortions of value systems. While there are numerous examples that illustrate this phenomenon, perhaps the most striking is the observation that, despite a series of international climate conferences (COP 1-27), agreements (e.g., Stockholm 1972; Rio 1992; Kyoto 1997; Paris 2015), and institutions (e.g., IPCC, 1988), meaningful reductions in carbon dioxide emissions have only occurred temporarily—during the global financial crisis of 2008 (Kallis, 2017) and the COVID-19 lockdowns. The question remains: why have we not met the goals of climate strategies? Why has the transition to a circular economy not occurred, and why does consumption continue to increase? The answer lies in the neoliberal economic

system, where the imperative for growth overrides the values underpinning sustainable strategies. The concept of sustainable development (Brundtland, 1987), while conceptually tautological, has been subject to criticism even before its formalization (Meadows, Randers, & Meadows, 2004; Illich, 1984; Lányi, 2022). Nevertheless, the United Nations adopted 17 Sustainable Development Goals (SDGs) based on this concept. Although the majority of these goals reflect a morally sound systemic perspective, the influence of market forces remains evident, particularly in SDG 8: Decent Work and Economic Growth.

The first session, entitled *Designing Education for Tomorrow,* focused on the integration of ecological perspectives into education. Both the morning session and the afternoon workshops highlighted the importance of developing education that is aligned with ecological principles. Whether addressing museum pedagogy, gamification, immersive UX design, or the introduction of new curricula, uncompromising solutions require the persistent efforts of dedicated practitioners. From Mongolia to Europe, during what was the warmest spring on record, it remains essential to emphasize that the ecological crisis is not separate from the crisis of civilization but rather a consequence of it. It is not global warming that we should be fighting—global warming is not an external threat to humanity, nor is it a catastrophe detached from us. Moreover, the aim is not to "save the planet," as the Earth will undoubtedly survive without us. Instead, we must redefine our understanding of progress and the good life, recognizing that the fundamental needs of humanity have remained unchanged over the past 20,000 years. These needs encompass more than just basic survival; they include the need for a meaningful existence and a sense of belonging within a supportive community. The unquestioning belief in progress has led to the reduction of knowledge to mere utility (thereby limiting our ability to understand both others and ourselves), the redefinition of freedom as consumption, and the conflation of creation and work with production. Means have become ends (Lányi, 2022, p. 23). To the question of whether there is still time to articulate and teach these concepts through the language of design, the presenters responded that there is not—yet they agreed that there is no alternative.

The second session, entitled *Taming Entropy by Products,* explored whether truly sustainable product and service design is possible. The inherent contradictions—whether a product is made from sustainable sources or produced through a reuse approach, it still results in new production and consumption—raise the question of whether these contradictions can be resolved through the principles of circularity and efficiency. The presentations, posters, and workshops in this session reflected a complex perspective, one that considers not only the energy and materials invested in a product or service but also its utility and the impact it has on shaping societal views. A disheartening conclusion from the panel discussion was that, contrary to the optimistic messages often conveyed by sustainability advocates, technologies that support circularity have been unable to keep pace with the increasing rates of production and consumption. A striking example of this is the millions of tons of textile waste that remain unprocessed and are often incinerated annually, as only a small percentage of clothing is recyclable, and the recycling industry lacks the political influence necessary to effect regulatory change.

The third session, titled *Systems Design,* adopted a broader interpretation of systems thinking, addressing urban-scale social problems as well as the physical and linguistic systems of ecology and the question of responsibility. The responsibility of designers extends far beyond the application of sustainable technologies, encompassing the broader interpretation of systemic perspectives. Why is there no overlap between the growing global housing crisis and the increasing sprawl of real estate developments? The institutionalized certification systems associated with greenwashing provide shameful evidence of this, as sustainability certifications are routinely awarded to building complexes that contribute to environmental degradation and have life cycles of less than 20 years. Despite the façade of sustainability, these practices obscure critical environmental and well-being issues. For instance, why was a particular building constructed in the first place? What was previously located on the site, and what alternatives could have been pursued? Whom does the building serve, and what are the environmental and social impacts of its construction and operation? Which building regulations had to be altered to facilitate its construction, and why? What message does this send to the city's residents, many of whom will never be able to afford to live in these spaces?

Capitalism, as it operates today, colonizes sustainable models and corrupts decision-making processes. In Track 8, our aim was to explore the coping strategies and intervention points identified by designers from diverse parts of the world, all of whom operate within this global framework. How do these designers attempt to avoid the traps embedded in the notion of sustainable development? The presenters and exhibitors of this track demonstrated a relentless commitment to the challenge of taming entropy, both within artificial environments and within the realm of human existence.

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FORMAT X

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Katarzyna Anosowicz



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FUTURE ISLAND: ENHANCING ANTICIPATORY COMPETENCE OF CHILDREN AGED 7 TO 11 IN ESD THROUGH GAME-BASED LEARNING.

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ABSTRACT | This study grounded in game-based learning theory, developed a board game based on the Education for Sustainable Development (ESD) theory for fostering anticipatory competency in 7-11-year-old children. The „Future Island" board game is designed for collaborative play among four players, aiming to protect islands from being submerged due to environmental crises. The game design incorporates five core concepts of anticipatory competency: future orientation, scenario planning, strategic systems thinking, interpersonal competence, and environmental knowledge. Qualitative research was conducted in both Guangzhou and Shenzhen using observational and interview methods with 28 children over two experiments. The purpose was to validate whether children's understanding of the game varies with age and whether the game effectively stimulates anticipatory competency in children. Analysis of the children's gameplay results revealed that their understanding of the game increased with age, and the "Future Island" board game effectively mobilizes children's anticipatory competency in the field of ESD.

1. Introduction

By 2022, the devastating impacts of climate change, biodiversity loss, pollution, and waste have become increasingly severe (UNEP, 2022). To enhance citizens' environmental awareness, the 2030 Sustainable Development Agenda explicitly integrates Education for Sustainable Development (ESD) principles into all educational category systems (UN, 2015). This article focuses on qualitative research using the Game-Based Learning method to explore the effectiveness of a board game to mobilize the anticipatory competence of children aged 7-11 in ESD.

ESD aims to develop competencies that empower individuals considering current and future social, cultural, economic, and environmental impacts, both locally and globally (Tejedor et al., 2019). Researchers have identified the anticipatory competence of the cognitive domain as one key competence that ESD ought to promote (Barth, Godemann & Rieckmann, 2007). Anticipatory competence involves the person's ability to envision and construct coherent future scenarios (Arnim, Lauren & Charles, 2011). The current focus is on insufficient coverage of age groups, that is, most research on expected abilities is concentrated in higher education rather than early childhood education (Senan & Marco, 2016). However, children in middle childhood already have logical thinking, reasoning, debating, and problem-solving abilities, which are the basic abilities required to develop anticipatory competence (Andrew, 1984). Thus, this article fills the research gap by studying the anticipatory competence of children aged 7-11 years old.

Game-Based Learning (GBL) is a type of gameplay with defined learning outcomes (Rosemary, Robert & James, 2002). Future Island is a board game designed to improve the anticipatory competence of children aged 7–11 in ESD. Addressing the impact of global climate warming on rising sea levels; players collaboratively anticipate environmental crises to protect the island from submersion due to increasing seawater levels. The game enhances children's anticipatory competence through engaging mechanics. Firstly, it cultivates children's Scenario Planning skill and Future Orientation skill by defending the island (Wiek, Withycombe & Redman, 2011). Secondly, it improves children's Strategic Systems Thinking ability by predicting the impact of human behavior on environmental crises. Thirdly, the multiplayer collaborative format of the game fosters children's capacity to connect with stakeholders. Lastly, the game promotes an understanding of environmental conservation through the presentation of diverse environmental crisis cards. Overall, the author posits Hypothesis 1: Children aged 7–11 years differed in their understanding level of the board game content developed in this study by age. And Hypothesis 2: This board game can effectively mobilize children's anticipatory competency in the field of ESD.

This study primarily involves qualitative research to validate these hypotheses, including board game experiments under GBL methods, Observation, interviews, etc. The team invited 7–11-year-old participants from Guangzhou and Shenzhen to participate in Future Island trials. The effectiveness of the model is measured by observing and analyzing children's performance in the game. Future work involves iterative optimization of the game model and incorporating Game-Based learning (GBL) to enhance various ESD capabilities, further advancing children's environmental awareness.

2. Literature Review

2.1 Anticipatory Competence in Education for Sustainable Development (ESD)

ESD is an educational approach that integrates the principles of sustainable development into teaching and learning practices. It aims to empower individuals to make informed decisions and take responsible actions for environmental integrity, economic viability, and a just society (UNESCO, 2014). ESD can be divided into three domains: Cognitive domain, Socio-emotional domain and Behavioral domain, and Anticipatory is one of the key competences in cognitive domain. A pivotal aspect of ESD is the development of anticipatory competence, which enables individuals to engage with future dimensions, anticipate potential outcomes, and craft visions for a sustainable future (Ojala, 2012). In the context of global environmental challenges, where the ability to think ahead and prepare for various future scenarios is crucial for effective decision-making and problem-solving.

Table 1. Key competencies in "ESD" can be divided into three domains.

	Cognitive domain	Socio-emotional domain	Behavioral domain
Key Competency	1 Systems thinking	5 Collaboration	7 Strategic
	2 Anticipatory	6 Self-awareness	8 Integrated problem-solving
	3 Normative		
	4 Critical thinking		

Anticipatory competence in ESD can be broken down into several components：

1. **Future Orientation:** This component involves the ability to think beyond the present and consider the long-term implications of current actions and decisions. It requires an understanding of the temporal scale and the ability to work across different time horizons, which is particularly important when dealing with sustainability issues that often have delayed consequences (Rieckmann, 2012).
2. **Scenario Planning:** Anticipatory competence includes the capacity to create and analyze alternative future scenarios, both desirable and undesirable. This allows individuals to identify potential risks and opportunities, and to develop strategies to achieve preferred outcomes while avoiding or mitigating negative ones (Ojala, 2012).
3. **Strategic Systems Thinking:** This combined component encompasses the capacity to create and analyze alternative future scenarios, both desirable and undesirable, and to understand the interconnectedness of systems. It allows individuals to identify potential risks and opportunities, develop strategies to achieve preferred outcomes, and navigate the complex feedback loops and unintended consequences that can arise from sustainability-related actions (Barth et al., 2007; Ojala, 2012).
4. **Interpersonal Competence:** Anticipatory competence is also about the ability to collaborate effectively with others. This includes the capacity to communicate, negotiate, and work in diverse teams to achieve common sustainability objectives (Wiek et al., 2011).
5. **Environmental Knowledge:** Environmental knowledge is essential for anticipatory competence as it provides the foundational understanding of ecological systems, natural resource management, and the impact of human activities on the environment. This knowledge enables individuals to make informed decisions that are grounded in scientific evidence and contribute to the conservation and restoration of ecosystems (Tschakert & Dietrich, 2010).

Anticipatory competence enables individuals to navigate these uncertainties by considering a range of possible futures, evaluating the plausibility and consistency of different scenarios, and making informed decisions that align with sustainability principles. Moreover, anticipatory competence supports the development of a proactive and adaptive mindset, which is crucial for addressing the 'wicked problems' of sustainability (Rittel & Webber, 1973). In conclusion, anticipatory competence in ESD is essential because it equips learners with the tools to actively shape their future rather than passively accept it (Gardiner & Rieckmann, 2015).

2.2 Anticipatory Competence in 7-11-Year-Old Children

Despite the recognized importance of anticipatory competence in ESD, the majority of research and educational initiatives have focused on adolescents and young adults (Taimur & Sattar, 2019). This demographic is often at the forefront of discussions surrounding sustainability, as they are the ones who will inherit the consequences of current environmental policies and practices. However, there is a notable absence of research and targeted educational strategies for children aged 7-11 years, a critical period in their cognitive and social development according to Piaget's theory of cognitive development (Piaget,

1952). This age group is in the concrete operational stage, where they begin to understand the reversibility of operations and can think logically about concrete events (Piaget, 1952). This stage is particularly suitable for introducing sustainability concepts and fostering anticipatory thinking, as children at this age can grasp the implications of their actions on the environment and society (Ojala, 2017).

The lack of focus on children in this age group in ESD research and practice is concerning, as this demographic represents the future stewards of the planet. By not engaging them in anticipatory thinking, we miss the opportunity to instill the foundational skills and values necessary for sustainable living from an early age. The importance of fostering anticipatory thinking in children is multifaceted. Firstly, it enhances their cognitive development by encouraging them to think critically and systematically about the future (Withycombe, 2010). This includes understanding cause and effect relationships, considering multiple perspectives, and evaluating potential risks and benefits. Secondly, it supports their social and emotional development by fostering empathy, collaboration, and a sense of responsibility towards the environment and future generations. Lastly, it prepares them for active citizenship, equipping them with the skills to participate in socio-political processes and contribute to sustainable development initiatives (Cebrián, Junyent, & Mulà, 2020).

In conclusion, the development of anticipatory thinking competencies in children aged 7-11 is a critical yet underexplored area within ESD. By integrating age-appropriate strategies into educational practices, educators can help shape a generation of children who are equipped to engage proactively with sustainability challenges and contribute to a more sustainable future. This requires a concerted effort from educators, policymakers, and researchers to create a more inclusive and holistic approach to sustainability education that reaches and empowers children from all backgrounds and cultures.

2.3 Game-Based Learning Approach and Board Game

Game-based learning refers to the utilization of certain gaming principles and their application in real-life scenarios to engage users (Trybus, 2015). Board Games as part of effective Game-Based Learning strategies, more and more researchers and producers are focusing on this area (Santos, 2017). Research including children aged 7 to 11 strongly suggests that board games are an effective tool for encouraging active learning and knowledge retention, and that board games can help children learn even better than traditional forms of teaching (Weisberg et al. 2015). Many game settings of board games are very useful in promoting children's learning, for example: teachers can ask open-ended questions to help children think more deeply; the introduction of dice helps reduce adult control and allows children to maintain a sense of control in the game; The mechanics of multiplayer games can help children enhance their social skills, etc. (Hassinger-Das et al. 2017). Therefore, as one of the important game forms of GBL, board games can well exercise children's independent learning ability.

Although board games have great benefits in promoting children's learning, there is currently a lack of board game designs for children in the field of ESD that enhance their expected abilities. The currently known training for expected competencies is the „The City of Phoenix" themed workshop designed for college students (Withycombe, 2010). Most of the board games in other ESD fields are simple environmentally themed games, such as the board game „Go, Goals" (SDG, 2020) designed by the United Nations Regional Information Center to help children understand the sustainable development goals. Therefore, there is currently a lack of environmentally themed children's serious board games in the research field, especially in the field of ESD ability training.

In conclusion, board games have the potential to promote children's learning more broadly (SuttonSmith 1979; Singer, Golinkoff, and Hirsh-Pasek 2006). And anticipatory abilities as an important ability in the field of ESD, and one of the abilities that children aged 7-11 years old most need to cultivate, there competency are need some suitable board games as GBL materials to help children better master anticipatory.

2.4 Research Gap

Firstly, there is limited attention to young audiences: current expectations learning primarily targets university students, with a notable lack of research focused on children aged 7-11. Despite the crucial role of this age group in the development of anticipatory competency, they have largely been overlooked in game-based learning research.

Secondly, training on anticipatory abilities in Education for Sustainable Development (ESD) mostly concentrates on workshops, classroom lectures, etc., lacking game-based learning approaches, particularly important and effective board game training for children.

Therefore, this study will design a board game for cultivating anticipatory competency in ESD for children aged 7-11, and validate its reliability through a series of qualitative experiments.

3. Research Questions

RQ1: In this study, would the content of the board game developed lead to different levels of understanding among children aged 7-11 based on their age differences?
H1: Children aged 7–11 years differed in their understanding level of the board game content developed in this study by age.

RQ2: Does this board game have the potential to engage children's anticipatory competency in the field of ESD?
H2: This board game can effectively mobilize children's anticipatory competency in the field of ESD.

4. Methodology

4.1 GBL Method: Board Game Design Background and Conceptual Structure

The method used in this study is the board game in game-based-learning, and the name of the board game is „The future island". The game was designed based on the principles of ESD, specifically targeting the development of anticipatory competence. The game's mechanics were crafted to simulate environmental challenges and encourage strategic decision-making, reflecting the cognitive, socio-emotional, and behavioral domains of ESD, etc.

The background of the board game is that four players must take on the roles of an artist, an engineer, a marine biologist, and a renewable energy scientist, respectively. Through teamwork and playing skill cards, they aim to prevent sea level rise and the submergence of islands to win the game. The rules of this board game are designed entirely around the five components of anticipatory competency:

1. **Future Orientation:** Players need to judge in each round whether the impact of human behavior on environmental crisis events will be exacerbated, weakened, or have no impact. In this process, players need to think about the dimension of time, focus on the present, and consider the impact of human behavior on the environment in the future. Therefore, children's Future Orientation ability can be developed.
2. **Scenario Planning:** Players need to reasonably analyze the environmental crisis events that occur in each round, then think about which skill card in their hand is most suitable for solving the current event. In the process of thinking, players naturally adapt solutions to environmental crisis scenarios, which exercises children's Scenario Planning abilities.

3. **Strategic Systems Thinking:** During the game, players need to constantly calculate which character skill cards are needed to solve the current environmental crisis. At the same time, it is also necessary to predict in advance what impact the drawn human behavior cards will have on the environmental crisis. Sometimes players need to give up staged victories in exchange for final victory. These combination thinking can effectively exercise children's Strategic Systems Thinking ability.
4. **Interpersonal Competence:** The game is a group cooperation mode. Players need to communicate multiple times to determine which character skill cards the entire group should play in this round to solve the current environmental crisis. What kind of choices need to be made when the interests of
the team and the interests of the individual are put in front of you? This is the Interpersonal Competence that players can develop while playing games.
5. **Environmental Knowledge:** The environmental crisis cards in this game include events such as melting glaciers, and extreme heat waves; the human behavior cards include environmentally related events such as "the tourist group in Future Island litters garbage"; the character skill cards include „monitoring the rate of sea level rise" and so on. In the process of playing the game, players will gradually master the knowledge related to the environment.

4.2 GBL Method: Cards, Rules and Steps of the Board Game

1. **Introduction of board game cards and other props:**

   Skill card: The skill cards are the available skills that players possess. There are a total of four roles and sixteen skill cards.



(a) (b) (c) (d)

Figure 1. Examples of skill cards: (a) Oceanographer Skill Card 1; (b) Oceanographer Skill Card 2; (c) Oceanographer Skill Card 3; (d) Oceanographer Skill Card 4.



(a) (b) (c)

Figure 2. Examples of skill cards: (a) Energy Scientist Skill Card 1; (b) Engineer Skill Card 1; (c) Artist Skill Card 1.

Environmental crisis card: Environmental crisis cards are environmental crisis events that need to be resolved in each round. There are six environmental crisis cards in total.



(a) (b) (c) (d) (e) (f)

Figure 3. Examples of Environmental crisis cards: (a) Energy Crisis Card; (b) Glacial Melting Card; (c) Extreme Heatwave Card; (d) Forest Loss Card; (e) Seawater Pollution Card; (f) Fish Decline Card.

Human Behavior Card: Human behavior cards are human behaviors that will have different impacts on the environment. There are 9 human behavior cards in total.



Figure 4. Example of Human Behavior Card.

Table 2. Example for what impact does human behavior have on different environmental crisis events.

	Energy Crisis Event	Glacial Melting Event	Extreme Heatwave Event	Forest Loss Event	Seawater Pollution Event	Fish Decline Event
In order to develop new projects, Future Island tourism has severely damaged the natural ecological reserve on the island.	No effect	Double crystals	Double crystals	Double crystals	Double crystals	Double crystals

Ocean Card: The ocean card is a scoring item, and each player initially has three ocean cards. For each round lost, a player must place one ocean card near the island, representing a rise in sea level by one unit.

Crystal: The crystal is a scoring item, and each player initially has 4 crystals representing their own character's color. White crystals are the ones that need to be spent to resolve the events on the environmental crisis cards.



(a) (b)

Figure 5. (a) Examples of the Ocean Card; (b) Examples of the Crystal.

2. **Introduction of basic rules:** In "The Future Island" board game, four players form a team, and the team's ultimate mission is to defend the island from rising sea levels. The game consists of six rounds in total. In each round, different environmental crisis events will occur. The team must cooperate to play skill cards to solve the current environmental crisis events. If the team can successfully solve three of the six environmental crisis events, the island will not be submerged.

3. **Introduction of game steps:** The board game is divided into four phases: Events Step, Skills Step, Human Behavior Step, Resolution Step, and a brief description of each phase is provided below.

Events Step: There are a total of 6 environmental crisis cards, one card is played in each round, and the cards are played in the order of 1-6. As a group, discuss what happened, and how many crystals are needed to solve this incident.

Skills Step: Everyone decides whether to play a skill card and which card to play based on the crystal points in their hand. There is no limit to the number of people playing cards in each round. It should be noted that when children play a skill card, they should say how this skill card solves the current environmental crisis. After playing a skill card in each round, place the consumed crystals in the counting area according to the „Crystal points" marked on the skill card.

Human Behavior Step: Each round, a random Human Behavior card is drawn. The group discusses its impact: Positive halves Environmental Crisis card's crystals, negative doubles, no

impact maintains. If the team's total skill card crystals match or exceed the Environmental Crisis card's, they win. Players using skill cards get 1 crystal each; most crystals on a card earn 1 extra. If not, team loses; each discards an Ocean card, raising sea level by 1.

Resolution Step: If three of the six rounds are won, the future island will not be submerged by the sea water and the defense will be successful! If the future island is successfully defended, the crystal points in the counting area will be counted, and the person with the most crystal points will win an additional personal championship victory. The game proceeds to the next round until the game's termination criteria are met.



Figure 6. Game Process Overview and First Round Game Example.

4.3 Research Method: Qualitative Research Method

The main purpose of this study is to answer the two hypotheses mentioned above. H1: Children aged 7–11 years differed in their understanding level of the board game content developed in this study by age; H2: This board game can effectively mobilize children's anticipatory competency in the field of ESD. In this study, the experimenters will use qualitative analysis to analyze the experimental results. Qualitative research is a research method focused on thoughts, concepts, or experiences (American University, 2020). There are many qualitative methods, with the most common types being interviews and observations (Creswell, 2007).

Observational method is described as a technique of observing and describing subjects' behavior, involving simply observing phenomena until some form of intuition or insight is gained (Kumar, 2022). Children's thinking and behavior patterns are very different from adults, and we cannot get the complete information we want by asking. Therefore, observation method is necessary in this study, and these observations can serve as the basis for subsequent analysis. Additionally, interviewing is another specific type of interaction, typically involving researchers asking questions to interview participants and participants responding to those questions (Brinkmann, S., & Kvale, S., 2018). Therefore, in this experiment, interviews are used as a complement to the observational method to help researchers obtain the necessary information.

To sum up, in this study, researchers will conduct two experiments using board games as props to verify H1 and H2. Specifically, Experiment 1 used the observation method, and Experiment 2 used the observation method and interviews.

5. Experiment

5.1 Experiment 1 Observation: Context and Procedure

In Experiment 1, the authors will test H1: Children aged 7–11 years differed in their understanding level of the board game content developed in this study by age. The study conducted its first qualitative survey on 8 children at the Another Art Museum in Guangzhou, Guangdong Province, China on May 19, 2023 (Guangzhou Group). A second qualitative survey was conducted on 12 children at the First Store Life Festival in Futian District, Shenzhen City, Guangdong Province, China on November 17, 2023 (Shenzhen Group). There are 20 qualitative experimenters in Experiment1, covering various age groups from 7 to 11 years old, and there are 4 experimenters in each age group. Both experiments used an open-ended board game experience workshop format, with participants randomly assigned to groups to ensure a mix of age and gender. The independent variables of this experiment are children of different ages, the control variables are the same game steps and the same number of children of each age group, and the dependent variable is whether the children can understand the rules of the game. The experimenters used observational methods to analyze whether children in the target age group's understanding of the game differed by age. In this experiment, the experimenter followed the following steps to conduct the observation experiment.

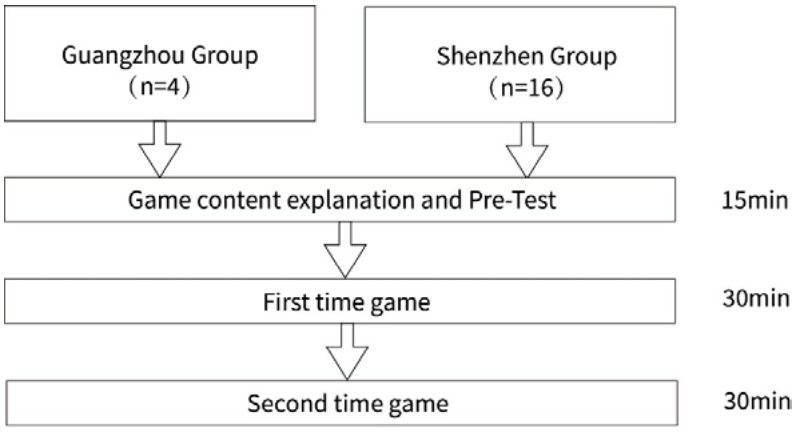


Figure 7. Experiment 1 Procedure.

1. Game content explanation and Pre-Test: Before the game starts, staff will explain the game content to each group and conduct pre-tests to ensure that the game-related information delivered to each child at the beginning is consistent.

2. First and second time Game: Observers use observation methods during the game to observe the children's understanding of the game. Children's understanding of game content can be divided into three dimensions: understanding of card text, understanding of game rules, and understanding of the way to victory. During the game, observers will carefully observe each player's choices, actions, judgments, and interactions with other players. Each dimension is rated on a seven-point scale and details low, medium, and high behaviors, with higher scores indicating greater understanding of the game content for that dimension. Ratings include the quality and frequency of observed behavior, and the scores are not mutually exclusive; for example, a child might simultaneously demonstrate understanding of card text, understanding of game rules, and understanding of winning in two rounds of play.



(a) (b)

Figure 8. (a) Game scene photo of the Guangzhou group; (b) Game scene photo of the Shenzhen group.

5.2 Experiment 1: Analysis and Summary

Firstly, in the observation phase, observers are asked to write down examples of relevant behaviors for each dimension. Then during the scoring phase, observers refer to "The Future Island" instruction manual and compare the descriptions of children's behavior it provides with their own observation notes to determine scores for each dimension. For example, a sign of a high score in the „Understanding of card text" dimension is that the child can read the text on the card fluently and conduct reasonable analysis of the text. Observers arrive at a final numerical score by determining how well the description matches the observed behavior. For example, a child whose behavior fully fits the description of „Completely understand the text on the card" would receive 5 points, while a child who mostly fits the description in the high range, but has some behaviors in the middle range, would receive 4 points. A child who fully fits the mid-range description will receive a 3, while a child who mostly fits the mid-range description but has some low-range behaviors will receive a 2. Finally in the calculation phase, the observers averaged the data for each age group to obtain a final score.

Table 3. Example for Score calculation for 7 years old age group.

Participant number	Participant age	The understanding of game content can be divided into three sub-items			Overall score	Average score
		Understanding of card text	Understanding of game rules	Understanding the way to victory		
1	7	4	5	4	13	10.25
2	7	4	4	4	12	
3	7	2	3	2	7	
4	7	2	3	4	9	

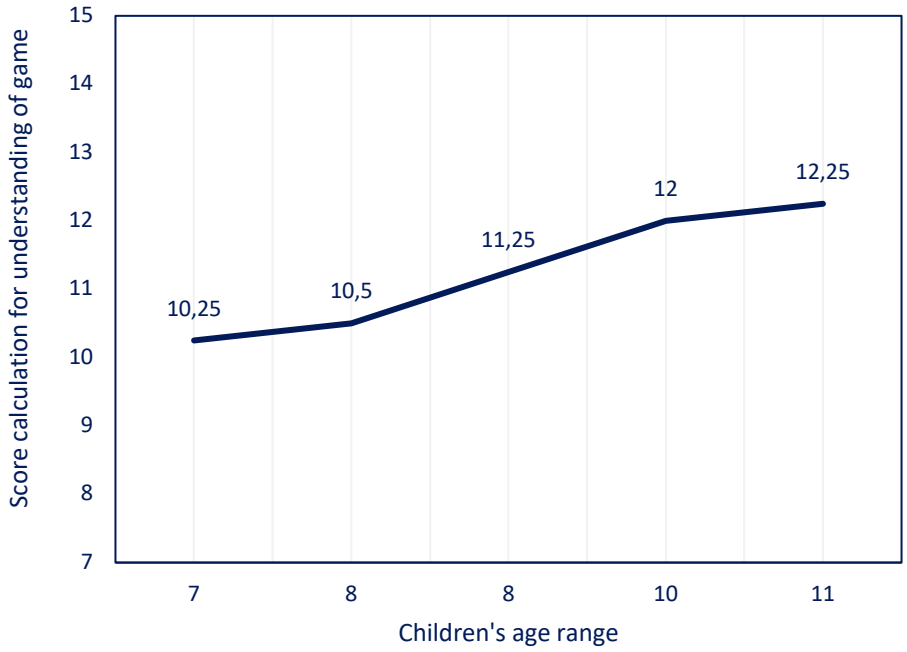


Figure 9. Line chart of scores for children of different ages on their level of understanding of the game.

Through data analysis, the author believes that hypothesis 1 is provable, that is, Children aged 7–11 years differed in their understanding level of the board game content developed in this study by age. And as age increases, children's understanding of the rules of the game gradually rises. In addition, it can be found that children aged 7-8 years old have a low understanding of the game, so the researcher made some modifications to the game rules, that is, simplifying the text content and game rules, so that children aged 7-8 years can better understand the game.

5.3 Experiment 2: Context and Procedure

In Experiment 2, the author will verify H2: This board game can effectively mobilize children's anticipatory abilities in the field of ESD. According to the results of the first experiment, the experimenters found that children aged 7-8 years old had a lower understanding of the content of board games. After improving the content of the board game, the experimenters will focus on selecting the age group of children aged 7-8 for E2 test. The study conducted a qualitative survey among 8 children on January 28, 2024, at the Futian District Library in Shenzhen, Guangdong Province, China (Shenzhen group2). Before starting the survey, each parent signed an informed consent form. The experiment used an open-ended board game

experience workshop format, with participants randomly assigned to groups to ensure a mix of age and gender. The research methods of Experiment 2 were observation and interview. In this experiment, the experimenter followed the following steps to conduct the experiment：

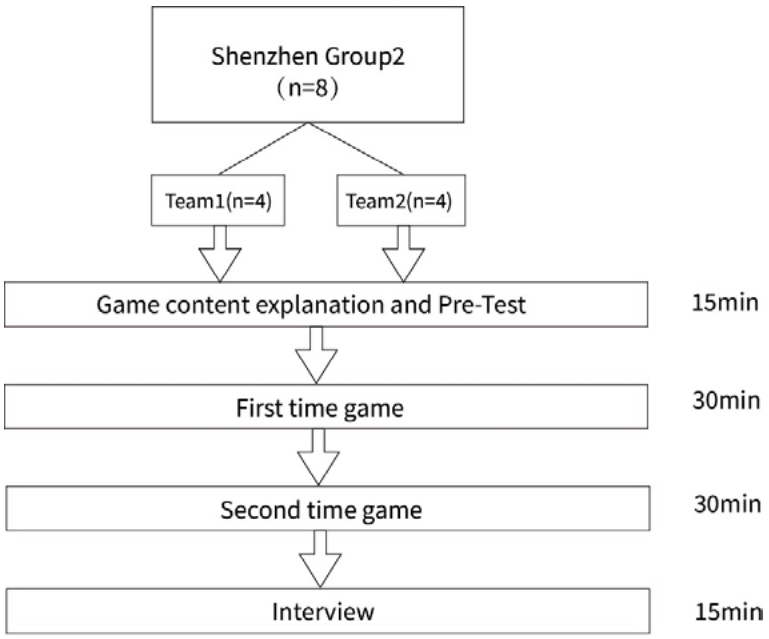


Figure 10. Experiment 2 Procedure.

1. First and second time Game: Observers used observation methods during the game to observe whether the children's expected abilities were mobilized by the board game. The observer will use the child's speech, decision-making, reaction speed and other information during the board game to judge the child's expected ability level in this round of the game. The researchers focused on the following questions and their corresponding abilities in the two-round game:

Scenario Planning: Can children understand the scenarios in the environmental crisis card and human behavior cards?
Future Orientation: Can children correctly judge the impact of human behavior cards after they are drawn?
Strategic Systems Thinking: How many times did children win the game and what strategies did they develop?
Interpersonal Competence: Do children communicate frequently with group members?

2. Interview: Observation methods will be supplemented by interview sessions, in which researchers will communicate directly with the children after the game. The interview session will help researchers obtain more information about whether children's predictive abilities are mobilized. The researchers focused on the following questions and their corresponding competencies during the interviews:

Strategic Systems Thinking: Do you know the methods that can both lead to team victory and individual victory?
Interpersonal Competence: What do you think your role is within the team? What efforts did you make to win?
Environmental Knowledge: What environmental knowledge did you learn after playing this game?



Figure 11. Game scene photo of the Shenzhen group 2.

5.4 Experiment 2 Analysis and Summary

The researchers obtained information about whether children's expected abilities were mobilized through observation and interviews, and sorted them out according to the framework of the five basic abilities of expected abilities:

1. Scenario Planning: After the second time of play, most children were able to accurately describe the scenarios on the environmental crisis cards and were able to provide diverse solutions to fixed events. For example, when Timmy, a 7-year-old boy who played the role of an oceanographer, encountered an energy crisis, he played a skill card for purifying seawater and explained that purified seawater can be used as a new energy source to solve the energy crisis. Therefore, the researchers believe that the game mechanism of this board game, which invites children to take their own roles into the situation and solve the current environmental crisis by providing a variety of scenario cards, can effectively mobilize children's scenario planning ability in anticipatory abilities.

2. Future Orientation: During the first time of play, children's judgments about human behavior cards were limited to whether they were good or bad behavior. However, in the second time of the game, most children were able to use the current human behavior cards to further think about how these behaviors will affect the environment in the future. For example, an 8-year-old boy named Duoduo was able to deduce that human fishing of large quantities of fish may have a negative impact on ocean biodiversity in the future. Therefore, researchers believe that this board game effectively mobilizes children's Future Orientation ability in anticipatory abilities by setting up human behavior cards and guiding children to think about the impact of these behaviors in the future.

3. Strategic Systems Thinking: During the observation phase, researchers discovered that neither team won in the first time of the game and that their crystals had been exhausted early in the game. In the second time of the game, they re-formulated their game strategy, allocated crystal points reasonably and won the game. During the interview phase, the researcher asked children what strategies could help the team win. Duoduo said: „In the early game, skill cards with fewer crystal points should be produced, and in the late game, skill cards with more crystal points should be produced, so that there are enough crystal points. „ Therefore, by observing and interviewing children as they developed different play strategies, the researchers determined that children's strategic systems thinking in anticipatory abilities was mobilized.

4. Interpersonal Competence: During the observation phase, the researcher found that children on the same team had almost no communication in the first time of the game. However, the frequency of communication between the two teams increased significantly in the second time of the game. For example: A girl named Xuanxuan explained the meaning of environmental crisis

cards to her teammates and discussed with her teammates what skills should be played. Her positive communication helped the team win consecutively. During the interview phase, the researcher asked what role did the children play in the team? Xuanxuan replied that she acted as translator and strategist. Therefore, researchers determined that the game mechanics of this board game can mobilize children's Interpersonal Competence in expected abilities.

5. Environmental Knowledge: During the interview session, the researchers asked the children what environmental knowledge they had gained through board games, and each child was able to answer more than two answers, such as: not throwing garbage into the sea, not wasting food, protecting forests, saving energy, etc. The researchers therefore determined that children's knowledge of environmental protection in their anticipatory abilities can be mobilized through this board game.

After analyzing the observation records and interview records, the author believes that hypothesis 2 can be proved, that is the board game can effectively mobilize children's anticipatory abilities in the field of ESD. Children can exercise the five details of anticipatory abilities when playing board games.

6. Contribution

6.1 Theoretical Contribution

Firstly, this study extends the research on anticipatory competence in the ESD field to the board game field, providing new insights into the application of this important capability in the ESD field in game-based-learning. It explores how the unique characteristics of board games influence children's Anticipatory Competence, thereby broadening the theoretical scope of ESD competency systems in contemporary learning environments. Moreover, this study addresses a significant gap in the literature on competency-based board games in the field of ESD. The study contributes to a deeper understanding of how board game design contributes to educational outcomes for children aged 7-11 years. Finally, the study refines board game design by unearthing a theoretical framework of expected abilities and provides a holistic view by linking it to qualitative insights into player experience. This approach enriches the academic conversation in ESD education and game research, providing an understanding of the interplay between game-based learning and ESD competency development.

6.2 Practical Implications

The results of this study provide valuable guidance for the development of board game designs. By studying how to translate theories that are difficult for children to understand into fun and accessible games, game designers can create more educational and effective learning tools. Futhermore, the results of this study can serve as a resource for educators by providing evidence-based strategies for integrating low-cost board games into educational curricula. This can increase student engagement and improve learning outcomes, especially in terms of expected competencies in the environmental field. Finally, the results of this study may help policymakers develop guidelines for the inclusion of board games as a learning tool in educational settings. By leveraging these insights, education policies can be better adapted to optimize the benefits of GBL in promoting student development and learning effectiveness.

7. Limitation and Future Work

Regarding the game design, children have reported that there are too few environmental crisis cards, which leads to a lack of variety and can result in boredom. Additionally, the initial quantities of crystals and positive human behavior cards are limited, causing the game to become more challenging in later rounds as players are more likely to lose. Moreover, about the experimental research: The sample size of the qualitative survey is too small, resulting in incomplete feedback from children. And there is a lack of quantitative research and control groups to determine whether children's anticipatory abilities have improved after playing the game.

Moving forward, the author plans to add more environmental crisis and human behavior cards to enhance the richness of the game. The study will also continue to investigate whether other competencies within the ESD field, beyond anticipatory abilities, can be adapted into game formats. In the experimental domain, quantitative research will be conducted using larger sample sizes to assess the effectiveness of the games in improving children's anticipatory abilities. Additionally, follow-up studies will be considered to examine the long-term impact of board games on the development of children's expected competencies.

8. Conclusion

This study uses a board game called "The Future Island" to improve children's anticipatory abilities in the field of ESD. Through the literature review, it was learned that expected capabilities can be divided into five factors: scenario planning, future orientation, strategic systems thinking, interpersonal competence and environmental knowledge. The game mechanism of this board game is designed around these five factors. During the research phase, observations and interviews were used to verify children's understanding of the game and the effect of mobilizing expected abilities. The research results show that "The Future Island" board game can effectively mobilize the anticipatory abilities of children aged 7-11, and as the children's age increases, children's understanding of the content of the board game becomes higher. In the future, the author will further optimize the game design, conduct diversified experiments, and increase the sample size of the experiments.

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P/REFERENCES OF DESIGN

WHAT DO WE MEAN: THE LANGUAGE OF DESIGN FOR SUSTAINABLE PRACTICES.

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KEYWORDS | POST-PARTICIPATION, ECOLOGICAL CITIZENSHIP, CO-CREATION, COMMUNICATION, SHARED AGENCY

ABSTRACT | Design research has metamorphosed over the last ten years, with discipline titles becoming muted and complex. Discipline terminology previously dictated outputs, for example product design included artefact outputs, but now includes strategic direction, highlighting the importance of clear communication. This change serves as a catalyst for enquiry, not only in what design is, but shifting the speculative realm of what it can do, cultivate, or foster.

This position paper underscores the importance of language in shaping sustainable futures diverging from conventional paths. Climate change impacts all life forms, and design has a dual role as a solution and a challenge in confronting climate-related issues (Godelnik, R. 2021). The distinction between participation and empowering individuals to have agency emerges as pivotal in this context. This however is reliant on the systems, interventions, and agency those individuals are empowered with. Emphasising language's significance in post-participatory activities - the shift in how we can think about design methods, moving beyond typical user involvement to empower communities and foster more inclusive, dynamic results, bringing agency, choice, and citizenship. This article addresses how language has been underexplored within "design for sustainable practices" compared to its prevalence in "design for inclusion" (Nuñez, 2013; Reed and Monk, 2006).

1. Introduction

Traditionally, 'participation' is defined as attending and participating rather than having a sense of autonomy. Going beyond this, into what has been termed ‘post-participatory,’ are approaches such as Engaging Design (ED). ED initiates active involvement (as a new route by which to generate design propositions) within communities and society. ED is an empowering practice, traversing beyond participation in the traditional sense of attending and participating, energizing communities, providing agency, and facilitating 'self-authored' and 'community-authored' responsible change (Phillips and Gant, 2021).

Our agenda within The Ecological Citizens network+ project aims to work collaboratively with citizens in this responsible way, actively shaping environments within a contemporary design framework. The project looks to foster and proactively encourage (through technologically appropriate interventions) Ecological Citizenship for positive climate action, while funding and working with a network of projects. As such, the project underscores language as a crucial component in design, influencing perceptions and power dynamics in co-design processes (Sanders et al., 2008, p.16).

The objective of this article is to propose a glossary of terms. The suggested glossary, curated here by team members of The Ecological Citizens network+, offers a preliminary glimpse into terms commonly employed in discussions about design for sustainable practices. These terms, including, for example, 'gatekeeper' and 'preferable futures,' prompt the need to interrogate and comprehend nuanced meanings, assumptions, potential cross-disciplinary misunderstanding, and variations in interpretation. Ultimately, the study advocates for an inclusive design approach driving responsible transformations in the face of challenges like the climate crisis, climate justice, and ecocide. The approach used here looks at language and terminology aiming to foster collaborative and inclusive approaches crucial for sustainable transitions without marginalizing or undermining societies or cultures.

The People & Planet Consumer Insights report (2023) underscores the significance of engaging diverse audiences on "people and planet" topics, blending rational and emotional dimensions. Language and comprehension, as the report suggests, become pivotal in this engagement. Here, the concept of people and planet encapsulates distant futures, envisioning a world where everyone is included, possesses agency, and collaborates to achieve shared goals. Plus, the glossary provokes reflection on the potential implications and nuances associated with linguistic choices, advocating for language that is not only reflective of contemporary design frameworks but also instrumental in driving positive and responsible transformations in societal and cultural contexts.

Our perception of design is inherently shaped by the intangible nature of speculative and design fictions, where the boundaries between imagination and reality blur. In these creative realms, language becomes the linchpin, weaving narratives that transcend the tangible, challenging conventional notions of what design can be. These speculative narratives not only illuminate potential futures but underscore the profound role language plays in anchoring and navigating the landscape of design exploration.

Understanding these terms holds significant importance in fostering collective action that does not reinforce systems of structural inequality (Costanza-Chock, 2020, p.23), especially in addressing the pervasive impact of climate change on our global community. Recognizing this, it becomes crucial to acknowledge the potential influence of language on individuals' autonomy and self-perception in their roles, considering diverse backgrounds and perspectives. In the context of 'post-participatory' co-design practices related to climate change, thoughtful cultivation of language becomes imperative.

Design practices are also intricately linked to individual roles, skills, relationships, and perspectives (Marxt and Hacklin, 2005, p.416). Therefore, it's crucial to grasp how this diverse array of backgrounds and experiences influences the definition of terms and the use of language. For example, designers and facilitators bring their own cultural perspectives, making language a fundamental component of co-design.

However, language encompasses more than just terms; it doesn't inherently spark dialogue on its own (Rodenburg, 2018). Within various fields like employment and education, power imbalances and hierarchies persist (Shenk et al., 2023). Language holds the ability to either empower or marginalise, influencing trust and inclusivity. Design, encompassing specialised practices across multiple fields and drawing from everyday lived experience knowledge (Costanza-Chock, 2020), serves as a dynamic arena where power imbalances persist, mirroring broader societal issues. Plus, interpretations can shield meanings held by different languages. Take, for example, the Welsh term "Cynefin." While its English translation is "habitat," its significance extends far beyond, encapsulating a holistic concept that integrates the physical, social, cultural, spiritual, and economic dimensions of a place. It delves into the intricate interactions among these dimensions, offering a comprehensive understanding of the interconnected nature of a locale (Mayo, 2023). Plus, consider the example "paint it" and "cover it in paint," which are used interchangeably in certain instances, alongside their unique implications in different contexts. In the realm of decorating, both phrases may essentially convey similar meanings, indicating the application of paint to an area. However, when applied to artistic painting, "paint it" may imply the creation of a scene or portrait, allowing for a more open and interpretive approach. On the other hand, "cover it in paint" implies a thorough and complete application, suggesting total coverage. Recognizing these subtle differences enhances our understanding of how language nuances contribute to varied interpretations in different scenarios.

These instances highlight the intricate nature of language, where subtle nuances can lead to misunderstandings or reinforce bias. This underscores the significance of navigating linguistic intricacies by conducting activities such as collaborative glossary generation, as detailed here.

1.1 Fostering Design in a Post-Participatory Landscape

Post-Participatory design represents a shift in how we think about design methods, moving beyond typical user involvement to empower communities and foster more inclusive, dynamic results, shifting the landscape bringing agency, choice, and citizenship. This shift in methodology is rooted in various design-led languages such as living labs, co-design, participatory design, pluriversal design, user-centred design, planet-centred design, and design for/with ageing (Tironi et al., 2023, Brophy et al., 2023). These interconnected concepts significantly impact the engagement of communities in the design process. Building upon Frayling's theories and design-driven approaches (Frayling, 1994), practitioners seek to enhance co-design practices by using precise terminology. A tangible demonstration of this impact is reflected in our deliberate use of the term 'design proposals' instead of 'solutions' (Gaver et al., 1999). This choice underscores the importance of incorporating diverse voices right from the inception of a design proposal, emphasising the avoidance of prescribing a solution. Careful choice of language is particularly important when engaging with diverse groups of people. By working in an effective collaborative way with communities, there is a necessity to acknowledge and honour the diverse values of indigenous populations, embracing non-colonial design principles (Valencia Sáiz, 2005), (Ivison et al., 2000). The differences in participatory design approaches based on national contexts and cultures, emphasise the need for heightened awareness of the limitations of personal viewpoints in representing diverse cultural backgrounds (Cahill et al., 2007). This restricted understanding of diverse perspectives constrains open discourse in emerging design propositions. Calls to revisit design-centric dialogues to include criteria guiding local solutions and broader visions are emerging. This discourse should foster a dialogic approach, encouraging diverse participants, including design experts, to interact, exchange ideas, and embrace their roles (Tham, 2021).

1.2 Why Focus on Language?

Language is integral to co-design and the 'post-participatory' discipline, shaping how parties perceive and engage in the process (Cooke and Soria-Donlan, 2019). In digital design, it goes beyond technical skills; it requires considering the human element and navigating cognitive complexities (Gray, 2016). Exploring semiotics and product language offers profound insights into how linguistic elements influence the product landscape, enhancing the co-design journey. Different language interpretations impact how co-design is

conveyed, executed, and measured (Kleinsmann and Valkenburg, 2008). Understanding diverse language perspectives is crucial for inclusive design in these realms, often dealing with intangibles and narratives (Huybrechts et al., 2017).

The recognition of language's power to both include and exclude emphasises the need for thoughtful word choices and a serious consideration of their impact. For instance, terms like 'user' and 'stakeholder' carry negative connotations, linked to addiction, exploitation, or corporate agendas that may perpetuate colonialist attitudes (Kleinsmann and Valkenburg, 2008; Banerjee, 1999). Exploring alternatives like 'interested party' instead of 'stakeholder' sparks pertinent discussions about fostering action and agency among citizens. The understanding gap in common terminology can significantly affect citizens' agency, calling for discussions around political agency and civil society perspectives in promoting citizenship. Language holds immense power in framing co-design sessions, influencing design justice, and contributing to the vision of a sustainable future. How we describe climate change and the emotions and actions these descriptions evoke are critical in shaping our collective perception of the future and our ability to instigate change.

1.3 Our Positionality

In the landscape of design discourse, the Ecological Citizen(s) team recognises its roles as citizens, researchers, and designers. Design (as a practice) has transformed in the last decade with advances in new practices, definitions including; Community Technology (Hess, 1979), Public-Interest Technologies (Ford Foundation, 2024) and Citizen Designers (Heller, & Vienne, 2003). Members of our team draw from these contemporary design practices and apply them to the critical questions of how humanity can live sustainably. Our strength is in our different disciplinary backgrounds, the network we are building lies in creative problem-solving within the expansive domain of design, distinct from the expertise of language experts. As we navigate this intersection of disciplines, we acknowledge and address the gaps in our knowledge. Embracing a holistic approach, we celebrate our expertise while openly acknowledging the expertise and lived experiences our team may lack. This conscious recognition fosters a culture of humility and openness within our collaborative efforts. This conscious acknowledgment allows us to address knowledge gaps effectively. We actively integrate diverse perspectives into our team, placing value on input beyond our immediate disciplines. This inclusive approach contributes to a comprehensive understanding of the challenges we tackle, promoting an environment where humility and openness are embraced.

We position ourselves as active participants in an expansive dialogue, presenting research characterised by an inclusive structure, delving into the profound impact of language in contemporary discussions on community action and citizen cultures. Our work serves as a valuable resource, fostering collaboration and fresh perspectives among scholars, practitioners, and participants. By avoiding the 'god trick' (Haraway, 2016) – the detached and objective reporting on subjects – we ground our perspectives in personal experiences and professional engagements, avoiding impersonal authorship and upholding accountability. In discussing language, we recognise the richness of cognitive and physical diversity, understanding that ways in which diverse brains and bodies work contribute uniquely to our understanding of ecological issues. Embracing varied perspectives allows us to glean insights from different modes of thinking, influencing design language beyond mere vocabulary into spatial, visual, haptic, and sonic experiences (Costanza-Chock, 2020). This multi-sensory approach acknowledges the importance of making ecological concepts more accessible and engaging. Inclusive design language bridges gaps in accessibility, fostering a shared understanding of environmental issues through interactive installations, visually compelling graphics, or immersive sonic experiences.

Additionally, we acknowledge our team's limitations and the lack of diversity in certain backgrounds. We openly admit our lack of experience in certain areas, understanding the importance of humility in the face of complex ecological challenges. Recognising that our approach is embedded in Western European viewpoints, and as such we need to emphasise inclusivity by embracing other perspectives. We aim to create a comprehensive strategy for building a sustainable global community, including non-humans. The project encourages a holistic approach that integrates insights from ecology, ethology, and environmental

science, recognising the intricate balance of our planet, involving both human and non-human realms. This approach challenges the dominance of predatory and capitalist ways of knowing, valuing alternative paradigms such as cooperation-based ecosystems (Energy Observer, 2023). By incorporating narratives that emphasise cooperation, reciprocity, and holistic interconnectedness, we aim to shift the focus from purely monetary values to a more comprehensive understanding of sustainability encompassing social, environmental, and economic well-being.

2. Method

The glossary of terms utilised in this study is curated through our collaborative efforts in *the Ecological Citizen(s) network*[+]. We, a diverse array of experts spanning ecological sustainability, design, and community engagement, have created this essential compendium aimed at cataloguing, refining, and unifying the terminologies crucial to our joint endeavours in participatory, sustainable, and design-led initiatives. Our discussions explore the intricate realms of design methodologies, with a particular focus on integrating participatory approaches and sustainable practices within projects.

This process is characterised by our collaborative sessions, conversations, and thorough deliberations, aiming to extract and articulate terms specifically pertinent to the convergence of Ecological Citizenship (Jagers et al., 2013), participatory design principles (Spinuzzi, 2005), and sustainability frameworks. Our primary objective is to construct a comprehensive repository that captures the intricate, multifaceted dimensions intrinsic to the essence and depth of our work. During our discussions, significant terms that naturally arise and spark conversation are documented and subsequently incorporated into the glossary. We are then encouraged to contribute our own perspectives, interpretations, and definitions for each term, thereby highlighting the diverse range of meanings associated with them. To promote transparency and clarity, the glossary document is made accessible to all of us. This accessibility allows us to add new terms, or clarify existing ones, if we perceive variations in understanding among our colleagues. To facilitate open and honest contributions, the option for anonymous input is also provided. Furthermore, the EC glossary has been designed with designated sections for us to append supplementary information, evidence, or factors we deem important. This structure aims to encourage thorough documentation, enabling us to provide context and substantiate our individual understandings of the terms.

The terms entered into the EC glossary, along with our respective explanations, undergo analysis with core members of our group (backgrounds in social science, design, art). This analytical process aims to unravel the diverse understandings of each term and elucidate the main reasons behind these variations. Firstly, we examine entries to identify patterns and commonalities in the provided explanations. By categorising and clustering similar interpretations, we seek to discern any consensus or recurring themes among us. Simultaneously, we delve into instances where discrepancies or varied understandings emerge. These points of contention are closely scrutinised to uncover the underlying factors contributing to the diversity of perspectives. Factors such as our individual experiences, professional backgrounds, or contextual nuances are incorporated where possible and considered in this analysis. Following the analysis of varied glossary term understandings within our group, an additional layer of depth is introduced by seeking theoretical insights. We recognise the value of grounding our interpretations in established theories and conceptual frameworks, to provide further evidence and context for the diverse perspectives captured in the glossary.

The process involves consulting relevant literature, academic sources, and established theoretical frameworks that pertain to the specific terms in question. This exploration aims to identify existing theories that align with, or contradict, the interpretations within the glossary entries. By doing so, we seek to validate and enrich our understanding of the terms, with insights from scholarly research and established academic discourse.

3. Results

Within the *Ecological Citizens*, the evolution of the glossary stemmed from the natural flow of organic discussions within routine team meetings. These sessions were characterised by their inclusivity, allowing for open dialogues that encourage team members to contribute insights from their diverse disciplinary backgrounds. As the team delved into various aspects of *Ecological Citizenship*, sustainability, and design, terms such as “gatekeeper”, “preferable futures”, “agency”, “bottom-up”, “client”, “citizen”, “community”, “expert”, “hyper-local”, “layperson”, “more than human”, “participant”, “non-human”, “stakeholder”, “steward”, “top down”, “touchpoint”, “user”, and “volunteer” naturally emerged in discussions. Table 1, details firstly the overview of the team regarding specific terms, along with reflection of varying cross-disciplinary theoretical commentaries on the term.

Table 1: Glossary terms and insights from *Ecological Citizens* team members are to their definitions, and understandings.

Term	Insights from EC team on terminology	Reflections on cross-disciplinary variations
Agency	‘Agency' was suggested to encompass the inherent capacity of an individual or group to take action and wield influence. The term sparked debates over the nuanced question of just how much autonomy and influence someone or a group genuinely holds within a specific system. It's crucial to note that agency isn't something that can simply be handed over to an individual; rather, it emerges from the intricate interplay of personal and collective capabilities within a given context, meaning care is needed in its use.	The concept of agency is intricately tied to personal empowerment in psychology, involving self-efficacy and autonomy. This underscores the importance of individuals acknowledging and leveraging their potential to influence preferred future trajectories, as the Ecological Citizen(s) seek to assist with. In governance and sociology, agency is closely associated with decision-making powers, exerting a significant impact on policy formation and societal frameworks. However, it is crucial to approach the use of agency with care, recognising its dual nature. While in psychology, it acts as an internal force driving personal empowerment, in governance and sociology, it manifests as a dynamic force influencing collective decision-making.
Bottom-up	Team members attributed different meanings to the term 'bottom-up' and its approach, with a significant aspect being its association with a lower-status position. Notably, ambiguity arises regarding its operationalisation and the extent of grassroots engagement, especially when scrutinising the intricate details of the precise origins of these initiatives. Caution was emphasised by team members when using the term due to the fluidity of the 'bottom-up' concept, which allows for interpretive flexibility. This flexibility enables organisations and individuals to tailor its definition to align with their specific objectives or ideological frameworks, further emphasising the potential for a lower-status connotation.	Within governance, it might involve community-driven policies; while in design, it could refer to user-driven innovations, further highlighting the need to be context specific and cautious in its use.
Client	Discussions on the use of the term ‘client’ revolved particularly around power dynamics, acknowledging that it implies a transactional relationship, with one party being in service to another, often failing to capture the iterative nature of many partnerships, such as designer/client relationships. The term "client" does not adequately reflect the evolving and collaborative nature of these interactions. Participatory activities, which involve individuals and stakeholders in decision-making processes, challenge the term "client" by underscoring the empowerment of those shaping the design or decision-making process. Terms like "partner" are considered more fitting as they better express the collaborative essence, moving away from the transactional connotations associated with the term "client."	In psychology, the term might relate to a patient; whereas in business or design, it could refer to a customer or user.

Term	Insights from EC team on terminology	Reflections on cross-disciplinary variations
Citizen	The term "citizen," traditionally signifying a member of a state or community with specific rights and responsibilities, requires caution in design and participatory activities due to variations in understanding, and the notion that citizenship and membership to nations is for many complex and perhaps, for some, harbours issues of exclusion. As such, team members suggested that designers might adopt more inclusive terms like "community member" or "vested interest party" to better capture the diversity and complexities inherent in the design and participation processes, avoiding unintended exclusions and promoting a more equitable and culturally sensitive approach.	In political science, it relates to legal status, whereas in sociology or design, it might emphasise community engagement or participation.
Community	The term "community" typically refers to a group of individuals sharing common interests, characteristics, or geographical locations; yet within design and participatory activities, its understanding can vary, necessitating caution in its use. Interpretations of "community" differ concerning boundaries, inclusivity, and cohesion. It might encompass a local neighbourhood, an online community, or a group bound by cultural ties. Discussions with the team suggested designers need to be mindful of these variations, as assumptions about the nature and extent of a community can impact the inclusivity of design processes. A term that seems universally understood may carry diverse meanings, potentially leading to miscommunications or overlooking the needs of specific subgroups. Therefore, precision and sensitivity in language are crucial to ensure that the term "community" is applied contextually, fostering a more accurate understanding of the diverse groups involved in design and participatory activities.	In sociology, it involves social structures, while in urban planning or design, it might relate to neighbourhood dynamics and spatial arrangements.
Expert	The term "expert" denotes an individual with specialised knowledge or skills in a particular field. However, within design and participatory activities, its understanding can vary, necessitating caution in its use. The contestation revolves around defining expertise, expertise hierarchy, and the criteria for labelling someone as an expert. In design, team members suggested expertise may encompass diverse domains, including technical proficiency, user experience insights, or cultural understanding, meaning caution is essential as the traditional hierarchical view of expertise might overlook valuable perspectives from non-traditional experts, such as end-users or community members.	In academia, expertise might be defined by research contributions; while in industry, it might focus on practical experience.
Gatekeeper	The term "gatekeeper" can have varied meanings within design and participatory activities, requiring caution in its use. In different contexts, a gatekeeper might be understood as a person, institution, or system controlling access to information, resources, or decision-making processes. Depending on the perspective, a gatekeeper can be seen as a facilitator enabling equitable access, or a barrier restricting entry. In design, issues can arise because design processes often involve multiple actors, and the role of gatekeepers can influence the inclusivity of these activities. When using the term, team members suggested a mindfulness of the potential power dynamics associated with gatekeeping is required, ensuring that it aligns with the principles of fairness, transparency, and equal representation.	The term might vary in interpretation between disciplines. For instance, in sociology, it could refer to social hierarchies, while in design, it might encompass access control in participatory processes.
Hyper-local	The term "hyper-local" refers to a highly localised or geographically specific context within design and participatory activities. Contested meanings arise regarding the scope and scale of what constitutes "hyper-local," particularly considering variations in geographical size and social dynamics. The definition may differ depending on the design project, cultural factors, or community characteristics. What is considered hyper-local in one context might not apply universally. Designers must be attentive to the nuances of the term, ensuring that its application aligns with the specific context at hand.	In journalism, it might relate to neighbourhood news, while in environmental studies, it could involve micro-scale ecological systems.

Term	Insights from EC team on terminology	Reflections on cross-disciplinary variations
Layperson	The term "layperson" refers to someone without specialised knowledge in a particular field, but its understanding within design and participatory activities can vary, necessitating caution in its use. Contestation emerged within the team around defining the extent of knowledge considered "specialised" and the expertise gap between professionals and laypersons. In design, where collaborative processes often involve diverse stakeholders, the term "layperson" may inadvertently imply a hierarchy that could marginalise the perspectives of individuals with lived experience. As such awareness is crucial as the line between specialised and general knowledge can be subjective and context-dependent.	In medicine, it refers to non-professionals, while in design or technology, it could relate to non-experts.
More than human	The term "more than human" emphasises considering entities beyond humans, including animals, ecosystems, or artificial intelligence, within the scope of human-centred design. However, discussions around meanings concerned the ethical considerations, responsibilities, and rights attributed to these "more than human" entities. In design and participatory activities, understanding the term can vary based on perspectives regarding the moral obligations and considerations owed to non-human elements. As a team there is the suggestion of a need to navigate the ethical complexities associated with extending design considerations to include these entities, with questions about their rights, agency, and the potential impact of design decisions on their well-being introducing challenges that require careful consideration.	In environmental ethics, it relates to non-human entities' intrinsic value, while in design, it might involve inclusive design practices considering diverse users.
Participant	The term "participant" refers to someone involved in a particular activity or process within design and participatory activities, but caution is needed in its use due to potential variations in understanding; however, the level of involvement, distinctions between active and passive participation, and the perceived roles of participants within a given process, are key aspects in need of discernment when using the term. Participant can encompass a spectrum of engagement, from those actively contributing, to those with more passive involvement. Team members suggested a need to be mindful of the diverse ways participants may interpret their roles and contributions, ensuring that the term accurately captures the range of engagement within a specific context.	In research, it could involve study subjects, while in design, it might involve actors engaged in co-creation processes.
Preferable future	"Preferable futures" refer to futures that are considered desirable, ethical, and just. Team members suggested that the concept of desirability and ethicality is subjective and as such discerning its precise use is important, especially considering 'preferable' can differ significantly based on cultural and disciplinary viewpoints. What may be deemed preferable in one cultural or disciplinary context might not align with the values or perspectives of another. There is a need to be cautious in assuming a universal understanding of what constitutes a preferable future and be attentive to diverse cultural, social, and ethical considerations.	The interpretation might vary between environmental sciences, sociology, and design. For environmental sciences, it could relate to sustainability, while in sociology, it could involve societal well-being.
Non-human	The term "non-human" refers to entities or beings that are not classified as human. However, its use within design and participatory activities can cause ambiguity, regarding the inclusion of various entities such as animals, ecosystems, or artificial intelligence within this category. Debates can emerge about the ethical considerations and treatment of these entities, as different perspectives exist on their rights, agency, and the responsibilities humans bear toward them.	In environmental studies, it might include ecosystems, while in technology, it could encompass AI or robotics.

Term	Insights from EC team on terminology	Reflections on cross-disciplinary variations
Stakeholder	The term "stakeholder" denotes an individual or group with vested interests or influence in a particular process or system within design and participatory activities. However, discussion within the team suggested its use may be contentious regarding the identification, prioritisation, and representation of stakeholders, as well as their roles and responsibilities. The understanding of who qualifies as a stakeholder can vary based on perspectives and may involve negotiations about whose interests should be considered. Additionally, debates may emerge concerning the level of influence different stakeholders should have, and the ethical considerations related to power dynamics. Plus "stakeholder" also holds colonial connections, with a stakeholder being a person who drove a stake into the land to demarcate the land they were occupying or, in many cases, stealing from indigenous territories. This historical association underscores the term's colonial legacy, and as such when considering the term, we must be acutely aware of this context to avoid perpetuating power imbalances, or inadvertently replicating colonial practices	In business, stakeholders might involve investors, while in urban planning, they could be residents or community groups.
Steward	The term "steward" refers to someone responsible for caring for or managing something within the context of design and participatory activities. Within the project's context, interpretations varied, leading to debates regarding the scope of stewardship, the extent of responsibilities, and the ethical considerations guiding stewardship actions. Different perspectives on what constitutes appropriate care, the boundaries of stewardship, and the ethical implications of management decisions can contribute to varying understandings of the term.	In ecology, it might relate to environmental conservation, while in governance, it could involve responsible management of resources.
Top down	The term "top-down" signifies an approach in which decisions or directives originate from higher levels of authority and are implemented downward. Within the team, concerns of the term's use centred around centralised versus decentralised decision-making and the efficacy of top-down approaches, criticising them for lacking inclusivity and neglecting grassroots perspectives.	In management, it might relate to hierarchical structures, while in governance, it could involve policy implementation.
Touchpoint	The term "touchpoint" signifies a specific interaction or moment of contact between an individual or group and a product, service, or system within the context of design and participatory activities. When using the term however, team members suggested interpretations may vary, leading to debates about defining the scope and significance of touchpoints. Some may emphasise the tangible points of contact, while others may consider broader aspects, including digital interactions and emotional engagements; meaning there should be caution to avoid assumptions about the universality of touchpoints and be attuned to diverse perspectives on what constitutes a meaningful interaction.	In marketing, it might relate to customer engagement, while in design, it could involve user interface interactions.
User	The term "user" details an individual who interacts with a product, service, or system(s). However, there were concerns raised that some may view users narrowly, focusing on their roles as consumers, while others may advocate for a more inclusive perspective that acknowledges diverse skill levels, backgrounds, and the potential for users to actively contribute to the design process through co-creation. As such the term "user" can imply a more passive role, lacking the recognition of active involvement and collaboration that co-creation entails, for instance. Consequently, there is the need to exercise caution to avoid limiting their understanding of users to mere consumers and recognise the potential for collaborative engagement, where users become contributors, providing valuable insights.	In technology, it might involve end-users, while in design, it could encompass diverse user personas.

Term	Insights from EC team on terminology	Reflections on cross-disciplinary variations
Volunteer	The term "volunteer" refers to someone who offers their time or services without monetary compensation within the context of design and participatory activities. Within the team, it was suggested that care is needed in the terms used, to avoid assumptions about the uniformity of motivations and commitment levels among volunteers. Additionally, recognising potential power dynamics and ensuring a respectful and inclusive environment for volunteers is essential to prevent unintended consequences.	In social sciences, it could relate to civic engagement, while in humanitarian fields, it might involve disaster relief efforts.

A key theme emerging from the glossary revolves around power dynamics. The term "agency" emerges as a concept with differing possible values attached, encapsulating the capacity of individuals or groups to act and exert influence (Bandura, 2000). While psychology tends to view it as personal empowerment; governance and sociology engage in debates concerning the distribution of decision-making power within systems. This ongoing discourse emphasises the crucial need for design practices that actively transform power dynamics. Such practices aim to empower communities and amplify the voices of marginalised groups, or indeed "grassroots groups" (Smith and Ely, 2015), enabling them to act as agents of change in shaping sustainable futures. Additionally, the reimagining of relationships talks to power dynamics, with terms such as ‘client’ and ‘collaborator’ in need of attention. The concept of the "client," traditionally denoting the receiver of services, is transformed in sustainable design. Power dynamics and responsibilities within this relationship become fluid, blurring the lines between passive recipient and active collaborator. Design demands a shift towards viewing users, citizens, and communities as co-creators with shared ownership and responsibility for shaping sustainable solutions. The potential power of gatekeepers is also emergent. Can they be facilitators of equitable participation or formidable barriers restricting entry? The answer lies not in the gatekeeper itself but in its function. Design must actively dismantle gatekeeping structures, ensuring open access to knowledge and resources for all participants, regardless of background or expertise.

The second key theme emergent from the glossary is the need to consider beyond traditional views of what citizens are, and can, do. For instance, embracing a diverse interpretation of what a "community" could be, paves the way for design practices embracing the fluidity and inclusivity of communities, weaving together diverse perspectives for holistic solutions. Connected to "community" (Sedita and Blasi, 2021) and its diverse perspectives, is the need to reconsider expertise, and challenge hierarchies. Indeed, the term "expert," signifying specialised knowledge, undergoes deconstruction in sustainable design. Traditional academic definitions face challenges from industry-focused perspectives valuing practical experience. This contest necessitates acknowledging diverse forms of expertise, including indigenous knowledge and local knowledge, embedded within communities, to enrich design processes and empower a wider range of voices. These voices, for instance, could be from "laypersons." However, by questioning the boundaries of "specialisation," design can empower multiple actors to become active co-creators. Open-source platforms, accessible tools, and inclusive workshops can bridge the knowledge gap, transforming laypeople from passive subjects into informed participants shaping their sustainable environments.

The third area of findings from the glossary is that of fostering different futures. For instance, the notion of hyper-local solutions for a global future: "hyper-local," emphasising highly localised contexts, sparks debate on scope and scale. While journalism associates it with neighbourhood news, environmental studies delve into micro-scale ecological systems. This diversity underscores the importance of tailoring design solutions to the specific characteristics and needs of each hyper-local context, recognising unique ecological, social, and cultural landscapes. Plus, there is the suggestion to envisage shared futures, and incorporate more than human perspectives. The concept of "more than human," encompassing entities beyond humans in design processes, challenges anthropocentric perspectives. Debates on ethical considerations and responsibilities towards these entities highlight the need for design to embrace a biocentric worldview. Ecological systems, animals, and even AI, are recognised as active participants in shaping sustainable futures. Lastly, there is also the need to navigate ethical complexities when it comes to building preferable futures. Cultural and disciplinary viewpoints significantly influence what constitutes a "preferable" future, necessitating cross-

disciplinary dialogue and collaborative visioning processes. Design plays a crucial role in facilitating these conversations, ensuring that sustainable solutions reflect diverse perspectives.

4. Discussion

The Ecological Citizen(s) organically developed its glossary through inclusive team meetings that encouraged contributions from diverse disciplinary backgrounds. As we explore Ecological Citizenship, sustainability, and design, terms like 'gatekeeper,' 'preferable futures,' 'agency,' 'bottom-up,' and 'volunteer' have naturally emerged, becoming integral components of our discussions, reflecting the multifaceted considerations of the project. In sustainable participatory design, terms are influential agents shaping foundational aspects and guiding ethical decision-making. Distinctions between terms like 'sustainability' and 'resilience' signal nuanced preferences, influencing the ethical framework. Recognising the contested nature of these terms is crucial to ensure shared understanding and cooperation, and respect for the diversity of backgrounds which formulate varied approaches and understandings.

This diversity of language and the multilingual nature of our international team, with Welsh, Norwegian, French, and English spoken, heightens the necessity for interpersonal understanding in the design realm. Language, extending beyond a mere communication tool, shapes cultural perspectives, especially in discussions about nature and the environment. Our commitment to linguistic diversity aligns with the acknowledgment that different languages offer distinct lenses through which we perceive and engage with the natural world. Recognising implicit hierarchies within terms, the team acknowledges the power dynamics in participatory design processes, emphasising language choices beyond communication efficiency to promote inclusivity and equity.

Furthermore, our commitment extends to promoting language that represents non-humans.The intentional shift towards inclusive and precise language within participatory design practices acknowledges the transformative potential of language in altering power dynamics. This conscious alteration ensures a more democratic decision-making process, allowing diverse voices, including non-human perspectives, to shape design outcomes. With members of *the Ecological Citizen(s)* team holding a particular interest in promoting non-humans in design decisions, the adoption of precise and inclusive language fostered collaboration, minimised misunderstandings, and created a common understanding, leading to more cohesive teamwork and a collective approach to problem-solving, particularly for non-human parties who cannot speak for themselves. Plus, the impact of knowledge encapsulated in terms within participatory design extends beyond the design community, resonating through various societal layers, and directly influencing communities with diverse values. The ethical considerations arising from the impact of knowledge involve awareness of the potential consequences of terms on diverse communities, emphasising the need for sensitivity to cultural nuances, and recognising the interconnectedness of social, cultural, and environmental challenges.

5. Conclusion

This article delves into the transformative journey of design research over the past decade, where disciplinary titles have evolved into complex, muted forms. The shift in design terminology, from focusing solely on tangible outputs to encompassing strategic direction, underscores the importance of language in shaping the field. This paper emphasises the role of language in propelling Ecological Citizenship and steering the trajectory toward sustainable futures, diverging from conventional paths.

As the impacts of climate change are ever more present, design emerges as both a solution and a challenge in confronting climate-related issues. The distinction between mere participation and empowering individuals to have agency becomes pivotal, contingent on the systems, interventions, and agency those individuals are empowered with. The article has shed light on the underexplored realm of language in "design for sustainable practices," compared to its prevalence in "design for inclusion." The presented iterative glossary lays the groundwork for the burgeoning field of post-participation, not as an authoritative guide, but as a collaborative effort reflecting the diverse interpretations within the evolving design

landscape. The exploration underscores language as a crucial component in design, influencing perceptions and power dynamics in co-design processes. The advocacy for language fostering collaboration, aligns with contemporary notions where precision in language cultivates trust and propagates cultural understanding. Exploring the significant impact of language within design emphasises its pivotal role in shaping perceptions, power dynamics, and socio-cultural intricacies. The example glossary, curated by the *Ecological Citizen(s)* team, offers a preliminary glimpse into terms commonly employed in discussions about design, for sustainable practices. These terms prompt the need to comprehend their nuanced meanings, potential cross-disciplinary misunderstandings, and variations in interpretation. Understanding how these terms are used and perceived differently becomes essential in fostering effective communication and shared understanding within the discourse.

Ultimately, this study advocates for an inclusive design approach that harnesses language to empower communities and individuals while driving responsible transformations in the face of challenges like the climate crisis and fostering climate justice. This article positions language and comprehension at the core of engaging diverse audiences on people and planet topics, recognising them as rational and emotional drivers. This encompasses distant futures where inclusivity, agency, and shared aims unite us all.

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P/REFERENCES OF DESIGN

SUSTAINABILITY BY DESIGN: A FIVE-YEAR CROSS-CURRICULAR PROGRAMME FOR DESIGN STUDENTS.

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KEYWORDS | ECOLOGY, DESIGN EDUCATION, SUSTAINABILITY BY DESIGN, TRANSITION DESIGN, PLANET-ORIENTED DESIGN

ABSTRACT | The Anthropocene era, marked by unprecedented human impact on the Earth's processes, necessitates a paradigm shift in education, particularly in design disciplines. This article explores the transformation of a five-year design curriculum at a French industrial design school, introducing a proposal for a cross-curricular "Sustainability by design" programme. The central question addressed is how to make ecology an integral pillar, not merely an additional dimension, in the design process. The article outlines the conceptual framework for this shift, emphasising the need for a planet-oriented design that considers Earth as a complex system intertwined with human history and culture. Divided into two sections, the first contextualises the necessity of changing cosmology for education, while the second provides a concrete proposal for the program, addressing challenges in content, methodology, and ethics. This article serves as a case study, aiming to be transposable to other design schools and highlighting the essential skills and knowledge required for designers to embrace a planet-oriented design approach.

1. Introduction

The new paradigms emerging from the Anthropocene (Crutzen and Stoermer, 2000) are challenging our understanding of the influence of human activities on the planet's processes and natural phenomena. A huge number of publications in various disciplines explain the urgent need for a profound shift in human perception and values for a more decentralised and sustainable way of living. So, how, and what to teach for a design adapted to the earth's new bio-geo-chemical regime? How to implement new teaching formats to better equip designers facing increasing challenges?

Future designers have the responsibility to design sustainable artefacts (viable, feasible, long-lasting, and socially desirable) that consider the environment and its limits. More than ever, they must mediate between different stakeholders and collaborate with other production professions (industrialists, engineers, developers, etc.). So, changing cosmology will call for new ways of thinking about design, limits, and leverages of designers in conjunction with the other disciplines. It also raises the question of the responsibility of design schools in preparing designers for the cross-disciplinary environment they will face in their professional path.

This article presents an initiative currently underway to transform the teaching model of a 5-year design curricula of a French industrial design school. The driving force behind the idea of a cross-curricular programme named “Sustainability by design” is the following question: How can we ensure that ecology is not an additional dimension of the design project but rather serves as a fundamental pillar? Therefore, the aim of this article isn’t to present a panorama of course results, but to sketch out the first milestones on the road to transforming the syllabus, so that ecology forms the spine of the curriculum, and consequently of the design process.

Even if this future programme shares many of the core beliefs of the Transition Design Approach developed at Carnegie Mellon University (Irwin, 2015; 2018; 2022), it is important to note that this programme is not intended as a specialization. It aims to add in the design process a holistic understanding of the relationship between humans and the planet, considering the Earth both as a physical entity and a complex system intertwined with human history and culture (Chakrabarty, 2019).
This article is therefore based on our school as a case study but is intended to be transposable to other design schools. It seeks to determine what invariants in terms of skills and knowledge all designers should have in order to move towards a planet-oriented design, i.e., that takes account of the planet as a system of systems, focusing not only on pedagogy—facilitating the acquisition of new skills and knowledge—but also on education, encompassing the execution of projects aligned with the values and ethics inherent to designers. Contents, formats, and ethics are thus the three categories of challenges to be addressed by a design school and constitute what this article seeks to enlighten.

To this end, the article is divided into two sections. The first explains and contextualises the need to change the cosmology of education, and then proposes a conceptual framework specific to design. The second section develops the programme proposal in more concrete terms. It is based on the challenges involved in making these changes in a design school and organized into four sub-categories: (1) new (and adaptable) contents, (2) a proposal of a strategy of implementation of these contents, (3) specific formats for design students’ profile, and (4) ethical positioning of the school through the hierarchization of values and a redefinition of assessment criteria.

2. Changing Cosmology: A Consensus for Education

A holistic understanding of the causes and effects of the Anthropocene (Crutzen and Stoermer, 2000) is necessary to have a multi-perspective overview of the Earth system. Considered as a dynamic network of relationships, an interdisciplinary vision of the planet allows designers to have a cross-scale approach, from the individual experience, passing through intermediary scales and different temporal consequences

to its planetary impact. It is the only way to find relevant answers to complex problems such as those we are facing and support a socio-technical transition.

Changing cosmology is clearly the first priority for students of all disciplines. It's about understanding how a world in which humans have evolved was created and how, as a humanity, we are now reshaping that world leading to uncertain futures. It involves updating educational content to align with the latest scientific discoveries and theories about the origins and evolution of the universe, and consequently the Earth system. This initial awareness enables students to envision a sustainable future for humanity within the Earth system. This involves integrating the science of global warming into existing subjects, taking into account other ecological disasters - biodiversity, pollution, etc. - as well as the principles of sustainability and the social and ethical dimensions of change.

2.1 From International to National Context

Meeting the challenges of the Anthropocene requires well-informed, committed individuals. Yet the complexity of climate change and other ecological challenges is still poorly understood by general population. In response, there is an emerging international consensus regarding the fundamental importance of education in addressing the ecological challenges that are being posed. Universities are intended to offer more space to develop essential knowledge and skills that allow individuals to contribute meaningfully to current challenges (Reimers, 2020; Leal Filho & al. 2021).

This consensus is obviously shared in France, which is moving from recommending to urging the universities to take action. In recent years, several recommendations on the transformation of higher education have been produced by non-governmental organizations or groups of researchers, such as *Campus des transitions* for various disciplines (Renouard & al., 2020) or *The Shift Project* in the field of engineering (The Shift Project & INSA Group, 2022) but also in finance, public administration, culture and health, examining also the issue of teacher training. At the same time, the French Ministry of Higher Education and Research (MESR) set up a working group comprising representatives from higher education, associations, businesses, local authorities and leading scientists in the fields of climate and biodiversity. Their report highlighted the urgent need to radically transform the French higher education system by adapting existing courses and, where necessary, creating new ones. In the short term, 100% of learners should be trained in the ecological transition. These changes must be developed based on a common foundation of five skills: understand the balances and limits of our world through a systems approach, grasping estimates and uncertainties through foresight analysis, elaborating shared diagnoses and solutions, using tools to bring about change and acting responsibly (Jouzel & Abadie, 2022).
Very recently, and based on these reports, the MESR published a set of specifications for all universities on how to integrate climate change education into formal education curricula including pedagogical teams training (MESR, 2023). The key point is that all bachelor's level students must have a knowledge base (of at least 30 hours) based on a scientific consensus with an interdisciplinary approach. It should cover climate change, biodiversity and its preservation, resources and their availability, as well as sustainable transition and social equity. The courses must be structured around action ("hands-on" projects, case studies).

Design schools are even more concerned by these transformations. Indeed, as a skills connector, and claiming the systems approach as part of their DNA, designers will have a crucial role in addressing the Anthropocene challenges. Sustainability has been integrated into design curricula already for several years. But a "subtle paradox" persists. Even if most design professors are fully convinced of the relevance of this issue, the assessment criteria for what makes a good design have not evolved enough in this direction (Ramirez, 2007). So, if "the task thus becomes the designing of the 'object of design' so that it, in turn, can design sustaining 'relations and effects', to which form, and function are subordinate." (Fry, 2009, p.187), what are the prerequisites for designers to adapt their profession?

Sharing the conviction that we need to change cosmology, and before presenting how the "sustainability by design" programme attempts to address this question, we propose to specify the conceptual framework chosen to think about the transformation of design and its teaching.

2.2 Mesology as Conceptual Framework for Design

In the French language, there is a distinction between two translations of the word environment: The first one, "*environnement*" refers to all the physical elements and phenomena that surround a living organism (including sometimes social and cultural conditions that surround the human). The second, "milieu" refers to all the material elements and physical circumstances that surround, influence or condition living organisms. Augustin Berque's concept of mesology is based on the study of "milieux" (in the plural form), which refers to the relations between all the elements that constitute the ecosystem and permit maintaining life (Bergue, 1996). Because it offers a better understanding of interdependencies between beings and the earth system, it is interesting to base the pedagogical programme on a mesological perspective to face the challenges of the Anthropocene. It means shifting our worldview from a world seen as an environment (something external we can change it without being affected) to a world seen as a *milieu* (both external and internal, shaping and shaped by the beings in it).

The philosopher Victor Petit breaks it down into two worldviews, each influencing a different approach to design:

> "In one case, it is possible to design 'ecologically' without compromising the standards of design; in the other, it is impossible. [...] In other words, to change the environment, all you have to do is change it, whereas to change the milieu, you have to change yourself (change your norms)." (Petit, 2015)

This change in norms requires a clear and well-enunciated ethical stance. This means redefining defended values and prioritizing them, and ideally in consultation with the people involved. A section devoted to this aspect, from a design school perspective, will be developed in the following section.

In addition, design practice can be more or less attentive to the living world: design that's indifferent to the living, design at odds with the living, or design in collaboration with the living (Pignier, 2017). So, when we talk about designing for the living, from a mesological perspective, it's not just about coming up with solutions for other living beings (even if it can be a part of this design), but designing for humans considering their "milieu" including natural, social, economic, and political environment. A milieu-oriented design has thus to consider living systems as both a starting and an end point. The concept of milieu also ties in with the principles of deep ecology laid out by Arne Næss. He introduced the idea of "ecosophy," a holistic and ecocentric approach to environmental philosophy that rejects the idea of humans as separate entities within the environment, favouring a relational perspective and recognizing the inherent worth of all living beings and ecosystems. Organisms are thus interdependent nodes in a network, and their identities hinge on their intrinsic relationships (Næss, 2017).

In this vein, milieu-oriented design plays a part in acknowledging the interconnectedness between humans and non-humans. It factors in the inclusion of humans in the living equation. Designing for and with the living is all about a milieu-focused design and requires designers to redefine our existence in this world as humans, redefining the boundaries of our influence and responsibilities.

Changing cosmology and adopting this conceptual framework raises several questions and challenges for design education. The following section presents a proposal of a cross-curricular "sustainability by design" programme incorporating recommendations emerging from scientific literature, various organizations' reports and official French government documents. It aims to initiate addressing the challenges in terms of content, methodology and ethics, corresponding to the three parts of the section.

3. Developing a Cross-Curricular Programme for Design Students

Starting from this conceptual framework, this section presents the three challenges underlying the development of a cross-curricular programme that allow design students learn about the physical constraints of climate change and integrate them in their milieu-oriented design process. First, the pedagogical contents up to date with the scientific research; second, the pedagogical formats which must provide a different learning experience appropriate to the design students profile; and finally values and ethics, which must be clearly formulated by the school and reflected in each project.

This article presents a framework for designing pedagogical progression (Fig.1). It has been thought out to allow design students to answer three questions progressively: (1) Where are we? (2) What can we do? (3) What is desirable versus what is really possible? Each question is paired with an objective to be reached in terms of knowledge (bringing by pedagogical contents) and skills to be developed (through experimenting different pedagogical formats): (1) Develop a sufficient and up-to-date scientific and technical culture, (2) strengthen the systemic approach and consider the global ecosystem (including technology) both as a starting and end point, and (3) Act for a milieu-oriented design (including all dimensions: biological, social, political, cultural, technical, economic, etc.), expressing its own specificity, values and ethical stance as a designer.

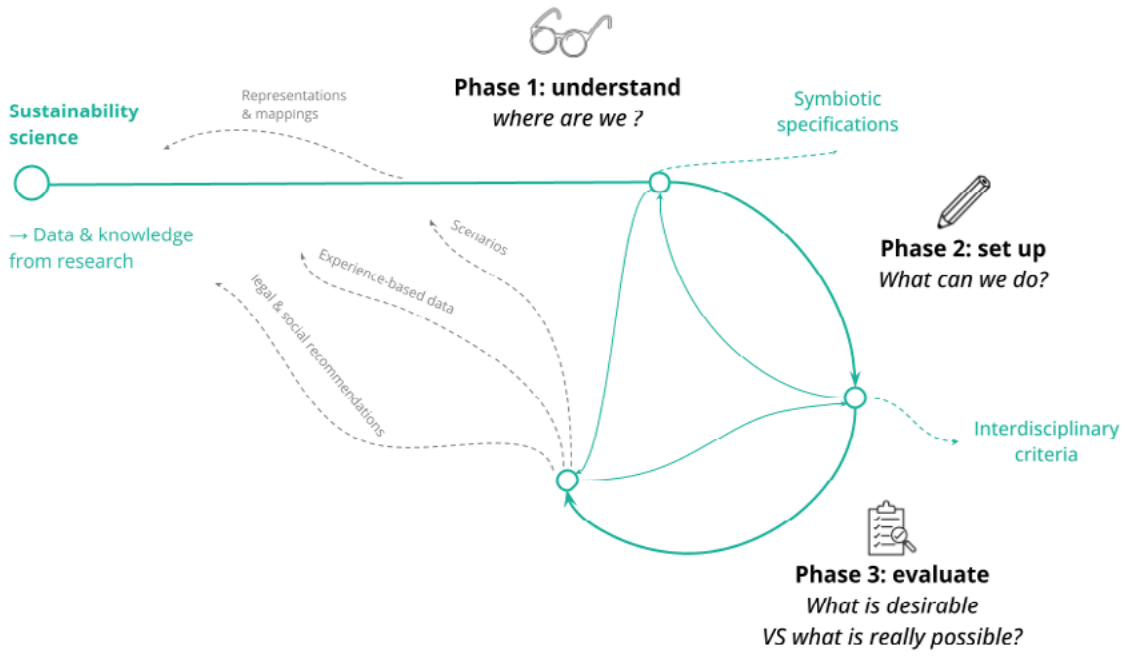


Figure 1. Pedagogical progression framework of the cross-curricular “sustainability by design” programme.

3.1 Pedagogical contents

The pedagogical content is based on inputs from sustainability science that bring together multi-perspective research from natural and social sciences, engineering and medicine (Clark & Harley, 2019). It is organised into three iterative phases: understand, set up and evaluate, which provide some of the answers to the three questions above (Figure 1). These three phases are interrelated and not necessarily chronological. As part of the project, the different inputs from each phase will enable the future designers to confront a reflexive process on several scales. This will develop the ability to zoom in and out, from the micro experience with the design artefact to its implications on a planetary scale, and vice versa, in designing from planetary constraints, helping individuals through the necessary transitions.

"*Where are we?*" Phase 1: Understand

In this first phase, the aim is to build an up-to-date scientific culture, backed up by research to include the latest established knowledge, particularly in the field of Earth System Science (including several disciplines such as chemistry, physics, biology, etc.).

Understanding well what is meant by the Anthropocene is crucial. Students need to know fundamental principles of living organisms (photosynthesis, biological cycles, biodiversity, etc.) and geo-biochemical cycles of the Earth system. Even if the current emergency focuses the debate on CO2 emissions and the measures to be put in place to decarbonise, it is important to have broader and more systemic considerations: criticality of materials, fossil/renewable energies, climatic trends by region, etc. This involves understanding materials, their classification and different potentialities, and the criticality of each material according to its characteristics and availability.

It is also very important to address concepts related to Anthropocene. Discussing several concepts as Planetary Boundaries (Steffen & al., 2015), "Technocene" focusing on the impact of technology on the Earth's systems and ecosystems, and "Capitalocene" highlighting the role of capitalism in ecological destruction (López-Corona & Magallanes-Guijón, 2020; Moore, 2017; Malm & Hornborg, 2014), is a way to understand how complexity of the current situation raises different questions depending on the disciplines and conceptual influences.

Moreover, to understand the planetary scale involved in developing any new product or service, designers need to understand the history that has made human activity the primary threat to the world's habitability for many species, including humans. So, it is essential that designers have a historical approach to technological development and its impact on the modification of individual needs, social organizations (political decisions, economic mouvements) and the Earth system dynamics. This includes a new, more global approach to history, including human civilization and the history of life and the Earth (Chakrabarty, 2019). The historical approach must also include the history of ecological struggles, as it informs about actions taken by various populations to face some climate change problems and the reasons for their success or failure.

"*What can we do?*" Phase 2: Set-Up

The second phase aims to connect knowledge with action. So, the courses should enable design students to circumscribe their limits and levers of action more clearly. With sufficient scientific knowledge to understand how living organisms and technologies work, new specifications that take into account the complexity of the Earth system are needed for the design project. The aim is to move away from technical specifications towards a kind of "symbiotic specifications" that encompasses the project in its "milieu", including material and energy resources, living beings and their (positive and negative) interactions with the socio-economic, legal and political systems in which they are embedded. So, an eco-design approach has to be redefined in the systemic meaning, as "it is not the object that must be 'eco-compatible', but the production-consumption system as a whole" (Petit, 2015).

And because changing the system entirely means coming up against regulations and administrative procedures, it is important training design students to deal with public policy. So, this programme includes a field project in partnership with local authorities, and preferably in collaboration with political science students to promote cross-fertilization of skills and prepare both of them working together.

Moreover, admitting the paradigm of interdependence between species opens up new avenues for designing methods with living organisms. So, the set-up phase therefore comprises two dimensions for reinventing the design process with living systems, to be applied separately or together in the project.

First, by learning from the way living beings use biological strategies to adapt their specific characteristics to an environment. Courses on biomimicry design can be a way to innovate about structures, materials,

energy efficiency…etc. But, using living beings as models and mentors (Stevens & al., 2019) must be coupled with a good scientific knowledge base (from the 'understand' phase) to avoid superficial or naive projects (i.e. that do "like nature" but with unsustainable materials).

Second, by designing for and with living systems. It requires reconsidering the human place in the whole system by building on ecosystem services. This approach aims at reinventing ways of collaborations between species, up to co-design with non-humans (Romani et al., 2022). This approach seeks to design, produce and recycle in a different way by integrating the 'know-how' of certain species (fungi, algae, bacteria, plants, etc.). As researchers work on the "intelligence" of living organism and their application to resolve some complex network problems (Poissonnier & al., 2019), the example of ecoLogicStudio project shows how architects involved a living being into their design process. Indeed, they trained an algorithm to behave as an acellular slime mould organism (commonly known as the blob) to redesign an urban network (ecoLogicStudio, 2021).

In fine, this phase provides skills to navigate complexity and find the way to act with living systems thinking from relationships between systems. Different ways and levels of actions can be experienced: changing trajectories by designing transitioning paths (Irwin, 2018), redirecting (Fry, 2009) or even dismantling and closing activities (Bonnet & al., 2021). Any design intervention needs to develop mediation skills to facilitate common understanding and debates between stakeholders to define the most advantageous, or at least the less harming, design intervention for all stakeholders, including non-human living beings.

"*What is desirable VS what is really possible?*" Phase 3: Evaluate

Recently, the designer Manuel Lima states that designers can no longer presume to deliver solutions without measuring their impact (Lima, 2023). He proposed to add an equally important third step to the double diamond design process theorized by the British Design Council. So, the third block of courses in our programme is a response to this 'third diamond' imperative. Design students need to learn how to assess the relevance of a project within its "milieu" by defining success metrics (impacts on the natural elements, climate, biodiversity and anthropological effects). Also, they do project these impacts over the medium and long term. Evaluation phase courses are obviously related to the knowledge acquired during the understanding phase, as it requires a solid grounding in physical and socio-cultural reality.

In other words, making the right assessment is a question of projecting into different futures and then coming back to the present to iterate on the project.

Moreover, visioning a sustainable world has the power of motivating us to reach this potential future. In 1993, Donella Meadows was already suggesting the use of visioning as a driving force to believe that radical changes are possible, and then to lead it (Meadows, 1994). So, as she said, "children are natural visionaries", design students have to re-learn visioning. In the Transition Design Approach, the ability to project futures from present data is an essential skill to improve for designers. This capacity of having a future vision where the problem is resolved is an important step to imagine a transition pathway with multiple design interventions (Irwin, 2015; 2018). So, to develop their ability to navigate between different timescales of a single problem and to project a multitude of potential scenarios, all designers must be trained with both foresight and design fiction methods. The foresight method enables students to reframe a problem at multiple levels and scales looking at the connections between people, problems and things (Irwin, 2018) while exploring short-, mid- and long-term effects of interrelated solutions. In a complementary way, design fiction allows students to generate a wide range of utopian and dystopian scenarios to hypothesize and ask questions about the transformation of values, beliefs and practices and their consequences. Moreover, the artefacts designed can create a communication situation so as to make people debate about desirability (or not) of future scenarios (Mollon, 2019). Integrating design fiction will therefore develop the mediation skill of designers. This skill is becoming increasingly necessary, as effective transitions are so closely contingent on collective decision-making.

To summarize, table 1 below presents the essential courses in this programme and how they correspond to the skills needed for the ecological transition identified in the two documents from the Ministry of Higher Education and Research (Jouzel & Abbadie, 2022; MESR, 2023). It is important to notify that this table is not a proposal of a pedagogical mockup in itself, but a theorical model that can be used as a guideline for improving, reorienting and implementing courses.

Table 1. Courses and associated skills of the cross-curricular “sustainability by design” programme.

Question to be answered	Where are we?	What can we do?	What is desirable versus what is really possible?
Phase	Understand	Set-Up	Evaluate
Courses	Introduction to Anthropocene and related concepts (technocene, capitalocene, planetary boundaries, etc.) Fundamental principles of living organisms (photosynthesis, biological cycles, biodiversity, etc.) Resources: materials & energy (classification, uses, recyclability, etc.) History of technological development and socio-economic effects History of ecological struggles	Governance models Workshop with local authorities Changing trajectories (transition, redirection, dismantling, closing) Design & biomimicry Design with living organisms	Foresight Fictional writing Design fiction
Associated skills	Consider a systemic approach and be aware of scales (local vs. global)		Developing a forecasting analysis
		Co-building diagnosis and solutions (mediation, facilitation, co-design)	
	Knowing how to implement transitions (realism, technical and organizational feasibility)		

To ensure the success of a transformation, we need to reach a unified agreement on the core elements of sustainability that must be incorporated into the curriculum for training designers. According to literature review and discussions within the school, there is common agreement on the relevance of modifying design education in this way. However, the way in which this material will be shared with students is still under discussion. The following section attempts to address this challenge by identifying emerging initiatives from which to continue building our cross-curricular “sustainability by design” programme and its deployment.

3.2 Implementation Strategies

Based on the theoretical proposal of pedagogical contents and a first overview of pedagogical formats that may be suitable to design students’ profile, the implementation strategy needs to be developed jointly with all the school's pedagogical supervisors. To do so, we have identified a number of key actions to be implemented progressively. Firstly, we need to carry out an analysis of existing courses. Then we need to study the possibility of redirecting the content of certain cross-disciplinary courses (such as storyboarding, writing or human and social sciences) towards ecology-related content. Next, we should experiment with setting up joint projects between these courses and the representation courses (such as sketching or prototyping). Finally, either simultaneously with the previous stage or afterwards, we need to add the necessary new specific courses (such as scientific culture or historical approach of ecological struggles).

So as a first step, an inventory of existing courses dealing wholly or partly with sustainability issues was conducted (see table 2). To compile this inventory, a 30-minute interview was held with each pedagogical supervisors (common core first years, product design, interior design, brand design, ux design, transportation design). As well as a design project, it's essential to determine what content had already been introduced, to explore the desire for new pedagogical developments, as well as the gaps and difficulties in deploying specific content or formats. It is also useful to start involving the pedagogical supervisors to co-build the strategy of deployment of this programme.

Table 2. Inventory of existing courses dealing wholly or partly with sustainability issues.

Year	Courses dedicated to ecological issues	Courses partially addressing ecological issues
First year	"Climate Fresk" workshop	Biomechanics Upcycling (or) make mycelium (or) experimental cooking Workshop*
Second year	Design & naturalistic immersion	Biomechanics Mapping Tools
Third year	Eco-design (systemic approach) Eco-construction/Eco-production (introduction to materials, carbon footprint, reparability, assembly & disassembly) Neo-industrial workshop Technical culture	Human and social sciences Lighting
Fourth year	Eco-design (systemic approach) Eco-construction /Eco-production Design in territories Industrial upcycling	Human and social sciences Projects in partnership with an organization
Fifth year		Projects in partnership with an organization

*These workshops are optional, so will only involve some of the students.

Table 2 aggregates all courses in the school. It should be noted that there are still disparities regarding courses and hours, depending on the design discipline. Moreover, from the fourth year, a major part of the courses is project-based, usually in partnership with organizations. So, the ratio of pedagogical time devoted to ecological issues is hard to measure as the content depends on the brief of the partner companies. Questions raised by this model of teaching through partnerships will be addressed in the section relating to the ethical challenge. Some other identified limitations relate to problems beyond the teacher or the school's scope. Interviews revealed frustrations linked to the limited levers of designers, such as infrastructures, business imperatives, outdated regulations, and too restrictive norms about some materials. Such restrictions sometimes inhibit alternative solutions deployment as reuse-based design, for example. This highlights the fact that technical skills alone are not enough to deal with complexity and confirms the need to train all designers in political issues so that they can anticipate, support, or take part in the transformation of public policies.

The initial actions to prepare for the implementation of the cross-curricular "sustainability by design" programme has also raised a number of issues in terms of the school's ethical positioning and its influence on the speed of deployment. This will be discussed in the "ethics challenge" section trying to address some of these questions but above all, its aim is to initiate a discussion that concerns design as much as other disciplines.

Following the inventory, the second stage of the implementation strategy is underway. We have therefore identified certain course formats to be adapted to the theoretical content (table 1) and investigated innovative formats that might be worth deploying. The following section presents several pedagogical formats that need to be supported, developed, and used as inspiration for other courses.

3.3 Pedagogical Formats

According to the UNESCO report on climate change education (2019), cognitive learning is favored over social and emotional or behavioral learning. However, it has been shown that in order to influence attitudes and behaviors, climate change education should be based on deeper learning because didactic approaches focused principally on the transmission of scientific knowledge do not (Reimers, 2020). This is even more important for disciplines such as design, where knowledge is based on practice. Indeed, it is important to adapt scientific content, which is sometimes highly technical, to pedagogy based on practice and projects. How can we preserve the specific characteristics of designers while providing them with the scientific knowledge they need to practice their profession in a constrained future?

In the beginning of their first year, students take part in a *Climate Fresk* workshop, a collaborative and science-based workshop, mostly from the IPCC reports (climatefresk.org). Its methodology is based on mapping the causes and effects of climate change about a specific object or problem to enable participants to have an open and positive conversation about climate change and imagine some solutions. It's generally animated by older students trained as facilitators by the organization that creates this workshop. This first step is seen as an introduction and an awareness-raising exercise rather than a course. Adding the *2tonnes* workshop (en.2tonnes.org) to the "sustainability by design" programme is also planned. This workshop, designed as a serious game, will provide an understanding of the individual, collective and influential levers for achieving concrete reductions in CO2 emissions, on the individual and the national level. It will help first year students move on from mapping problems and potential solutions (experienced in the *Climate Fresk* workshop) to taking decisions on concrete actions to implement.

In 2023, another experiment at the start of the academic year involved the whole school. All the students took part in a design fiction workshop, in partnership with a reference consultancy firm regarding energy and climate challenges. Each group dealt with a use (clothing, food, housing, transport, healthcare, transport, information, entertainment) that was constrained by a model of society, a trajectory for global warming (from 1.5° to 3°) and a state of biodiversity. The aim was to imagine what life could be like in 2060, informed by several scientific studies.

Another example of a course to consider for its format. In response to the need to combat "environmental amnesia" (Kahn, 2007), the "*design & naturalistic immersion*" course offers an off-campus format that immerses second-year students in a direct relationship with living things. Combining knowledge of biology and design tools, the teacher takes advantage of a walk in the forest to explain the fundamentals of photosynthesis and the biological cycle. The students are invited to take notes by sketching, collecting elements and creating maps. This methodology permits a concrete and powerful insight into the 'others' who inhabit the world and on whom we depend. Similar initiatives are in the process of co-design with some professors before being implemented.

Understanding how we reached the Anthropocene also involves learning the tools for diagnosing a complex situation. As well, in addition to the courses to be incorporated (for phase 1 understand, Table 1) a large part of the courses focusing on developing reading and writing skills will be devoted to ecology-related themes. So, courses such as sketching, storyboarding or narrative writing are meant to be reoriented to address sustainability topics. During those courses, design representation skills will be used to extract and organize data from scientific papers and reports. For example, in the reading course, students will have to read the latest IPCC report and extract data that will be used during both narrative writing and sketch courses to describe the process of a research project and represent its results using more easily accessible media. It implies a new kind of coordination between teachers of different disciplines.

Once the contributions of scientific disciplines to the teaching of design have been discussed, it is important to note that design methodologies can also provide valuable contributions to the scientific community (see figure 1). Indeed, in their process of understanding, designers do not reproduce knowledge in the same way as researchers, science journalists or popularisation specialists, but provide their own expertise through their sensitive interpretation of the world. Formalised into models, visualisations or maps, these contributions can enrich scientific productions by making data tangible. This helps first in making complexity legible and apprehensible. Creative media used by designers are useful for researchers to popularise and spread knowledge that can be understood by a wide audience. Secondly, the designers' methods of fieldwork provide an enrichment of the research with sensitive data derived from narratives and illustrations of real-life experiences. Ultimately, this can shed light on blind areas or highlighting links that were previously undetected due to the hyper-specialisation of research disciplines, thus inspiring the exploration of new fields of research. Design can consequently play a role and be one of the disciplines contributing to sustainability science.

3.4 Ethics Challenge

If the question of sustainability is limited to the preservation or restoration of conditions favorable to human life, to a matter of subsistence (Fry, 2009), then design should only be assessed through the materialistic prism of what it produces and destroys. Yet the symbolic dimension is just as vital to human life, as it conditions our being-in-the-world, and therefore our use of its resources. Thus, we need to change preconceptions about what comprises good design including all those dimensions of habitability: physical, psychological, socio-economic and spiritual (Findeli, 2022).

One of the major challenges in terms of ethics is therefore to reconsider the project evaluation system and redefine what comprises good design. If we consider a new framework for assessing projects, what balance should be made between criteria that are strictly material and criteria linked to experiential benefits?

Currently the evaluation criteria focus more on the acquisition of skills and respect of the design process steps. Sustainability can have almost a similar value to form, functionality, user-friendliness and other criteria (Ramirez, 2007). Instead, a new multidisciplinary evaluation grid must be established. The physical aspects of the project should be systematically assessed, i.e., the level to which the project has addressed the impacts of the entire value chain (supply & production chain). In addition, the social implications of this physical aspect also need to be considered, i.e., the social effects of the potential extraction of natural resources or the waste management involved. Thus, the courses in the evaluation phase will also contribute to this ethical positioning of the school visible through a project-wide scale. This aligns with the idea of introducing the third diamond in the design process (Lima, 2023). In this case, students will then have to present, with each project, a mapping of all these aspects, similar to what they do regarding business issues, for example.

The school's values are also reflected in the collaboration model it establishes with organizations for pedagogical projects. Training models based on partnerships with companies, like that of our school, is highly beneficial for both companies and students. But, in a world where dominant industrial paradigms are no longer sustainable, it raises several new questions about ethical stance: as a school, should we assess the maturity of companies on this topic before setting up a partnership? Should we select only those that are clearly committed to the ecological transition? Or should we decide to redirect the briefs so that the projects provide a deeper understanding of the sciences of sustainability?
Those questions are still discussed between pedagogical staff and students.

4. Conclusion

"The designer of the future is a mix of psychologist and anthropologist, sociologist and ecologist, system theorist and futurist, activist and reformer" (Lima, 2023, p.197). In the conclusion of his latest book, the designer Manuel Lima came to the same conclusions as many of us. As a design school, we therefore have a responsibility to cultivate all these facets of the designer of the future, in addition to provide a scientific knowledge to understand Earth system and technologies on which humanity depends.

The cross-curricular programme "sustainability by design" presented in this article has been designed accordingly. Drawing on the etymological definition of ecology as the study of relationships between living organisms and their physical environment, this programme is aimed at making ecology the driving principle behind the design process. It is based on three iterative phases: understand, set up and evaluate, enabling future designers to link knowledge to action.

To get started, based on the recommendations of the scientific literature, as well as those of government institutions or teachers, the most urgent thing is to strengthen the foundations of fundamental knowledge in the first three years, so that design students can then put their knowledge into practice and experiment as early and as much as possible during their studies. The main objective is to provide them with operational skills to address different levels of change (behavioral, organizational and political). The "sustainability by design" programme outlined in this article is a proposal of the pedagogical progression over a five-year curriculum. However, even if it has been conceived as a cross-curricular programme, it must be adapted according to the specific needs of each design specialization (product design, interior design, brand design, UX design, transportation design…).

This contribution has three aims. Firstly, to join the international scientific community in emphasising the urgency and necessity of changing cosmology, which implies changing content and methods of transmitting information. Knowing that this knowledge is recent and growing, and that some of it remains unknown, raises new questions in scientific research and can enable design to contribute concretely to research into sustainability science.

Secondly, to propose a framework for building a cross-curricular programme meeting the challenges of transforming design education in a French Industrial Design School. This framework is associated with a proposal of a strategy of implementation that would allow this framework to be generalized to other design schools. As a perspective, it would also be interesting to test its adaptation to other disciplines.
In fine, if we follow the principles of living systems, collaboration is one of the strategies that can ensure the survival and evolution of a system. This contribution is thus intended as a way of initiating a dialogue to connect design schools and share best practices on implementation strategies and ethical positioning.

Let's remember that the human origin of the alarming situation we are collectively experiencing can be seen as good news, because we still have the power to change it. The near future can therefore be seen as an enthusiastic period because there are so many things to reinvent, and designers have an important role to play in supporting these multi-level transformations.

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TOWARDS CIRCULAR UPHOLSTERY: PRACTICE-BASED RESEARCH FOR THE CIRCULAR TRANSITION OF THE MADE IN ITALY UPHOLSTERED FURNITURE SECTOR.

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KEYWORDS | CIRCULAR DESIGN, TRANSITION DESIGN, ADVANCED DESIGN, DESIGN FOR DISASSEMBLY, ECOLOGICAL AWARENESS

ABSTRACT | In Made in Italy industries, craft and industry production coexist, with a continuous relationship between manual technical knowledge and the use of advanced machines. The use of material is fundamental, Italian design has a recognized aesthetic and material imagery because it experiments with materials from the noblest to the most artificial. In this context, the theme of circularity and sustainability is not always central: traditional upholstered products are a conglomerate of components made of different materials whose disposal hardly ever involves disassembly and reuse or repair processes. Through experimentation of circular re-design of an upholstered seat carried out by the author, the article proposes reflections on how to integrate design practices that can allow a circular and sustainable transition of the upholstered product. In the research, Circular Design, an approach capable of shifting perspective between user needs and the systemic implications of the process, is a central discipline of application and study. The anticipatory attributes of Advanced Design and Transition Design are also key disciplines involved. The practice-based methodology used makes it possible to integrate desk and field research and to verify it through an experimentation that aims to be an object of future design vision. The intention is to open the discussion on what strategies the designer can implement to support a circular and sustainable transition of systems products in sectors where experimentation is part of traditional production.

1. Introduction

In the upholstered furniture industry production can be artisanal and industrial. In industrial production, the quality of the products must be predetermined, the materials are designed for machine processing to obtain the greatest number of pieces at the lowest possible cost (Colaço & Matos, 2020). In craft production, on the other hand, quality is closely linked to the skills of the craftsman (Sennet, 2008), to the characteristics of the material he or she knows how to handle, and which determine the production techniques, not vice versa (Cavalli & Comerci, 2017). In Made in Italy industries, craft and industry production coexist, through which there is "a continuous relationship between manual technical knowledge, testing and verification through the use of manual machines and design for industry with technologically advanced machines" (Conti & Motta, 2020, p. 175). Moreover, it is "a production with a strongly artisanal DNA to the point of contemplating the borderline case 'of self-production by the designer'" with a "dedicated and tailor-made business approach, of handmade objects, also tailored to individual needs." (Trincherini, 2020). The use of material in connection with the process is therefore fundamental, Italian design has a recognised aesthetic, morphological and material imagery because it experiments with materials from the noblest to the most artificial and serial (Di Lucchio, 2005).
In this context of traditional knowledge and technological innovation, the theme of circularity and sustainability is not always central: often the creative, when guiding the design process, puts style and aesthetics of the product before. Upholstered products are a conglomerate of components made of different materials whose disposal at the end of their life hardly ever involves disassembly, reuse, maintenance, or repair processes during their service life (Bruno et al., 2022).

Through a design experimentation of circular re-design of an upholstered seat carried out by the author, the article proposes reflections on how to integrate in these contexts sustainable practices that can allow a circular and sustainable transition of the product, give more performing design tools both at an aesthetic and functional level, and provide them in a way that is useful to both the furniture company and the final user. The intention is, therefore, to open the discussion on what design strategies the designer can implement to support a circular and sustainable transition of systems-products critical for the use, application, and selection of materials, in sectors, such as that of Made in Italy, where experimentation is part and parcel of traditional production.

2. A Suitable Context for a Circular and Sustainable Transition

Made in Italy is defined as a set of high-quality products and services made by small and medium-sized enterprises in sectors recognized by the collective imagination and characterized by cultural contents linked to the values and heritage of the territory they belong to (Bertola & Colombi, 2014). The connection with the designer's practices is strong and characterized by complex multi-level logics; product diversity, formal and material identity of products, attention to quality and connection to local communities and knowledge are all characteristics that drive foreign companies to produce parts of their products in Italy (Turrini & Sbordone, 2020). These peculiarities, with the artisanal and industrial process described in the introduction, have over time created a territory capable of integrating sustainable and circular practices, strongly marked by experimentation and innovation.

The circular economy is a regenerative industrial strategy (Ellen MacArthur Foundation, 2013) based on eco-efficiency to keep products, materials, and resources in use as much as possible by reintegrating waste into production processes (European Commission, 2022). Historically, Italy is a country that has found circular strategies to create an economy from a lack of raw materials, characterized by its vocation to offer quality products (Massarutto, 2019). The textile district of Prato, for example, is characterized by production processes that can potentially be considered anticipatory of the circular process for its ability to process regenerated fibers (Trivellin, 2020). In fact, the territory possesses a production culture rooted in recovery and regenerated products, personified in the figure of the “cenciaiolo”, a person who selects rags by composition and color, and enables the recovery of the “cenci” (rags) derived from the textile production.

In Europe, Italy is the first country in terms of recycling (Lotti et al., 2021, p. 17): in 2022 it ranked first in Europe for urban waste recycling with a percentage of 80% compared to 39% of the EU average and, at the same time, waste going to landfills or incinerators without energy recovery decreased from 54% to 40% (ANSA, 2022). Today in Italy, 117 million tons of waste sent for recycling are used as a secondary raw material in the building/infrastructure industry and the Italian industry achieves a circularity rate of around 50% (Symbola, 2021).

However, if we look at the upholstered furniture industry, attention to circularity and sustainability issues are often less rooted for different reasons. Cerulo et al. (2022) identifies several of them:

- The environmental impact resulting from the disposal of textiles and polyurethanes;
- The complex disposal of products as they are made of materials assembled in a mixed and non-reversible way making the product not disassemblable at the end of its life;
- An impactful logistics due to the weight of the finished products that influences packaging and transport modes;
- A supply chain on a global scale with suppliers from different regions.

Each of these characteristics is strongly influenced by material selection, but the cited difficulty of this sector makes it one of the most impactful sectors (Barbaritano et a., 2019), despite the territorial predisposition to adhere to circular practices. The upholstered furniture industry is a relevant production area in the scenario of Made in Italy, and there are several regional districts that are identified internationally for their skills and competences. To avoid fast-furniture products (Griffith, 2017) that lead to the production of furniture with inexpensive materials and not designed to last (Maier, 2021), there is a strong need to understand how to transition the sector's enterprises to circular practices (Cerulo et al., 2022).

In this article, we want to reflect on this circular and sustainable transition process, seeing the designer as a key player, who starts with the material but acts systemically around it.

3. Critical Materials in the Upholstery Industry

Woods, plastics, textiles, and metals are part of the material identity that represents the high-quality level of Italian furniture production. Pellizzari and Genovesi (2021) define circular materials as 'neo-materials' because they come from renewable cultivated resources or because they are made of material that has 're-entered' the production cycle, whether from a homogeneous or different supply chain.

Not all materials mentioned are circular and, in different ways, participate in increasing the environmental impacts of the finished product: while some of them are often recyclable, it happens that in the production phase they consume a high level of energy, emit CO2 and, if the product is not used to last as long as possible, their impact is excessively significant in the production economy (Bruno et al., 2022).

Among the most critical materials are polyurethanes, which are foams of non-renewable fossil origin, assembled with other foamed plastics that, while guaranteeing the desired softness performance by combining different layers of materials, are often not separable at the end of their life. The production of these materials actively participates in CO2 emissions and when they degrade, they release environmentally toxic microparticles into the environment (Bruno et al., 2022). The use of these materials is now being strongly debated and solutions are being sought to introduce the use of expanded polyurethanes of recycled origin into the industry.

Another critical material is textiles and thus cover of upholstered products. Cover poses critical issues both from the point of view of the origin of the materials used - as non-recyclable polyesters, interwoven with other materials in a non-reversible manner - and of the assembly - as they are often sewn to the upholstery making

them not washable, repairable, and replaceable at the end of their life. Furthermore, the assembly of covers on sofas and seats often takes place using fasteners, elements found in various product sectors, which allow the assembly of the various parts of a product. In the fashion and textile sector, they form the connection point between fabrics and act as fastening, adjusting and/or opening elements. Furthermore, in the fashion industry, they can be an identity element for brands (Mitchell & McLoughlin, 2014). From the point of view of product composition, fasteners can be elements that interrupt material continuity as they often consist of different types of plastics also connected to metal components. Their composition is designed to ensure wear resistance but makes recycling complex, in fact, for example in the fashion industry, fabrics need to be separated from fasteners before the material is introduced into a new production cycle (Fantin et al., 2020) as they affect the purity of the material as well as can cause damage to machines (McKinsey & Company, 2022). Today, fasteners are used in the upholstery industry mainly for production reasons: zips are used to facilitate the assembly of pillowcases that cover the foam of the upholstery, buttons are used to make the cover adhere to the foam. Fasteners, in addition to making disassembly for maintenance, washing and disposal difficult, limit the customization possibilities of the product during use as their opening system is often blocked and they do not allow the user to change the cover. Never being able to change the appearance of a product may be one of the reasons why people discard it, the designer must anticipate the human need for modification over time (Goldsworthy & Earley, 2018).

The reasoning on the latter type of product and material is what guided the following experimentation in order to activate a theoretical reasoning based on practice to visualize the designer's scope of action to move the sector towards a circular and sustainable vision.

4. Practice-Based Research for Circular and Sustainable Transition, Guided by Material Selection

Working in anticipation is a key concept in the circular process: being able to foresee the future life cycles of the material and the product that contains it means anticipating the impermanence of needs (Rau & Oberhuber, 2019) and the possible evolutions of current technologies. Advanced Design's ability to work with anticipation and, moreover, to mediate between knowledge (Celaschi, 2008) is a key competence in these contexts in which it is necessary to be able to manage hybrid skills and professions between materials science, economics, and the sustainable use of technologies. In a different but related way, Transition Design seeks to define strategies to design transition paths for complex problems (Irwin 2015), strongly linked to concepts of sustainability, through techniques derived from the intersection between design and the study of futures. The experimentation arose from the application of a design method identified in the author's doctoral research that seeks to integrate these two disciplines with the themes of circularity and sustainability. This methodology sees the designer as a possible support for companies in the sustainable and circular transition of their products made of critical materials; the designer, called “Transition Matter Designer” (Rosato, 2023), designs the gradual metamorphosis of a critical product-system over time in such a way as to allow companies to absorb the change (Irwin, 2015). To activate this process, the Transition Matter Designer applies changes to the product-system by anticipating its metamorphosis over time, applying a gradual transformation from the micro to the macro scale. This means starting from more circumscribed actions, such as changing the material of a single component, and moving to the scale of the supply chain, and to the active involvement of the user in the process to make them aware of the importance of circular processes. The Transition Matter Designer thus proposes an approach to lower Transition Design practices (Irwin, 2018; Kossoff et al., 2015) into system-product design, feeding on the anticipatory attributes of Advanced Design (Celaschi, 2015; Celi, 2010) and aiming at the goals of Circular Design (De los Rios & Charnley, 2017; Moreno et al., 2016), working from materials, the central point of the circular economy (Fig 1). The article applies this methodology to the redesign of the cover of an upholstered seat, as it highlights one of the product components whose materials influence production, service life and disposal, while showing its future systemic development. In defining the transition, the creation of prototypes is a fundamental tool as it materializes futures and outlines possible trajectories of innovation (Celaschi et al., 2014; Iñiguez Flores et al. 2014). The practice-based methodology

(Mossé & Bassereau, 2019) used makes it possible to integrate desk and field research and to verify it through an experimentation that aims to be an object of future design vision. The intention is to open the discussion on what strategies the designer can implement to support a circular and sustainable transition of systems-products in sectors, such as that of Made in Italy upholstered furniture, where experimentation is part of traditional production. The experimentation, which interweaves craft and industrial knowledge typical of the sector, focuses on new solutions for connecting fabrics that allow mono-materiality (Rosato et al., 2023) applied to upholstered seating, and reasoning on how, starting from the selection of materials, technologies, processes and the anticipation of material life cycles, the transition levels of a critical system-product can be designed over time.

In Made in Italy context, designer role is central to work on the historical, psychological, cultural identities, skills and ongoing mutations of the sector (Turrini & Sbordone, 2020).

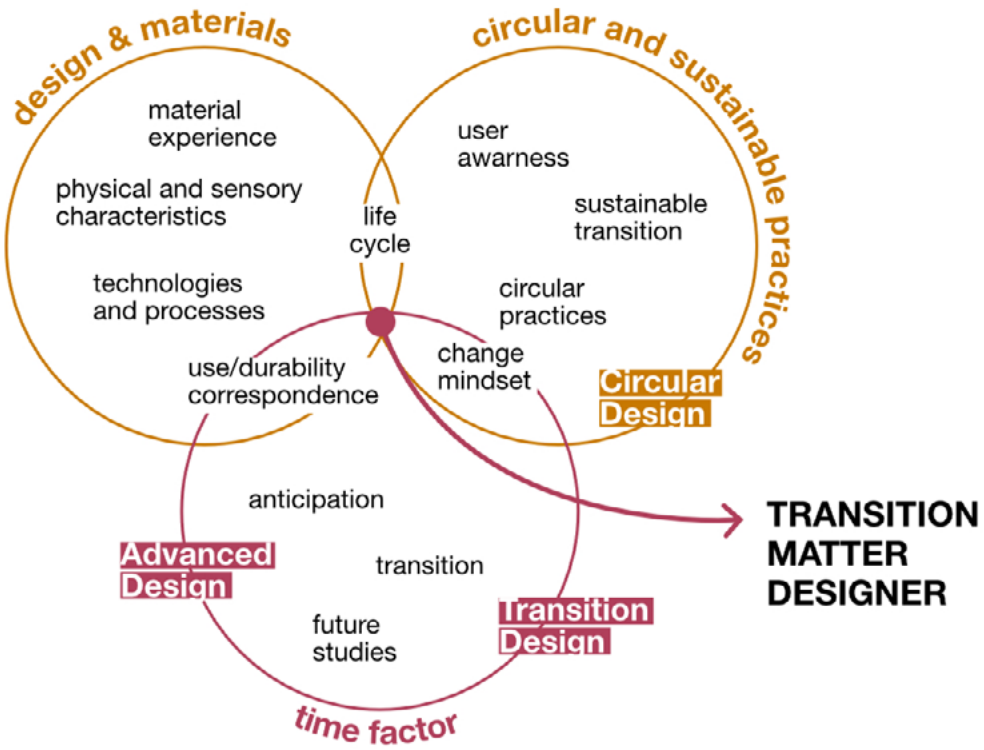


Figure 1. Disciplines relevant to the work of the Transition Matter Designer. Credits: L. Rosato, 2023.

5. Circular Re-Design of the Cover of an Upholstered Chair

The experimentation was therefore developed from the design methodologies of the Transition Matter Designer (Rosato, 2023). He or she uses a transition model that allows him or her to identify which actions to apply to the product in order to design its sustainable and circular transition. These actions are design suggestions of how to modify the product system by acting on four levels: user education, material characterisation, selection of circular production processes and anticipation of material life cycles. These 35 suggestions work on these four design perimeters, working from a micro to a macro scale, and the Transition Matter Designer can select them based on: 1) which ones are not dealt with in existing projects (of which he conducts a thorough research), 2) his personal design sensibility (Celaschi, Formia & Lupo, 2013) and 3) the component of the project on which he wants to act (education, production process, material...).

For the prototype in question, the author applied the methodology of the Transition Matter Designer and identified 10 practices pertaining to the project levels identified to work (Fig. 2).

The redesign of the cover of the upholstered seat started from the integration of the “Knitted Fasteners” (Fig. 3), a metamorphosis of zips, buttons and rivets and conceived to be designed from the textile product assembly, integrated into a knitwear process (Rosato et al., 2023). These elements, realized by the author from the previously described methodology, consist of buttonholes and rings which, when assembled in different combinations, allow the functions of closing, fastening and adjusting systems. Knitted Fasteners create a system that allows the creation of a collection of sustainable and circular fasteners as they allow the creation of mono-material coatings that thus facilitate product recyclability. Furthermore, the use of knitting allows a reduction in pre-consumer waste as it is a technique based on material addition, not subtraction. It is a reversible technique if the tightness of the yarn allows it (Motta, 2019) and, combined with 3D knitting or seamless techniques, can eliminate any element other than the material used in the garment, including seams. The design process of a knitwear garment starts from the selection of the yarn and therefore has more control over the final product, being able to decide on shape, color, texture, material, weight, stitch, processing (Conti & Motta, 2020).

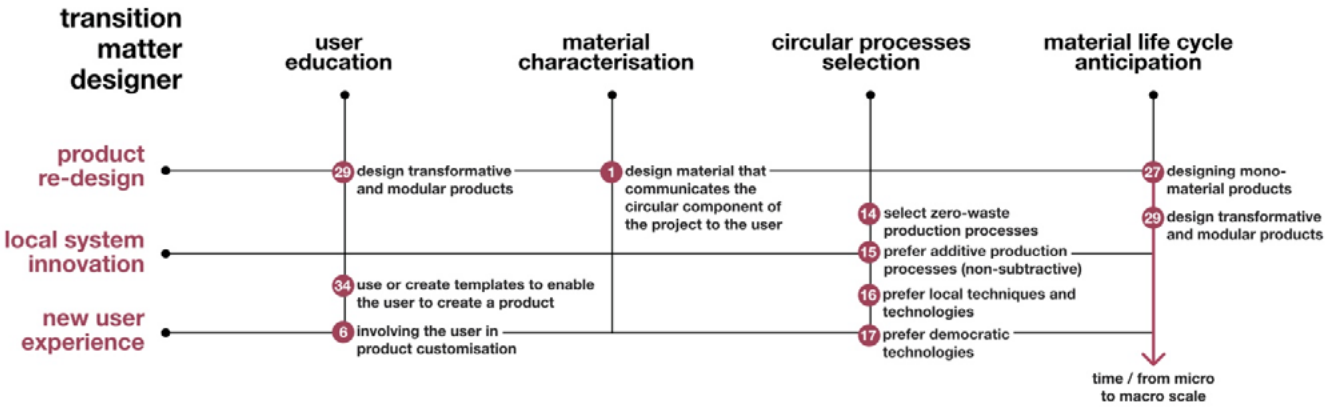


Figure 2. Practices identified for the experimentation. Credits: L. Rosato, 2023.

Knitwear allows more than other technologies to integrate the Knitted Fasteners in the direct production of the garment because it is a technique that already includes in its process both the creation of the fabric and the realization of the textile product, closely linking aesthetics and technique (Eckert, 1999). In the course of the research, other weaving techniques were also identified such as three-dimensional or integral non-rectangular weaving production (Thomas, 2009) or integral weaving approaches (McQuillan 2020; Drews, 2019; Vicerial 2019) but because of the elements described, and the author's close territorial connection of the knitwear districts, it was decided to investigate this technique further, in the knowledge that further developments could include studies on other textile strategies.

By taking advantage of these elements, it was possible to change the configuration of the backrest of the upholstered chair by dividing it into a front and a back and leaving the Knitted Fasteners along the side so as not to bother the user when sitting. For the prototype, a basic model from IKEA was used. This provocative choice was made with respect to the subject of the research both to highlight how small design actions can transform these fast-furniture sectors into places dedicated to circular processes and to focus on the individual object of the research and not the entire product. Due to the shape of the seat chosen and the elasticity of the mesh, the cover of the front and back of the backrest are exactly the same but mirrored. This choice was made to allow the user to create different combinations with only three covers available. This makes it possible to customize the two sides of the back in material, texture, and color, facilitating repair and maintenance but also following the user's need to change tastes over time (Goldsworthy et al., 2018; Karana et. al., 2017). The seat cover is designed in such a way that it can be closed using a system reminiscent of an elastic band in order to allow for quick disassembly and maintenance.

The selected yarns must be pure, recyclable/biodegradable and with renewable origin and therefore circular materials. In the experimentation illustrated, integrating these materials in a design-friendly manner is possible thanks to the techniques used and the conformation of Knitted Fasteners. For the prototypes, 100% recycled and recyclable organic cotton was chosen for reasons of availability, but future tests are planned with other circular materials.

The redesigned seat and back cover (Fig. 4) therefore allow for different levels of complexity in the industry:

- Enables the decrease in the use of complex textile materials that have impacts on component disposal in the industry. Different materials and colors can be used for the front and back of the seat, but the designed fastener system allows this to be reversible and disassembled;
- Promotes product disassembly systems in the short to medium term to customize the product and in the long term to repair or dispose of it in a circular manner through recycling;
- At the production level, disconnecting the upholstery process from the assembly process would allow to increase formal and aesthetic possibilities in the design of the seat. Whereas previously the form was constrained to the need to create a customized cover to be inserted before assembly, with this system the cover could be assembled directly onto the upholstered seat;
- It provides the user with a strong awareness of the process as it makes him an active participant in the circularity of the product. In fact, it participates in the extension of the product's life thanks to the medium to long term choice of customization of the covers and, moreover, the possibility of acting in the same circular aesthetics by finding new combinations of rings and loops. Knitting is a potentially democratic and affordable technology whereby the user can independently produce covers with the same assembly and fastening strategy.

Future developments of the prototype will concern improving the accessibility of opening and closing systems: in order to guarantee the correct tightness of the upholstery and avoid wrinkles, there are many rings and loops in the backrest, and opening and closing the upholstery can become a cumbersome job that is not intuitive or accessible to everyone. Further development of the prototype should focus on speeding up the closing process through the creation of an ad-hoc tool. Furthermore, the limitation of this application of Knitted Fasteners is the contemporary aesthetic tendency to conceal any seams in upholstered seats; a more aesthetically straightforward and suitable system could be thought of.

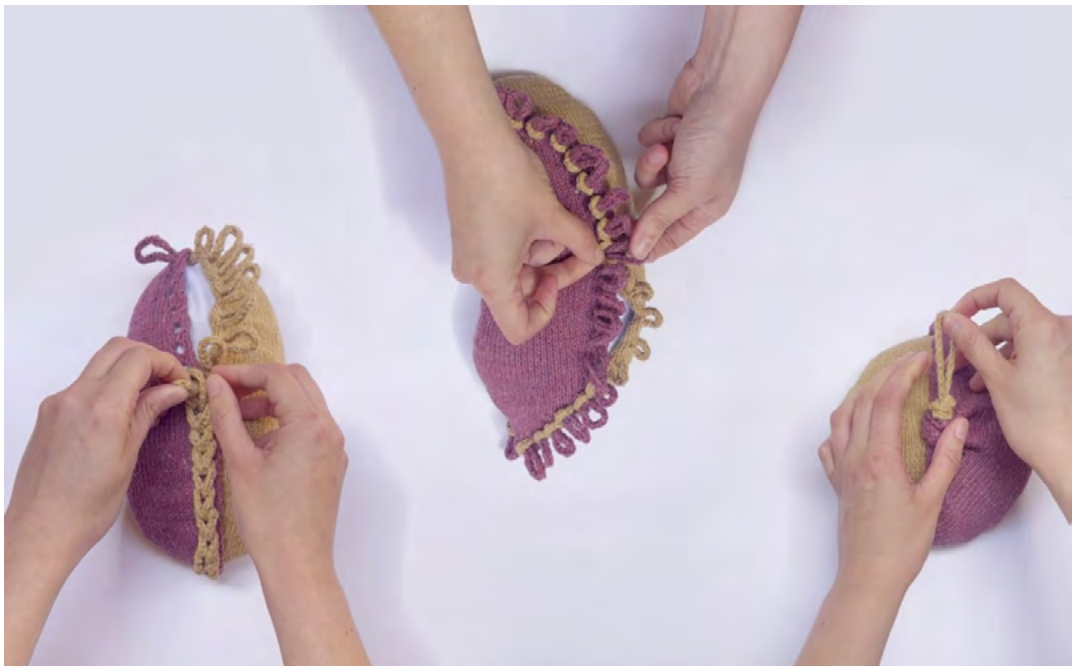


Figure 3. Knitted Fasteners. Credits: L. Rosato, 2023.



Figure 4. Circular re-design of the cover of an upholstered chair. Credits: L. Rosato, 2023.

6. A Circular Project Strategy Based on Anticipation and Transition

The practices of anticipation and transition intersected with circularity and sustainability allowed a vision of how to redesign, starting from a reflection on materials, a critical component of a product system. This, starting from a single component, however, has allowed a systemic work that also intervenes at the level of the supply chain, production and use intervention. In fact, using a transitional logic typical of Transition Design, intersected with the anticipation practices of Advanced Design, applied to the desires of Circular Design, has made it possible to foresee interventions, beginning with these illustrated on a small scale, but already sensing those to come on a large scale. The single-material seat upholstery was the excuse to reason about the future customization of the product, its longevity and how this can be implemented in the future with further modifications. In this sense, the user's awareness increases, and the product is itself the bearer of a message of circularity that educates the user not critically but positively by giving him new opportunities for use. These manifestations of future latent metamorphoses in a gradual logic make changes more easily absorbable and acceptable by companies and the market. In the same way, the reasoning carried out on the selection of circular materials may have tomorrow a deepening on the concept of short and local supply chain that would allow the reduction of transport and logistic impacts as well as an interesting implication on the connection to the knowledge and cultural traditions of the territory, avoiding delocalization and possible unethically controllable processes. Reasoning on a transitional intervention scale allows with small present actions to foresee future ones and to scale the intervention to macro and gradual actions (Rosato, 2023).

At the same time, the selection of circular and sustainable technologies is a fundamental step which, from a systemic perspective, also influences the variables described above. Made in Italy is a context that lends itself well to these transformations and knitwear is a technique that enhances the specificities and skills of the Italian territory. It is one of the historically largest production sectors in Italy, of which there are several districts with extensive technical knowledge that borrows from traditional know-how and relates to a

strong industrial fabric (Conti, 2013). Among the Made in Italy sectors that have evolved from an ancient craftsmanship know-how that Italy has possessed for centuries and that is often due to expertise in the processing of raw materials' (Motta 2019, p. 34), is knitwear, a practice where the link with raw materials is very strong and has led to products that generate an essential link with the world of production (Bertola & Colombi, 2014). This complexity of the knitwear product is one of the reasons that has determined the permanence of knitwear companies in Italy, which, thanks to the small size of the companies involved, have managed to keep production in the territory, avoiding delocalisation to other parts of the world (Motta 2019). These actions highlight how, in acting on the redesign of products where the material is critical, it is essential to bring back innovation for the user who uses it that can improve the quality of life and behavior with and for the product-system.

The practice-based research presented highlights how the potential areas of intervention are diverse and each of them can have different levels of depth, sometimes preparatory to each other, and integrating them all together would lead to a too sudden transformation of the supply chain that would create significant integration difficulties. As Transition Design emphasizes, for interventions to be absorbable there must be the right mindset and predisposition (Irwin, 2015) and, according to the author, this can be done with a gradual transformation time.

7. Conclusion

The article presented a practice-based research to identify possible strategies that, starting from the individual components, lead to the systemic redesign of a product, particularly in the upholstery sector. This was carried out through the use of a methodology being experimented by the author, which envisages the integration of anticipation and transition practices with those typical of circular design in order to identify what the design strategies might be to gradually make companies and the production territory absorb circular innovation in a transition perspective. The research was carried out by choosing the territory of the Made in Italy companies as a context which, due to its characteristics, skills and ability to absorb innovation, constitutes a terrain open to these practices and considering it suitable for metabolizing “projects with hybrid practices between conceptual art and complex projects that circumvent the norms of industrial production by challenging their premises and objectives" and where to contaminate knowledge using "the signs and codes of one discipline as leverage to infiltrate the terrain of another discipline” (Quinz, 2020, pp. 301–302). This project highlights what the designer can do first in designing these products and which are the ones to strive for in order to design the sustainable and circular transition in the sector: the selection of circular materials that improve the monomateriality of the components and thus facilitate disassemblability, the choice of technologies that implement circularity and decrease the production of waste already in the pre-consumption phase, a design process that anticipates the product's life cycles and foresees the different lifetimes of use by extending their temporariness as much as possible, and, finally, in all these processes understand how to make the user responsible and aware as well so as to sensitize him/her to his/her active role in the circularity of the product.

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P/REFERENCES OF DESIGN

CO-DESIGNING A DECARBONISATION ROADMAP FOR THE HUNGARIAN CONSTRUCTION SECTOR. A DESIGN-LED MISSION APPROACH TO STAKEHOLDER ENGAGEMENT: A CASE STUDY.

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KEYWORDS | NET ZERO, BUILDING, DECARBONIZATION, ROADMAP, CO-CREATION

ABSTRACT | In line with global climate goals, the decarbonization of the building sector is an urgent matter. The sector is one of the largest CO2 emitters globally, therefore its potential for emission reduction is unparalleled (IPF, 2022). The World Green Building Council (WGBC) is catalysing this process by funding the creation of sectoral-level decarbonization roadmaps. Such country-specific roadmaps set out a long-term vision for reaching net zero by mid-century for the entire industry. The Hungary Green Building Council, a member of the WGBC is currently in the process of co-designing such a roadmap together with the industry. Hungary is bound by law to reach net zero by 2050. Even though the technology for net zero buildings is widely available (Ürge-Vorsatz et al., 2020), currently there is a very low market and policy awareness on this topic (Szalay et al., 2022). The transition requires a systemic approach regarding the complex character of the construction industry made up of coevolving social and technical components (Singh, 2001). The creation of a macro-level roadmap requires the concerted cooperation of many actors, based on clear and consistent principles. Due to the complexity and interdependence of the value chain, coordinated action is challenging. The process is observed methodologically in the framework of practice based action-research. The research builds on the results of the net zero readiness market research done in 2023, where strategic design methods were employed. This paper summarizes the results of the first Cycle of research. It investigates how design-based methods can function in the Hungarian context to build the case for the engagement strategy for the roadmap where the method of mission-oriented innovation is planned to be employed. The secondary research method is qualitative case study analysis to reflect on transitional barriers and how the chosen method can help overcome them (Robson, 2002). The research contributes to developing a broader body of empirical contextual knowledge of transition barriers for an emerging field of inquiry and can inform diagnosis of problem areas in comparable transition contexts.

1. Introduction

In order to meet global environmental targets, the built environment sector also needs to deliver the required emission reductions. The sector is one of the largest CO2 emitters globally, therefore its potential for emission reduction and neutralization is unparalleled (Ürge-Vorsatz et al., 2020; IPF, 2022). Net zero carbon buildings (NZCBs) are recognized as viable solutions in this context (Ohene et al., 2022a, 2022b, 2023; Pan-Pan, 2020; Þórólfsdóttir, 2023).

Regulations and policies play a key role in promoting NZCBs, with governments globally committing to achieving zero carbon emissions between 2030 and 2060. There is also an increase in market demand for sustainable properties, which is a key catalyst behind the growing interest in NZCBs (IPF, 2022; WGBC, 2022). However, the industry's consciousness of the scale of the problem and responsibilities varies across geographies (IPF).

While there is global advocacy for NZCBs, a consensus on precise parameters and requirements remains elusive (Ohene et al., 2022a; Ohene et al., 2022b; Ohene et al., 2023; Pan-Pan, 2020; Þórólfsdóttir, 2023). Even though the technology for reaching NZCBs is considered widely available (Ürge-Vorsatz et al., 2020), the transition requires a systemic approach taking into account the complex character of the construction industry made up of coevolving social and technical components, such as technologies, policies, infrastructures, markets, institutions, and behaviors, construction industry business and organizational models, demand patterns (Singh, 2021). The complexity and interdependence of the value chain make coordinated action for delivering net-zero (NZ) solutions challenging, requiring concerted cooperation among stakeholders based on clear and consistent principles and criteria (Ohene et al., 2022a; Þórólfsdóttir, 2023). To facilitate this process, design-based methods are increasingly applied in the net-zero transition contexts (Bailie et al. 2023; Wachsmuth et al., 2023; Corr et al., 2023).

In line with the above developments, the Hungarian construction sector also needs to prepare for the transformation and achieve the necessary emission reductions. Even though Hungary is among the few countries obliged by law to reach NZ by mid-century (Act XLIV of 2020), there is a very low market and policy-maker awareness of NZCBs (Szalay et al., 2022).

The Hungary Green Building Council (HuGBC), acting as a business intermediary organization, holds a significant role in uniting stakeholders to raise awareness of NZCBs. It currently represents 156 individual and company members across various segments of the construction sector (see Figure 1 in Appendix). HuGBC leverages its membership in the World Green Building Council (WGBC), a globally operating NGO and a thought leader in the area, to access international best practices and recent developments in the field. The organization currently participates in two WGBC programs aiming to build industry capacity for the NZ transition through the creation of decarburization roadmaps - the *Advancing Net Zero* (ANZ) project at the company level and the *BuildingLife* project at the sectoral level (WGBC, n.d.a, n.d.b).

The ANZ project aims for global buildings to achieve net-zero carbon from 2030 to 2050. It develops tools and programs, including the *Net Zero Carbon Buildings Commitment* (the Commitment), challenging industries to decarbonize building operations by 2030. Signatories of the Commitment accelerate market transformation by acting ahead of mainstream players. Hungary joined the ANZ program in 2022 to advocate for its goals locally (WGBC, n.d.a).

In addition to engaging individual actors, many Green Building Councils (GBCs) commit to developing sectoral strategies for decarbonizing the built environment (Þórólfsdóttir, 2023). These roadmaps outline a vision for achieving NZ by mid-century, incorporating stakeholder action plans. So far, thirty-one countries, including ten in Europe, have published such roadmaps. The *BuildingLife* project harmonizes this process in Europe, and HuGBC is currently involved in the roadmap co-creation with its members and wider industry stakeholders.

In order to explore how to engage its members towards the targets of the ANZ project, HuGBC ran a Net Zero Readiness Stakeholder Research. It aimed to explore barriers and enablers towards the transition to NZCBs. The research also employed design-based methods to develop the engagement strategy and to test a potential tool for engagement. The process was observed in the frame of an action research cycle. The results form the basis of the engagement strategy for the sectoral decarbonization roadmap. This paper summarizes the results of the first cycle and gives an insight into a work in progress with regards to the second.

2. Theoretical Background and Literature Review

The paper frames the decarbonization of the built environment as a transition within a socio-technical regime, encompassing established systems of technologies, building practices, regulations, and actors shaping the design, construction, and maintenance of buildings and infrastructure (Singh, 2001). Transitions are primarily place-based phenomenon, embedded into specific political, institutional, regulatory, and economic settings (Ehnert et al., 2018). It can be conceptually analyzed through the lens of sustainability transition studies and system innovations (Elzen et al., 2004; Markard et al., 2012; Markard et al., 2020).

This view of transition stresses the importance of a multi-level and multi-stakeholder perspective and entails the involvement of actors not traditionally tackled in innovation management and policy (Geels, 2011). It places great emphasis on the collaboration among diverse entities, including state policymakers, regulatory agencies, local authorities, NGOs, citizen groups, private companies, industry organizations, special interest groups, or independent individuals (Kemp et al., 1998 as cited in Elzen et al., 2004). While emphasizing the state's crucial role in driving systemic change, innovation in this context is positioned as a collaborative effort, giving significant importance to bottom-up approaches (Foulds et al., 2023). They act as intermediaries with the capacity of mobilizing communities, facilitating knowledge creation and transfer, fostering civic innovation and allowing room for experimentation (Jütting et al., 2020, Foulds et al., 2023). As such they have the capacity to generate impact on the policy level (Elzen et al., 2004, p. 80.). However, the role of the agency of various actor groups during transition processes, including the strategies of firms has been relatively overlooked in the existing literature on socio-technical transitions (Farla et al., 2012; Markard and Truffer, 2008a as cited in Markard et al., 2012).

Design approaches (e.g. service design, strategic design) are considered as adequate methods in the context of sustainability transitions and systemic change (Jütting, 2020; Whichler, 2018). They can facilitate collaboration, integrate knowledge from various disciplines, help frame challenges and develop clear visions and roadmaps for breaking down missions into actionable steps (Le Masson et al., 2017; Magistretti et al., 2021 as cited in Rabello, 2023). Within the context of sustainability transitions, transition design is becoming a separate and emerging field of inquiry (Gaziulusoy and Ryan, 2017; Gaziulusoy and Öztekin, 2019; Gaziulusoy, 2019).

Research on the relationship between innovation and design ecosystems at the country or regional level is limited (Whicher, 2018). While several studies explore design methodologies in the context of sustainability transitions (e.g. energy, circular economy, transportation) (Glowacki, 2020; Whicher, 2018; Mullaly et al., 2022; Cohen et al., 2023; Baile et al., 2023; Wachsmuth et al., 2023; Gaziulusoy and Öztekin, 2019; Silver, 2022; Auvinen, 2023; Corr et al.), research on the role of design-based methods in building decarbonization is limited and primarily concentrates on technological aspects (Moren-Rangel et al., 2022) or other geographical contexts (Glowacki, 2020).

Most studies in the context of building decarbonization concentrate on various types of technological and socio-political barriers related to the performance and market uptake of NZCBs (Ohene et al., 2022a, 2022b, 2023; Pan-Pan, 2020; Þórólfsdóttir, 2023). Little empirical research exists concerning emerging markets (Ohene et al., 2023). In the Hungarian case of NZCBs, studies have focused on technical characteristics (Ürge-

Vorsatz et al., 2020; Szalay et al., 2018), but the wider range of NZCBs barriers, including policy, political, and cooperative ones, remains underexplored. Some recent studies have examined sustainability transition with a focus on the urban level (Siko-Tomay et al.; 2023; Óvári et al.; 2023; Ehnert et al., 2023) but with limited focus on design-led stakeholder engagement processes (Varjó et al., 2023) and/or the role of NGOs (Neulinger et al., 2023), especially in the context of the building sector. No research was found specifically focusing on stakeholder connectivity in the design of building sector decarbonization within Hungary.

3. Methodology and Research Questions

Considering the above research gaps, the present research aims to apply a multi-stakeholder perspective in order to develop a qualitative case study, informed by action and stakeholder research to answer the following questions:

1. What are the barriers that constrain the transition to NZCBs in Hungary?
2. How can HuGBC engage its members towards the ANZ Commitment and to develop company-level decarbonization roadmaps?
3. How do design-based methods work in this particular geographic context of building decarbonization in helping stakeholder engagement and collaboration?
4. Are design-based methods suitable for the sectoral level roadmap co-creation and what lessons learned from the stakeholder research (Cycle 1) can be utilized in that process?

The research used mixed methods, both quantitative and qualitative.

The primary method used in the study is collaborative inquiry in the tradition of action research (AR) (Reason and Bradbury, 2001). AR falls is a form for engaged scholarship and suits well for studying sustainability transitions. According to the theorist who originated the method, change is facilitated more by identifying and removing barriers than by reinforcing enablers (Coghlan and Miller, 2001). The best way of understanding the system is to change it, and accordingly, AR is increasingly used in system change and sustainability transition contexts (Bartels et al., 2020).

The first cycle of the research was the Net Zero Readiness Stakeholder Research aiming to engage companies to produce company-level decarbonization roadmaps. The aim was to assess their level of awareness and practices on building decarbonization, and their readiness to join the ANZ Commitment. It also aimed to inform the development of an engagement strategy and to explore the role HuGBC can play in accelerating change. The research also aimed to inform the actual state of the sector from the NZ transition perspective.

The lessons from the first cycle served as the basis for the second, the engagement plan for the sectoral level roadmap and the roadmap itself.

Data is derived from the quantitative and qualitative phases of the stakeholder research as detailed below and is supplemented by observational data obtained through participant observation by the authors practitioners throughout the process. This is extended by notes and observations from the design team based on the conviction that participant observation produces significant insights when combined with other primary and secondary data (Lofland et al., 2006; Brannan and Oultram, 2012 as cited in Rabello et al., 2023).

The secondary research method was a qualitative case study analysis of the transitional barriers based on in-depth information from a small number of individuals (Robson, 2002).

The research adopted the organizational level as the unit of stakeholder analysis (Avelino et al., 2016 as cited in Argyriou, 2023). A heterogeneous group of stakeholders from the policy, market, industry, and third sector were approached.

3.1. Cycle 1: Net Zero Readiness Stakeholder Research

The first cycle was composed of 2 phases. The first part was a stakeholder research conducted by HuGBC by two researchers (program manager, and sustainability consultant). This then informed the design research phase run in cooperation with a service design agency (second phase) where two service designers joined the team.

Research among HuGBC Members

In the first phase stakeholder research among HuGBC members was conducted.

It started with a literature review that culminated in the publication of a position paper entitled *Zero Carbon Guideline* (Beleznay et al., 2023). This paper aimed to provide a baseline understanding of NZCBs synthesizing international knowledge (certification schemes, regulations and standards and developed an NZ definition suitable for the Hungarian context).

Then a non-representative online questionnaire was circulated among members of the organization to assess their attitudes and practices vis á vis the papers' findings. Among 136 members 60 responses were collected (Figure 2 in the Appendix).

The results of the questionnaire set the scene for the semi-structured interviews (N = 14) (Figure 6 in Appendix). The aim was to select frontrunners in NZCBs with decision-maker capacity, representing a wide range of actors across the industry including non-members (from policy and related industry fields). Interview participants were asked to describe enablers and barriers and potential solutions and potential first steps to reach the NZCBs sector by 2050.

Phase 2. Inclusion of Design-Based Methods in the Stakeholder Research

The results of the first phase informed the commissioning of a service design agency with the aim to inform the development of the engagement strategy. Two service designers were assigned to the project. They were also tasked to be external eyes, "critical friends" in AR terms in the research.

This phase also aimed to lay the groundwork for meaningful interactions, align stakeholders and gauge their engagement levels to foster a conducive atmosphere for co-creation.

The second phase was composed of 3 steps:

Step 1. Define: two workshops were organized to define the objectives for the process and mapping stakeholders in a Power Interest Matrix. The agency also looked at the interviews and mapped the results into a COM-B model (see below).

Step 2. Co-creation workshops: to test a potential engagement tool, named as a "roadmap template". It was conceived as a strategic gap analysis framework that took the steps and objectives set in the ANZ Commitment as a benchmark and looked at companies' current status, gaps and potential next steps towards it. Stakeholders were grouped as property owners and tenants and could provide feedback on this prototype tool during the workshops (see Figure 7 in the Appendix).

Step 3. Stakeholder workshops: running parallel to Step 2. This third step aimed to look at collaboration opportunities between stakeholders and test a future-oriented design game called Sustainable Future Game (participants in Figure 8 in the Appendix).

Justification for the Design-Based Tools Selected for Phase 2

The COM-B Behavior Change Framework

The COM-B behavior change model (Michie et al., 2011) was used as a key analytical tool in the second phase. It comprises Capability, Opportunity, and Motivation, providing a comprehensive framework to understand and analyze behavior. This model was applied to systematically assess stakeholder's attitudes towards the ANZ objectives. By doing so, valuable insights into the dynamics of behavioral patterns were gained, informing strategies for positive changes aligned with ANZ objectives. Interview transcriptions were meticulously coded to align with COM-B themes, forming the foundation for guiding creative activities in subsequent workshops. This coding system ensured systematic examination and analysis of all data through the COM-B model, offering a cohesive understanding of stakeholder dynamics towards the ANZ initiative.

Integrating Future Scenarios and Gaming for Stakeholder Engagement

Games, traditionally used in urban planning for deliberation and scenario testing (Alexander, 1979), took on a novel role within the context of the research. Their integration with future thinking, crucial for shaping sustainable futures, presented a unique opportunity for engagement. Designed for purposes beyond play, games can become powerful tools for exploring speculative futures, encouraging participants to break from routine thinking and generate desirable alternatives (Rupprecht et al., 2020). The game was adapted to the built environment context based on two game models (Sustainability Futures Game (Hellon, n.d.) and the Nordic Urban Mobility 2050 Futures Game (Nordic Innovation, n.d.)). The resulting game focused on crafting built environment scenarios for 2050, fostering discussions on future states and serving as a basis for prototypical projects. The game sessions aimed to facilitate collaborative exploration, dissolve information silos, and build trust through engagement based on agreed principles (Ampatzidou et al., 2022).

4. Analysis of the Results of Cycle 1

4.1 Drivers and Barriers of Building Decarbonization and the Role of HuGBC

There are 175 signatories of the ANZ commitment on a global level (WGBCb, 2023). Besides companies, public authorities, cities, and regions can also join. Two of the corporate signatories have an outlet in Hungary: a technology company and a building manufacturer, both members of HuGBC. The initial hypothesis of the research was that members of HuGBC wouldn't be ready to sign the *Commitment* due to a lack of capabilities and motivation as it represents a very advanced trajectory within the market of voluntary schemes in building decarbonization. This assumption was based on the literature review and the initial interviews with regional GBCs (Poland, Croatia) and was confirmed by the stakeholder research.

The research has shown that 80% of respondents to the online questionnaire have already taken steps to decarbonize their buildings (for respondents' composition see Figure 2 in Appendix). Reducing energy demand is the most common decarbonization objective, followed by mechanical systems and building automation, strategy development, improvement of the building envelope improvement and the use of on-site renewable energy (Figure 3). Circular resource use and reducing the embodied carbon impact of built-in materials are among the most important and most challenging topics (see Figure 4).

According to respondents' commitment to climate change mitigation and associated branding/PR objectives are the primary drivers (Figure 5), while barriers include high costs, lack of customer expectations and lack of an expert base and decision support strategy. From interviews, it turned out, however, that efforts to reduce operational carbon emissions are driven by the energy crisis.
Global companies with Hungarian subsidiaries lead the way in building decarbonization. But even those companies face challenges regarding the delivery of NZCBs. Even if companies in the construction sector do have a sustainability strategy this does not include determining a pathway on how to reach NZCBs and portfolio by 2030/2050. The high costs and skills requirements to design and deliver NZCBs and the low

demand from clients and investors make the situation more difficult. This is also hampered by a data challenge (lack of available country-specific databases, and lack of transparency of data sources).

Most actors expect an increase in climate ambitions from regulatory change. In this regard the EU Taxonomy (EU, 2020), the Corporate Social Responsibility Directive (EU, 2022) and the current review of the EPBD (EC, 2022) represent opportunities, however, “there is a lot of fumbling in the dark about the concrete effect of these regulations”, as one interviewee put it.

Three key thematic areas emerged from the research where HuGBC should concentrate its efforts.

The first is the lack of appropriate data and measurement systems. Only 30% of respondents to the questionnaire use energy and CO2 emissions records. Moreover, the interviews showed that even frontrunners struggle with this challenge, which also relates to the organizational challenge of developing the right data strategy and new internal processes. This currently hinders commitment as if companies want to set realistic targets, first, they need to know where they currently stand. This could be accelerated with a country-specific scope and target.

The second is education and awareness-raising where HuGBC could step in more actively. 60% of respondents mentioned the need for education on NZCBs. Lack of knowledge on whole-life carbon assessment and methods for embodied carbon measurements are the most sought-after knowledge. This simultaneously means an internal organizational challenge (training need for employees) and the educative role companies might have within their supply chain. Respondents expect "concrete guidelines, case studies, life-cycle analyses based on local and regional data, and best practices to reduce embodied carbon." According to the research, educational activity should focus on the data challenge, internal training revealing climate risks, and the links between ESG compliance and building decarbonization.

The third challenge is the need for new kinds of collaborations based on the culture of openness and transparency that allows for the sharing of best practices. All stakeholders agreed that to achieve the desired carbon-free vision, partnerships and cooperation must be strengthened. The research showed that companies are in the competing phase but to achieve systemic change there is a need to move towards a non-competitive cooperation (Beleznay et al., 2023).

Based on the COM-B analysis, a lack of customer expectations and financial resources can be considered as a lack of opportunity and motivation, however, they are also capability issues, which HuGBC can tackle with an appropriate training portfolio and as a platform of good practices. Apart from the professional service provider stakeholder group, there is no difference between the stakeholders in this regard.

However, to promote corporate engagement, new ways of segmentation are also needed; In the case of front runners (mostly those following a parent company strategy), it is not fear or motivation that needs to be addressed. They make committed and conscious decisions. Their challenge is the international transformation process and a lack of knowledge and data measurement procedures. On the other hand, companies at the beginning of the decarbonization journey have fewer resources but more freedom to adapt their processes. Therefore, HuGBC can have a greater role and impact in facilitating corporate engagement (Figure 9 in Appendix).

The research identified three key players and their challenges HuGBC should focus its activities on:

1. Users as drivers – Users currently lack the knowledge and often the need to create a low-carbon environment. Even with a strong will to change behavior is not clear.
2. Real estate developers as innovators – The transformation processes in large companies are slow and influenced by many factors simultaneously (strategy creation, changing of internal processes, education).
3. State as regulator – The right incentive system, and measurement-based ratings are essential drivers for transformation, which requires increased advocacy efforts.

The research identified three other target groups:

1. New generation – To meet the needs of building users and related students. The office environment and energy use context is a good opportunity for community engagement and partnership building to support responsible use patterns.
2. Utility companies and financial institutions – are less integrated parts of the construction ecosystem, but as both their interest and impact is high, their inclusion is pivotal in the roadmap creation process.
3. Start-ups – integrating start-ups and small businesses experimenting with technological innovation, and new business models into the ecosystem.

These lessons are also consistent with the directions of the ongoing global reassessment of the ANZ project, which is currently being run in consultation with WGBC members and key local industry players.

4.2 The Potential for Design-Based Methods in Sparking Stakeholder Engagement Towards Decarbonization Objectives

In assessing the evaluation of design methods within cycle one, it is essential to establish clear criteria considering aspects such as effectiveness, usability, inclusivity, and adaptability. These criteria serve as guiding parameters to systematically evaluate the success and potential challenges associated with the implementation of design methodologies.

Effectiveness: The tools introduced strategic decision-making methodologies, extending beyond the ANZ project. For instance, they provided insights into which stakeholders would be strategic partners worth strengthening ties with. Interviews and the availability of data unequivocally revealed future ANZ ambassadors. Furthermore, during the future games session, previously less visible players in the ANZ context, such as small manufacturers, were effectively engaged.

Challenges arose from the intention to align with the global ANZ Commitment framework. Interviews highlighted limitations in the roadmap template, affecting its ability to address distinct organizational issues. This led to adjustments in the design of co-creation workshops. While awareness increased, workshops underscored the ongoing need for refinement. This is consistent with the finding that context-specific conditions should be taken into account when replicating and transferring solutions (Foulds et al., 2023). On the other hand, new opportunities have been identified through workshops.

Usability: the games and co-creation sessions successfully reinforced participants' belief in the necessity of closer collaboration. These methods achieved their goal as far as they motivated and engaged participants expressing commitment to initiating changes in collaboration frameworks and promoting more active knowledge-sharing. However, within the ANZ context, which typically emphasizes data-driven methodologies and organizational inertia, some participants found tools like games challenging. This aligns with usability concerns raised in various studies, questioning the tangible results of games. Despite their reported benefits – in providing a comprehensive understanding of complex systems, fostering idea

generation, and a 'fun way' of learning –, challenges in adoption persist. The limited application of serious games and gamified activities in urban planning can be traced back to apprehensions about their immediate, tangible impact (Vervoort, 2022).

Inclusivity: HuGBC engaged with 102 stakeholders, extending the reach of ANZ initiatives beyond the construction sector. While utility companies and financial institutions were included, the implementation of inclusivity remained partial. Inherent limitations, common to NGOs, led to engagement within existing motivated members. However, even among this group, critical voices emerged, emphasizing the need for ongoing collaborative discussions. Critical stakeholders like regulatory bodies and building occupants (e.g. representatives of multinational companies within the service sector) were absent from the engagement. However, the tools highlighted the importance of their future involvement. These initial steps mark the beginning; a fuller systemic inclusion is yet to unfold in the framework of the sectoral roadmap creation.

Adaptability: Cooperation between the research and design team faced obstacles because of several reasons. The abstract and experimental nature of design methods was challenging, particularly for someone with an engineering background lacking prior exposure to these methods, and accustomed to different mindsets and work environments. On the other hand, designers primarily focused on digital products and services found it difficult to navigate the terminology within the sustainability domain, and the lack of specific NZ knowledge made the adaptation of design methods challenging. These difficulties highlight the need for new skills for transition designers (Gaziulusoy, 2018).

Additionally, adaptability plays a crucial role in navigating stakeholder engagement's complex landscape. In a strategic move to enhance effectiveness and scalability, we have introduced advocacy roles within the ecosystem. The identification of advocates by using these methods sets the foundation for transformative advancements, ensuring continuous evolution and widespread impact. The sectoral roadmap stands as a pivotal opportunity in leveraging the identified advocates, paving the way for smoother scalability and extended influence.

4.3 Participant Engagement and Satisfaction Perspective

Stakeholder engagement, as an integral aspect of co-creation, has been meticulously addressed throughout our process, aligning with the principles outlined by Morello and Mahmoud (2018a). Recognizing the importance of a comprehensive understanding of involved stakeholders, we implemented inclusive and tailored approaches at various stages, employing a range of tools to enhance engagement. One noteworthy outcome, drawn from NGO perspectives, identified a pivotal leverage point from COM-B analysis - the deficiency in capability overshadowing motivation. This insight is instrumental for evaluating engagement and satisfaction since it precisely highlights the interventions required. The research elucidated that strengthening collaborations along the knowledge-sharing and value chain is a primary aspiration among stakeholders. The design methods also yielded promising results in drawing in easily accessible yet influential participants. Additionally, participants spontaneously extended assistance to one another during workshops, surpassing prescribed tasks, and revealing a self-driven commitment to collective progress.

Sessions encouraged participants to contemplate their individual sense of responsibility, envision alternative futures, and connect these to their real-world context played a crucial role in enhancing a sense of agency among participants. During the game sessions, participant feedback revealed unexpected opportunities for organizational-level use, emphasizing the transformative impact of the methods and their potential to foster widespread inclusion within organizations. Our experience confirmed that games could indeed play a role in reshaping decision-making models and fostering transformative change at both institutional and community levels with their “all learning together” approach (Bradley et al., 2022, based on Emerson and Nabatchi, 2015). While the unexpected organizational impact is encouraging, challenges faced by participants, such as difficulties detaching from negative scenarios and a tendency towards pessimism, show the need for further refinement.

5. Plans for Cycle 2: Sectoral Decarbonization Roadmap

5.1 Building the Case for Mission-Oriented Innovation

The co-design process of the sectoral decarbonization roadmap has the potential to engage stakeholders beyond HuGBC membership and to make it a truly co-creative endeavor, where the process itself plays as important a role as the end product. We envision the creation of a living document, constantly updated, in which all participants take ownership of the actions and collectively drive the agenda sparking further collaborations.

The results of Cycle 1 inform the planning of the engagement process. The results overall justified the use of design-based methods in our context.

All decarbonization roadmaps produced in the *BuildingLife* projects so far relied on stakeholder engagement but to varying degrees and in different methods. A traditional approach is to set up a steering group composed of key industry actors and sub-working groups segmented by types of actors (e.g. developers, construction companies, policy actors, NGOs) or building types (e.g. new built, retrofit, infrastructure, commercial, public buildings).

In our case we plan to extend this method with the inclusion of the mission-oriented innovation (MOI) approach, which has emerged as a robust method for systemic innovation, aligning stakeholders towards sustainability goals (Jütting, 2020; Bellinson 2021). It fits into our context as it has the potential of breaking down grand challenges (like climate change) into missions (e.g. zero emissions building stock by 2050) and further down into actionable projects in a multi-sectoral way. The method is also being employed in the built environment decarbonisation context at the city level (Bellinson). It will be the first time an NGO would employ the method both in the context of the *BuildingLife* project and in Hungary. This intention is justified by recent academic research where some argue that the growing interest in MOI policy, could result in NGOs taking up this method, and stresses the necessity to enhance their capacities in this regard (Jütting).

The underlying method of MOI is strategic design, which is detailed in a practical guidebook that serves as our starting point (Hill, 2022). The engagement process starts in March, the below table details the plan for stakeholder engagement.

Table 1. Stakeholder engagement plan for the sectoral decarbonization roadmap.

Activity	Justification	Output	Deadline
Literature review (12 roadmaps and academic literature)	To inform the roadmap development and the workshops	Drivers, barriers, stakeholder action plans from the 12 European roadmaps	February
Steering Group (SG) composed of 10 HuGBC members	Results of Cycle 1 mapping will inform the selection, inclusion of identified change agents	Engaged and active SG overseeing the project	February
4 SG meetings	SG work together to oversee the roadmap development and the engagement	Roadmap text	May
8 working groups (WG) per segment	To produce the action plans by segments. Segmented by 8 segments (Figure 10 in Appendix) informed by motivated actors	8 working groups per segment	February
min. 8 Working Group meetings	To produce the action plans by segments		
3 Actors Workshop	to produce a system map which can be considered as a real-time snapshot of the system (i.e. system in the room, Hill, 2022)	System maps that serves the basis of the action/mission planning, candidate mission themes	March - April
SG Design Workshop I.	to synthesize results and reframe them based on angles, levers, layers, levels (Hill, 2022)	candidate mission themes	April
3 Design Workshops	allowing for selected WGs to work in diverse setups, content is informed by the reframing process and Cycle 1 inclusion of scenario planning, visual, narrative techniques	Candidate mission themes, prototype projects, potential demonstrators	May
SG Design Workshop II.	Bringing it all together, roadmap drafting session	Refined mission themes, prototype projects, demonstrators	May

There are several challenges that can be anticipated in the process that should be addressed.

Both Cycle 1 results and the MOI method calls for greater inclusion of policy actors, in order to generate systemic impact, therefore advocacy efforts will have to be increased in this regard. This is also the direction of the current revision of the global ANZ project.

Operationalization of theoretical frameworks into practical actions may present challenges. To resonate with diverse local actors and their unique perspectives, concepts related to decarbonization must be made tangible in practice. Achieving this requires a multilateral dialogue process to break down these concepts, fostering ownership and understanding among participants.

Carbon modelling that will be produced as part of the roadmap introduces another layer of complexity, as finding equilibrium between the “desirable” and “feasible” might involve ongoing negotiation (Wachsmuth, 2023). Tensions may arise between modelled pathways and real-world situations. Balancing aspirations with practical implementation is essential in this context.

The proposed trajectory raises the potential risk of "workshop fatigue" among participants. Successful implementation hinges on strong leadership and commitment from the Steering Group and ultimately from other participants. The advocates identified in Cycle I. are expected to become catalysts by acting as ambassadors and driving the initiative forward.

Additionally, establishing a robust monitoring and evaluation process for the roadmap to become a living document, addressing a current challenge faced by other GBCs, is imperative for tracking progress and ensuring accountability.

6. Future Research and Extension of the Paper

The present paper could be extended with the results and insights gained during the Cycle 2, which is still ongoing. This would enable us to reflect on the design-based and MOI methods based on a larger sample in terms of actors engaged, workshop conducted.

Framing the results as a qualitative case study analysis guided by stakeholder theory and cooperative environmental governance perspectives, as a future research extension, could explore the wider political-economic context of the expected NZ transition, and look at the barriers (both the technical and non-technical) that might constrain the transition process in a more derailed and potentially comparative way. There is limited understanding of these barriers, but addressing them can help to catalyze the system-level change that is required for NZ vision. Such an analysis could inform the practice of professionals within the building industry by providing a context for understanding the obstacles to transition and their impact on systemic change. It is expected that if transition plans are to be successful and inclusive, it is assumed that barriers must be overcome beyond the NZ and construction sector focus.

Such an analysis of the Hungarian context contributes to developing a broader body of empirical knowledge of transition barriers for an emerging field of inquiry, namely net zero transitions and MOI. Further research can also inform the diagnosis of problem areas in comparable transition contexts.

7. Conclusion

The research revealed key, context-specific barriers hindering the transition to NZCBs in Hungary. These barriers include limited awareness, financial constraints, and regulatory uncertainties among HuGBC members. These insights underline the need for tailored engagement strategies that address these specific challenges for which the sectoral roadmap gives an opportunity. A common understanding of the NZCBs objectives for achieving greater alignment, will be helped through the roadmap creation process.

Efforts to engage HuGBC members towards the ANZ Commitment and the development of company- and sectoral-level decarbonization roadmaps are still underway. Transparency and openness, as revealed in expert interviews, are pivotal for overcoming conventional ways of thinking and acting. It requires all participants to critically reflect on their current roles and associated behavioral patterns. Businesses in this regard need to take on increased responsibility, extending beyond their individual companies to encompass their roles in supply chains and society at large. HuGBC has limited capacity and capability in changing a firm's motivation, however with carefully crafted engagement processes, could step into this arena in three key areas. By facilitating sharing of best practices, developing educational activities and promoting increased coherence in addressing the data challenge. For this the carbon-modelling for the sectoral roadmap gives an opportunity. Advocacy efforts for clearer regulatory frameworks should also be

increased. Special emphasis should be placed on actively recruiting and retaining particular groups, such as policymakers and businesses outside the existing HuGBC membership.

Design-based methods have proven effective in this context. Co-creation workshops and game experiments highlighted the adaptability of these methods, showcasing their effectiveness in fostering stakeholder engagement, creative problem-solving, and a sense of ownership.

The study finds that design-based methods are indeed suitable for the collaborative development of sectoral-level roadmaps. Lessons learned from the stakeholder research, can be effectively utilized in this process. The multifaceted approach, incorporating design-based methods, emerges as a valuable strategy for the roadmap. For this the method of mission-oriented innovation is chosen and justified, which incorporates design-methods while providing an effective framework in addressing grand systemic challenges, such as building decarbonization. Breaking away from conventional ways of thinking and doing takes a lot of effort and time. The engagement process itself requires significant motivation from participants who - partly with the help of these methods - should recognize the personal, normative, or moral advantages linked to their engagement.

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8. Appendix

Table 1. Membership composition of Hungary Green Building Council, 15.02.2024.

HuGBC membership composition	**Nr.**	**Percentage**
company members	**88**	**56**
building product manufacturers and distributors	28	18
developers, construction companies & contractors	18	12
professional services	28	18
real estate agents, property management & facility management	11	7
other	**3**	**2**
associated members	21	13
environmental NGOs, associations, and professional societies	21	
individual members	**47**	**30**
	156	

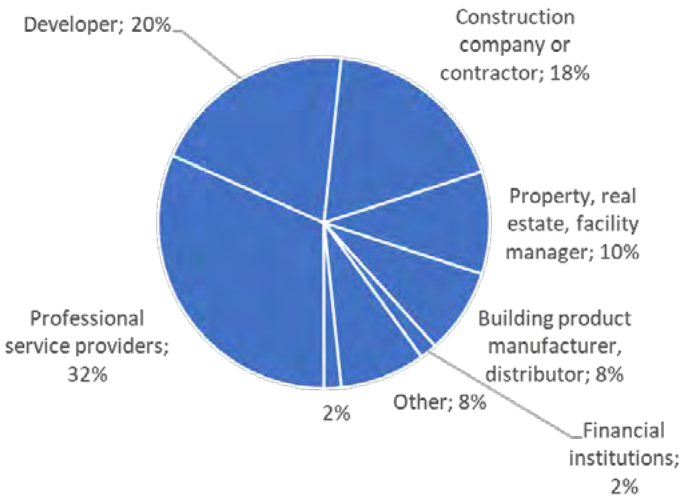


Figure 1. Respondents for the online questionnaire. By the deadline (17.04.2023) among the 134 members, 44% have completed the questionnaire, n = 60.

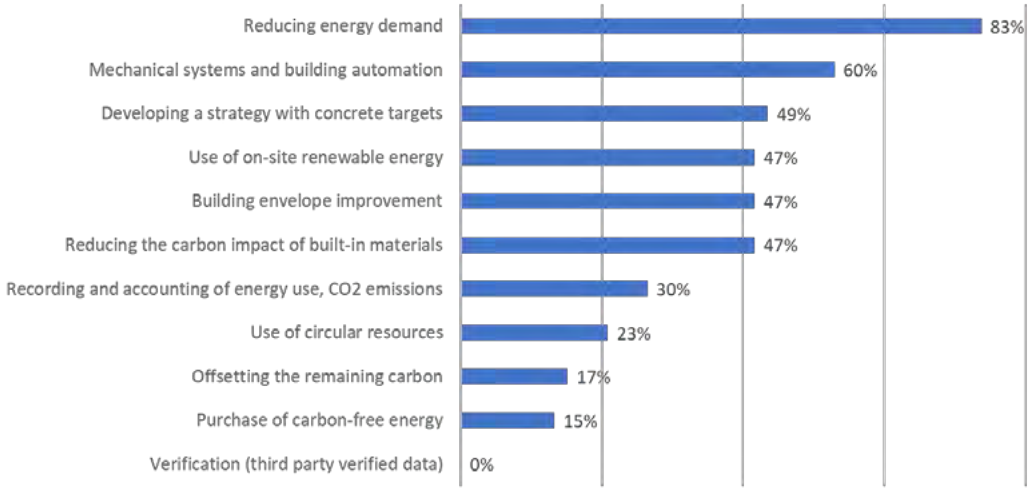


Figure 2. Decarbonisation measures employed be member companies. Question 5. Which measures are used in the realization of targets related to NZCBs? Base, who already have taken steps (N=47).

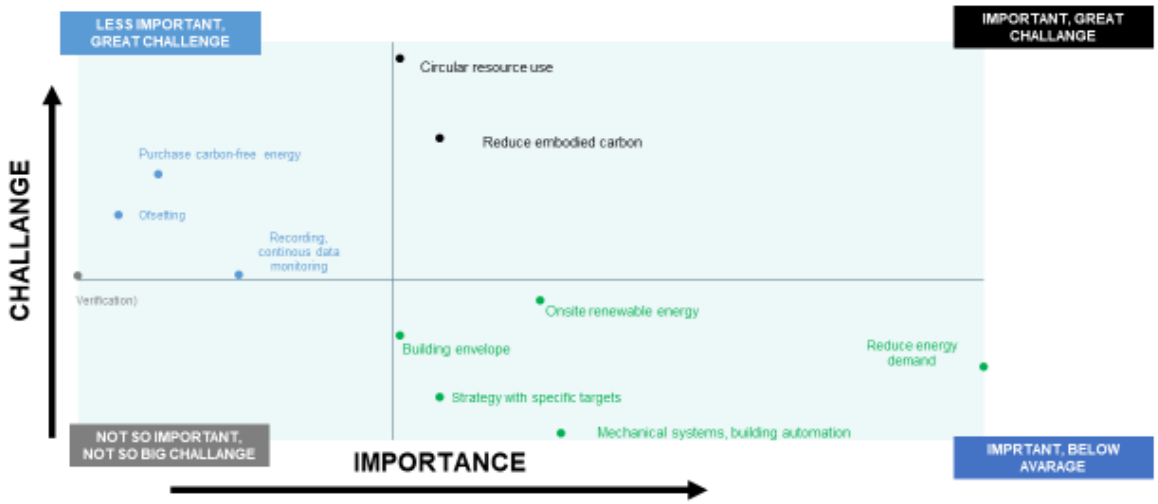


Figure 3. Decarbonization measures rated based the challenge and importance.
IMPORTANCE: Q4. Which of the following do you think are the most important in achieving the objectives related to Net Zero Carbon buildings? (N=60).
CHALLENGE: How challenging is the implementation of these for your organization? Base who rated the challenge (N=37-57).

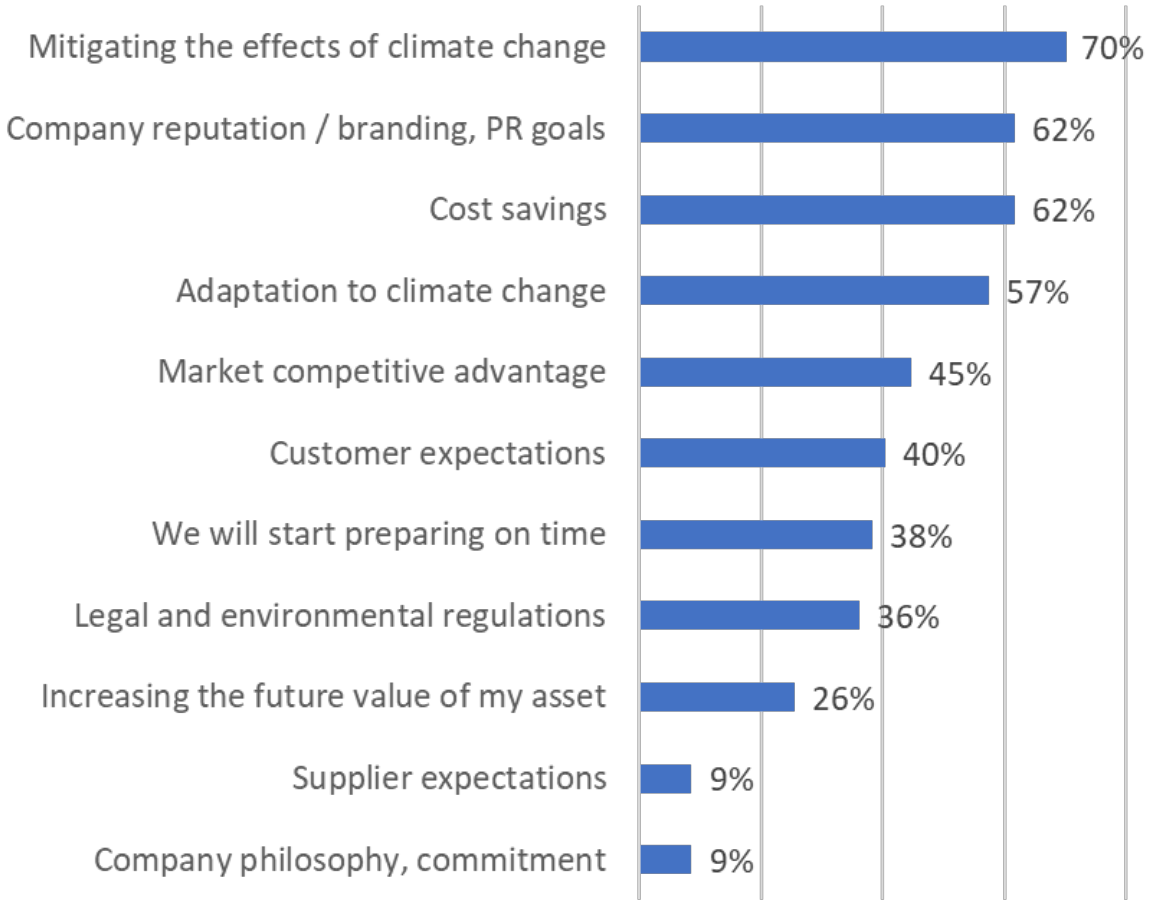


Figure 4. Drivers.
Q5. Which ones are used in the implementation of the objectives related to Net Zero Carbon buildings? Base, who have already taken steps (N=47).

Table 2. List of interviews.

Sector	Organization	Position	Rationale	Date
Utility companies, energy suppliers	Energy supplier	Deputy CEO	Bring the energy sector's perspective	17.08.2023
Building owners, property developers	Sustainability Manager	Property Developer	Net zero readiness assessment	11.07.2023
Building owners, property developers	Multinational Property Developer Company	Project Manager	Net zero readiness assessment	29.06.2023.
Building material manufacturers, distributors, suppliers	Multinational technology conglomerate	Head of Building Products	ANZ	
Contractors	Hungarian contractor company	Sustainability Manager	ANZ	05.07.2023
Contractors	Hungarian contractor company	Head of Real Estate Development	ANZ	05.07.2023
Building owners, property developers	Hungarian contractor company	CEO	market leader	26.06.2023
Building owners, property developers	Hungarian contractor company	Head of Design	market leader	26.06.2023
Building owners, property developers	Hungarian contractor company	Sustainability Manager	market leader	26.06.2023
Professional services	Consultant firm	CEO	Experienced with certificates, market overview	10.07.2023
Professional services	Consultant firm	CEO	Experienced with certificates, market overview	10.07.2023
Professional services	Architecture firm	CEO	role model	24.07.2023
Building operators, tenants, building users	American commercial real estate services and investment firm	Sustainability Manager	ANZ	27.06.2023
Building operators, tenants, building users	investment management company	Head of ESG Strategic Advisory	ANZ	24.07.2023
Professional organizations	a CEO-led organization of international companies	CEO	industry overview	27.06.2023
Professional organizations	Think tank	Head of Climate Policy	policy aspect	24.07.2023
Professional organizations	Multinational strategy and management consulting firm	Partner	industry overview	24.07.2024
Financial institution	Hungarian National Bank	Head of Department	Green finance expert	24.07.2024

Table 3. Participants of the co-design workshops / sector.

Sector	Co-design workshop 1 Focus: owners, developers	Co-design workshop 2 Focus: tenants
Building owners, property developers	5	0
Professional service providers (i.e. consultants)	1	1
Building operators, tenants, building users	0	4
TOTAL	6	5

Table 4. Participants of the stakeholder workshops / sector.

Sector	Stakeholder workshop 1	Stakeholder workshop 2
Developers, construction companies & contractors	2	2
Professional service providers (i.e. consultants)	3	2
Real estate agents, property management, facility management	2	1
Building product manufacturers and distributors	3	1
Other	1	0
TOTAL	11	6



Figure 5. Pictures from the game sessions.

Table 5. Segments in the sectoral decarbonization roadmap.

	Segment
1	National, regional and local government
2	Property and project developers
3	Financial institutions
4	Architects and engineers, consultants
5	Contractors
6	Manufacturers, distributors, suppliers
7	Building owners and users
8	Civil/professional society

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P/REFERENCES OF DESIGN

FROM CABINETS OF CURIOSITIES TO DESIGN RESEARCH LABS?: HOW TO REIMAGINE NATURAL HISTORY MUSEUMS THROUGH DESIGN IN TIMES OF ECOLOGICAL CRISIS.

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KEYWORDS | NATURAL HISTORY MUSEUM, DESIGN RESEARCH LAB, ECO-SOCIAL DESIGN, CLIMATE ACTION, SPECULATIVE DESIGN

ABSTRACT | This abstract delves into the overlooked realm of design practices within the context of the evolving roles of natural history museums in times of social and ecological crisis.

Natural History Museums (NHMs) have evolved from mere cabinets of curiosities to vital institutions for interdisciplinary research and education. However, faced with the urgent challenges of the climate crisis, NHMs must question their traditional exhibition spaces and their anthropocentric roles against the backdrop of biodiversity loss, invasive species and changing climates.

This study explores NHMs' complex historical roots and their need to overcome oppressive, colonial, and anthropocentric perspectives on nature. It is considering the design discipline as a stakeholder in reshaping NHMs for climate action and formulates the hypothetical question: "What if NHMs are understood as Design Research Labs for eco-social transition?" This inquiry lays the groundwork for speculative scenarios that explore the transformative potential of design and NHMs. The paper advocates for NHMs to embrace a pluriverse and more-than-human understanding of nature and become playgrounds for co-creative socio-ecological transitions. The study uses the Museum für Naturkunde Berlin as an illustrative example, highlighting innovative initiatives and collaborations but acknowledging challenges in translating visions into reality.
A central focus is on redefining NHMs as places for design-driven democracy, emphasizing the role of design in socio-ecological transformations. The paper discusses the potentials of design for sustainable transitions, highlighting current developments and the role of Design Research Labs as interfaces for NHMs. The study concludes by calling for NHMs to leverage the untapped potential of Design Research Labs, offering a pathway for NHMs to become catalysts for eco-social transitions.

1. Introduction: Rethinking Natural History Museums Through Design Research

Natural History Museums (NHMs) have undergone a remarkable evolution in the past century. Once mere cabinets of curiosities, they have transformed into essential public institutions for interdisciplinary research and educational innovation. Many Natural History Museums were established in the late 19th century – counting more than 600 institutions worldwide until today. Their purpose now extends beyond showcasing the wonders and curiosities of the natural world, dedicated to studying, preserving, and digitizing our planet's biodiversity. However, with the escalating climate crisis, these institutions must rethink their future roles, transitioning from traditional exhibition spaces to interdisciplinary hubs of knowledge transfer, collaborative learning, responsible innovation, community engagement, public debates, and policymaking (Dorfman, 2018; Bakker et al., 2020; Carnall et al., 2013). Their natural history collections give an idea about the vast biodiversity of this planet, telling unlimited stories of resilience, failure, and creative solutions to environmental challenges. Their well-curated exhibitions halls, showcasing the vast diversity of planetary life evoke great enthusiasm until today and become crucial places where people consciously engage with the unknown and unimaginable. Yet behind this lies a partly questionable past and thought patterns that need to be reconsidered.

Especially in light of pressing societal and ecological issues, such as mass extinction, biodiversity loss, species migration, changing climate, rising sea levels, food insecurities and zoonotic pandemics, there is a need for NHMs to question their complex historical roots entangled with oppressive, racist, colonial pasts and the dissemination of human-centred and Western perspectives on nature. They were a fertile ground for narrations, in which (western) humans were perceived as the dominant species. Paradoxically, Natural History Museums are the origin of an understanding of nature that is responsible for many socio-ecological challenges, for which they are now attempting to generate knowledge and solutions.

So, how can they overcome their pasts and pave the way towards a transition to pluriverse and more-than-human understandings of nature and move beyond static exhibition concepts while evolving into playgrounds for co-creative socio-ecological transitions?

This study is a thought experiment that takes a new and unforeseen perspective on Natural History Museums from the design research perspective. In this case, the design discipline is considered as an important stakeholder to shape societal and ecological transformations while including perspectives and needs of different stakeholders and communities – described as “eco-social transitions”. This highlights the systemic role of design that is negotiated against the backdrop of current socio-ecological challenges and is expanded through approaches such as Transition Design (Irwin, 2015), Eco-Social Design (Krois, 2020) or Pluriversal Design (Escobar, 2017). These approaches distinguish themselves by not aiming to develop ready-made solutions, but by using design to raise ecological and socially relevant questions. Furthermore, design research is understood as a practice-based, interdisciplinary, and participatory mode of knowledge transfer that extends beyond academic thinking (Mareis, 2011). This becomes clear through the rise of “Design Research Labs” that function as institutional hubs for knowledge production and exchange, bridging design, science, society, politics, and the economy. If the design discipline has the power to shape transitions on systemic levels, then it is worth exploring these potentials for the urgent transformation of Natural History Museums. Against this backdrop, this study poses the explorative question: "What if NHMs are understood as Design Research Labs for eco-social transition?" This inquiry serves as a foundation for exploring the potential roles of the design discipline in reshaping NHMs.

2. Challenges of Natural History Museums

Despite their importance for an ecological transition, Natural History Museums are currently facing a broad range of challenges on different levels: from dealing with their colonial pasts, anthropocentric understandings of nature, digitalization efforts, to the race against time to preserve and study biodiversity that is disappearing before it is discovered. These hurdles are the starting point of this exploratory study on the potential of design for NHMs and are summarised below.

2.1 Overcoming Colonial Pasts

NHMs grapple with their colonial past, perpetuating a Western-centric understanding of nature that compartmentalizes species within taxonomic groups, reinforcing hierarchical (Western) human evolutionary perspectives. NHMs have long been associated with racism and colonialism, as many of their collections were amassed during the height of European imperialism (Ashby & Machin, 2021; Das & Lowe, 2018; Sheets-Pyenson, 1987). This colonial legacy has led to criticisms of NHMs for their role in the exploitation and erasure of indigenous peoples and cultures, and for perpetuating a Eurocentric view of this planet. Recently, NHMs have begun to grapple with their colonial pasts in various ways. Some NHMs have acknowledged their role in colonialism and have developed action plans to decolonize their collections, exhibitions, and practices, such as the Musée des Confluence in Lyon (Green, 2019) or the Museum für Naturkunde in Berlin (Kaiser et al., 2023). Decolonial museum practices can include returning artefacts to their rightful owners or communities, employing more diverse staff and leadership, including more Indigenous and people of colour, encouraging visitors to reflect on the historical and ongoing legacies of colonialism, or providing more context for the ways in which collections were acquired and showcasing the impacts of colonialism on the peoples and cultures represented in the collections (Van Broekhoven, 2019). While the number of publications about decolonialisation in NHMs are rising, it can be observed that action plans for decolonizing Natural History Museums are not yet an integral part of current exhibitions and are seldomly part of public engagement activities.

To summarise, a look into the current exhibitions of many NHMs still perpetuates in large parts a western-centric perspective on natural history through traditional exhibition concepts that have merely unchanged since the past decade, for instance the Mineral Gallery at the Natural History Museum in London (see images below).

Dealing with the colonial pasts of NHMs requires a commitment to ongoing dialogue, reflection, and action. It also requires a recognition that colonialism is not only a thing of the past, but an ongoing and present reality that continues to shape the world and the relationships between people and institutions.

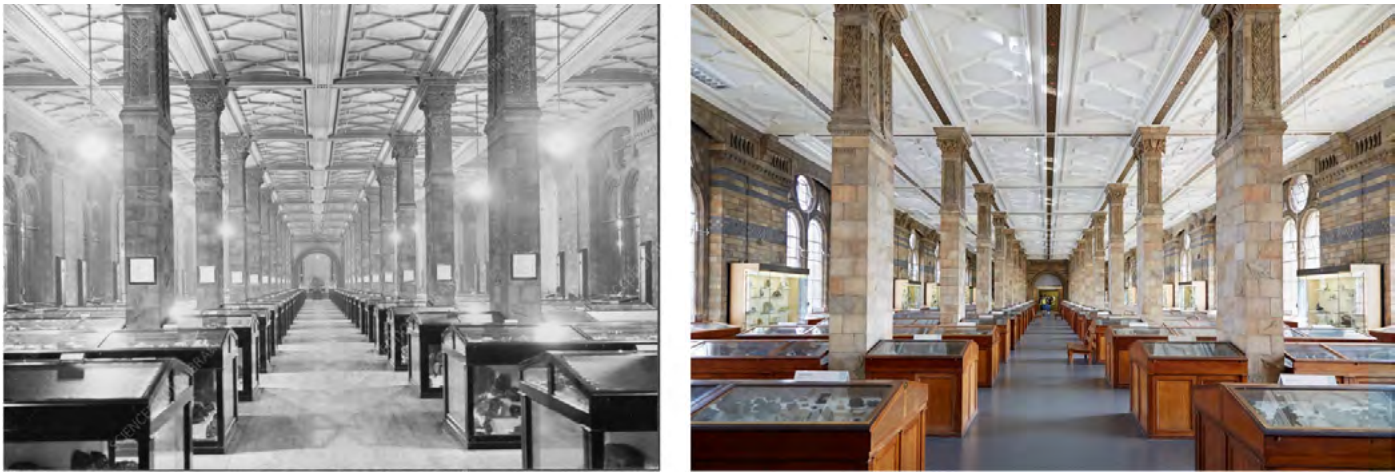


Figure 1. Mineral Gallery in London unchanged since 1881 (1923 and today).

2.2 Rethinking Anthropocentric Understandings of Nature

Natural History Museums (NHMs) have played an important role in gaining knowledge about the interconnectedness of nature, by promoting and interpreting evolutionary theory and Post-Darwinism through their collections, exhibitions, and research programs (Sterling, 2017; Winker, 2004). NHMs have helped establish evolutionary theory as a cornerstone of modern biology and emphasized the interconnectedness of all living things, challenging a human-centred view of nature and establishing a more holistic and integrated understanding of the natural world (Cameron, 2015).

However, NHMs also have a responsibility to address the ways in which their exhibitions and research programs may perpetuate a critically human-dominated and Western-centric understanding of nature. This includes recognizing the impact of the Linnaean system of classification, which has reinforced a human-centred view of nature, reflected Western cultural and philosophical assumptions, and been used to justify the exploitation and domination of non-human organisms and the natural world.

In the context of ecological crisis, it is particularly important for NHMs to take a critical approach to their exhibitions and research programs to challenge human-centred views of nature and establish a more sustainable and equitable relationship between humans, cultures and nature. This study postulates, that NHMs need to find new ways to do this by emphasizing multispecies perspectives that are challenging human exceptionalism. Furthermore, they need to embrace different ways of nature knowledge that go beyond academic knowledge-production.

2.3 Curating the Anthropocene

Against the backdrop of the Anthropocene, NHMs are facing the challenge to include present narratives of a natural history, shaped by human impacts and ecological crisis. This requires a perspective on overarching global connections and impacts of issues such as climate change and biodiversity loss, as well as a reflection of what the effects mean concretely at the local level for different communities (Cameron et al., 2013; Newell et al., 2017; (Koster et al., 2017). Climate change can have different meanings for communities based on geographical roots, values, and cultural beliefs (Hulme, 2014; Reichel, 2020). It emphasizes the moral responsibilities of museums to address socio-ecological challenges, not just by communicating scientific facts but also by engaging communities to debate what the impacts and necessary measures for the preservation of habitats and ecosystems mean for their everyday life. Natural History Museums thus also have a political responsibility, which in turn leads to the challenge of mastering the balancing act between a neutral educational institution and becoming an agent of change.

2.4 Telling Post-Natural Histories and Futures

In addition to the point above, a further challenge is to show how natural history will be written in the future. How do species adapt to a changing climate and anthropocentric habitats? And how do they expand the human-centred concept of the environment and ecosystem in natural history? Adaptation strategies in natural history can be summarized in under the acronym MAD—Migrate, Adapt, or Die. Particularly, migration and the associated invasion of species pose challenge to deal with a high number of uncertainties and unforeseeable consequences in urban and rural planning. Humans have changed the environment so profoundly that it cannot be reverted to its original state – many species have adapted to these new environments, especially observable in urban spaces. Here, Natural History Museums, as central research institutions for the study of evolution, can make a significant contribution to shaping future habitats that provide healthy environments for human and non-human beings (Bakker et al., 2020; Sterling, 2017).

However, human activities (such as urban planning, agriculture or the use of pesticides) also lead to a significant loss of biodiversity. At the same time, a development in modern biotechnology is observable, whose transformative power can have a profound impact on the evolution of life. Genetic research and

synthetic biology not only allow us to read the code of life (DNA) but also to entirely rewrite it. As a result, species could be genetically modified to adapt more quickly to new environmental conditions, however, the effects of such changes on very complex ecosystems are difficult to predict. Some research projects go even further and aim to synthetically create life or even revive extinct species (see George Church or Craig Venter). These developments merge technology, nature, and culture in a very drastic way. They write a new chapter in the natural history of the future. While such developments are already addressed through speculative design interventions in museum contexts (design and art museums, e.g. “Designing for the Sixth Extinction” by Alexandra Daisy Ginsberg), they are only sporadically explored in Natural History Museums. These developments pose a question for Natural History Museums on how they can curate possible natural histories of the future.

2.5 Digitalizing the Infinite

Today, NHMs serve as crucial repositories of genomic information, enabling scientists to unravel ecological and evolutionary knowledge using technological innovations in genetic research, to explore the museum collections in a way that was not imaginable 50 years ago. However, accessibility to the vast and expanding natural history collections remains a challenge, as the majority is hidden behind public exhibition areas and distributed to a few institutions in the western hemisphere (e.g., the Natural History Museums in Washington, Chicago, or London, Berlin). NHMs want to overcome these challenges by digitalizing their collections and adding digital information layers to the specimens and to share them on a global scale (Bakker et al., 2020).

Despite extensive digitization efforts, the full potential of these “extended specimens” (Lendemer et al., 2020) remains underutilized, as there are challenges to make digital archives accessible and to link different knowledge bases (Bakker et al., 2020). Moreover, digitization is associated with high financial costs, which often come at the expense of research. Resources are diverted that are necessary to research and expand collections. The discovery of new species highlights the vastness of the unknown. In particular, the most abundant species, such as insects and microorganisms, and invisible but very relevant actors in ecosystems, are estimated to be only marginally recorded and researched. Preserving and researching these collections is crucial, encapsulating not only billions of years of evolution but also lessons and narratives of resilience, strategy, and innovation. However, in the face of climate change, many species are dying out before they can be discovered and researched.

Above all these specific challenges, NHMs struggle with their own accessibility, aiming to attract "non-visitors" and questioning how to extend the NHM beyond the museum space. Visitors continue to enjoy consistent or increasing numbers, but NHMs remain static places with exhibition concepts largely unchanged for the past 100 years—stuffed animals, minerals, fossils, dinosaurs, and biodiversity walls. Many Natural History Museums, such as the NHM in Berlin are still based on concepts dating back to the 1890s, separating Education and Scientific Collections in the "New Museum" concept (Moldrzyk, 2015). Thus, the challenge lies in bridging science, society, and nature, evolving from occasional public engagement activities towards consistent playgrounds for participation and democracy.

3. The Future Natural History Museum – A Design Challenge?

This study underscores the role of Natural History Museums that integrate exhibition curation with ongoing research in biodiversity, the development of tools for exploration, conservation, and digitization of collections, as well as the establishment and research of educational formats targeting the inclusion of societal target groups. The NHM in Berlin (Museum für Naturkunde Berlin, MfN) serves as an illustrative example. As a former research associate at MfN, the author of this study spent over a year conducting auto-ethnographic observations about challenges and possibilities for NHMs from a design research perspective. The NHM in Berlin boasts one of the largest collections with 30 million specimens in Europe, represents an intriguing use case, as it discusses some innovative initiatives and visions (Moldrzyk, 2015; Rössig et al., 2023)– simultaneously, it shares overall challenges faced by other NHMs, making the implementation of

these initiatives difficult or very slow. Among the initiatives are architectural and strategic reconceptualisations (as exemplified by the "Zukunftsplan" and “Museum Evolution”), as well as new curatorial and collecting approaches (e.g. Moldrzyk, 2015; Sturm et al., 2022), knowledge-transfer initiatives (Weißpflug et al., 2019), and cross-cultural collaborations (as illustrated by the “Museums Lab”). Additionally, MfN Berlin promotes several projects at the intersection of art, design, and science, such as *Art/Nature Interventions* (Hermannstädter, 2019)*Mediasphere for Nature Lab*, *Experimentierfeld* (Rössig et al., 2023), *Netzwerk Naturwissen*, or the *Pollinator Pathmaker* in collaboration with Daisy Ginsberg and the LAS Art Foundation. These initiatives negotiate the future roles and relevance of the museum and demonstrate potential interdisciplinary collaboration with the art and design sector.

However, the museum faces central challenges in translating its vision of becoming an interdisciplinary hub for public engagement and nature-based innovations into reality. These challenges include those explained above, as well as structural issues such as short-term contracts and project durations due to public funding logics, bureaucratic processes, high departmental competition, rigid hierarchical structures on middle management levels, traditional organisational culture, public accessibility, and a lack of open spaces in the exhibition area for explorative formats, to name a few.

So, what is the matter with design? A significant challenge facing the potential of collaborations between design, art, and science lies in the prevalent misunderstanding of design and artistic research within institutional frameworks. Art and design are often perceived primarily as tools for enhancing science communication and public engagement, serving to make scientific concepts more accessible or entertaining to a wide audience. However, in initiatives aimed at Public Engagement within NHMs, this misconception of design proves detrimental.

Public Engagement involves fostering a mutual dialogue between society and science, aiming to address societal needs early in research and innovation processes. Yet, this objective is compromised when design is merely utilized to aesthetically enhance predetermined scientific content for a target audience. Such an approach contradicts contemporary discourses on the transformative potential of design, including Transition Design, Public Interest Design, and Speculative and Critical Design Practices, which advocate for a broader role of design in fostering societal debates.

This paradigm shift entails not only *designing for* communities but also *co-designing with* them. Therefore, for Public Engagement to serve as a vital strategic component within NHMs, the potential of design lies not in the creation of creative participation formats or exhibition concepts but rather in facilitating critical reflections on the roles of NHMs in society. The author posits that by regarding design as an agent of change within NHMs, design researchers can lead impact-oriented, interdisciplinary, and practice-based transformation processes that embrace diverse perspectives and modes of knowledge production.

Against the backdrop of the ecological crisis, which holds varied meanings for different communities, there is an urgent need for more empathetic, inclusive approaches to Public Engagement. Merely fulfilling research-political demands for increased participation risks relegating individuals to involuntary roles in sporadic outreach activities, often lacking in meaningful engagement.

To summarise, participation and involvement are essential drivers for socio-ecological transformations, particularly within public spaces such as NHMs. Therefore, the development of inclusive engagement strategies through design becomes crucial for shaping the future transitions of NHMs.

While this study addresses sensitive issues within NHMs, its aim is not solely to critique challenges but to provide space for radical reimagining from a design perspective. It proposes reconceptualizing NHMs as venues for design-driven innovations, democracy, and safe spaces for exploring collaborative visions of the future that integrate both human and non-human needs.

Furthermore, it advocates for the repositioning of NHMs as co-creative innovation hubs, where design, critical societal reflection, interdisciplinary collaborations, and radical innovations converge to generate

tangible roadmaps for eco-social transitions. These transitions address pressing issues such as biodiversity loss, rising sea levels, climate change, food security, and zoonotic pandemic diseases.

4. The Potentials of Design for Sustainable Transitions

4.1 Current Developments in Design

In summary, there is a fundamental lack of discourse on understanding and knowledge about the actual potentials of design for sustainable transformation, societal inclusion, and critical thinking within Natural History Museums. This gap exists despite ongoing discussions since the 1960s, such as the *Design Methods Movement*, *Radical Design*, or *Participatory Design*, further developed and researched today under numerous practice approaches: Social Design, Transition Design, Critical and Speculative Design, Pluriversal Design, Multispecies Design only to mention a few.

These approaches demonstrate design potentials beyond capitalist, market-driven and (western) human-centric understandings of innovation and transformation. Design plays crucial roles in transdisciplinary and transcultural knowledge transfer by including different stakeholders and approaches from science, politics, business, and ecology from the outset. The involvement of local communities plays a central role, simultaneously expanding the concept of the public towards a more-than-human-centred understanding that also involves the interests of non-human beings (Harles, 2024). Design also acts as an enabler, actively involving target groups through design-based methods to explore and shape desirable futures collaboratively, as well as to critically question technological and societal developments. The potential of design as a relevant force in societal transformation processes becomes obvious within as well outside the discipline.

On the one hand, there is a trend in student projects at interdisciplinary intersections with social and ecological sustainability, showing that emerging designers are aware of their responsibility during their education, as initiatives like the Dutch Design Week or German Design Graduates Award demonstrate. Examples include sustainable material design, critical interventions, and the design of social safe zones.

On the other hand, there is also a structural change through the increasing promotion and establishment of knowledge transfer offices at design universities and networks explicitly seeking application-oriented collaboration to tackle societal and ecological challenges. These transfer offices become essential actors for transformation processes and are often referred to as “Design Research Labs”, such as the Sustainability by Design Lab at Folkwang University of the Arts, Burg Labs at Burg Giebichenstein University of Art, DESIS Labs or the Design Friction Lab at the University of Bozen, to name a few.

Against this background, this study wants to highlight these structural, methodological, and practical approaches evolving in design discipline to showcase how they can support NHMs to transition from static intuitions to driving forces for co-creative innovations, public engagement, educational spaces, political debating grounds for nature rights, and socio-ecological transitions.

4.2 Proposing Design Research Labs as Interfaces for Natural History Museums

The paper emphasizes the untapped potential of Design Research Labs within NHMs as "platforms for collaborative inquiry based on design experiments" (Binder & Brandt, 2008), bridging the gap between lessons learned from the past, contemporary challenges, and collective imaginaries of the future. Design Research Labs seek collaboration between stakeholders from design, public, politics, science and economy and offer unexplored potentials for sustainable transitions which can be summarized through four pillars (Augsten & Harles, 2024):

- Fostering Real-life Innovations: Design Research Labs (DRLs) blend controlled lab environments with real-world scenarios, engaging diverse stakeholders for collaborative knowledge production.
- Acting Responsible and Mission-oriented: DRLs prioritize societal issues, aligning with Responsible Research and Innovation frameworks. They involve the public, marginalized groups, and non-human entities in research, fostering comprehensive, ethically sound, and sustainable innovations.
- Crafting Collaborative Images of the Future: DRLs address uncertainties by intertwining technological, societal, and ecological trends, using design-based approaches like Design Fiction and Speculative Design to facilitate discussions, anticipate future developments, and initiate societal progress.
- Promoting a Multiplicity of Knowledge: DRLs redefine knowledge production by encouraging design-based processes that go beyond traditional academic approaches. They empower both experts and non-experts, promoting shared authorship and inclusive design-based public engagement, ultimately reshaping scientific outcomes.

Against this backdrop, this exploratory paper asks whether the concept of Design Research Labs can act as an interface that bridges the societal responsibility of Natural History Museums with the transformative potentials of design. This leads to a speculative design investigation, opening up a debating ground for stakeholders from the design discipline and NHMs alike: "What if NHMs are understood as Design Research Labs for eco-social transition?" This lays the foundation for the creation of speculative scenarios that explore the transformative potential of design within NHMs.

5. Methodology

The aim of this study is to explore how Natural History Museums can be reconceptualized as Design Research Labs for climate action through speculative scenarios. Drawing on interviews, literature research, and use-case analysis, the paper explores five fields of action for NHMs by developing speculative scenarios with distinct special focuses on relevant developments within the design discipline.
As these scenarios are currently a work-in-progress, this paper gives an overview about the methodological approach, the research framework and first results of possible speculations.

5.1 Research Framework

Since the intersection between design research, design labs, and natural history museums is a subject of investigation that has received little attention thus far, this study attempts to develop its own approach through interdisciplinary integration of various theories and methods. These form the basis for scenario development. The theoretical research is built on three pillars that combine theoretical and practical concepts from museum studies, design research, and anthropology.

1. Museum Studies:
   While focusing on the Natural History Museum as the subject of investigation through design, it is pertinent to outline developments and theoretical concepts discussed in Museum Studies, that are dealing with different modes of visitor and community engagement that extend beyond one-directional science communication such as the *Metabolic Museum* (Deliss, 2020), *Liquid Museum*, the *Interrogative Museum* (Karp & Kratz, 2015)or *The Museum as Process* (Silverman, 2015). A special research focus lies in exploring discussions on science museums, particularly Natural History Museums, at the intersection of Climate Change, the Anthropocene, and future thinking (Dorfman, 2018; Cameron & Nielson, 2015; Newell et al., 2017).

These theoretical foundations provide the fertile starting ground for further explorations into what is coined by the author as *"The Museum as Design Lab."* This concept involves viewing museums not only as repositories of artifacts but as dynamic spaces for design experimentation and innovation.

2. Design Labs as Agents of Change and Knowledge Culture:
To argue the value of the design discipline in transforming static places into hubs for participation, democracy, social innovation, and climate action, the study is based on ongoing investigation of unexplored potentials of *Design Research Labs* as agents of change (Augsten & Harles, 2024). This research builds upon the definition by Binder, who describes labs as 'platforms for collaborative inquiry based on design experiments' (Binder & Brandt 2008). This concept is currently gaining popularity within design education in the D-A-CH region through increased funded projects, such as the *Sustainability by Design Lab* at the University of the Arts Folkwang and *Burg Labs* at the Burg Giebichenstein.
3. Potentials of Speculative, Multispecies, and Pluriversal Design Approaches:
Based on the exploration of Design Research labs, a further look onto specific methodological developments applied within these labs is crucial to pave the way towards practice-based transformative shift. These include *Critical and Speculative Design practices* (Auger, 2013; Bleecker, 2009; Dunne & Raby, 2013; Heidingsfelder, 2018), *Multispecies and Interspecies Design* (Gatto & McCardle, 2019; Haldrup et al., 2022; Harles, 2024; Mancini & Lehtonen, 2018; Metcalfe, 2015; Roudavski, 2021), and Pluriversal and *Decolonizing Design* (Escobar, 2017; Tunstall, 2013*)*. This theoretical deep dive serves as a bridge to the practical part of the research project, illustrated by a range of use-cases. The aim is to provide guidance and requirements for actions that demonstrate the impacts of design-led approaches from a strategic level to practical implementation within NHMs' programs and activities. A special focus is placed on the vast potentials of multispecies design approaches for public engagement, drawing from *the non-human turn* in humanities and social sciences (Grusin, 2015). This encompasses multispecies ethnographies, multispecies histories, posthumanism, political ecologies, among other areas (Haraway, 2013; Kirksey & Helmreich, 2010; Latour & Latour, 2007; Tsing, 2023).

In addition to the theoretical research, a further investigation use-cases at the intersection of design of design practices, museum studies, natural histories, and Anthropocene challenges is part of the research framework. Examples also include investigations on transformative concepts of Natural History Museum, such as the *Richard Gilder Center for Education and Innovation* at the American Museum for Natural History in New York, Musée des Confluences in Lyon or the Naturalis in Leiden. A detailed description of these use-case goes beyond the scope of this paper.

6. Speculations on the Natural History Museum of the Future

The following section briefly outlines four speculative Design Research Lab concepts that are currently being further developed. These initial drafts present initial possible approaches and are open for discussion.

6.1 The Pluriversal Knowledge Lab

This scenario explores the potential of Pluriversal and Decolonizing Design approaches (Escobar, 2017; Tunstall, 2019). Both concepts aim to challenge and transcend dominant Western, colonial, and anthropocentric perspectives that have traditionally influenced design practice and education. Pluriversal and decolonizing design seeks to foster a more diverse, inclusive, and equitable design environment while questioning established Western, colonial, and anthropocentric norms. They aspire to create spaces and processes that enable the coexistence and co-creation of multiple worlds, supporting the self-

determination and self-representation of marginalized communities and contributing to the dismantling of colonial and imperial structures. Additionally, both concepts are concerned with decolonizing knowledge and power structures and promoting a more diverse, inclusive, and equitable design practice and education.

This scenario will investigate how these design approaches provide methodological knowledge for scrutinizing the value of indigenous knowledge and exploring colonial legacies within Natural History Museums.

6.2 The Post Nature Lab

This scenario explores influential concepts of Discursive, Critical, and Speculative Design (Dunne & Raby, 2013; Tharp & Tharp, 2018; Heidingsfelder, 2019) that enable Natural History Museums (NHMs) to reconsider their public engagement strategies, taking action towards future natural histories defined by anthropocentric impacts and driven by significant advancements in Modern Biotechnology and Synthetic Biology. Speculative Design Practices (SDP) constitute a collective category rooted in Radical Design since the 1960s, incorporating methodologies like Speculative Design, Design Fiction, and Adversarial Design. These approaches aim to detach design from market-oriented utility, critically examining societal, technological, economic, and ecological developments. Instead of describing current conditions, they generate fictional narratives and prototypes to stimulate discourse. Recognized beyond disciplinary boundaries, SDP engages the public in scientific and technological innovations. Against the backdrop of climate change, it has the potential to connect researchers, industrial partners, and society to question post-natural developments and their implications on the natural histories of the future. SDP offers the potential to integrate speculative artifacts as a significant part of public outreach. In contrast to previous artifacts and specimens, these are not intended as passive objects of observation but encourage active participation. They bridge lessons from the past with challenges of the present through speculative imaginaries of the future.

6.3 The Nature Rights Lab

This scenario explores the potential of More-than-Human and Multispecies Design approaches (Gatto & McCardle, 2019; Mancini & Lehtonen, 2018; Metcalf, 2015) that engage with non-human agents in the design process. These diverse initiatives, spanning environmental conservation, multispecies urban habitats, coastal region enhancement prototypes, human-plant interactions, and Animal-Computer Interaction for non-human empathy, employ speculative and immersive methodologies. Contemplating socio-ecological challenges from a more-than-human perspective, they generate research questions at the intersection of multispecies ethnographies, conservation, and biological impact assessments. Actively collaborating with experts, NGOs, communities, and stakeholders fosters knowledge transfer and meaningful partnerships. By bridging theory and practice, they contribute to a nuanced approach in speculative design, addressing urgent socio-ecological challenges and translating debates into tangible actions for improvement. Furthermore, the potential of Multispecies Engagement becomes visible in policymaking and democratic processes, where other-than-human beings are considered eligible actors in democratic processes (Sheikh et al., 2023). The necessity to include non-human agents becomes evident as the notion of granting legal rights to non-human beings gains traction at governmental levels, exemplified by initiatives like the “Sumac Kawsay” in Ecuador or the “Te Awa Tupua Act” in New Zealand (Kauffmann & Martin, 2018). They encourage strengthening the political responsibility of NHMs by including other-than-human beings in discussions. In this way, NHMs can rethink public and policy engagement beyond intervention formats toward co-creative policymaking processes.

6.4 The Otherminds Lab

This scenario explores Animal-Interaction Design (Hook, 2019)anticipating the otherness of non-human beings, paving the way for human-nature-machine interactions, and learning from “otherminds,”

representing non-human forms of intelligence (e.g., plants or cephalopods). This scenario lies at the intersection of the first three scenarios above. It pushes the boundaries of the educational and research programs of NHMs, speculating on how such institutions can also position themselves as important collaborators in applied innovation research.

7. Summary and Conclusion

In reimagining the role of Natural History Museums through the lens of design research, this study delves into the evolving narrative of these institutions, recognizing their historical transformations and the pivotal juncture they face amidst escalating ecological crises. From their origins as mere cabinets of curiosities, NHMs have grown into essential interdisciplinary hubs, tasked with studying, preserving, and digitizing the planet's biodiversity.

The challenges confronted by NHMs are multifaceted, ranging from grappling with colonial pasts and anthropocentric views of nature to addressing climate futures, post-natural histories, and the digitalization of vast collections. The paper not only underscores the hurdles faced by NHMs but also introduces a novel perspective, proposing a fundamental shift – envisioning NHMs as Design Research Labs for climate action.

By framing NHMs as Design Research Labs, the study aims to explore the untapped potential of the design discipline in reshaping these institutions. Design Research Labs, as interfaces between design, science, society, and politics, are presented as platforms for collaborative inquiry, fostering real-life innovations, responsible mission-oriented actions, crafting collaborative images of the future, and promoting a multiplicity of knowledge. The paper suggests that such labs within NHMs could serve as dynamic spaces where societal responsibility meets the transformative power of design.

The challenges identified, such as overcoming colonial legacies and anthropocentric perspectives, are viewed not merely as obstacles but as opportunities for design-driven democracy and inclusive participation. The study argues for a paradigm shift, emphasizing that design should be more than an embellishment for science communication. Instead, it should play a strategic role in shaping impactful, empathetic, and inclusive public engagement processes.

In considering NHMs as potential Design Research Labs, the paper raises a speculative question: "What if NHMs are understood as Design Research Labs for eco-social transition?" This inquiry prompts exploration into the transformative potentials of design, initiating a conversation that extends beyond the traditional boundaries of NHMs. The envisioned future is one where NHMs evolve into dynamic, participatory spaces, bridging the gap between static exhibitions and collaborative platforms for socio-ecological imaginaries of the future.

In conclusion, this study serves as a call to action, urging NHMs to embrace their potential as catalysts for biodiversity conservation, environmental justice, and planetary health through design-driven approaches. The envisioned Design Research Labs within NHMs are proposed as catalysts for change, reshaping the narrative of these institutions and fostering a broader understanding of their roles in the face of complex socio-ecological challenges.

By showcasing these use-cases and speculative scenarios for contemplation, the paper not only encourages a reassessment of NHMs as Design Research Labs but also seeks to stimulate conversations about the spatial dimensions of design research and practice within emerging interdisciplinary environments like NHMs.

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P/REFERENCES OF DESIGN

SERVICE DESIGN FOR FOOD SYSTEMS: AN EDUCATIONAL EXPERIMENT TO EXPLORE ALTERNATIVES FOR THE MILANESE FOOD SYSTEM IN ITALY.

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KEYWORDS | SERVICE DESIGN, SERVICE MASTER PLAN, URBAN FOOD SYSTEM, ALTERNATIVE FOOD NETWORKS

ABSTRACT | Prioritizing sustainable and fair food is essential to achieve the Sustainable Development Goals. While food systems contribute significantly to climate change and social inequality, these issues also severely impact them. Moreover, urbanization intensifies these concerns in cities, highlighting the need for design interventions across various domains. In this context, the Milanese Food System presents an interesting study area. Since 2015, the city has seen alternative food networks flourish alongside the conventional supply chain. These contributions have emerged as critical transformational nodes within Milan's food system. However, together with the conventional ones, they face several challenges, mainly connected to their evolution into actual service solutions. This paper presents ten service design projects by MSc students from the School of Design of Politecnico di Milano (A.Y. 2023-2024) that challenge and rethink the current Milanese Food System and its nodes. Solutions intend to combine social and environmental sustainability in a mitigation or adaptation strategy. At the end of the course, students and the teaching staff collaborated to map their projects into what the authors define as a 'Service Master Plan' for the Milanese Food System in 2030. The plan, already shared with stakeholders in the closing event of the course, provides a comprehensive overview of the actions, people, and infrastructure necessary to implement node-related changes in the city, offering provocations for future development. The course was developed under the OnFoods project, which aims to set the basis for starting design-driven conversations with the Milanese Food System actors, igniting design activism processes that could influence decision-making policies.

1. Background Knowledge: Food Systems, Urban Areas, and Service Design

Contemporary food systems manifest a paradox within themselves. On the one hand, food is one of the goods whose production, delivery, and consumption impact climate change and social inequalities; on the other, climate change has directly reduced food security by affecting water safety and agricultural productivity. If we keep moving inside this paradox, there will be negative impacts on the achievement of the Sustainable Development Goals, as envisioned in the 2030 Agenda for Sustainable Development (IPCC, 2023).

FAO projections (2003) indicate that by 2050, almost seven in ten people will live in cities. With the current food consumption behaviours and globalization of goods, this increasing trend makes cities a strategic point for food studies. During the last years, since the outbreak of the COVID-19 pandemic in 2020 and the conflict in Ukraine in 2022, the weaknesses of the current food system have been exposed, showing an increase in food insecurity and global hunger in comparison to pre-pandemic numbers (FAO, 2023).

Urban areas are relevant in studying agri-food systems, given their impact on food production, distribution, procurement, and consumption. Factors such as the consequences of population density, the effect of citizens' consumption choices, and the emergencies cities risk facing because of climate change (FAO, 2023) make urban areas a context in which possible design actions are several and touch many points of the food system, directly involving the demand side (IPCC, 2023).

Knorr et al. (2018) discuss the challenges of urban food systems and how their complex interrelationships have made it harder to ensure a resilient supply chain. They also underline the impact that the current large-scale and centralized approach to food production has had on the accessibility to food in cities. Because of this complexity and the short time ahead, a deep and effective systemic rethinking is urgently required.

In this context, Milan stands out as an area of study. Since 2015, the city has taken a path of envisioning a new food system with a focus on sustainability. After the Expo 2015, 'Feeding the Planet, Energy for Life', Milan Municipality implemented its own Food Policy. Through the Food Policy, and with actions involving citizens and local organisations, the city has set a future vision for its food system. It is working to rebalance the presence of different operators, rewarding supply chains and systems that prove to be more socially and environmentally virtuous (Comune di Milano, 2024).

Over the past nine years, the city has continued its path towards optimising the food system by involving all stakeholders in improving food quality, promoting healthier and more sustainable diets, creating advanced logistics platforms, coordinating major operators, supporting local producers and businesses, and fighting food waste. A big part of this work comes from informed and proactive groups of citizens joining together to experiment with alternative solutions to the large-centralised system. We can cluster these actions under the umbrella of Alternative Food Networks (AFN); a concept that, as Michael-Villareal et al. (2018) define, arrives in opposition to conventional food systems. While the main distinctions between the two models still need to be clarified, some authors have characterised AFNs by their proximity (short distances, etc.) and sustainability. In this direction, Milan has encouraged experimentation with alternative solutions in an effort to radically transform food practices, increase participation, and spread environmental and social sustainability practices. The city promotes the integration of various systems, scales, and actors within these approaches. Awareness, activation, and collaboration of all stakeholders are recognized as priorities to achieve the changes made urgent by climate change and growing social disparities (Comune di Milano, 2024).

Food system actors use adaptation and mitigation[1] strategies to rethink the Milanese food system processes, to integrate new services, and connect its different nodes. A 'node' is a space (digital, physical or both) inside of the system where different actors and products interact and make exchanges (Aucoin & Fry, 2015). In the case of Milan, the identified nodes are the wholesale market, indoor and outdoor markets, food waste hubs, farmers' markets, and public and private canteens. These nodes constitute an interconnected network that, although characteristic of Milan, can also be identified in other urban areas.

Although Milan has received international recognition for its good practices and policy vision, it still faces many challenges due to the complexity of the system. Several nodes and actors interact at different levels of governance, with imbalanced power, and low and inefficient communication between them. Additionally, managing complex logistics is difficult. As a result, AFNs may struggle to create a model that allows them to replicate or scale their initiatives and distribute their services to different contexts while safeguarding their purpose and identity. Here, there is a clear opportunity and need to rethink Milan's nodes around food.

Design has long played a role in the food sector, covering areas from products and packaging to services and strategies. In cities like Milan, design has significant potential to impact the food system, especially on the demand side. Here, we have identified design opportunities in various areas regarding solutions around mitigation and adaptation strategies. These strategies are crucial not just for cutting carbon emissions but also for addressing climate change impacts (Wang et al., 2023). Studies show that feasible, effective, and low-cost mitigation and adaptation options exist, and that many options are available for reducing emission-intensive consumption, including behavioural and lifestyle changes, which can improve societal well-being. Moreover, research also highlights the importance of integrating climate adaptation into social protection programmes to improve resilience (IPCC, 2023).

This paper presents ten service design projects by MSc students from the School of Design of the Politecnico di Milano (A.Y. 2023-2024) that challenge and rethink the current Milanese Food System and its nodes. Solutions intend to combine social and environmental sustainability in a strategy of mitigation or adaptation. At the end of the course, students and the teaching staff collaborated to map their projects into what the authors define as a 'Service Master Plan' for the food system of Milan in 2030. The plan provides a comprehensive overview of the actions, people, and infrastructure necessary to implement node-related changes in the city.

Following this introduction, the paper outlines the methodology implemented in the design studio course, proceeds with descriptions of the student projects, and concludes with a focus on the Service Master Plan, highlighting results and next steps.

2. A Case Study: Envisioning Alternatives for the Milanese Food System in the 'Urban Food Systems' Design Studio

Our case study builds on the current work of the Politecnico di Milano for OnFoods, a research programme funded under the National Recovery and Resilience Plan (NRRP). The university is working on Spoke 1 of the programme, which aims to improve the efficiency of food value chains to provide food access for society's most vulnerable.

As part of this project, a team of service design researchers from the Polimi Desis Lab is developing scenarios for Milan's food system in 2035. These scenarios intend to spark design-driven conversations with

[1] Adaptation means anticipating the adverse effects of climate change and taking appropriate action to prevent or minimise the damage they can cause, or taking advantage of opportunities that may arise. (...) In essence, adaptation can be understood as the process of adjusting to the current and future effects of climate change (European Environment Agency, 2023). Mitigation means making the impacts of climate change less severe by preventing or reducing the emission of greenhouse gases (GHG) into the atmosphere. (...) In short, mitigation is a human intervention that reduces the sources of GHG emissions and/or enhances the sinks (European Environment Agency, 2023).

different food system actors, identifying contexts that improve food access in the city and encourage new partnerships. The project will end in 2026 with pre-prototyping these new food services, showcasing possible evolutions of the food system.

Aligning with the research project, the ‘Urban Food Systems’ Final Synthesis Studio (LSF) course of the 2023/2024 academic year explored opportunities for reimagining existing or creating new services centred around food in Milan. LSF courses at Politecnico are the culmination of the master's degree in Product-Service System Design. They wrap up the programme's design work by teaching business modelling and co-design methods, preparing students to tackle complex challenges. Each LSF has a unique topic, runs for 4 months, and closes with a public event.

The LSF named ‘Urban Food Systems’ had the general goal of designing a collection of services and solutions that would focus on social and environmental sustainability and combine them into a strategy of adaptation or mitigation to climate change. Students worked with different 'nodes' within the system: pivotal points where significant activities and interactions related to food production, transformation, distribution, and consumption occur. These nodes are the wholesale market, the food hubs, the indoor markets, street markets, farmers' markets, and public and private canteens.

Each node is assigned starting challenges to guide the student's path (table 1). These challenges were identified in advance thanks to the first research phase of the OnFoods project. Here, design researchers analysed food-related nodes from Milan and other cities worldwide through mainly desk research, on-site visits, and interviews with different actors. This process supported the recognition of the most critical nodes and actors in Milan and opened the conversation about the sustainability issues they usually faced. Issues were summarised in eighteen challenges, representing the situation of one node, or different nodes, or the whole food system.

For each node, a short description in the Milanese context is provided below:

Wholesale market: Milan's fruit and vegetable wholesale market, managed by SOGEMI (the Joint Stock Company that, on behalf of the city, manages its wholesale agri-food markets), is the largest wholesale market in Italy, supplying national and international goods to Italy and Europe. Based on small and medium business clients, they also open their spaces to the public on Saturday mornings, selling food at lower prices.

Other activities connect to the distribution of surplus food for charitable purposes.

Food hubs: The Neighbourhood Hubs Against Food Waste are a Milan Food Policy project. The initiative aims to reduce urban food insecurity and food waste by implementing innovative ways of recovering and redistributing surplus food to fragile citizens. Together, actors from the private and public sectors, associations, and academia join to offer food and welfare services at the neighbourhood level.

Indoor markets: Milan's municipality established covered markets in response to urban expansion and growing commercial activities. These markets hold historical significance for Milanese citizens. However, after years of witnessing their commercial activities decrease and their infrastructures decay, the municipality has started a renewal project. The project aims to transform these markets into diffused food distribution points around the city, where citizens can access different non-food services.

Street markets: Itinerant markets that move around neighbourhoods in Milan selling fresh food sourced from the wholesale market. They improve access to fresh food in areas where there are no other markets. However, they face challenges related to their use of public spaces, such as safety concerns, street circulation, and ensuring that the public space is clean after use.

Farmers' markets: Weekly markets where small producers and food crafters from areas near Milan sell their products directly to the public. These markets are always located in the same area, and their participants comply with a set of sustainable and social values for the production and distribution of their goods.

University canteens: They operate through a contracting process, where businesses compete in an open call, and the contract is awarded to the company that presents the most cost-effective proposal. Unfortunately, this approach has led to university food services that often overlook environmental and social considerations.

Table 1. The challenges and nodes.

Challenges	Wholesale market	Farmers' market	Food hubs	Indoor markets	Street markets	University canteens
1. Reducing food waste in all steps of the food chain, from producer to consumer (from: canteens, restaurants, and catering services; greengroceries, indoor and outdoor district markets; the wholesale market; home)	X	X	X	X	X	X
2. Reducing emission of CO2 in all steps of the food chain, from producer to consumer, and achieving net-zero carbon food systems.	X	X	X	X	X	X
3. Facilitating the local supply of local produce to restaurants and canteens.	X	X	X	X	X	X
4.Designing sustainable intra city transportation solutions for food recovery, distribution, and delivery for both B2C and BTB supply chains, considering light vehicles and means.	X	X	X	X	X	X
5. Improving traceability of local food supply chains, including food recovery and redistribution, for social purposes.	X	X	X	X	X	X
6. Defining strategies and solutions to develop agriculture and food production activities within the city (outdoor/indoor).	X	X	X	X	X	X
7. Facilitating the accessibility of final consumers to the wholesale market, to purchase surplus/end-of-life food in bulk.	X					
8. Integrating the kitchen of Milan Restoration (the main food catering for the school system and welfare services in Milano) to the wholesale market.	X		X			X
9. Facilitating the planning, running and management of a farmers' market for both organizers and participants.		X				
10. Facilitating customer access and loyalty to a farmers' market.		X				

11. Integrating food hubs into neighbourhoods and combine them with relevant and complementary services, such as welfare and social services, composting, education, food processing and transformation, etc.			X			
12. Integrating the food neighbourhood hubs with the wholesale market and with the food-hub there located			X			
13. Designing an innovative concept of indoor food market in an integration with the wider food system and the neighbourhood.				X		
14. Increasing and improving the collection and redistribution for charity and social purposes of the surplus/end-of-life food, from outdoor street markets and indoor markets.			X	X	X	
15. Integrating policies and services of healthy dietary guidelines with sustainability guidelines	X	X	X	X	X	X
16. Increasing the consumption of fresh food and plant-based foods, reducing animal proteins in the human diet.	X	X	X	X	X	X
17. Understanding and improving the condition of health and nutrition inequity, and access to urban fresh and healthy food, combating maldistribution of nutrition intake.	X	X	X	X	X	X
18. Providing fresh, nutritious, and quality food to vulnerable people (people in need, urban poor, working poor, etc.) while ensuring fair treatment of all actors.	X	X	X	X	X	X

3. From Research to Service Development: The 'Urban Food Systems' Studio Journey

The field of service design encompasses a wide range of applications. In this final synthesis studio (LSF), the approach to services was twofold. At the node level, the aim was to improve existing solutions or suggest new ones (Meroni & Sangiorgi, 2011), focusing on service-level aspects. At a more systemic and macro level, the goal shifted. Through co-design workshops that introduced these new service ideas as provocations to system actors (Meroni et al., 2018) and by examining and presenting these final services collectively, the aim as service designers was to act as a catalyst for broader transformations (Meroni & Sangiorgi, 2011).

The design studio was organised into 3 macro-phases: a research phase to investigate the food topic and context in Milan, a concept generation phase complemented with the opportunity to co-design new service ideas with the stakeholders of the Milanese food system, and a development and prototyping phase stage in which students, divided into ten groups, went in depth in elaborating ten related service solutions. The studio culminated in a public event, a sort of fair of sustainable ideas engaging all participants at its conclusion. In doing so, the student projects provided actual provocations around what is possible and desirable for the development of the nodes to those currently managing and shaping them.

3.1 Research

Two assignments make up this first phase to help students understand the context and generate an initial compass for envisioning possible project directions. After composing ten groups, students selected a design challenge that crossed with a node (table 1). Parting from the challenge, a desk and field research was performed to better understand the context and stakeholders (figure 1). The aim was to narrow their focus by redefining a more specific challenge that would later fuel the concept creation process.



Figure 1. Some of the results from desk and field research.

Next, students engaged in a blue-sky research exercise. By looking into different cultural inspirations like movies, talks, and exhibitions they gathered new ideas and perspectives about their chosen challenge that they later materialised on an object. The goal was to stimulate the students' creativity and provide a more innovative catalyst for concept creation (figure 2).

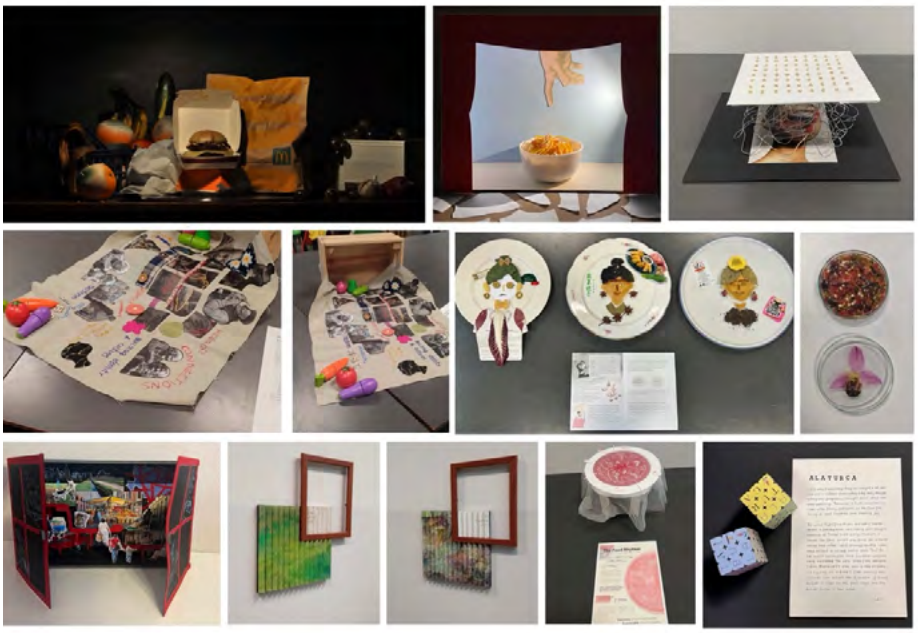


Figure 2. Some objects from Blue Sky research.

3.2 Concept Generation and Co-Design

Students then took their challenge redefinitions and insights from their blue-sky research and performed several brainstorming exercises, some powered by AI, to boost creativity. The result was three most-promising concepts for each group, which they then narrowed down to one.

To assess and enrich their concepts, students then conducted co-design workshops with node stakeholders, users, and experts. This co-design phase aimed to facilitate collaboration between students and various actors in the food system during the concept definition process. Here, the aim was to elaborate on the students' already existing ideas through a thought-provoking process for the actors engaged in the workshops (Meroni et al., 2018).

In advanced design phases, that seek to expand on and consolidate options, like this one, designers recur to specific types of 'prototypes.' These co-design tools (figure 3) are a sort of physical manifestation of the concepts the students see promise in developing (Sanders & Stappers, 2014) mixed with additional components that simulate interactions and behaviours (Meroni et al., 2018). Here, students used the co-design prototypes to explore their ideas with participants, starting a strategic conversation around them.

The co-design workshops served not only for the students to question and enrich their ideas but also as a first provocation for the actors involved in shaping and managing the nodes. The resulting insights altered the students' original service concepts, leading to a rethought concept for each student group.



Figure 3. Codesign tools and presentations.

3.3 PSS Design and Prototyping

In this last phase, students fully fleshed out the resulting concepts from many angles, mirroring the steps that real-world projects take to turn ideas into tangible innovations. They defined the product-service system offering, the user experience, the front and backstage, the touchpoints, and the spatial/urban requirements. They also focused on criteria to measure their idea's impact and how it engaged with different stakeholders, along with its business model and feasibility. (figure 4)



Figure 4. Closing event of the course at the NoLo Market.

The outputs of the 'Urban Food Systems' studio are ten service ideas aiming to make Milan's food system more equitable and sustainable. When we bring these ideas together, showing where they happen and what or who they need to function, we get a big picture of the actions, people, and infrastructure needed to activate node-related changes in the city.

Twine – Connecting indoor markets and the wholesale market

Twine is an online marketplace and distribution network that optimises urban B2B food logistics. With its collection/delivery model, Twine connects suppliers with distributors through a warehouse at the Wholesale market and distribution points in indoor markets.

By optimising intra-urban food logistics, this model presents an opportunity from both an ecological and commercial perspective. It shortens the chain not only geographically—reducing physical distance—but also relationally and informationally, directly connecting suppliers and customers and offering transparency on products and their impact. This solution could lead to improved relationships, a reduced carbon footprint, and an overall more sustainable city.

Al Mercà – Indoor markets

Al Mercà is a digital-enhanced shopping experience in Milan's indoor markets, offering recipe-based shopping lists, market navigation, and real-time product availability, saving time and reducing stress for shoppers.

By leveraging technology and appealing to younger generations, neighbourhood services could strengthen their position in the food distribution sector, offering a competitive alternative to supermarkets. This approach would also enable the expansion of home delivery services, providing an incentive to promote neighbourhood communities and relationships among vendors, encouraging personal promotion.

A un passo da te – Food hubs

A un passo da te is a Mini hub, operating at the neighbourhood scale and distributing food by bicycle, paired with a digital platform that matches beneficiaries with the nearest option for food pick-up and neighbourhood services, benefitting users but also non-profits in delivering their services.

The project aims at creating a network, an opportunity that various stakeholders consider necessary to better achieve common goals, and which is in line with the non-profits' mission to facilitate meaningful dialogue and cooperation.

Cozina – Food hubs

Cozina is a training service linked to the Food hub Gallaratese, providing unemployed youth with professional and life skills in the food sector, offering a pathway to employment and personal empowerment.

Acknowledging the shortcomings of current educational models, which often overlook the distinct needs of individuals and result in a lack of engagement and inclusion, particularly among the youth, this initiative seeks to fill a critical gap. Together with the need in Milan for qualified personnel in the food sector, there is an open opportunity to provide specialised training and employment in this area for individuals who are currently the most vulnerable and marginalised.

Cucinando – Food hubs

Cucinando is a catering training programme using surplus food to address unemployment and food waste, providing practical culinary skills and job market entry support to unemployed persons.

This initiative capitalises on the transformation of surplus food through culinary processes, aligning with the Food Hubs' objectives to maximise the utilization of surplus food, which often arrives in limited quantity and quality. At the same time, it is creating new paths to autonomy and professionalism for the hub's beneficiaries.

ResQ – Food hubs and supermarkets

ResQ is a service that, through a dedicated shelve and refrigerator supermarket section, streamlines the collection and distribution of surplus foods, offering them at advantageous prices for everyone while mitigating the differences between regular consumers and those in need.

Although supermarkets were not initially listed among the nodes presented to students, the project introduces a valuable collaboration between them and social actors. This would lead to the involvement of supermarkets in sustainable practices and to the creation of a network with different partners inside of the system.

ATMarket – Street markets and the wholesale market

ATMarket is a mobile market that travels via buses and trams delivering fresh, quality food to Milan's suburbs with a pricing strategy that makes healthy food more accessible to underserved communities.

The offer combines the already available options of food in the city center with the ones on the outskirts of the city, an opens an opportunity to use public transportation to reduce gaps in peripheral areas.

Co_MAP – Farmers' markets

Co_MAP is a service mapping farmers' markets in Milan and their associated farms to strengthen their connections and facilitate their expansion. The service allows producers, consumers, and the entities organising the markets to have clarity on agricultural production and to better manage market offerings.

Given that Milanese farmers' markets are managed by various entities under differing regulations, this presents a crucial need to enhance their temporal organisation and foster collaboration among organisers. This situation also creates an opportunity to publicise information about agricultural businesses and their

product sales, making it readily accessible and integrated into a digital space for shared knowledge, network growth, and, as a result, increased market participation.

Nostra – University Canteens

Nostra is a student-run canteen at the Bovisa Campus of the Politecnico di Milano offering plant-based meals, where students actively contribute to the food supply on campus, participating in both the management and preparation of meals.

This initiative acknowledges that while plant-based diets are increasingly common, maintaining them can be challenging due to evolving food trends and preferences. University students, however, represent a demographic likely to welcome this dietary approach, especially when combined with culinary education and integrated with management and organisational skills.

CareBites – Hospitals

A new care experience in hospitals starting from food, introducing hydroponic systems for fresh produce and creating an alternative environment for patient care that highlights the link between nutrition and healthcare.

The service would allow for shortening the supply chain, reducing transportation, and fostering a new food culture in a sensitive context where the food system remains "invisible", introducing an element of well-being in an environment characterized by waiting, vulnerability, and pain.

Each of these service ideas, ranging from logistics solutions to canteen services, tackles different aspects of our food system. Despite their diversity, they gain deeper meaning and impact when considered together. This 'vision of togetherness' leads to a Service Master Plan (Meroni & Selloni, 2022) for the Milanese Food System in 2030, showing how these new service ideas link to current nodes in the system, as illustrated in the following section.

4. Conclusions: Towards a Service Master Plan for the Food System of Milan

The main outcome of the studio is the integration of the resulting ten service solutions into a comprehensive document named Service Master Plan that describes how the city could transform and enrich itself over the next decade to increase the sustainability, accessibility, and quality of the food it produces, distributes, and consumes. The general notion of Service Master Plan was originally developed by Meroni and Selloni (2022) in their book ‘Service Design for Urban Commons’: it is described as a planning tool that results from understanding a place and designing services for it, going beyond the spatial planning logic while embedding a service logic (Vargo & Lausch, 2016). It has a high strategic value, as it provides multiple alternatives of what might happen in a specific context in terms of services to facilitate public administrations, stakeholders, civic organizations, and citizens in populating a place with activities consistent with a shared strategy.

The Service Master Plan can be considered as complementary to the traditional urban planning tools. According to Kelly (2010), it must include all the land area subject to the planning jurisdiction, all subject matter connected to the physical development of the community and all the physical elements of plans associated to economic developments. Another important feature that characterises a Service Master Plan is the time dimension: it is crucial to develop it considering a time horizon of about ten to twenty years, envisioning possible scenarios for the future. Here is why, Selloni and Meroni (2022) suggest that the Service Master Plan is above all a ‘scenario driven’ tool that must comprise more than one single option: the underlying reasons for comprising multiple possibilities rather than one can be found in the very nature

of the scenario building theory (Ogilvy, 2002) that assumes that the future is not predictable and the best way to align the interests of diverse stakeholders is to consider a variety of different narratives, providing a range of possible options, even if guided by a common vision and values.

This was precisely what happened in the LSF 'Urban Food Systems': various alternative solutions populate the ideal Service Master Plan for the food system of Milan in 2030, shaping a city distinguished by an increasingly pronounced commitment to sustainability. More specifically, the services are linked and integrated to the 3network of the previously described food nodes (figure 5) and have strategic connections with the stakeholders of both conventional and alternative urban supply chains. This food-related Service Master Plan presents a desirable future scenario for the Milanese food system, emphasising on one side some existing options, but also showing some counter-narratives to the current system. The work of the students was particularly useful to unveil unprecedented possibilities: the educational aim of the studio was to develop their specific ability to propose counter-narratives related to new and more sustainable ways of living, to exercise an activity of envisioning and thinking out-of-the-box that is indeed the very nature of the design job. As Margolin (2012) states, design is essentially a propositional activity and in this specific case the studio 'Urban Food Systems' brought the contribution of proposing new contents: this was valuable to ignite a strategic conversation among the different stakeholders, allowing differentiation in views but also bringing people together toward a shared understanding and envisioning of the Milanese food system (Nardone & Salvini, 2004; Meroni, 2008).

The contribution of the LSF studio was not only to propose contents but also to integrate them in a common Service Master Plan and to add stimuli that raised the conversation within the OnFoods programme to a more 'expert' level (Manzini, 2015). This was fundamental to provide the basis for next steps of the programme and to shape strategies of adaptation and mitigation across various scales and systems, to better identify those modifications made urgent by climate change and social inequalities. In another words, the Service Master Plan was useful to raise crucial (and sometimes neglected) issues and, above all, to propose them in a way that shows their interconnection and interdependence, as this is the very nature of a shared strategic document as the master plan is.



Figure 5. The Milan Food System Service Master Plan for 2030.

Hopefully, the Service Master Plan may well integrate the Milano Food Policy, the strategic plan of the Municipality that, since 2015, governs the urban food system with the aim of making it more sustainable from all perspectives and it may contribute to the evolution of the OnFoods programme that is currently undergoing and aims at developing a new sustainable food model from production to distribution and

consumption. Here there is room for further research, in which the design contribution can span from ideating product, packaging, and communication, to conceiving services, systems and strategies and as stated, to providing scenario-building activities that can generate counter-narratives and ideas out-of-the-box challenging the current situation and envisioning alternative futures.

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RETHINKING THE LIFESPAN OF TEXTILES: A FRAMEWORK FOR SUSTAINABLE MATERIAL DESIGN BASED ON ENHANCED MULTIMODAL ATTRIBUTES.

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ABSTRACT | Sustainable design thinking challenges perspectives on approaches to material development that are considerate of resources from the natural environment. This involves limiting energy consumption and re-purposing materials' use, qualities, and functions for an extended life span. Using a practice-based research methodology, this research proposes an alternative framework for sustainable textiles with a strong emphasis on designing a material's expressive qualities related to its extended use values: co-creation and wear. The experimental practice looks at the interplay between a material's inherent properties and its craftmanship, as well as aesthetic and expressive values which could extend the duration of use. The research takes a bottom-up approach to sustainable design thinking and exemplifies the design of diverse material strategies through a curated library of responsive textile expressions. The responsive textile samples developed in this research illustrate rich ways of responding and adapting to user actions and their environmental surroundings. The textiles' extended multimodal attributes suggest an alternative framework to design for prolonged lifespan, and exemplify materials that enhance daily life by conserving energy and allowing for customization and location-specific applications.

1. Introduction: A Role of Material Design in the Development of Sustainable Design Thinking

Materials, serving as raw matter for the design of products and spaces, represent our physical interface to the surrounding man-made world, from body to architecture. Similar to the ubiquitous role of technology in our lives, the function of proximate materiality can be termed by using Verbeek's (2004, p.200) descriptions as both pragmatic and hermeneutic. The notions he introduced imply dual values: as a mediator of people's presence and actions in the world, and as a mediator of how reality is presented to us when informing our experiences of the surrounding world. Like technology, the presence of materials is essential in shaping our interactions with artifacts and influencing our daily activities and behavior in the world.

From the perspective of the designer's practice, the value of materials encompasses a range of dimensions from technological development to craftsmanship and artistic expression. Moreover, exposed to use and user's actions, the material transcends the disciplinary borders of the design profession, moving towards the methodology of other disciplines–social sciences. In the context of sustainability, Corbin (2018) refers to the fluid roles materials can play in communicating and connecting diverse knowledge domains across disciplines: art, science, engineering, and social sciences. Designing for sustainability is a dynamic concept that initiates in the technical and product-centric perspective and evolves by integrating the synergy of social and ecological systems (Ceschin and Gaziulusoy, 2016). Thus, seen bottom-up from and outside the design practice, the place of materials in influencing a systemic approach towards sustainable design thinking tackles different aspects of technology, function, expression, human behavior, and empathy for nature.

2. Designing for Extended Lifespan

2.1 Reflections on Product Aesthetics

The enormous amount of resources employed to develop, design, produce, and commercialize products that support and enrich our lives accentuate the importance of looking at the surrounding materiality through the perspective of designing and producing for longevity rather than obsolescence and waste. The length of the life span and obsolescence of the textile products we use depends on the interlace of material qualities, for example, intrinsic raw properties and technologies, as well as immaterial qualities such as aesthetics and emotional values. Design decisions play an important role in influencing the shape and use of objects that surround us. The basic principles for circular design proposed by the Ellen McArthur Foundation (2024) refer to three categories of placeholders: eliminate: focusing on the appropriate material choice with consciousness to the environment; regenerate: using the bio-based material properties to reintegrate them in nature, and third element refers to circulate: keeping the materials in use at their highest value by expanding their life span to the maximum through emotional durability. Moreover, referring to causes of product obsolescence, Packard (c.f. Burns., 2016, p. 42) describes products as being influenced by three fundamental criteria that link to emotional durability: function, quality, and desirability. Even minor technological improvements of newly realized products open the curiosity of use, transforming the existing objects into obsolete ones. As a result, the fast-paced wear of products generates an obsolescence of quality. Referring to the emotional value of products, Packard introduces the term "psychological obsolescence," which refers to the outdated expressions or styles of products that also influence their desirability.

The need for designing for an extended lifespan rather than obsolescence has opened questions regarding the forming of alternative sustainable systems of thinking applied to material design and innovation. This approach views design not only as a problem-solving process but as an innovative approach. It encompasses new territories of understanding for design through expressive dimensions, methods, tools, and skills, as well as behaviours, use, values, alternative consumption and a systemic thinking (Harper,2018; Manzini, 2009))To some people there is no such thing as a sustainable material, rather it is the use of a material that

introduces a sustainable advantage (Thackara, 1997) and it connects to the designer's choices to design for an extended life span. As he describes:

> "Design for sustainability means fostering innovation – not just in products and services, but in work methods, behaviors, and in business processes. This takes designers into uncharted territory; they need new tools, skills, and understanding." (Thackara,1997, p.14)

Hence, there is a need for new ways to approach sustainability as Thakara emphasizes, not just a problem-solving process but from an innovative perspective, that opens new territories of understanding for the practice of design.

The importance of changing perspective by designing for durability and longevity is a strategy pioneered and promoted by the Eternally Yours foundation (van Hinte, 1997). The foundation addresses the importance of designing for an extended "'psychological life span': the time products are able to be perceived and used as worthy objects" (van Hinte, 1997, p.19). Preoccupied with the extended length of the lifetime of products through use and dignified ageing, Hofland (van Hinte, 1997) makes the distinction of two stages to consider in durable design: First, cherishable objects as being cared for and appreciated, and second having a nostalgic value to the user. He emphasizes that nowadays, due to the continuous development of technologies, product development focuses on adding new functions, a development strategy that swiftly transforms products into obsolete objects without ever reaching the cherishable stage. Inspired by the ideology introduced by the Eternally Yours, Materially Yours (Karana, et al, 2017) proposes an alternative framework for sustainable material design with a prolonged life span. In the vision proposed by the researchers, undesired aesthetic qualities such as imperfection become desired in the material design. In addition, the framework proposes new processes that imply the use of more democratic tools and open for the experiential engagement of the designer in the making, together with proposing more open relations between materiality and functionality of objects in daily life.

Another complementary perspective regarding the longevity of use as a response to aesthetic obsolescence is introduced by Chapman (2005). One of the design strategies he proposed in Emotional Durable design refers to the importance of designing complex objects. In his vision, the multiple layers of narratives embedded in objects open for the user's continuous curiosity of discovery. From this, it is understood that complex aesthetic experiences embedded in the design of objects extend the time of discovery and generate new temporal dimensions in relation to use.

Further addressing the temporal dimension of products, Harper (2018) analyzes the role of time expression when designing sustainable products. Reflecting on the expression of time embedded in the character of the artifact, Harper suggests viewing the aesthetics of objects as 'containers of time' can be a method of building durable relationships between users and objects, thereby increasing the importance of the aesthetic dimension in designing sustainable artifacts. The notion of time in product design links the user to the aesthetic dimension of objects as an expression of the quality of craftsmanship, expression of use, and wear, and through the prolonged aesthetic discovery embedded in the design.

2.2 Rethinking Life-Span in Textiles

In the field of textiles, the life span of textile products is relatively short. The rhythm of use, which combines slow and fast paces, depends on the symbolic relation created between the wearer and the garment as a matter of clothing or fashion, as defined by Fletcher and Tham (2004). The durability of the material and expression do not always align, causing a shortening of the life span of textile products (Goldsworthy et al., 2018).

Thus, mass production and the shortening length of life of materials for garments and interiors have created an assiduous search for alternative systems of thinking, starting from the design of material properties to craftsmanship, production, consumption, and end-of-life disassembly and recycling of textile products (Fletcher, 2014; Bigolin et al., 2022). Niinimaki and Lassi (2011) open the discussion on the need for a systemic change in the textile and fashion business to become sustainable. The proposed change is

inclusive, based on real needs and values that demand more engagement from the consumer. This can be understood as an active value creator in the material design chain. Thus, in the framework recommended by Niinimaki and Lassi, new strategies for design should be founded on and include values such as use, emotion, culture, society, and customization.

In the field of responsive and innovative materials, sustainable design thinking introduces alternative perspectives on how to tackle material development in a way considerate to the resources of the natural environment by limiting energy consumption and re-purposing material use and function for a prolonged life span. In this context, textile systems capable of responding and adapting to their environmental surroundings could offer sustainable alternatives to daily living that source and preserve energy, are more locally obtained, and offer multiple possibilities for customization and location-specific applications. Thus, designing textiles with changeability of expression can be a way of extending an emotional bond between a textile object and the user, as well as "a way of creating the potential for durability and aesthetic sustainability" (Harper, 2018, p.85).

Exemplary works in the textile research field introduce alternative perspectives on textile products' lifespan by placing the design of the material changeability in focus and envisioning alternative scenarios of use. The design of temporal textiles expressions with irreversible colour changes, which are created by plant dyes on textiles without the use of mordants, is investigated by Worbin (2013). Signs of ageing, use, and degradation transform the quality of wear as a value rather than a criterion of obsolescence, thus expanding the life span of garments. By exploring the richness of the color palettes achieved by different plant mixtures and by analyzing the perceived transformability of colours on yarns and fabrics, the project proposes an alternative way of using and perceiving changeable colours on textiles. Compared to conventional views, which look at colour durability as a desired quality of textiles, irreversible colour expressions are those that fade and evolve over time due to exposure to natural light and use. The collection of garments that emerge from Worbin's research is designed from the initial stages of the process with the intention to evolve over time. It aims to change preconceptions on the performance of colour and textiles in use by generating acceptance to natural transformability over time.

Keune (2017) proposes another view on the design of transformable textile expressions and use. The transformability of textiles is designed by embedding seeds as active natural materials into woven textile structures. The temporality of the textile expression is dependent on the agency of the raw material used with a specific temporal frame to grow, mature, and decay. The user's involvement and autoethnographic approach become part of the transformation process, ensuring the maintenance of the textile pieces through the management of necessary nutrients for supporting plant growth and appropriate exposure to light sources. The temporality and life span of textile transformation and use determine the transformation of the interiors and their daily experience, which depend on the properties of plants grown in the textile structures and natural seasons.

Sustainable design thinking challenges perspectives on how to approach material development in a way that is considerate of the resources of the natural environment and influence a prolonged use. This may be by conserving energy and re-purposing materials, qualities, and functions for an extended life span. As the research examples demonstrate, alternative uses and life spans that can be generated by the responsive expressions of the emerging bio-based raw materials (Karana, et al., 2017), natural dyes (Worbin, 2013) and active natural materials, for example, seeds (Keune, 2017). Using a similar research methodology based on material exploration, this research aims to start with a bottom-up process to expand the material palette of responsive material systems using the agency of the natural environment and user's actions. Furthermore, the research aims to speculate on diverse design strategies for an extended life span of responsive textiles. This is based on the creation of expressive ways of responding and adapting to user actions and their environmental surroundings.

3. An Experimental Approach

3.1 Method

In order to address the challenges of designing for alternative textile/material life span, the research presented in this paper uses an experimental research methodology (Bang and Eriksen, 2014) and explores the design of responsive textile material systems through the lens of textile design methods. Material prototyping was used here as a method to give a tangible dimension to the ideas contained in the research program and to speculate on the possible scenarios that these materials can inspire. The research began with near-field design at the structural level of textiles using techniques of weaving and knitting. This approach enabled an experiential understanding of the capabilities of the raw material and allowed for speculation on possible scenarios for sustainable making and use of textiles.

Experiments are formed around two primary placeholders: First, extending the material expressive dimension by exploring the intrinsic value of the raw material agency and the appropriateness of craftmanship; and second, speculating on the use dimension by exploring the value of aesthetic discovery embedded in the material design through co-creation and natural phenomena. The prolonged longevity of a material's use is a quintessential dimension for the decisions taken in each sample in the making and design and is informed by the aesthetics of material transformation and use. In the creation of textile samples, we combined reactive yarns (UV rays, PH with conventional textile raw material yarns (wool, cotton, and paper) to explore their relation to the agency of natural phenomena (i.e. UV rays) and how they affect the expression of textiles.

As a result, a material library is developed to present alternative perspectives on sustainable transformative textiles that change their expressions due to environmental stimuli rather than using energy-driven electronics. The material library illustrates different design methods that explore material responsiveness in relationship with the variation of expression as valuable dimensions for proposing alternative life spans. The experiments presented explore methods for designing the expressions of textile materials to vary over their lifespans through changes in colour and light emission in structural textiles triggered by natural phenomena or user’s action. In doing so, ambient energies and considerations of use are incorporated into the design process.

The experiments investigate two types of lifespans: one involved gradual, irreversible colour changes created using the varying properties of fibres, and the other involved reversible colour changes created using UV-responsive yarns that change colour from white to another colour when exposed to UV rays and then back again when no longer exposed to them.

3.2 Exploring the Influence of Natural Phenomena on Textile Expressions Over Time

Designing with Nature: Experiment 1

Gradual, irreversible changes were explored using woven fabrics that had been dyed by taking advantage of fibre properties and using naturally occurring dyestuffs such as organic matter and minerals in the seawater (Talman, 2018). Thus, Jacquard-woven fabrics were exposed to these dyestuffs for varying lengths of time in order to explore the range of colours created. The materials used were selected based on differences in susceptibility to various types of dyestuff and expected lifespans when used in fabrics, and included cellulose-based cotton and paper, protein-based wool, and petroleum-based polyester yarns. These materials absorbed different pigment particles, leading to them reacting differently when exposed to the same dyestuff or environmental conditions.

The influence of exposure to ambient stimuli on the expression of textiles was explored by placing samples of Jacquard-woven fabrics made using wool, paper, polyester, and cotton yarns out environment. One set of samples submerged in the Baltic Sea. Later, the samples were reproduced in the lab using similar water

conditions to test if we could replicate their change (Fig. 1). The samples were exposed to various agents such as minerals, soil, and water, as well as fluctuations in temperature for two months, after which inspection showed that the fabrics had developed a specific colour scheme depending on the environment they had been placed in. The samples that had been submerged in iron-rich water had taken on a range of stronger shades of brown orange and light yellow towards green shades, with the wool yarn also being dyed towards dark brown. The overall surface design of the textile has been altered due to the occurrence in the foreground of the dominant triangular shapes as repeated patterns (Fig. 1). Activated by the conditions in the water, the triangles were capturing the colour in an uneven way that enhanced the depth of the final surface expression.

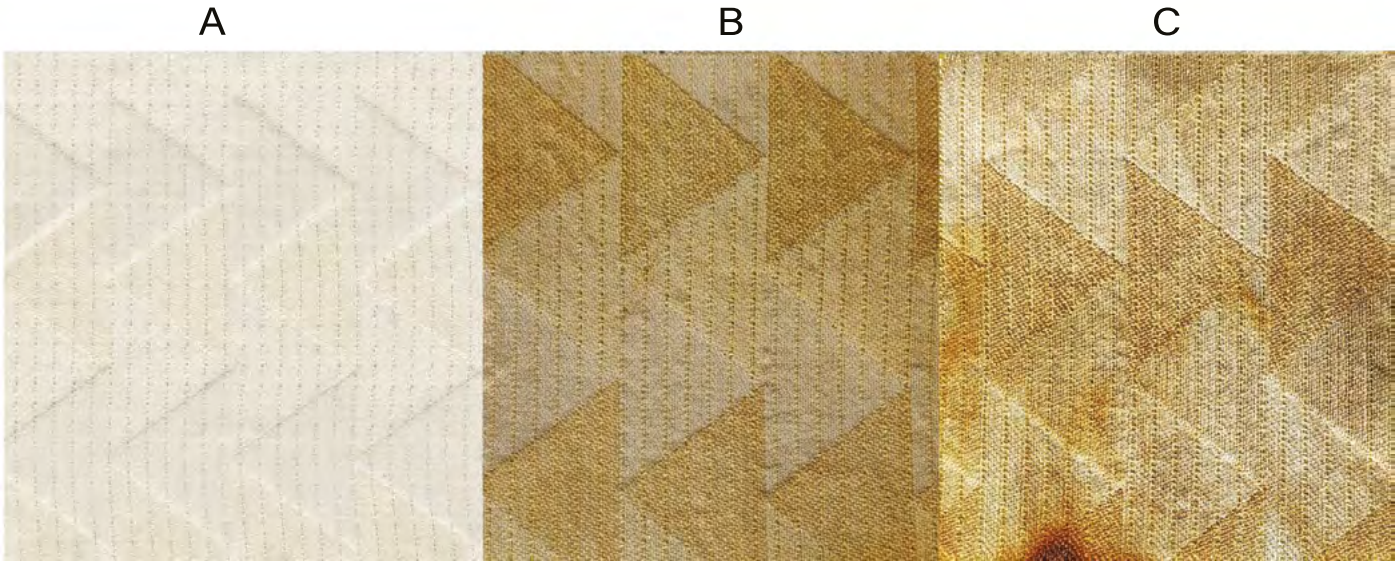


Figure 1. The transformation of the textile design into various color schemes after the exposure to changing water conditions that are rich in iron similar to the iron-rich areas of the Baltic Sea.

Co-designing with Nature: Experiment 2

In the second experiment, colour changes brought about by long-time exposure to natural conditions were explored by placing plain wool/cotton and paper/cotton textile samples along with patterned, Jacquard-woven samples made in wool, paper, polyester, and cotton in closed jars together with different kinds of food waste for a period of several years. At the time of writing, the experiment was on its eighth year and still ongoing. Four of the jars were prepared with plain wool/cotton and paper/cotton textile samples at the bottom and vegetable peels, lingonberries, a banana, and an orange, respectively, were placed on top of the textile samples, and two of the jars had patterned, Jacquard-woven textile samples made of wool, paper, polyester, and cotton yarn placed at the bottom and vegetable peels and coffee grounds, respectively, on top of the samples. The samples were photo-documented after three years, and again after seven years without removing them from the jars (Fig. 2). After three years, the foodstuff had dyed the fabrics in varying shades ranging from red (Fig. 2, row 6: the jar with lingonberries) and orange (Fig. 2, row 2: the jar with vegetable peels) to brown (Fig. 2, row 1: the jar with coffee grounds). The textile samples placed together with the banana and the orange displayed the smallest change (Fig. 2, rows 4 and 5, respectively). After seven years, the colours of all textile samples had faded and were tinted in shades of brown (Fig. 2, column 4). In all samples, the wool yarn had acquired the most colour. It should be noted that there was practically no mould in the jars, which was likely due to the jars having been thoroughly disinfected prior to being prepared.

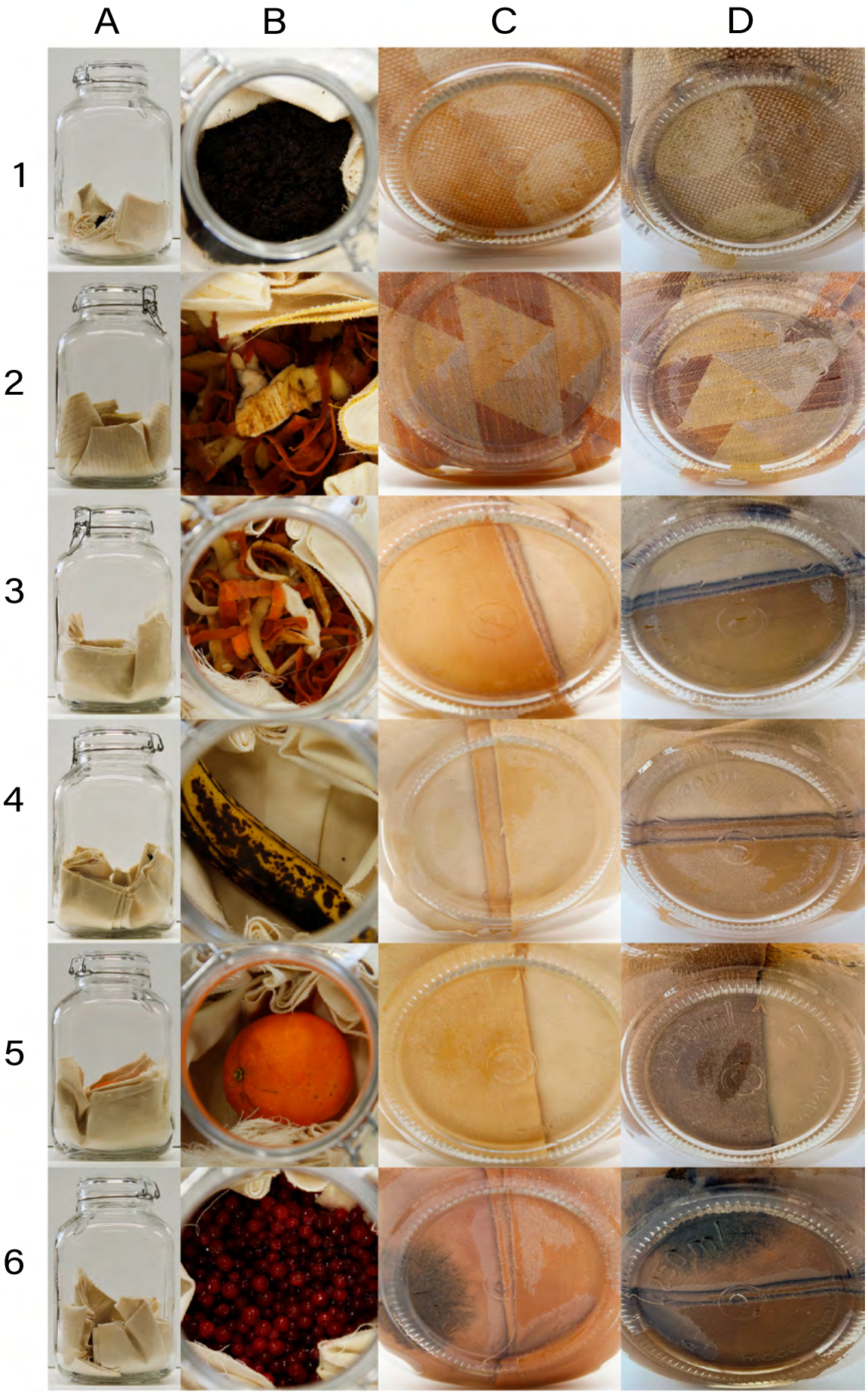


Figure 2. Experiments showing the variation in color on textiles after exposure using fruits and food waste.

3.3 Exploring Recurring Changes Over Time in Response to Ambient Stimuli

Extending the Aesthetic Discovery with Responsive Materials: From Mono-Changes to Multimodal Changes

Mono-Changes: Experiment 3

Short-term, recurring changes were explored using UV-reactive, colour-changing, and light-emitting yarns, which react to the ambient energy of sunlight and therefore change their expressions in outdoor contexts depending on UV intensity. Using yarns in which the colour changes were reversible allowed the creation of textiles that had different expressions in daytime or nighttime, and the UV-reactive, colour-changing yarns changed colour from white to another colour when exposed to UV light, and then back to white again when no longer exposed to light. The light-emitting yarns recharged when placed outdoors, even when not exposed to direct sunlight, and emitted a yellowish glow that was visible in the dark and which lasted for several hours. The UV-reactive colour-changing yarns were made of polyester and had different lengths of life. The photochromic pigments used in colour-changing yarns have a relatively low lightfastness, meaning that over time the dynamic effect decreases and the yarns cease to react to UV stimuli. More durable alternatives based on natural hackmanite crystals exist but are not yet commercially available in yarn form. The photoluminescent pigments used in the light-emitting yarns are harmless to the environment and have exceptionally long lives, as their light-emitting properties either do not deteriorate over time at all or do so to a lesser extent.

The textile samples used in the Experiments 3 were created using Dubied hand-knitting machines and computerized ARM handlooms. The knitted samples explored the effect of UV-reactive colour-changing yarns (Fig 3). Delicate lines of different colors occur in the knitted as exposed to the UV value of daylight. The colour effect is stronger in direct sunlight. When activated, lines of different colours enhance the three-dimensional expression of the knitted shape.



Figure 3. Emerging color changes patterns in knitted structures.

The second series of experiments were woven on a computerised ARM loom. Experiments 4 explored gradient colour effects created by varying the proportion of materials used, as well as weft-warp thread ratio (Fig. 4) in order to create a smooth gradient colour effect that went from relatively low to relatively high light intensity.

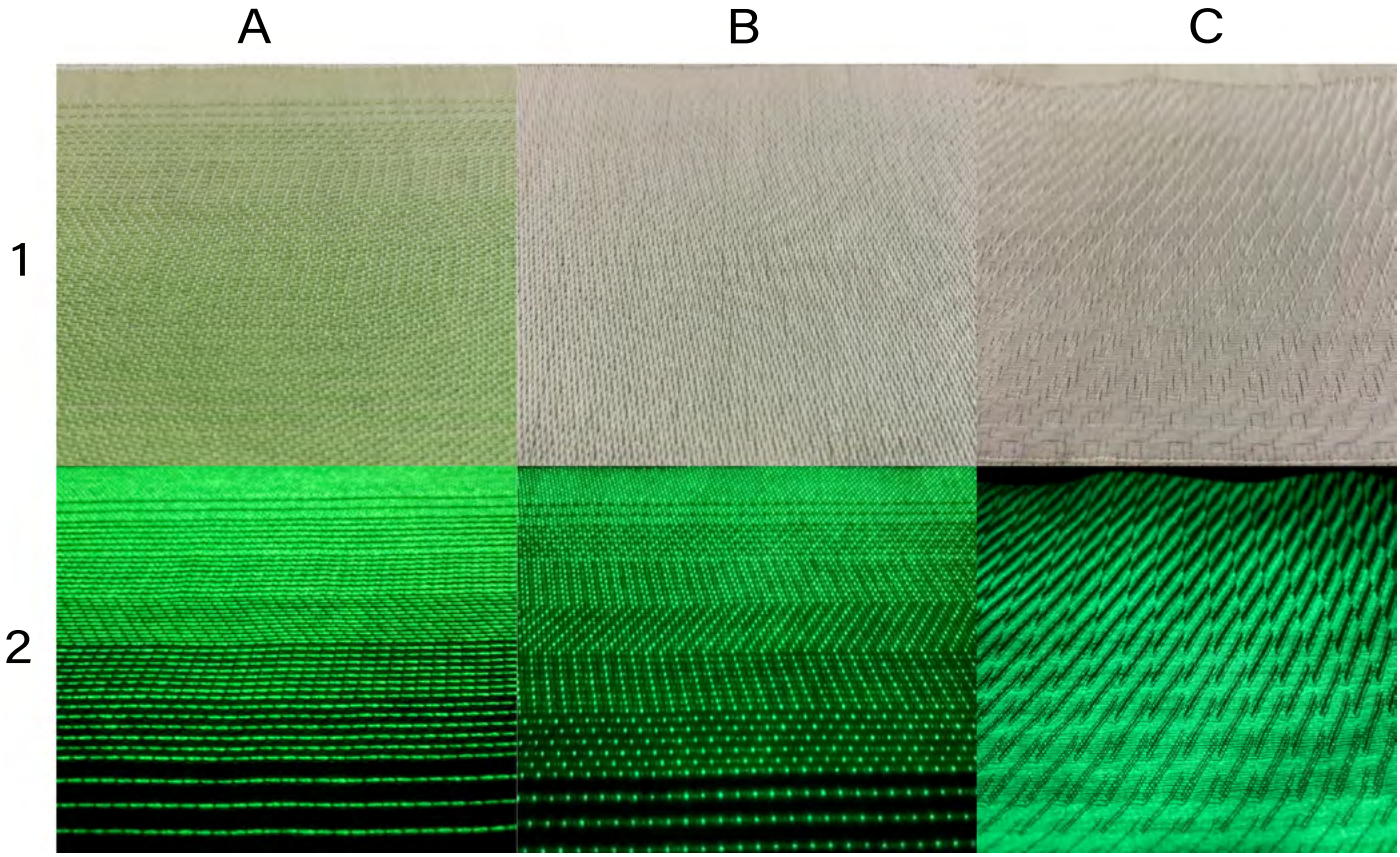


Figure 4. Emerging expressions of the UV-graded patterns in different woven structures.

Dual Changes: Experiment 4

Experiment 4 explored different methods of enhancing the light intensity of the light-emitting yarn and making less prominent the line pattern it created in its inactive state. White paper yarn reflected some light, enhanced the glow effect, and slightly diffused the lines of light created by the light-emitting yarn (Fig. 5, column 1, row 1). Two reflective yarns were also tested, but the intensity of the light emitted by the light-emitting yarn was not strong enough to activate them, therefore they appeared to be black in the dark, which enhanced the contrast in the striped pattern (Fig. 5, column 1, row 2). Reflective yarns could, however, be used to make the fabric visible in the dark when struck by strong light, such as the headlights of cars. To enhance the intensity of the emitted light and disrupt the pattern of the textile, two polyester Lurex bands with metallic coating were used, one of which was a matte gold colour and the other a shiny silver (Fig. 5, column 3, row 1). These gave a subtle shine and texture at close range but were not visible from a distance (Fig. 5, column 3, row 2). An attempt to change the colour of the yellowish glow of the textile sample was made by placing light-emitting yarn between two layers of the transparent, red plastic band; this did not change the colour of the glow, however, and the only effect produced was the glow becoming dimmer due to the red plastic band blocking the light emitted by the light-emitting yarn (Fig. 5, column 3, row 2). In addition, water-soluble polyvinyl alcohol (PVA) and heat-dissolving thermoplastic copolyamide (coPA) yarns were used as auxiliary materials to enable layers of materials in the woven textile samples to be separated from one another. Both PVA and coPA yarns and their residual waste products are harmless to the environment.

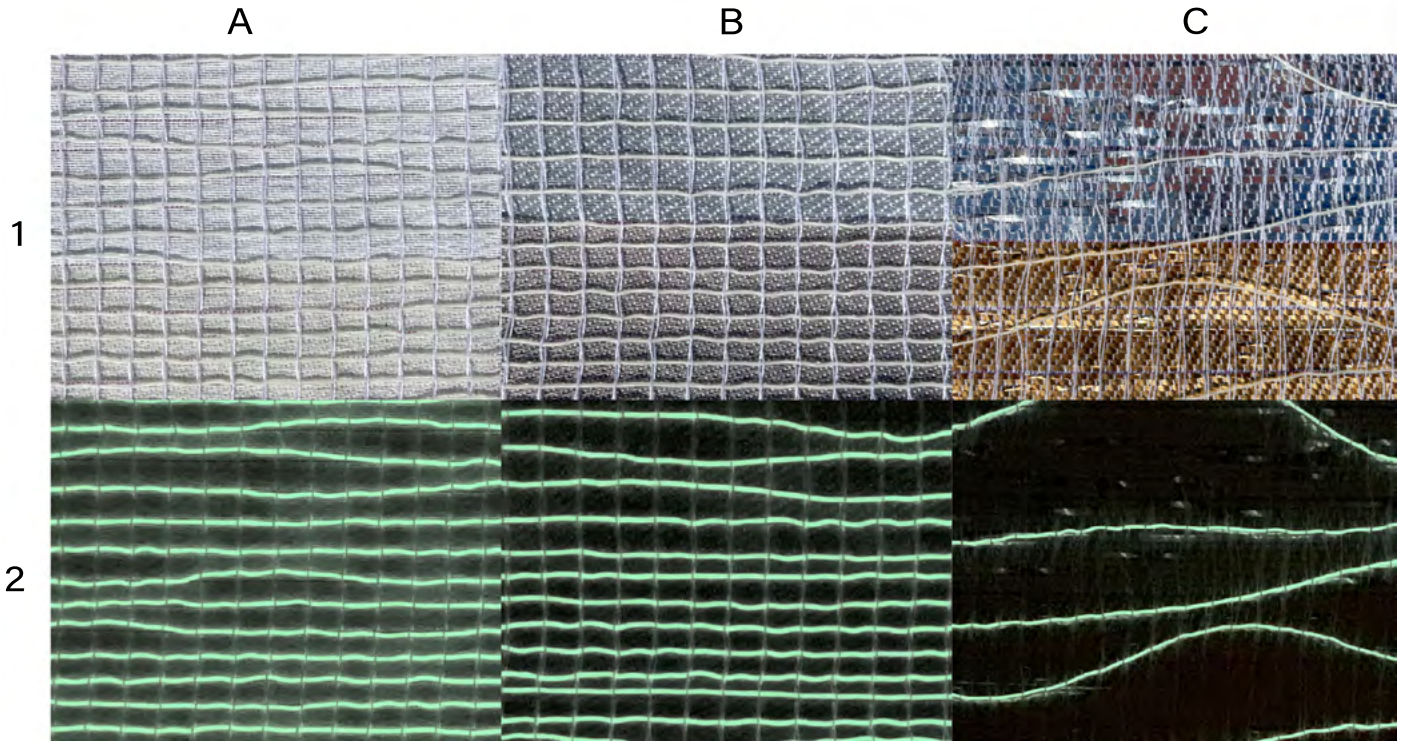


Figure 5. Details of the material layers in the structural design woven design that are seen in the daylight and night time.

Multi-Modal Changes: Experiment 5

Experiment 5 (Fig. 6) is focused on the development of multi-modal expressions that are triggered by the appearance and intensity of UV light. The sample is a mono-material textile based on polyester yarns with different charging capabilities. The background material is knitted with heat-reactive yarns. When exposed to heat, the yarns shrink irreversibly and can keep the desired shape. An origami structure was transferred by pleating the material to demonstrate how three-dimensional shaping can be applied to the material after production. The sample is knitted in an industrial process using an inverse plating technique to apply a repeated pattern on a mesh structure.

The plated pattern is designed with three UV-reactive yarns: two color-changing and one light-emitting. During the daytime, the color-changing yarns transform from white to pink and purple, following a repeated geometric pattern (Fig. 6, B). The quality and the position of the UV light influence the intensity, gradation, and occurrence of the colored pattern on the textile surface and form. The light-emitting yarns are charged during the day and become visible when dark. The creases of the surface influence the difference in intensity of the light pattern (Fig. 6, C). The pattern activates a part of the shape, providing a new expression to the initial form. The sample aims to demonstrate how multi-modal expressions can be embedded in structural design, extending by design the curiosity of surface exploration. The rhythm of change in the pattern of the surface design has a seasonal quality that depends on the intensity of the UV light in the environment. A rainy day can trigger discrete changes in pattern, while in the summer, the color design appears with full intensity. The way the textiles are positioned by the user in relation to the window and the length of exposure determine the color changes and the accuracy of the light-emitting pattern. Changes can also be triggered by the user when using a UV lamp. In this case, the changes appear and disappear at a fast pace compared to the activation given by the natural light.

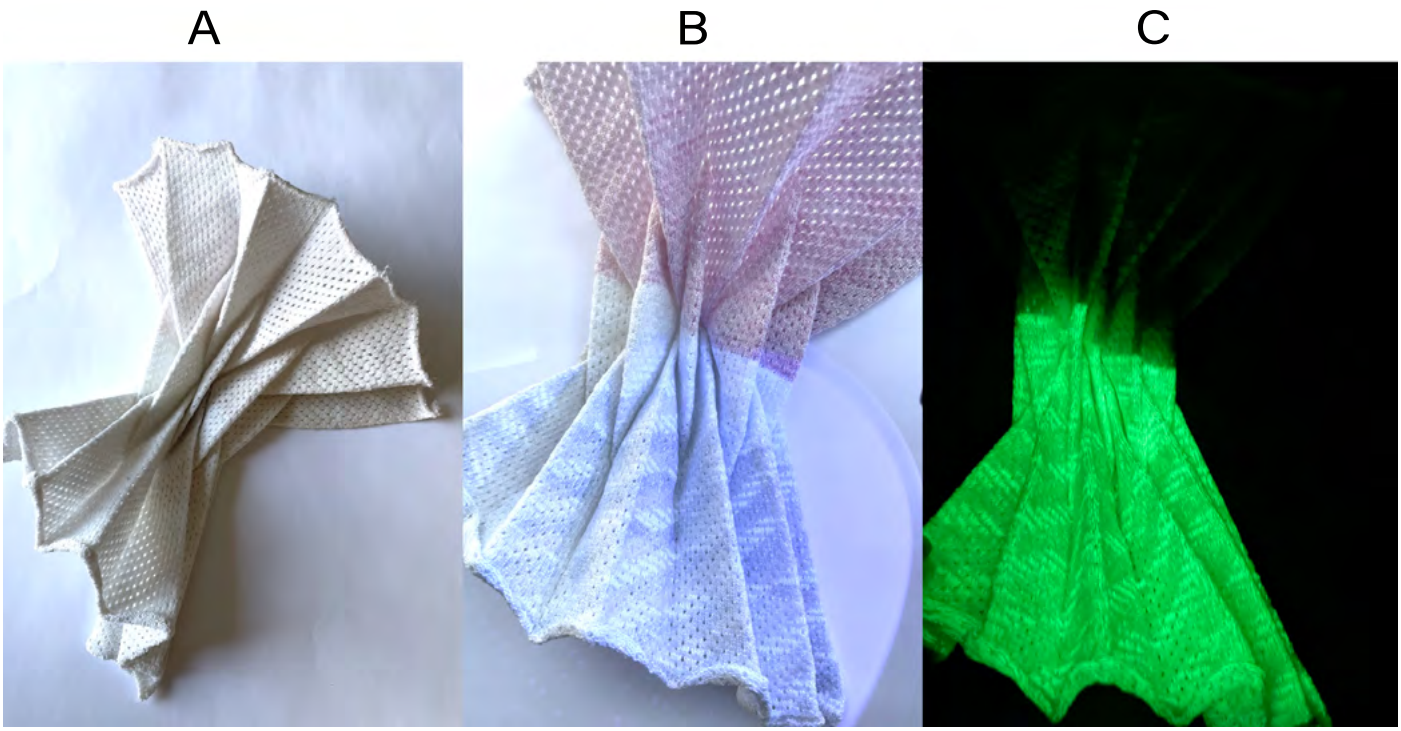


Figure 6. The changeability of textile patterns when exposed to UV light under different lighting conditions.

3.4 Summarizing the Experiments

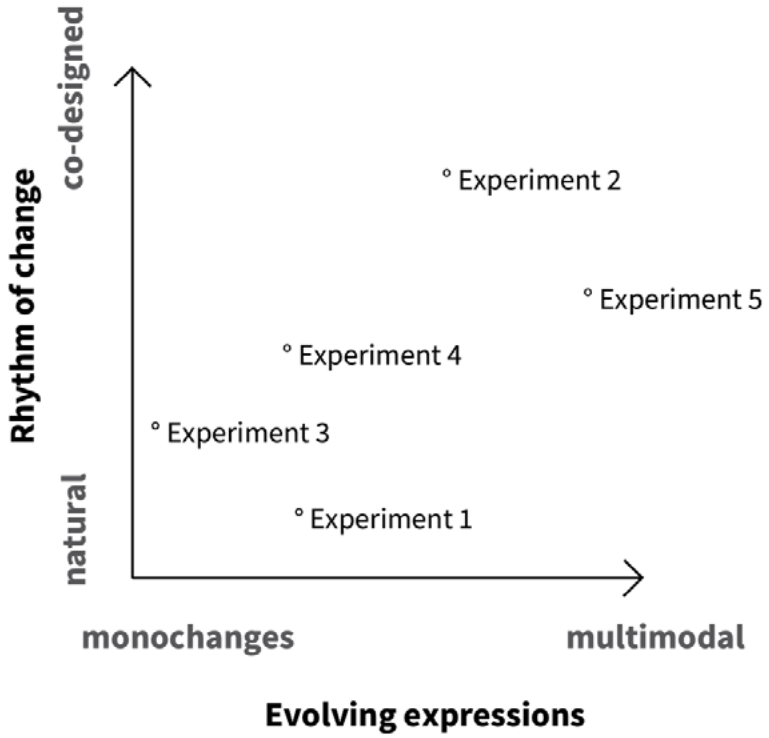


Figure 7. A graphical representation of the experiments structured according to the rhythm of change related to the evolving expressions of textile structures.

A graphical representation (Fig. 7) is proposed as a framework for the experiments to give structure to the material library. The samples are positioned according to rhythms of transformation and the variation of

expressions each material embeds. The evolving expressions in each sample depend on the property of the yarns used and how the structure is designed to exhibit changes. The changes in expression can vary from dual expressions to multi-modal expressions, and the changes may be permanent or reversible. The rhythm of transformation can depend on activation triggered by natural phenomena like the exposure to UV light from the surrounding environment (as in Experiment 3) or the conditions of water such as the presence of bacteria, minerals and the variation of PH values (as in Experiments 1 and 2). Human actions also influence the rhythm of change by manipulating the material surface (as in Experiment 4), varying the material placement in the environment (as in Experiment 5), or by using the agency of the environment to co-design (as in Experiment 2) in the textile using natural or artificial triggers for change.

4. Discussion: Expanding Sustainable Material Systems

For years, material innovation in the field of textiles has been linked to smart textiles as computational materials, which are activated by electrical power. Integrated into daily living, smart textiles aimed to hide complex technology in products using the familiar interface of textiles. However, in recent years, the material paradigm shifted from digital to bio-based materials. Recent research demonstrates that transformation and responsiveness in textile materials can be achieved using bio-based matter to trigger changes through using the agency of the natural environment (Worbin, 2013; Keune, 2017; Talman, 2018). Users can be co-designers to enhance the material expressiveness by surface manipulation and wear (Karana, et al., 2017). To complement this, the textile's extended multimodal attributes presented in this research suggest an alternative responsive material system to design for a prolonged lifespan.

Using experimental research methods, the research illustrates how textile methodology and materiality can be tackled to support sustainability from a bottom-up perspective. The sample library provided by this research extends the research in sustainable, innovative textile systems by exploring the role of material expressiveness. The material library developed exemplifies alternatives to the experience of daily living that both source and preserve energy and offer multiple possibilities for customization and location-specific applications. The context of use for these textiles spans from body to space. Some of the material choices, wool and cotton linen, indicate that some textile samples are more appropriate for use in clothing, such as in the case of Experiments 1, 2 and 3. The material choices in Experiments 4, and 5, which are based on the use of man-made responsive yarns and multimodal expressions, suggest the interior as a context of use. Further, material science collaborations with design fields can innovate on bio-based smart yarns that have properties and expressions like the man-made yarns that were used in this research. This aligns with a vision of sustainable smart materials that can bring a gentler imprint to the environment and can be used in products for daily living that capture and maintain our interest over extended periods of time. A holistic approach can be further developed to combine the properties of the raw materials, their sustainability, and the emotional aspects that counter the obsolescence of expression.

Generally, in the design field, the lifespan of textiles has been discussed from a material durability perspective. In contrast, in this research, we aim to open new dialogues towards the role of design methodology and aesthetics in sustainable product development by suggesting complementary perspectives and strategies. These include the perspective of emotional durability and the strategy of generating more sustainable behaviors through understanding and direct interaction with textile materials and products. The materials proposed relate through their design of natural and man-made fibers and are used to speculate how multi-modal textile expressions can be designed, and how alternative rhythms of use can be created. Complementary to the method of Fletcher and Tham (2004), here, the rhythm of nature as an agent for change is integrated into the textile expression relating to the user's actions and mediates how reality can be presented to us when linking our daily experiences through textiles to the pace of nature. As a result, the graphical illustration proposed by this research aims to structure and characterize the materials developed. The illustration can be used as a framework by others to further develop new material ideas, for example, how responsive textiles as design materials can act as a mediator of people's presence and actions in specific geographic locations or environmental conditions.

The framework developed in this research can also be integrated in the sustainable model proposed by Ceschin & Gaziulusoy (2016) to add the textile/material perspective at the product development level. By relating in this way frameworks of different domains, cross-disciplinary approaches can be further created to expand the material domain to a systemic level. Furthermore, the strategies proposed can be integrated into the design of a broader systemic thinking model for sustainability where the product design level can be enriched, for example, by projecting the concept of emotional durability within new visions. These new visions could start at the material level and generate more personalized object interactions, services, and social innovation that expand on user understanding within its social context.

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P/REFERENCES OF DESIGN

DESIGNERS' COMMITMENT TOWARDS SUSTAINABILITY: CLIMATE CARE AS A CHALLENGE FOR DESIGN EDUCATION.

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ABSTRACT | The current climate crisis poses an urgent need to raise people's awareness to promote a socio-cultural transition towards more sustainable and environmentally friendly lifestyles. In this case, technological innovation becomes a tool to support this change by designing interactive experiences that promote social education for sustainable development. Starting from this, the contribution presents the outcomes of an experimental and participatory workshop that uses the Sustainable Interaction Design (SIxD) approach, for the development of design solutions, capable of increasing people's knowledge, values and attitudes, in order to encourage them to adopt pro-environmental behaviours, through experiential learning and interaction.

1. Introduction

The current climate crisis poses an urgent need to raise designers' awareness to promote a socio-cultural transition towards more sustainable and environmentally friendly lifestyles (Clayton, Schwartz, 2019). Designing artefacts, services, and environments effectively about complex, confusing, uncertain, sometimes overwhelming, and often emotionally and politically loaded, such as climate change, climate extremes, and compound events, is challenging but related to the responsibility of design and education to increase ecological awareness.

This field has rapidly grown with the contribution of numerous disciplines, among which we consider Sustainable Interaction Design (SIxD) (Blevis, 2007; Blevis & Blevis, 2010), which has widened and deepened its scope towards establishing an experimental design-driven and human-centred discipline for motivating behavioural change, also concerning automated decisions that overcome people's awareness. Another impact of SIxD relies on integrating meaningfully rich visualisation of climate change trends with design, pedagogy, experiential and reflective actions about ethical decision-making, and emotional interactions (Clarke et al., 2019).

Starting from this, the contribution presents the outcomes of an interaction design education initiative, the Sustainable interaction Design for Climate Care, that has been developed as a design research and education workshop with the goal to foster sustainable futures. The design education workshop applied participatory, experimental, and collective design research competences to the interpretation of the world as made up of complex human-technology-environment assemblages (Light, 2022). The design education activities described in this contribution have been implemented within the EU H2020 funded research and innovation project GreenScent – Smart Citizen Education for a Green Future, a multidisciplinary project aiming to support and enable European citizens, especially the younger generations, to actively become the main actors of social change for sustainable development and environmental protection through education, citizen science, and civic engagement. GreenScent researchers and educators involved in the project have been engaged in the design workshop activities to answer questions like “Can we build on and expand the trained sensitivity to complexity for understanding complex phenomena through design?”, “Can we make use of design research methods to proliferate the means to make sense of the world?”, “Can we design interactive technologies aimed at fostering awareness, empowerment, culture and social coexistence?”.

In particular, the initiative provided the participant students coming from fields like interaction and experience design, graphic design, communication design, and service design, with concepts, methods, materials to tame challenges like designing systems for mitigating complex socio-technical and multi-layered phenomena (Norman & Stappers, 2015), such as climate change.

This contribution has the goal to increase designers' commitment towards sustainability and ultimately to turn design community culture into care through experiential learning and interaction. Par.2 introduces the two main aspects of the design brief that has been proposed to design students: the climate change challenge as a multi-layered and complex issue, and the Sustainable Interaction Design as the main perspective to take and develop for the education initiative.

2. The Design Brief of Sustainable Interaction Design for Climate Care

2.1 Climate Change as a Challenge

In the last few years, recent climate anomalies provoked by global warming, which have caused the hottest record of modern meteorological history and increased the frequency and intensity of extreme climate events, are the indisputable reality of an increasing climate crisis closest to the tipping point (Loi, 2022; Lovelock, 2020).

Indeed, all catastrophic effects caused by the Anthropocene are accelerating their negative impact on our global ecosystem with significant climatic, ecological and environmental changes that encompass environmental pollution, biodiversity loss, desertification, floods, and rising sea levels, which undermine the survival of all living species, including humans (Clarke et al., 2019; Toni, 2020).

Our society must limit Earth's temperature to 1.5°, compared to pre-industrial levels, to mitigate catastrophic consequences on our lives. This manoeuvre would require the reduction of global anthropogenic carbon dioxide emissions by about 45% from 2010 levels by 2030, reaching net zero around 2050 (IPCC, 2018). Since a significant part of these phenomena arises directly from the accumulation of lifestyles and habits related to an economic-industrial society without limits, the current environmental scenario requires a drastic change of direction, which would foster the social transition from an ecological-cultural point of view (Clayton & Schwartz, 2019).

Furthermore, limiting global warming is not only a matter of environmental justice but also social justice towards the new generations and the most vulnerable and marginalised people who suffer the most severe consequences of the dominant industrial system (Escobar, 2018). For these reasons, it is vitally essential to inclusively equip all people with an integrated and holistic approach to sustainability education to untangle and deconstruct the logic of the present and critically reflect on the values, beliefs, and visions that affect the today's technocratic and anthropocentric world, aiming at co-constructing new shared meanings that can contribute growing more accessible, equitable, and environmentally friendly societies (Cebrián & Junyent, 2015; Thackara, 2006).

2.2 Sustainable Interaction Design as a Critical Perspective

Within this scenario, the field of Human-Computer Interaction (HCI) can take on a significant role in supporting and promoting a new social transition capable of increasing people's knowledge, values, and attitudes towards a more sustainable future. That can happen through the construction of new relationships with digital technologies that go beyond the idea of evaluating interaction design as a simple bridging discipline for communicating with machines and of considering it more as a cultural phenomenon capable of transforming anthropocentric design principles and practices into a more responsible approach that relies on climate cure (Light, 2022).

This perspective can find great support in Sustainable Interaction Design (SIxD), i.e. a recent design movement that uses the complex concept of environmental sustainability as a critical key to rethinking the role and outcomes of those design practices that focus their objectives on ideating and developing interactive technologies (Blevis & Stolterman, 2007). As defined by Mankoff and his colleagues (Mankoff et al., 2007), two macro design principles are the backbone of SIxD:

Sustainability through Design: this principle uses interactive technologies for behavioural change that promotes sustainable decision-making processes and lifestyles. It can intervene both at an individual level (for example, making environmental data tangible to encourage people to increase their awareness in improving their ecological footprint) and at a public level, the aim of which is to allow a social movement, collective actions, and a long-term cultural change for advocating environmental sustainability (for example, simulating or predicting the long-term consequences of improper use of fossil fuel transportation or poor waste management).

Sustainability in Design: this principle focuses on promoting responsible design processes and practices for environmental sustainability to limit those technological developing systems implied in producing new physical products and hardware that could have a material impact on the environment, according to practices of minimising material content and consumption, increasing energy efficiency and extending the product life cycle to reduce potential scraps and discards at a minimum.

The objective of the proposition of the Sustainable Interaction Design for Climate Care education initiative is to embrace the principles of participatory and experimental design concerning the creation of interactive

training experiences based on technology-enhanced learning, which are promoted to encourage people to adopt and include pro-environmental behaviours (PEBs) within their lives in everyday society.
The GreenSCENT project framework to provides students participants with examples of hybrid scenarios capable of intertwining the interdisciplinary learning approach of Education for Sustainable Development (Cebrián & Junyent, 2015) – consisting of prioritising competencies such as problem-solving, critical and systemic thinking, and ethical decision-making and behavioural processes – with accessible and inclusive narratives and interactions that enrich the quality and engagement of the user experience.

3. The Sustainable Interaction Design for Climate Care Workshop

3.1 Workshop Methodology

This contribution highlights a particular experimental and participatory design research conducted within the program of annual summer workshops organised and promoted by the Department of Design at the University of the Republic of San Marino. On that occasion, the researchers organised an intensive co-design laboratory on topics related to SIxD for climate care involving 20 students from different Bachelor and Master Degree courses in Design from all over Italy. The entire workshop lasted five working days from Monday to Friday, in which the researchers structured the activities into a strict set of lectures and theoretical and practical activities (Figure 1).

Time Schedule

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
9:30		**Lecture 03**	**Workshop**	**Workshop**	**Exhibit development**
10:00		**Lecture 04**	Group presentation	UI Concept development	Poster Preparation & Print
11:00	**Brief Presentation**		Concept development - Interactions - User Experience - Service & Technologies		UI Prototype DEMO Preparation
11:30		**Workshop**			
12:00	**Lecture 01**	Concept generation - Cycle 3	Scenarios > Interactions > Flows		
13:00					
14:00	**Workshop**	Design Concept development:			
15:00	Concept generation - Cycle 1	- Presentation - Concept assessment - Ratings - Concept evolution	Scenarios > Interactions > Flows	UI Concept refinement and validation	**Final Exhibition**
16:00	**Lecture 02**		UI Concept development		
17:00	Concept generation - Cycle 2	Expression of interest > Group creation			
18:00					

Figure 1. Workshop time schedule.

The close collaboration between the participants generates the opportunity to conceive and prototype tangible design solutions aiming at increasing ecological awareness and pro-environmental behaviours. Starting from a short introductory brief in which the research team presented the purpose of the Sustainable Interaction Design for Climate Care education initiative, the same researchers introduced and described the specific objectives and expected outcomes of the workshop. Specifically, the introductory part of the workshop explained to the participants the design methodology they would have adopted during the design process, which was based on design challenge-based learning (Blevis, 2010). This methodology, which lays on the studio-style learning approach, uses a combination of learning strategies such as:

- promoting collaboration;
- encouraging public critique and engagement in peer learning;
- ensuring that thoughtful problem-setting precedes problem-solving;
- fostering transdisciplinary, values-centred goals.

The entire design process divided the laboratory into three macro theoretical and practical modules or activities to develop the project:

- lectures;
- concept generation;
- interaction design concepts prototyping.

The first two macro activities were carried out in the first two days of the workshop. At the same time, the third and most important activity was carried out in the three remaining days that have concluded the laboratory. The proposed design education activities are described in detail in the following sections.

3.2 Design Education 1 – Lectures from the Experts

Over the first two days, this first macro phase provided a series of lectures' and insights conducted by four different experts in the fields of physical geography, behavioural psychology, energy and environmental engineering, digital media accessibility, and responsible innovation for society. Such a diverse panel of researchers allowed participants to acquire fundamental knowledge and skills to address the complexities of issues related to climate change and sustainability through a transdisciplinary perspective. Furthermore, the topics exposed by the various lectures served as theoretical content to support the concept design activity, aiming at helping participants devise design solutions capable of addressing environmental issues related to sustainability and, at the same time, encouraging pro-environmental actions associated with climate care.

During Day 1 and Day 2 the workshop hosted four lectures. That provided specific skills and design ideas that were as consistent as possible with the objectives of the overall research project. In particular, the lessons concerned the following research topics:

- "Climate change: the urgency for a change and a challenge for the future", Prof. Biljana Basarin, Department of Geography, University of Novi Sad, Novi Sad, Serbia;
- "Pro-environmental behaviours", Dr. Raffaele Barresi, Faculty of Psychology, International Telematic University UNINETTUNO, Rome, Italy;
- "Sustainable because Accessible: Inclusion & Diversity", Dr. Sarah Anne Mcdonagh, TransMedia Catalonia, Universitat Autònoma de Barcelona, Barcelona, Spain;
- "Responsible Research and Innovation", Dr. Zarrin Fatima, VTT Technical Research Centre, Helsinki, Finland.

3.3 Design Education 2 – Iterative and Collective Concept Generation

As for the first module, the second activity was conducted in the first two days of the laboratory through two main phases, which allowed the students to creatively generate different design concepts that offered valid solutions for climate care. The first phase was characterised by an intense brainstorming sessopm, which generated a collective mind map in which each participant individually collected and sorted numerous themes, trends, and keywords on sustainability that consequently allowed the students' groups to define the design challenges associated with raising awareness on the urgency of environmental sustainability.

All the design challenges have been identified and collected around eight specific areas of intervention that coincide with the strategic objectives of climate neutrality pursued by the European Green Deal: 1. Climate Change, 2. Clean Energy, 3. Circular Economy, 4. Green Buildings, 5. Smart Mobility, 6. From Farm to Fork, 7. Biodiversity, 8. Zero Pollution.

In particular, design students' groups identified a series of critical issues related to human factors like intrinsic motivation for behavioural change, the role of personal values, the influence of community and group culture. Afterwards, in the second phase of the module, the students associated the design challenges with a divergent design phase of generating future concepts. This last phase adopted the speculative design approach (Dunne & Raby, 2013), which enabled students to imagine possible and alternative technological educational experiences that could solve specific environmental challenges, aiming at encouraging and promoting sustainable solutions for climate care.

In order to facilitate the design concept reporting and documentation of each group design process, the research team provided everyone with paper-based graphic templates to collect and describe all functional, technological, and morphological characteristics of each generated concept. Subsequently, the students clustered all the concept solutions through card sorting based on common areas, characteristics, and keywords on a whiteboard. That process created a collective design space to encourage collective design critique to validate, improve, and/or integrate the proposed solutions (Figure 2). The second module included a further brainstorming cycle and two iterative concept generation and refinement cycles. This last phase concluded in the afternoon of the second day with a definitive design concept development process, where the students presented, discussed and voted on all the final solutions that emerged during the whole concept generation activity. At the end of the voting, the research team divided the students into four groups of four people each. Every group selected a concept among those that received the most interest in being developed and prototyped it in the third phase of the workshop.



Figure 2. Image representing the idea concept generation process for documenting students' ideas and design concepts.

3.4 Design Education 3 – Interaction Design Concept Development and Modelling

The third phase of the research team conducted this third phase of activity in the last three days of the workshop. That module allowed participants to carry out a converging and synthetic design activity, which enabled students to transform the most promising concepts – selected in the previous module – into more defined and tangible design solutions through developing mock-ups and functioning digital prototypes. To study and define all interaction principles and models, and the functional characteristics of each design project, the researchers proposed the students adopt the scenario-based design method. That approach enables designers to report relevant user experiences that show representative cases of real-life situations, which expresses in detail the actions performed by the end-users while interacting with a specific context through a step-by-step description (Carroll, 2000; Rosson & Carroll, 2012). According to the purposes of the workshop, the students represented user scenarios where specific challenges or problems related to sustainability education occurred and were resolved by envisioning possible design futures.

The students envisioned interaction scenarios by adopting at first the visual form of the storyboard (Carroll, 2000) and then the prototyping define and implement the role and look-and-feel of the projects. Once the technological, aesthetic, and functional properties and interaction principles were defined, the students transformed their design into concrete working interface prototypes. Although there were only three days to develop the projects concretely, with the help of the researchers, the participants had the opportunity to validate the functionality and usability of their solutions through a quick interactive and iterative cycle of testing and measurement of the results achieved (Rizzo et al., 2001).

To conclude the work process of design education, all four projects were presented and exhibited by the students in a public plenary presentation in a small exhibition within the university, which involved other students, teachers and external visitors. The presentation consisted of a description of the projects depicted on an A2 presentation table – where students showcased their objectives, interaction scenarios and interface mock-ups – and a demonstration of the interactive prototypes.

4. Results of the Design Workshop

4.1 Design Projects

The final results of the research and design experimentation were represented by design projects, which, in turn, guided them in developing interactive prototypes inspired by SIxD principles. All the final projects open a critical reflection around four themes related to climate care: biodiversity, zero pollution, circular economy, and climate change, which arose from the future scenarios and concept generation and prototyping. The four research projects conceived during the design process of the workshop are described below.

4.2 First Project – B-Place

The B-Place mobile application offers a community-based service based on collaborative and participatory social innovation, which aims to promote travel experiences with reduced environmental impact from a bottom-up perspective (Figure 3). The digital platform aims to facilitate sustainable mobility and ethical and conscious consumption by providing users with an AI-based service that evaluates and compares different destinations to each other according to the degree of sustainability generated by their travel offers.

The level of environmental impact of a given location is generated by an algorithm that combines:

- A quantitative data analysis consisting of open-source environmental parameters deriving from meteorological and air quality stations presented in the local area,
- A qualitative data analysis produced by the reviews by the travellers, which take into consideration a series of evaluation parameters, such as the air quality and liveability of the place, the availability of urban green spaces and the sustainable mobility services, the use of clean energy and the zero-mile power supply provided by local facilities, and the presence of sustainable products and services based on circular economy.

In that way, this open and spontaneous sharing of information allows users to plan their travel itineraries by responsibly choosing many factors, such as sustainable transport, services, and facilities that the community recommends or even provides on the application as a responsible alternative to fast travelling.



Figure 3. Interface mock-ups of the B-Place project.

4.3 Second Project – 123…Earth!

The 123...Earth! design is a relevant example of design for children approach that aims to raise awareness among young generations through hybrid narratives and mobile experiences that allow children to understand and touch the emergency of the climate crisis first-hand (Figure 4). The goal is to develop a multi-sensory experience based on the interaction with a personal teddy bear, which acts as the main character in a Augmented Reality (AR) based storytelling. The teddy bear is thought to demonstrate a tale by mean of a conversational interface. Through personal dialogue with it, the system stimulates reflective learning by requiring kids to take notes of their daily pro-environmental actions, as it is a personal diary capable of recording users' everyday behaviours.
Based on the choices made by the young, the system compares them in relation with those of other online

users to calculate the expected consequences of particular behaviour on the environment at a collective level.

Furthermore, by using some principles of gamification, 123…Earth pushes children to improve themselves and acquire new sustainable skills, collaborating, aiming at overcoming daily challenges that encourage sustainable development (for example, reducing water or energy consumption by carrying out daily environmental activities such as turning off lights when they are not needed or not wasting water for brushing teeth).

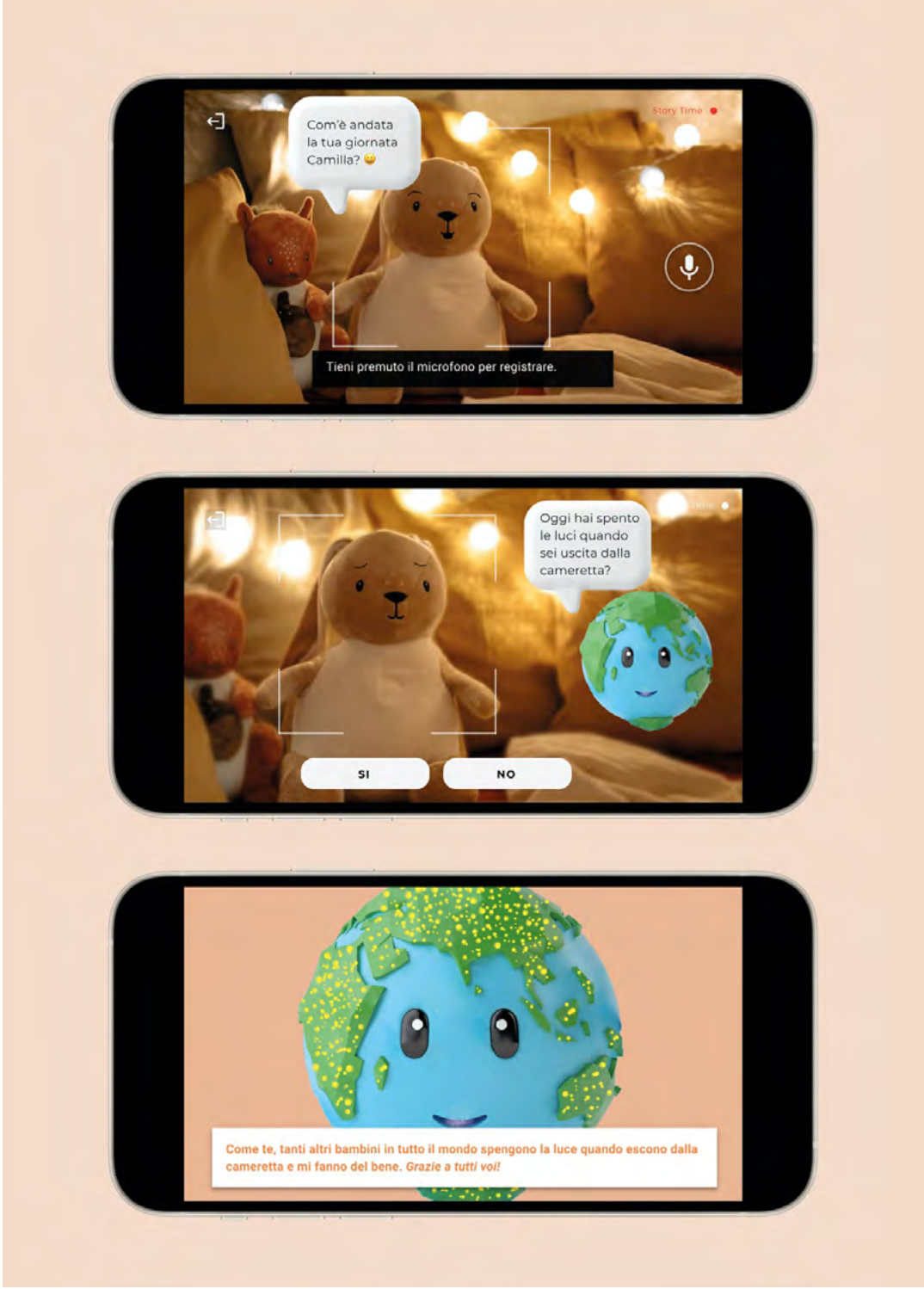


Figure 4. Use case scenario of the project 123…Heart!.

4.4 Third Project – Focus

Focus is a mobile app that explores the biodiversity loss caused by the negative impact of anthropocentric activities on natural ecosystems. In particular, the service aims to increase citizens' awareness of digital pollution through AI-based services. That is a sensitive argument nowadays even though not properly addressed as a source of environmental pollution because invisible and intangible to the users: for example, it is difficult to make it evident in the act of sending an email or uploading a post on a social network. It is hard thus to increase the appropriate awareness of each individual on their behaviour in the digital world.

The service offers a hybrid educational experience that takes place by scanning the photo of specific local vegetable or animal species through the app, from which the users can trace and display all the values relating to its taxonomy and its risk of extinction. Focus will display photos of endangered animals or plants in specific spots of an urban location that are easily visible and accessible to all citizens who wish to engage with the mobile app.

Once the image has been scanned, an image recognition and web crawling service provides the user with the extinction rate of a given species and visualise that through the graphical resolution rate of its corresponding image (Figure 5). The resulting graphic effect, that negatively or positively affects the quality of the image, is therefore proportionally influenced by the percentage rate of extinction of the scanned animal or plant. The greater the degree of extinction of the given species, the greater the degree of pixelation of its image. The species of a given habitat are interconnected with each other as well. So, users can observe how the loss of a species can inevitably compromise the survival of the remaining species annexes.

Furthermore, to stress the urgency that affects the degradation and fragmentation of natural habitats caused by global warming, the system can simulate the loss of biodiversity in a specific local area in the short- or medium-term period by visualising a georeferenced map associated with a timeline.

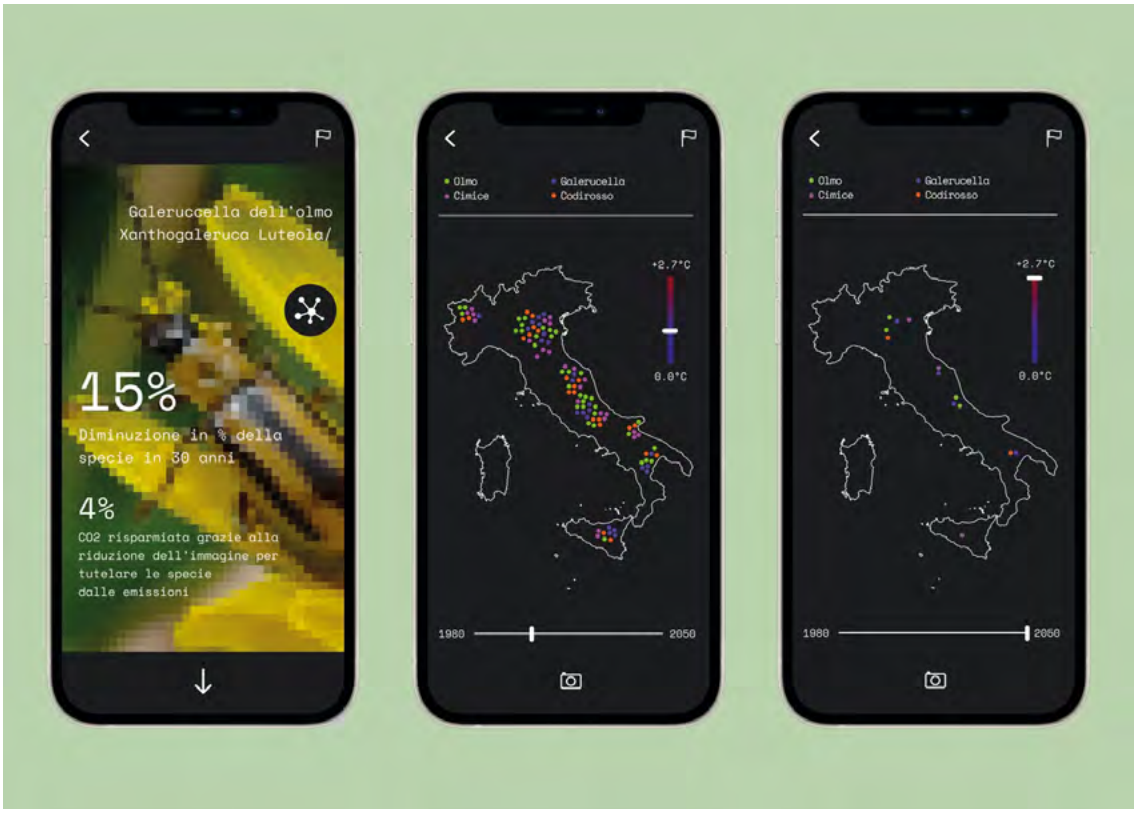


Figure 5. Interface mock-ups of the Focus project: The effect of pixelation emphasises the percentage of extinction of a specific animal or vegetal species.

4.5 Fourth Project – How Much Does it Cost for Us?

How Much Does it Cost for Us? proposes an AI-based mobile app that analyses human decision-making responsibility on conscious consumption choices through a more-than-human perspective in which man lives in an ecosystem that is increasingly interwoven and interconnected with autonomous agents and smart things that give rise to increasingly sustainable, augmented, and intelligent new interactions (Giaccardi & Redström, 2020). Specifically, starting from Lovelock's speculative vision of the Novacene (Lovelock, 2020), namely the era where artificial intelligence permeates everyday life, completely autonomous and intuitive artificial agents become assets that contribute to resolving the problems of climate change by removing human awareness of the climate care equation.

In this case, the prototype explores the idea that human irresponsible behaviours towards environmental care may have no relevance for a sustainable future any more because of that issue will be solved by hyper-intelligent machines – as already happens among the living species of our biosphere – that will be able to adopt resilient and mitigative strategies to regulate the terrestrial ecosystem.

Based on these considerations, the prototype explores and traces new and innovative interaction scenarios between human and technological artefacts in the domestic context.

The project concerns the development of an AI-based plug-in specifically designed for home automation systems such as Alexa, which autonomously manages the consumption on behalf of the users, providing them with affordances and constraints for the action that are designed for making them reflect upon home sustainability. In that case, the plug-in maintains the household carbon footprint within the correct thresholds of environmental sustainability dynamically and adaptively based on the changing situations occurring in the home environment.

However, How Much Does it Cost for Us? seeks a peculiar solution to support users' pro-environmental awareness through daily training. The educational approach occurs through a constant negotiation of decisions with the users, in which each individual is encouraged to reflect on the detriments of their irresponsible actions and, therefore, to adopt virtuous and sustainable behaviours towards the environment (Figure 6). The app monitors the users' daily domestic consumption through the home automation system. If the AI intercepts negative consumption behaviours – for example, the under-load of the washing machine – it temporarily stops human action and invites the users to negotiate their behaviour and to encourage them to make responsible and sustainable decisions. If the users maintain correct and efficient behaviour, the AI supports their actions by showing data and infographics highlighting the reduction of their CO_2 emissions.



Figure 6. An interaction scenario of the How Much Does it Cost for Us? project in the form of visual storytelling.

5. Discussion

The reflections and educational design experiences reported so far highlight the urgency of a substantial change in our lifestyles to promote climate care, which will have to pass through a profound rethinking of the educational paradigms and principles if modern society wants to foster sustainable development. That will aim to become a framework of integrative and multidisciplinary education for behavioural change, which can be adopted and shared at a systemic level by all individuals and social and institutional groups. Specifically, the potential of design-driven approaches for climate care action can take advantage by integrating data-driven explanatory models and AI-based solutions with user-driven approaches. This will enable the definition of intelligent systems for awareness raising, emotional, moral and cognitive engagement, and self-efficacy in introducing behavioural change and novel habits thorugh new interactive artefacts (Garito et al., 2021; Lovelock, 2020).

The results that emerged from the educational experience outline many design values linked to SIxD that can make human-machine interaction more effective in increasing the learning process of pro-environmental behaviours. Final reflections are described here below.

5.1 Making the Invisible Visible

Through the use of data, SIxD must develop design solutions that make those intangible aspects imperceptible to humans visible, such as visualizing complex phenomena related to climate change, predicting the outcome of particular personal decision-making choices or simulating the side effects of anthropocentric development on the planet (Blevis & Blevis, 2010). The proper use of storytelling can support the subjective experience of the interaction by displaying clear evidence of the phenomena objectively and concretely to avoid users generating the formulation of bias or preconceptions on specific assumptions on environmental sustainability.

5.2 Responsible Training

If sustainability is considered a lifelong learning journey (Cebrián & Junyent, 2015), educational training experiences based on SIxD need to sustain their values and principles over time to constantly support people in integrating pro-environmental practices into their everyday practices. For example, products or services that make visible that each of our actions is interconnected to a broader system of ecological interactions are significant solutions that can encourage people to carry out, in many of their habits, only actions that have positive scalar effects on a given environmental problem. In the same way, interactive experiences based on coaching or training that encourage people to compare multiple behavioural choices and habits can increase people's awareness of adopting pro-environmental decisions as they can constantly stimulate people's decision-making process during their routines.

5.3 Sense of Belonging

The SIxD strategies must elicit behavioural change through emotional communication that sensitizes individuals to acquire empathy towards global and collective problems of climate change relating to care and respect for the planet with the same level of attention that we adopt for ourselves (Light, 2022). To do that, products and services must provide engaging experiences that make users feel connected to other people through the same interests, attitudes, or environmental issues to elevate the active participation and collaboration of individuals in a broader social coalition, which can increase climate care collectively (Dourish, 2010; Manzini, 2015).

6. Conclusion

The Sustainable Interaction Design for Climate Care Workshop as been conceived as a design education method for University students with the goal of engaging them in tackling the entropy of our post-modern ecosystems and to exercise with complex systems design, often requiring to reflect upon social, technical and environmental components of our experience in the world.

Interaction design has been centred on information technology and computing innovation from its foundations as an autonomous discipline. The workshop allowed the design students to both get acknowledged about technologies such as Artificial Intelligence and Augmented reality and to design the appropriate interaction and interface models, within the situation of their future design scenarios.

The education initiative taken by the authors wanted to experiment with a workshop arrangement for:

- engaging design students in dealing with complexity as a paradigm for learning systemic, critical and transformative design research;
- committing design students in environmental sustainability and climate care, with the goal of developing their sense of ownership, responsibility and accountability towards the planet survival;
- reaching out a broader audience of those that will be engaged by the design students' work, meaning leveraging upon their design to raise awareness on climate care and to create an impact on the local communities.

The Sustainable Interaction Design for Climate Care Workshop implemented a project-based and challenge-based one-week residential design education centred on teaching, practising and improving the quality of design research methods. Interaction design didactics is thought to benefit from the application and critical revision of methods related to research and study, design concept and design critique, as well as prototyping with digital and material forms, in view of design project improvement.

To conclude, the research shows how SIxD can have a strategic role in increasing designers' commitment towards sustainability because it enables technology-enhanced learning to provide meaningful digital and hybrid experiences, which support experiential and reflective learning, stimulate and support awareness and individual decision-making actively, and promote collective participation to generate common critical thinking that can address the challenges of the climate crisis by contributing to more responsible and sustainable social and cultural progress.

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P/REFERENCES OF DESIGN

QUANTIFYING CIRCULARITY: TOOLS AND INSIGHTS FOR FASHION DESIGN FOR RECYCLING.

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ABSTRACT | The reduction in carbon emissions achieved in this decade will be crucial to limiting climate change and the threat it causes to people and planet (Calvin et al., 2023). To contribute to a transition to net zero, the textile and fashion industry must urgently decouple itself from the use of virgin resources (Sadowski, Perkins and McGarvey, 2021). As put forward by WRAP's Textiles 2030 roadmap, the use of recycled fibres is a key leverage point to reduce impacts including CO2 (WRAP, 2021). However, the textile-to-textile recycling system is currently fractured by the inadequate design of garments. Most garments on the market are not designed for recyclability, and even when they are, they are difficult to identify as such. To limit entropy in the form of material waste, it is therefore urgent that all new clothes should be designed for recycling and clearly labelled for efficient collection.

McKinsey's Scaling Textile Recycling in Europe (McKinsey, 2022) report highlights that real collaboration is needed for the textiles value chain to reach the critical scale needed to provide sufficient feedstock for fibre-to-fibre recycling technologies. Building on previous research providing 'insights for designing with future garments with full recyclability in mind' (Goldsworthy et al, 2019, p47, Hornbuckle et al, 2023, p11) the Quantifying Circularity project brings together partners from both sides of the garment circularity equation: brands and recyclers. The research is carried out by academic and industry go-betweens who bridge the divide between technical recyclers and creative brands. Importantly the project also brought environmental analysts into the process to apply LCA methods to better 'understand the environmental impacts of design decisions' (Goldsworthy et al., 2017, Goldsworthy and Ellams, 2019, Forst et al., 2023). The project aims to develop tools to facilitate the access to specific recycler parameters in the early stages of the design process.

This paper will present the insights from developing and testing guidelines to support designers in embedding recyclability within each product of their collections. The guidelines were tested and refined through three workshops carried out with fashion and textiles brands across the UK. These collaborative sessions produced a range of garment concepts that offered solutions to current recyclability challenges. Across the wide range of brand type and size, some common challenges were identified. These issues highlight the need for a systemic approach to recyclability, one that addresses both the detailed scale of trims as well as shifting agendas and complex communications between stakeholders in the field.

1. Net-Zero Objectives for Fashion

1.1 A Circular Textiles Economy

The fashion and textiles industry is a substantial contributor to the environmental harm generated by human activity (Waste and Resources Action Programme, 2012). To remain within planetary boundaries and work towards the Paris Agreement, it is widely acknowledged that it must undergo rapid and radical change (Amed et al., 2022; World Economic Forum, 2022). Sustainable design practices must be implemented across the entire sector, whether with micro and small fashion brands or large multinational retailers. Reducing impacts through green energy and non-toxic processing is key, but the waste created by manufacturing and consumption and the impacts that come with it must also be addressed. A part of reducing the impacts of fashion on the environment is to transition to a circular textile economy (Ellen MacArthur Foundation, 2017). This includes multiple strategies that enable sustainability, including designing for product longevity, but also importantly designing for materials to be recovered at the end of life to be made into new products of equivalent value.

Research estimates the apparel industry produces approximately 93.1 million tonnes of textile waste annually (Quantis, 2018), yet only 0.5% of global fibres are from recycled pre- or post-consumer textiles (Textile Exchange, 2020). Closing the loop on textiles is a key component of net-zero objectives. As pointed out by WRAP, the diversion of textile waste from landfill and incineration and its use as a secondary resource in the production of new garments is key to achieving targets for decarbonisation (WRAP, 2021). However, there exist multiple challenges to the efficient recovery and recycling of textiles at end of life.

1.2 Design for Recycling

Currently, clothing is not circular because it is not designed to be recycled. Design for recycling is a fundamental principle of circular design that needs to be implemented in all products to achieve the needed shift in the industry. It entails an understanding of end-of-life trajectories for the materials and products that are put on the market today. Initiatives such as the ‘Jeans Redesign Challenge’ (Ellen MacArthur Foundation, 2021) show the enthusiasm for circularity in fashion, but in order for future clothing to be fully circular it must be ‘designed for defined recycling processes and technologies’ (Hornbuckle et al., 2023, p11). Rules such as mono-material design, limiting disruptors and adequate labelling are all key to enabling an uninterrupted flow of resources in a circular economy.

Designers hold a key role in this transition to circularity, it is therefore key to put the tools and knowledge concerning recycling at their disposal, but these tools are not static recommendations. They need to align with the development of recycling technologies as they progress. The quantifying Circularity project thus aims to provide clear and concrete guidelines for design for recycling with input from the recyclers at every stage. Garments are produced based on existing frameworks without this connection cannot guarantee success. The novel angle of this project creates circular design principles on specific and targeted capabilities of fibre-to-fibre recyclers. If we work ‘with recycling science to set the brief for recyclability’ at the outset we improve our chances of success significantly (Goldsworthy et al., 2019, p23).

One major challenge when taking on this approach is the current underdeveloped state of the textile-to-textile recycling sector. While change is happening fast, most recyclers are still in the teething phase of the development of their technology, with key innovation still at pilot stage. While technically textile to textile recycling is completely possible, there are still systemic issues to overcome for garments to be recovered, identified, sorted, and recycled so that they can become fibres in new garments. Much of circular design, including the work presented here, is pre-empting the full optimisation of the recycling system to contribute to its development.

1.3 The Circular Textiles Foundation

From the learnings of setting up the Plan B textile-to-textile thermo-mechanical recycling technology and company, the Circular Textiles Foundation emerged as an answer to the systemic issues slowing down the shift to circularity in the textile industry. The work described is based on the CTF's identification of challenges and opportunities for circularity in fashion. Developing recycling technology is necessary, but will only achieve impact at scale if products are designed to comply with the, sometimes quite strict, parameters for acceptability.

The CTF acts as a spokesperson for recyclers across the world, collecting the most up-to-date information on what input can be accepted for mechanical or chemical recycling. They translate this information into training and support for brands wishing to embark on a circularity journey, addressing the challenges of the current discrepancy between product design and recycling parameters.

1.4 The Textiles Circularity Vision

The overarching aim of the Quantifying Circularity project is to contribute to a shift in circularity across the textile industry, but its focus is on design for recycling. This means that several assumptions about other parts of the system are made. Other aspects of the system including customer behaviours, collection sorting and pre-processing are assumed to work optimally in a best-case scenario configuration. While it is known that improvements are needed in these segments of the system, they are out of scope for this study.

In the vision for circularity represented by this work, garments are collected from the user after a long use phase. The post-consumer waste will then be identified as either fit for resale or non-re-wearable. The non-re-wearable fraction can then be identified for recycling routes. Any garment designed for recycling could be singled out as such thanks to the CTF logo, once recyclability has been noted, the sorter can determine what type of recycling is most adequate by using hand-held spectroscopic devices which can tell what type of fibre the garment is made of even if labels have been removed. These devices are seen as a key contributor to circularity at the sorting stage (Circle Economy and Fashion for Good, 2022) and will work alongside certification to channel end of life garments to the right recycler. Once the fibre type is identified, the garments are aggregated into the recycler category, with for example white 100% cotton garments destined for mechanical recycling and garments with 5% contamination to 95% cotton destined to chemical cellulose recycling. Those products can then be pre-processed to remove any unavoidable disruptors and shredded to fit the recycler's specifications. The input is then processed in the appropriate technology and made into fibres or yarn that replace the need for virgin fibres in the design of new products. The project's aim is to provide the best possible guidelines and support for the design of products that can travel smoothly and efficiently through this system to be recovered for recycled fibre production.

2. Cross-Sector Collaboration

2.1 Recyclers Advisory Board

Setting up an advisory board with a selected panel of recyclers anchors the project in the specific criteria for recyclability. Currently, much of the work that is done on educating designers and brands in terms of circularity is based on generic recommendations. When exploring the specific criteria for each recycler it becomes apparent that finer detail is key to enabling true circularity.

The recyclers integrated to the project represent a range of technologies and development stages, offering a holistic perspective of possible end of life trajectories for post-consumer garments. Mechanical recyclers of cotton and wool show the options for historic and well-established fibre to fibre recycling, whereas chemical recyclers of cellulosic fibres demonstrate an area in development but with solutions already at

scale. The thermo-mechanical polyester recycler included in the project opened the first ever at-scale textile to textile recycling machine during the project timeframe. And finally, a mixed fibres chemical recycler currently at pilot scale shows options for the future of the sector.

A challenge to acknowledge when working across this range of recycling stakeholders is that the different technologies are not all optimised to the same level, and it may appear as though some are much more efficient in terms of energy and water use than others. While there is a difference between mechanical and chemical processes, the maturity of the technology must be taken into account and allowances for progress with wider take-up must be made. The restrictions for input to each of these processes also vary. Chemical processes generally accept more contamination than mechanical processes making them look favourable to brands designing for circularity. While the chemical process allows for the extraction of contaminants, the process to break the material down takes more energy and chemical inputs than a mechanical process which retains all contaminants in the recycled output. This points to the need for a concerted effort amongst recycling stakeholders to realise the vision for textiles to cascade from low impact processes to more comprehensive deconstruction in successive garment lifecycles. In this model the different recycling technologies don't compete but complete each other.

2.2 Brand Participation

Circularity principles need to be adopted across the full value chain. However, it can sometimes be difficult for brands in the fashion sector to see the value of design for recycling as the end of life of the garments they produce is often beyond their control or horizon. The project builds on networks of proactive fashion companies which see circularity as an essential part of their sustainability commitments.

Participants in this research have provided valuable perspectives on the types of products in their ranges which can be designed for recyclability and what challenges persist when operating this shift. By participating in workshops as cohorts of brands, they have generously contributed to the progression of circular design strategies. Increasing knowledge of circularity in the industry will come through more brands allocating time to training such as that offered in the QC project, understanding what methods and language are most adequate to onboard key stakeholders in part of the insights from this work. Part of the impact and legacy of this project lies in the onboarding of brands which hold the keys to an industry-wide transition to circularity. The connections between the organisations involved in this collaboration is designed to extend beyond the project timeframe.

2.3 WRAP Perspective

The Waste and Resources Action Programme is a UK non-profit working towards sustainability and circularity in a range of sectors. With the Textiles 2030 Roadmap, the organisation is galvanising the fashion industry to achieve net-zero targets in the UK. Textiles 2030 is a voluntary agreement to change practices and move towards sustainability through design for circularity, new business models, closing the loop on materials, and encouraging consumer behaviour change. WRAP's involvement in the Quantifying Circularity project stems from the development of the Textiles 2030 Footprint Calculator. This tool offers a simplified LCA method to support brands in assessing and amending their impacts through a review of their fibre use across their full product range, and the modelling of the effects of improvement strategies on their carbon, water, and energy impacts. The calculation of the impact savings afforded by design for recycling will expand the footprint calculator work with a focus on circularity and carbon calculation. The approach provided by WRAP contributes to making the guidelines for recycling specific and truly understanding the quantified implications of different trajectories at the end of life.

3. Quantifying Circularity

3.1 Workshops to Apply Design for Recycling

The project is structured around four workshops taking place in various UK locations offering more accessible opportunities to brands near their headquarters. At the time of writing, three of the four events have taken place. Plymouth, London, and Kettering saw each four or five brands joining for a full day of learning and work on the topic of circularity. A final workshop in Manchester will close this programme of in-person events. Insights on the most effective communication approaches and best prompts to encourage creativity in the redesign activity were taken on after each iteration and included in the design of the following session.

Each workshop followed a similar pattern by introducing participants to the notions and imperatives of design for recycling, showing successful case studies of brands having taken on such an approach as inspiration. The brands worked in groups amongst themselves to get in-depth perspectives on the products brought to the table. Working through the step-by-step redesign activity with three garments in turn led to seeing the different challenges based on various types of garments. A final round of presentations by each participant group allowed us to see the range of challenges across brands. While some garments were deemed impossible to redesign without compromising the brand's sales, other redesigns were seen as very easy switches that could be taken on almost immediately with no price increase or big changes to the product style. In multiple cases, brands realised that while the products they had brought to the workshop, presenting what they saw as an interesting challenge to address, were too difficult to design for recycling, the lessons they learned during the day could apply to other products in their range that could be 'easy wins'. Overall, the participants left feeling empowered to change the way they design to enable more circularity in their ranges.



Figure 1. Quantifying Circularity workshop in London.

3.2 Practical Guidelines for Brands

A key tool for the workshop activities was a practical guide for design for recycling: the three-step recycler identifier. The approach functions on the basis of a redesign exercise (Ellen MacArthur Foundation and IDEO, 2017), where an existing product is taken as a starting point and improvements are considered to make a circular version of it. A key criteria of a redesign challenge is that the key characteristics of the original product such as functionality, aesthetics, and price point should be maintained so that the redesigned version can truly replace the purchase of the original 'unsustainable' product. This means that the designers taking part in the activity need to aptly balance the requirements of recyclers with the product's specifications.



Figure 2. The Quantifying Circularity worksheets guiding workshop participants through the three-step recycler identification process.

The first step to this approach is to identify the garment's main fibre type, this then directs the designer towards the most likely recycler. For example, if a product is mainly made of cotton, they will want to consider either cotton mechanical recycling or cellulose chemical recycling as possible end-of-life options. Once this has been defined, then designers can take a closer look at the specific parameters of the intended recycler. A set of 'recycler parameter' sheets is available as part of the toolkit, each detailing precisely the tolerances for fibre blends, trims, print or coatings for a given recycler. The designers can then identify what disruptors are currently part of the existing garment and discuss how they could be swapped out for alternatives that do not impact the recycling process or simply be removed from the product's design. As an increment from current generic circularity guidelines the instructions are specific to the recyclers involved in the project was created for brands to follow. This allows us to see how features such as prints or trims will impact recycling to various levels.

4. Case Studies of Design for Recycling

4.1 Overview of Case Studies

In each of the three industry-facing workshops which structured the Quantifying Circularity project, the brand attendees were asked to bring three garments from their range. These could be bestsellers or high-volume products that could have a strong impact when redesigned, or more challenging products that represent a key offer from their brand. Alongside the physical product, detailed spec-sheets were provided so that as much information as possible could be gathered on the baseline products. The products that were redesigned ranged from waterproof jackets to wool jumpers, from children fancy-dress to baby pyjamas. A smaller selection of products also represented home-wear ranges. A wide range of product types and recyclability challenges were thus covered.

The redesigned garments form a collection of 32 exemplars showing challenges and opportunities for design for recycling. This collection forms the basis of the analysis presented here. Of the 32 garments reviewed, six were identified as possibly recycled in a thermo-mechanical polyester recycling process, six were seen as destined to both mechanical and chemical cellulose recycling, three as only chemical cellulose recycling, one for wool mechanical recycling, and sixteen could not be attributed to a recycling technology without significant design changes which may affect the product's market value. In the proportion of these latter products, the main reason for their non-recyclability was the main fabric composition, either due to a blend of fibres belonging to different recycling systems (such as cotton and polyester for example), or due to the presence of a large proportion of elastane which is a barrier to all recycling processes. Hard trims such as zips or buttons were identified as disruptors in sixteen garments across all recycling categories, fusing was a disruptor in nine garments, and print was identified as an issue in five garments. This sample thus shows the relevance of various tips for redesigning challenges for recycling.

4.2 Key Challenges in Garment Redesign

The review of the garment redesign case studies provides key lessons that apply across product types when designing for recycling. These must be addressed as a priority and solutions to minimise these disruptors or develop recycling systems to accommodate them must be explored. The challenges laid out here relate specifically to physical components in product design.

Signature sustainable fibres are not recyclable.

Several of the garments brought to the workshops were front-runner products, representing the brand's most forward approach to sustainable design and thus using low-impact fibres or alternatives to cotton and polyester. These fibres often become an important part of a brands identity, for example with linen or bamboo viscose products being a sign of quality and sustainability in the customer's eye. However, as the recycling sector is still in development, the current focus is on fibres that represent a majority share of the market. Thus viscose-like fibres and bast fibres, while not technically impossible to recycle, will not be accepted by any recycler for the foreseeable future. The challenge to brands is then to balance sustainable design with the choice of alternative fibres, and circularity which focuses on more common resources.

Removing trims makes the product less attractive.

Removing disruptors to recycling formed the basis of the garment redesign, yet in some cases, removing these elements can collide with the product's identity or functionality. Fusing for example, can be easily be reconsidered with no visible changes to the user, but for elements like pocket zips, removing them would diminish the product's functionality, meaning that the redesigned version would not fully replace the functional unit of the original version. The baseline for a redesign exercise is that the product that is

redesigned should fully replace the original version. If there are discrepancies in terms of look, functionality, or price point, them it is likely that the customer will fulfil their need at their expected budget point with another product and dismiss the sustainably redesigned option.

Stretch is a challenge across a wide range of products.

It is widely known that elastane is a strong disruptor for all recycling technologies (Östlund et al., 2017). While it will end up as waste in chemical recycling processes, in mechanical processes, it is a contaminant that negatively affect the output. Yet, stretch is a key characteristic for comfort and elastane is used both as a fibre blend across the base fabric or in trims such as cuffs and waist band elastics. There are currently no alternatives which can be used to provide the same effect without limiting recyclability. In a few of the garment redesigns, the use of elastane was argued as a key contributor to longevity, removing it potentially leading to the garment being disposed of much earlier than if there is some elastane. This connects to the overall discussion on finding a balance between performance and recyclability.

4.3 Systemic Challenges for Circularity

Alongside the issues identified in products themselves, the process of redesigning garments brought up challenges that relate to recycling systems. These will need to be addressed and clarified in tandem with physical redesigns.

Recycler timelines are varied and changing.

Sector-wide circularity will mean that designers will need to integrate the requirements of a range of recycling technologies in their products. The Quantifying Circularity project is one of many endeavours to make these requirements available to decision makers. However, even within the short timeframe of the project, it was noticed that recycler parameters change and need revisions as the technology is tested and scaled. This means that guidelines need to be regularly updated and that the role of mediators between recyclers and brands such as the CTF is key.

In parallel to timeline within a specific recycler's technology development, the difference in development speed between different recyclers also needs to be considered. The policy for certification of recyclability by the Circular Textile Foundation is that garments should abide by the parameters of recyclers that already function at scale and can handle end-of-life garments today. However, many of the solutions for recycling more complex products are currently just on the horizon. The technology has been tested in lab and/or pilot scale, but investment to scale for large quantities is still lagging. The assumption amongst experts is that the clothing designed today will only be collected as a non-re-wearable waste garment in several years, allowing time for the recycling landscape to evolve in the meantime. However, design recommendations today must stick to what is known about available technology and assumptions could have negative effects.

Recycled outputs are not recyclable in turn.

A circular textile economy aims to decouple the production of products from the extraction of virgin resources, effectively using existing materials in infinite loops of recycling. There is much ground to cover before this vision becomes reality, and one challenge is that the output of some of the most promising recycling processes is not currently recyclable itself. For instance, when recycling cotton in a chemical process, the output is a regenerated cellulose similar to viscose. Currently, viscose will not be accepted as input by cellulose recyclers. While the technology and approach of recyclers may evolve in the future, this means that the product of this recycling process will not in turn be recycled which is a challenge to true circularity.

5. Conclusions

5.1 Removing Disruptors and Providing Recyclable Alternatives

A key part of designing for recycling lies in the removal of disruptors. These can take the form of zips, buttons, fusing or sewing thread which is in a different material to the base fabric of the garment and thus acts as a contaminant to the recycled output. Discussion between brands and recycling experts in the Quantifying Circularity workshops led to realise that in some cases, heavy disruptors such as zips or elasticated wastes could not be designed out without impacting the value of the garment. Thus, recommendations to remove trims need to take account of the garment's specifications and functionality. While it must be acknowledged that not all trims are equal, and different redesign strategies may apply, there is also a need for more detail on what can be addressed in pre-processing would support better circular design. The Quantifying Circularity project focuses on product design, but improvements and innovation can also happen in the overall logistics for the sorting and preparation of textile waste. Efficiency of removing some necessary trims could support a more balanced compromise between recyclability and functionality. The library of circular trims developed by the CTF offers a product-based response to this challenge. While not all functions can be performed by trims that are suitable for recycling, selecting lighter elements such as buttons or zips in the same material as the base fabric (generally possible with polyester) can highly increase product recyclability. More research and development is needed in this sector to develop sturdy trims that abide by recycler and sorter parameters. The same goes for elastane, the availability of stretch fibres and elastic trims compatible with polyester and/or cellulosic recycling would be a breakthrough to achieve high product specifications without compromising on circularity.

5.2 Communication Across Actors

Circularity is inherently highly collaborative as all actors from across the sector need to communicate to facilitate the flow of resources. The insights concerning the physical and systemic challenges to recycling presented in this paper are useful to a range of fashion stakeholders from designers to recyclers and policymakers. Working across design research, business support, and environmental engineering in this project has provided a holistic view of recyclability challenges, moving between the hyper-specific level of disruptors, to the general questions relating to systems and logistics. The guidelines and a step-by-step process for designers to follow are framed by this three-pronged vision for circularity. This approach provides designers with clear steps to apply to each product they design in order to enable its future recycling. The next steps for the project are to better frame the benefits of design for recycling over the entire range of a brand's products. Working more closely with WRAP in this next phase, carbon calculations that quantify the assumed benefits of circularity will support a wider change in the industry.

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About the Authors:

Laetitia Forst is a circular textile design research associate at the University of the Arts London. She completed her PhD in 2020 on the subject of Textile Design for Disassembly as a circular design strategy. Since then, she has been involved in a range of projects addressing the challenges of sustainability and circularity for the fashion and textiles industry. She is interested in bridging the gap between design and scientific understandings of next gen materials.

Kate Goldsworthy is Chair of Circular Design & Innovation and Co-Director of the Centre for Circular Design, based at Chelsea College of Arts. Her core research interests are designing for sustainability, the circular economy and material innovation within textile and fashion contexts. Her methods are transdisciplinary & practice-led, with a focus on fibre-to-fibre recovery and new finishing technologies. This includes more sustainable production systems for the textile industry, and pioneering design solutions for the recycling and recovery of both synthetic polymers and bio-based materials.

Tim Cross has 30 years of experience in garment manufacturing. In the last 5 years, he's been focused on supporting fibre to fibre recycling systems, specifically for post-consumer textiles, as Director of Project Plan B, a thermomechanical textile polyester recycler, in the UK. His work at the Circular Textiles Foundation sees him leading the adoption of circular principles and practices by multiple brands and retailers across the UK.

Jenny Valarino has over 20 years of experience in garment design across womenswear, menswear, and childrenswear. Her experience spans high street to high-end fashion, and her expertise exists across the entire product life cycle. As Head of Circular Design at the Circular Textiles Foundation, Jenny collaborates on circular design solutions to reduce clothing impact. Passionate about using design to tackle industry challenges, she is dedicated to driving change through innovative solutions.

Padouk Fielding brings over 12 years of experience in partnership development and project management, working across multiple sectors, from international development to circular fashion innovation. As Head of Partnerships at the Circular Textiles Foundation, Padouk builds impactful and lasting relationships with brands on their journey to circularity. Padouk is dedicated to driving positive change and firmly believes in the power of strong relationships and collective action.

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P/REFERENCES OF DESIGN

SUSTAINABLE ARCTIC PRODUCT DESIGN: OPPORTUNITIES FOR SNOW GLASS DEVELOPMENT WITH STUDENTS.

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DOI: 10.63442/EULK1530

KEYWORDS | ARCTIC PRODUCT DESIGN, ARCTIC GLASS DESIGN, SNOW GLASS, DESIGN EDUCATION, SUSTAINABILITY

ABSTRACT | One of the key challenges for the future of Arctic design is considering the highly sensitive environment and culture in the Arctic regions. The problem is how to design products in a more sustainable way in the Arctic context. To achieve this, designers need education, skills, and support to create socially and environmentally responsible products (Lofthouse, 2017). Arctic design creates products, services, and systems addressing the unique environmental conditions of the Arctic regions. It centers on a commitment to sustainability and a deep respect for the delicate Arctic environment (Häkkilä & Johansson, 2018, p.33). This examination contributes to the broader discussion on sustainable systems design, particularly tackling challenges posed by climate change.

This study delves into the specifics of Arctic product design, exploring the intersection of nature-based solutions in the potential of snow glass development. The study contributes to the conference's overarching theme, envisioning a harmonious synergy between human creativity and the resilience and opportunities of the Arctic ecosystem. The focus is on designing products within the Arctic context, emphasizing the importance of sustainable design practices and the role of students in shaping the future of Arctic product design.

Firstly, the University of Lapland´s Art and Design students (n=184) were surveyed from 2021 to 2023, aiming to understand their insights on Arctic product design and potential future directions. Results show how these products embody authenticity and responsibility through a profound appreciation for nature and sustainable materials. Nature's conditions are an important part of Arctic product design, where Arctic materials such as snow can be used in different stages of the design process. In the second part, Arctic glass design was explored, emphasizing its potential for integration with sustainable materials. *Arctic glass design is a specific field within the realm of art and design that focuses on the innovative application of glass, incorporating distinctive characteristics and elements related to the Arctic.* The study unveiled numerous possibilities to incorporate, e.g., snow into the glass design process. Thirdly, respondents' insights were gathered on the use, features, distinctions, challenges, opportunities, and definition of an innovative glassblowing technique, snow glass. These perspectives improve understanding when using snow in Arctic glass design. *Snow glass is defined here as a type of glass that is shaped and manipulated in different ways with snow during the hot glass working process.* The term does not, therefore, refer to the aesthetic qualities of glass, such as aiming to resemble the appearance of snow.

The findings reveal that perceptions of Arctic product design are strongly associated with nature and emphasize sustainable and responsible qualities integrated with durable and functional designs. To develop Arctic product design, we need to sustain Arctic materials for the future. Therefore, when aiming for sustainable Arctic product design, it is essential to minimize climate impact, ensure resource efficiency, respect cultural aspects, and meet demands for environmentally responsible products. Applying Arctic materials such as snow in suitable product design processes can meet these demands. This study sparks ongoing dialogue, promoting further investigation into the possibilities of snow glass.

Sustainable Arctic Product Design

One of the key challenges for the future of Arctic design is considering the highly sensitive environment and culture in the Arctic regions. The problem is how to design products in a more sustainable way in the Arctic context.

Arctic product design adjusts contributions to the unique environmental aspects of the Arctic, striving to develop resilient, sustainable and culturally fitting solutions.

One way to affect the future of a more sustainable design is through design education. This study underscores the significance of sustainable design practices in the Arctic, with a particular emphasis on students playing a crucial role in shaping the future of Arctic product design.

The exploration of nature-based solutions aligns with the broader theme of envisioning a harmonious synergy between human creativity and the resilience of the Arctic ecosystem.



1. Reindeer antlers pressed on hot glass form a supportive structure for the fragile Arctic flower. Glass design symbolizes the connection with nature. Kannatella (*Cherish*), design by Milla Johansson (2023).

Arctic Product Design: A User Study with Design Students

Students' perspectives enrich the viewpoint, align with future visions and foster a more inclusive and forward-thinking approach to Arctic product design. University of Lapland´s Art and Design students (*n=184*) were surveyed from 2021 to 2023 to understand their insights on Arctic product design.

"In the future, sustainable development and recycling should be considered in Arctic product design. When utilizing raw materials from nature, consideration should be given to their availability also in the future." A design student's response.

Respondents emphasize the use of natural materials and sustainable manufacturing methods in Arctic product design. Nature's conditions are an important part of Arctic product design where Arctic materials such as snow can be used in different stages of the design process. Snow's unique qualities contribute to various stages of the Arctic product design process and serve as a source of inspiration for creative and sustainable product designs.



2. Glassblowing mold can be refined by examining the shape with snow. Design by Milla Johansson (2024).

Arctic Glass Design

Arctic glass design, as a facet of Arctic product design, is intricately linked and grounded to the overall research areas of the University of Lapland. Arctic glass design has been examined through diverse perspectives in various design student projects during 2020-2024.

Arctic glass design is a specific field within the realm of art and design that focuses on the innovative application of glass, incorporating distinctive characteristics and elements related to the Arctic.

Sustainable Arctic materials, uniquely linked to the region, are responsibly sourced, produced and utilized with features like renewability and recyclability, contributing to the creation of environmentally friendly products.

This versatile study explores the opportunities and concretizes the topic with the Arctic glass design case, where design students collaborate with artisan students.



3. Snow forms distinctive surface patterns on glass. The potential of snow glass in artistic works is clear, but it might also be suitable for small series products. Kaltio, design by Milla Johansson (2023).

Snow Glass

The potential of incorporating snow into glass design within the Arctic context, offers an intriguing intersection of unique and experimental technique linked to Northern nature. Variables such as air and surface temperatures, moisture levels and snow crystal shapes impact snow texture and overall quality and are crucial considerations in snow glass design. This research aims to initiate a discourse regarding the categorization of snow glass as a novel and distinctive glass technique.

Snow glass is defined here as a type of glass, which is shaped and manipulated in different ways with snow during the hot glass working process.

Water typically creates crackled patterns to glass, but contrasting imprints arise when compared to those made by snow. Furthermore, unlike water, snow shape can be controlled and formed into a specific, detailed form repeatedly.



4. Snow glass creates vivid and unique shadows. Here, the term “snow glass” does not refer to the aesthetic qualities of glass, such as aiming to resemble the appearance of snow. Design by Netta Kandelin (2023).

Snow Glass: A User Study with Design Students

Empirical data was collected to integrate snow into glass design by examining trends, challenges, and opportunities to lay the groundwork for further exploration. Hands-on experiences were facilitated through practical design sessions where tests were done with snow to provide insights into the creative potential of snow in glass design.

Snow can be used in several stages of the glass design process, in diverse manners:
- creating ideas and finding shape;
- prototyping and mold making;
- user testing;
- glass manufacturing process.

Aspects to consider when making snow glass:
- quality of snow, influenced by various elements; temperature, humidity, texture and structure
- quality of glass; temperature and thickness;
- time and timing; duration and stage of contact between snow and glass;
- movement; controlling the interaction between glass and snow in different ways;
- finishing; snow effects are either retained or smoothed through glass reheating.



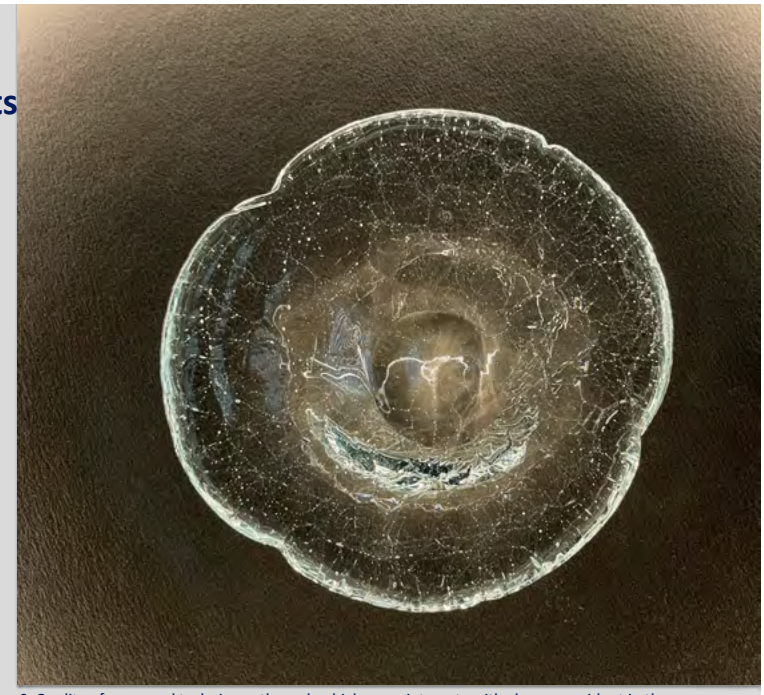
5. Different pattern effects can be achieved by controlling the technique of applying snow to hot glass. The traces can vary to be e.g. lichen-like or sequin-like. Design by Milla Johansson (2023).

Glassblowing with Snow: A User Study with Experienced Participants

Thirdly, a supportive survey was conducted for artisan students and glassblowers who had experimented glassblowing with snow. The aim was to inquire their experiences regarding:
- exploring perspectives on snow glass qualities;
- distinctions from other glass types;
- potential challenges or opportunities for the future of snow glass.

With a limited sample size, the results offer preliminary insights to spark discussion. Overall, respondents employed snow in various glassblowing techniques:
- both within and outside the glass;
- by sprinkling snow onto the glass piece;
- pressing or embedding objects into snow;
- incorporating snow within blown pieces;
- using snow as a mold.

Overall, snow glass is portrayed as an intriguing approach to glass design, offering visual appeal and potential symbolic significance.



6. Quality of snow and techniques through which snow interacts with glass are evident in the characteristics of glass. Powder snow markings. Design by Netta Kandelin (2023).

Discussion

Nature plays a crucial role in sustainable Arctic product design, requiring minimal climate impact, efficient resource utilization, cultural respect and environmental responsibility. The overarching goal is to create ecological products tailored for Arctic environments while considering user needs and product quality. Engaging design students in research activities parallel with ongoing courses benefits both education and research.

Snow emerges as a key Arctic material offering unique properties conducive to design innovation, particularly in glass design. Snow's versatility in design processes, as an alternative to environmentally harmful materials, highlights its potential for more sustainable product development.

Snow possesses unique qualities, allowing the creation of designs that might be unattainable with other substances. Moreover, snow glass signifies a harmonious union of natural materials and contemporary design practices, representing a fusion of tradition, innovation, and sustainability, paving the way for future explorations in Arctic design.



7. Reindeer antler and snow as mold parts. Arctic product design can contribute to sustainable development while maintaining cultural authenticity with locally sourced materials and eco-friendly methods.

Future Perspectives

The future of sustainable Arctic product design hinges on navigating the distinctive challenges posed by the region's delicate environment and culture. It must prioritize cultural sensitivity and environmental issues with resource scarcity.

The discourse surrounding Arctic glass design underscores the significance of further exploration in this area. Snow emerges as a promising yet underexplored medium in glass design, offering unique capabilities and distinct qualities.

We advocate for the development and examination of Arctic product design through the lens of Arctic glass design with particularly the snow glass technique. This study serves as a catalyst for ongoing dialogue, paving the way for continued exploration into the possibilities of snow glass.



8. Snow glass has captivating opportunities to create unique shapes, patterns and surfaces. Kaltio, design by Milla Johansson (2023).

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Figures

1. Kannatella (Cherish). Picture by Juuso Kiviniemi (2024). Glassblowing by Silja Skoglund, Markus André Eriksen, Astrid Elise at Glasshytta Blåst in Tromsø, Norway. Supported by Taike.
2. Glassblowing mold. Picture by Annu Kuivas (2024).
3. Kaltio. Picture by Elli Alasaari (2023). Glassblowing by Elina Reinola, Julia Öhman, Nikke Relasi, Paula Hjelt, Kirsti Doukas and Marika Kinnunen.
4. Snow glass shadows. Glassblowing and picture by Netta Kandelin (2023).
5. Snow glass patterns. Pictures by Milla Johansson (2023). Glassblowing by (right) Eija Yli-Knuuttila, (left) Elina Reinola, Julia Öhman, Nikke Relasi, Paula Hjelt, Kirsti Doukas and Marika Kinnunen.
6. Powder snow glass. Glassblowing and picture by Netta Kandelin (2023).
7. Reindeer antler and snow as mold. Design by Milla Johansson. Picture by Sami Mikkola (2023). Glassblowing by Marika Kinnunen.
8. Kaltio. Picture by Elli Alasaari (2023).

Profile picture by Juuso Kiviniemi (2023).

P/REFERENCES OF DESIGN

8 STRATEGIES FOR A NEW MILLENNIUM.

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DOI: 10.63442/PIHQ9542

KEYWORDS | RESPONSIBILITY, HYBRID ECOLOGIES, NATURAL SYSTEMS

ABSTRACT | Confluences of Cultural, Environmental and Social Responsibility

Introduction: We present our proposal for the upcoming conference, entitled “8 Strategies for the New Millennium.”

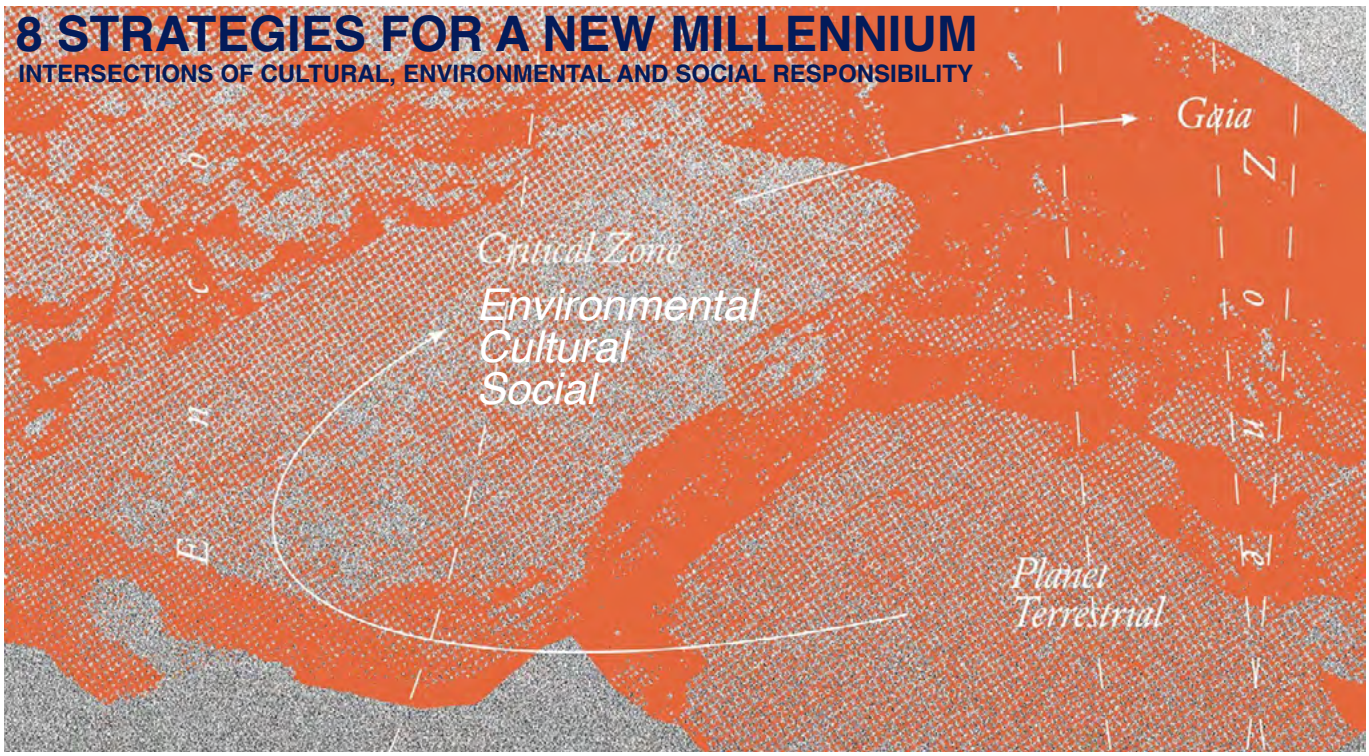
As we stand on the brink of an era defined by rapid technological advancements, global shifts, and unprecedented environmental challenges, our presentation aims to share 8 intentional strategies that prioritize shared responsibility and accountability over the current emphasis on innovation and disruption.

Remedial Design Strategies: Recognizing the limitations of an exclusive focus on technological innovation, our proposed eight strategies advocate a design methodology embracing natural systems and temporalities that extend from immediate concerns to geological timescales. Simultaneously, these strategies consider ethnographic time and social practices, emphasizing communal well-being.
Significance of Research: Backed by extensive research and analysis, our insights promise to significantly contribute to the conference theme, offering a nuanced perspective on navigating the contemporary landscape.
Objective: Our primary objective is to provide an actionable blueprint for individuals and organizations to positively contribute to the evolving design landscape of the new millennium. Focused on eight strategic pillars encapsulating responsibility, adaptability, and agency, our presentation aims to equip participants with insightful tools for shaping a collective future.

Structure of the Presentation:
Introduction to the New Millennium Landscape: We will set the stage by outlining key characteristics and challenges of the new millennium, providing a contextual foundation for understanding the presented strategies.
Overview of the 8 Strategies: A brief overview will precede a detailed exploration of each strategy, creating anticipation for the insights to be shared during the presentation.
Exploration of Each Strategy: Detailed exploration of each strategy will highlight its significance, practical applications, and real-world success stories. The presentation will incorporate professional work from our studio, as well as , and relevant research and case studies by colleagues and students from the institution where I serve as department head.
Open Dialogue and Networking: Allocating time for open dialogue and networking opportunities will allow participants to share experiences, pose questions, and build connections. This collaborative exchange may lead to potential institutional crossover and collaborations.
Conclusion: The presentation aims to be thought-provoking and action-oriented, resonating with the audience to foster a collaborative and forward-thinking mindset. We look forward to contributing to the conference discussions and inspiring a collective vision for a shared future.

* (NB: The slide deck includes animations and audio-visual content which would prove helpful in appreciating the dynamics and intricacies of the final presentation which we intend to submit upon your acceptance and/or approval of our submission. We are more than willing to resend the presentation in Keynote Format for your comprehensive review.)
**While the original plan was to present this topic as an academic paper, several professional deadlines before the year’s end were given precedence.


8 STRATEGIES FOR A NEW MILLENNIUM
SYSTEMS OF INTERCONNECTIVITY


8 STRATEGIES FOR A NEW MILLENNIUM
INTERSECTIONS OF CULTURAL, ENVIRONMENTAL AND SOCIAL RESPONSIBILITY
Gaia
Critical Zone
Environmental
Cultural
Social
Planet
Terrestrial

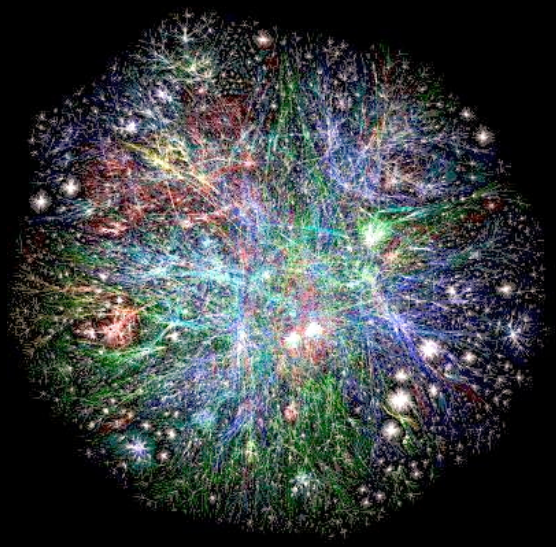

8 STRATEGIES FOR A NEW MILLENNIUM
QUESTIONS THAT MATTER
1_RADICAL CONNECTIONS
2_NON_BINARY ECOLOGIES
3_10 / 30 / 70 EARTH
4_UNLINKING TIMESCAPES
5_SHARING SOCIETY
6_MULTISPECIES COHABITATION
7_COLLECTIVE SURVIVILISM
8_REUSE_RECYCLE_RESTORE
Frequency
Proportion of time, over five years, spent in drought
Frequent, though moderate, drought
WV
KY
TN
SC
GA
AL
MS
LA
MO
KS
AZ


8 STRATEGIES FOR A NEW MILLENNIUM
RESEARCH
NEW EARTH CATALOGUE
ASSYMETRICAL AFRICA
EPIGENTIC LANDSCAPES
OUR HOUSE IS BURNING
ALTERNATIVE LIVES _ ALTERNATIVE LIVING
A SPACE CALLED PUBLIC _ THE CARING CITY
BOXES FOR MEANINGLESS WORK
FUTURE ECOLOGIES _ WATER INDEX

8 STRATEGIES FOR A NEW MILLENNIUM

1_ RADICAL CONNECTIONS





"Eventually everything connects - people, ideas, objects.
The quality of the connections is the key to quality. "
Charles Eames

8 STRATEGIES FOR A NEW MILLENNIUM

2 _ NON BINARY ECOLOGIES



8 STRATEGIES FOR A NEW MILLENNIUM
2 _ NON BINARY ECOLOGIES

8 STRATEGIES FOR A NEW MILLENNIUM
2 _ NON BINARY ECOLOGIES

AGRONICA _ TERRITORY FOR THE NEW ECONOMY
ANDREA BRANZI _ DOMUS ACADEMY

Branzi's work reanimates the long tradition of using the urban project as a social and cultural critique — of seeing urban design as an opportunity not simply to illustrate a "vision" but also to demystify and critically describe ongoing social problems. In this sense Branzi's wortically engaged and politically literate delineation of the power structures, forces and flows shaping contemporary urbanism; and in the past four decades he has articulated a remarkably consistent critique of the failings — social, cultural, intellectual, also economic, environmental and aesthetic — of laissez-faire development and of the realpolitik assumptions of much design and planning.

8 STRATEGIES FOR A NEW MILLENNIUM
2 _ NON BINARY ECOLOGIES

A generation of contemporary urbanists — ranging from Stan Allen and James Corner to Alex Wall to Alejandro Zaera-Polo — has drawn from Branzi's intellectual commitments. Still more recently, Pier Vittorio Aureli and Martino Tattara's "Stop-City" project directly references Branzi's use of non-figurative urban projection as a kind of social and political critique.

Branzi's projects have also informed contemporary attention to such diverse topics as animalia, indeterminacy and genericity.

8 STRATEGIES FOR A NEW MILLENNIUM
2 _ NON BINARY ECOLOGIES

Branzi's "weak work" maintains its critical and projective relevance for a new generation of urbanists. His longstanding call for the development of what he defines as weak urban forms and non-figural fields — forms and fields that are flexible, mobile, open to change — influenced the formulation of landscape urbanism over a decade ago and promises to animate the emerging discussions of ecological urbanism. And his projective and polemic propositions illuminate the possibilities for agrarian urbanism.

Charles Waldheim
"Notes Toward a History of Agrarian Urbanism,"
Places Journal, November 2010.


8 STRATEGIES FOR A NEW MILLENNIUM
3 _ UNLINKING TIMESCAPES


8 STRATEGIES FOR A NEW MILLENNIUM
3 _ UNLINKING TIMESCAPES


8 STRATEGIES FOR A NEW MILLENNIUM
3 _ UNLINKING TIMESCAPES


8 STRATEGIES FOR A NEW MILLENNIUM
8 _ REUSE_RECYCLE_RESTORE

8 STRATEGIES FOR A NEW MILLENNIUM

8 _ REUSE_RECYCLE_RESTORE

HouseEurope!

Goal

HouseEurope! is a citizens' initiative for an EU-legislation that boosts the renovation of existing buildings and stops their demolition driven by speculation

The Speculation Issue

Today, buildings are treated as investments rather than spaces for people to live. Due to financial speculation, millions of square meters sit empty and ruin, or they are being demolished and replaced: from functioning family homes to abandoned industrial and office spaces. This practice creates social and environmental problems. People are left without livable spaces and resources are unnecessarily strained for new building construction.
While the public eye is focused on areas such as mobility and energy, the building sector plays a significant role in the problems we face today. The building industry accounts for 38% of global CO2 emissions. All the parties involved – from the real estate sector to architects to the con- struction industry – profoundly influence our environment and the fabric of our societies.

Join, Support, Sign

You rent an apartment? You own a building? You care about the environment? You work in the building sector? Almost everyone is or will be affected by speculative real estate practices and the harm they cause. Because here's the deal: potentially every building is up for demolition! In fact, speculation fuels demolition and new construction. This comes with a loss of homes, a loss of jobs, and a loss of energy.
You can make a difference – put an end to this practice and make a change in reality! With your support, your voice, and your signature we can push for regulations that recognize and protect the value of existing buildings. But this is not just about materials and energy; it is also about the values we hold as a society. By activating buildings that have been abandoned, we will pave the way for a livable future – for ourselves, our children and all future generations.
Status: Currently we are in the process of drafting our legislative proposal. Sign up for the newsletter and receive updates on the initiative and a reminder when the signature period starts.



8 STRATEGIES FOR A NEW MILLENNIUM

7 _ COLLECTIVE SURVIVILISM



8 STRATEGIES FOR A NEW MILLENNIUM




8 STRATEGIES FOR A NEW MILLENNIUM
SYSTEMS DESIGN FOR CLIMATE AND CHANGE
P/REFERENCES OF DESIGN
TAMING ENTROPY: SYSTEMS DESIGN FOR CLIMATE AND CHANGE

P/REFERENCES OF DESIGN

ADAPTIVE CITIES: TEMPORARY INTERVENTIONS & FLEXIBLE STREET FURNITURE DESIGN.

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DOI: 10.63442/DDRR5773

KEYWORDS | STREET FURNITURE DESIGN, PUBLIC SPACE, TEMPORARY URBAN INTERVENTIONS, TACTICAL URBANISM

ABSTRACT | If we examine the processes defining the city from the perspective of activities taking place in the city (such as transportation, public space use, leisure, tourism, etc.) and not from the physical characteristics (building stock, road network, terrain, etc.), we get an extremely variable, fluid picture that changes quickly in time and space. In the city, we see an ocean of fluctuating activities. This fluctuation and change can often be very fast, activities intensify, appear, or even disappear within a few years. A few years ago, the electric scooter was almost unknown, today, it is a defining part of the micro-mobility toolkit. But the same is true for the increasing presence of urban sports activities or the change in the intensity of cycling according to the seasons and the weather. The change in tourism due to climate change can be included here. Change is constantly present, and the needs associated with it also arise with constantly changing intensity. How can we respond to this? What can be expected in the future?

Currently, about 57% of the world's population is urban, meaning that for every second person, the majority of their daily activities are related to some city. The city has become our way of life, our "natural" habitat. And we rightly expect our habitat to be adaptable to our needs, to adapt to activities, needs, or even changes in seasons and climate. What tools do we have for this?

In my presentation, I focus on temporary urban interventions and flexible street furniture, deliberately narrowing down the topic of adaptive cities. Through the examples of temporary interventions, the changing needs of urban activities can be well examined while also presenting the possibilities and tasks of design in street furniture design in an environment where changing usage needs appear. These changing needs are increasingly colliding with inflexible urban systems and infrastructures, often generating strong conflicts (cycling vs car driving vs. pedestrian traffic; parking vs. green space; weekday/weekend vs. working time/ leisure time; tourism vs. locality, etc.). In my presentation, through a current case study (Valyó Quay project in Budapest) along with a few examples from the international context (Supermanzana Barcelona), I present the city-shaping possibilities of temporary interventions and the changing needs appearing in cities. Among these, highlighting cycling, I present street furniture systems from our design studio, where the basic principle of the design concept was adaptability to changing needs (VELÓ and MONÓ bicycle storage systems; LENA bicycle lane separator). These products were invited to the Dutch Design Week in 2023, where they made a successful debut in the Mobility Expo section.

The message of my presentation is dual:

1. Traditional urban planning tools are now inadequate for handling the rapidly changing needs and phenomena that arise in cities. We need tools and systems that allow space for dynamically changing activities in the city, i.e., they are flexible and adaptable.
2. This also poses new challenges for street furniture design: we need a design mindset and public furniture solutions that can handle the rapid changes in needs and uses in public spaces.

The question of liveable cities

55% of the world's population resides in urban areas in 2018
and expected to increase to 68% by 2050*

The city is our "natural" habitat

**Should we adapt to the cities
or the city should adapt to us?**

* Published by the Population Division of the United Nations Department of Economic and Social Affairs (UN DESA), 2018

Elements of Urban Design

FIXED STRUCTURES

topography
building density
street network
greenery
public means
…

static
slowly / gradually changing

PROCESSES & ACTIVITIES

transportation
public space usage
commuting
leisure
tourism
events
…

turbulent
changing by time, season, usage etc.

ADAPTIVE CITY

Interventions and systems based on constantly evolving urban processes and activities, which are temporary and/or flexible

ADAPTIVE DESIGN OF URBAN FURNITURE

WHAT IF the outdoor furniture could be rearranged just like the chairs in your living room?









VELÓ mobile bicycle rack

IF Design Award 2023

temporary usage and exhibition at Dutch Design Week 2023, Mobility Expo

temporary usage at the World Athletics Championship Budapest 2023

temporary usage at Rakpart project Budapest 2023, 2024






Spoon



CONCLUSION

1. Traditional urban planning tools are inadequate for handling rapid changes. Flexible and adaptive tools needed.

2. New challenges for street furniture design.

NEW CHALLENGES FOR STREET FURNITURE DESIGN

- based on urban processes and activities
- temporary and/or periodic usage
- adaptability and flexibility
- quick to change

P/REFERENCES OF DESIGN

PUTTING THE “VOCATION” IN VOCATIONAL DESIGN EDUCATION.

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DOI: 10.63442/RQBS5026

KEYWORDS | INNER DEVELOPMENT GOALS, DIGITAL DESIGN, DESIGN EDUCATION, ECOLOGICAL AWARENESS

ABSTRACT | In this era of important and monumental societal challenges, the role of designers is evolving, necessitating a profound reimagining of design education. Our (inter)active session aims to ignite a collaborative exploration into what design education should do differently to cultivate the “ideal” designer—one equipped to address global challenges and one that is intrinsically motivated. The primary objective of the workshop is to collectively and creatively construct a tangible “image” or model of the ideal design education that empowers designers for transformative global impact and instills in them a sense of calling to take meaningful action.

1. Introduction

Communication and Multimedia Design (CMD) is a bachelor-level design education programme at the Amsterdam University of Applied Sciences (AUAS). At CMD, we aim to address urgent, complex societal challenges such as the climate crisis, growing inequality, and accessibility issues in healthcare by educating changemakers. We believe that our students could be changemakers and skilled and engaged digital designers capable of making meaningful contributions to these complex societal challenges.

To effectively address these complex issues, alongside creative, systemic approaches and knowledge, "changemaker" skills are required. Design education is particularly suited to educate changemakers because some of the necessary affective inner skills, as defined by the Inner Development Goals1, such as empathy and creativity, are already embedded in the curricula. However, other crucial skills such as self-awareness, a sense of connection to a larger whole, and global, environmental, and cultural awareness are not yet addressed at CMD. The first version of this workshop was conducted with colleagues from similar digital design education programmes in the Netherlands (see image 1 for an impression) and proved that these skills were lacking in their curricula as well.

In this workshop, we aim to further explore, in collaboration with participants, which inner skills are essential for contributing to complex societal challenges and are currently lacking or insufficiently addressed in (design) education.

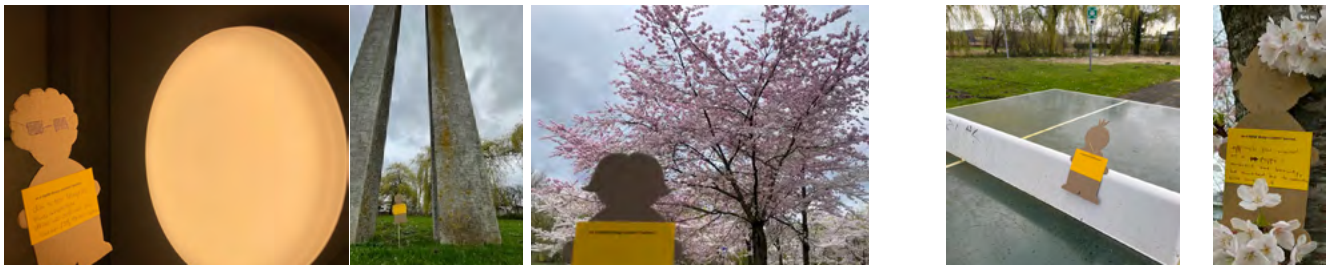


Figure 1. Impression of the outcomes from a previously conducted workshop.

2. Objective and Schedule

We believe this workshop is interesting for (digital) design educators and professionals who wish to contribute to imagining the future (digital) designer. The primary objective of the workshop is to construct, collectively and creatively, a tangible "image" or model of the future designer. Furthermore, we hope to outline its implications for the ideal design education that empowers designers for transformative global impact and instills a sense of calling to take meaningful action.

In this workshop, walking is a key component of our activities. We believe that the value of movement is in enhancing creativity, fostering open dialogue, and deepening connections among individuals. By incorporating walking into our workshop, we aim to create a dynamic and engaging environment that stimulates both the body and the mind. However, we will only proceed with walking activities when *every* participant can take part.

We have compiled the following schedule:

- Introduction [10 min]
- “Wandertalk” (walk guided with questions and provoking statements to discuss while walking) [45 min.]
- Collecting insights from walk [30 min.]
- Final summary [5 min.]

In the event of bad weather or participants being unable to partake in the walk, we created the following alternative programme:

- Introduction [10 min]
- Collective imagining [10 min.]
- Discussing in small groups the new role of designers and how design education should change – prepare the presentation. [30 min.]
- Break [5 min.]
- Presentation to group [30 min.]
- Final summary [5 min.]

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About the Authors:

Astrid Lubsen worked 15+ years as a design researcher with organizations such as Waag and STBY, both pioneering in critically examining technology, ensuring sustainability and public values in the design process. Since 2019, she has been an educator at the CMD programme.

Irene Kamp completed her PhD on comfort, happiness, and design at the Delft University of Technology. She has been working in higher education and applied research since 2012, focusing on futuring sustainable behaviour interventions and speculative design.

P/REFERENCES OF DESIGN

MATERIALS DIALOGUES: MATERIALS DESIGN FOR SUSTAINABLE SYSTEMS, NAVIGATING CONTEMPORARY MATERIALS DESIGN CULTURE.

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KEYWORDS | MATERIALS DESIGNER, PROFESSIONAL PRACTICE, ENVIRONMENTAL SUSTAINABILITY, DESIGN COMPANIES

ABSTRACT | In various design domains, such as industrial, product, and fashion design, the role and importance of materials is undeniable (Ashby & Johnson, 2014; Karana et al., 2014; Pedgley et al., 2021). However, designers' exploration of material attributes and impacts has often been partial, contributing to resource depletion, waste production, and environmental damage (Vezzoli, 2018). Recognising the imperative for a more profound sensitivity and understanding of materials in the current context, this workshop centres on materials designers as crucial figures in addressing these challenges (Clèries & Rognoli, 2021). Despite their essential role, their professional identity remains emergent and under-recognised, compounded by a lack of consensus on fundamental skills for future materials designers.

1. Introduction

This workshop seeks to crystallise the concept of the materials designer, elevating its recognition as a distinct profession. It aims to foster dialogue, engaging participants in reimagining materials design practices for our complex systems. Furthermore, it will bring the 'Emerging materials for transition framework,' providing a context of novel materials and practices for environmental sustainability and circularity in materials design. Attendees, whether designers, researchers, or makers with an affinity for materials design, will collaborate to understand the materials designer's role, skills, and worldview, addressing the challenges of sustainable production and consumption systems.

2. Planned Activities and Expected Outcomes

In this 90-minute workshop, we aim to unite researchers interested in exploring the next generation of materials designers. It will serve as a platform for stimulating discussions, presentations, and brainstorming sessions on future lines of professional practice in materials design. Emerging materials and processes have garnered attention, but their effective contribution to accelerating the transition to sustainable systems remains unclear. The session will commence with a theoretical overview, setting the stage for an intense debate on the evolving role of materials designers amidst contemporary production and consumption trends. We expect 15 participants.

Table 1. Proposed organisation and activities of the workshop.

Minutes	Activity	Presenter	Tools
10	Welcome: presentation, workshop aims, research context, schedule and roles	Organiser	Slides/presentations
10	Warm-up: Participant introductions	Participants	---
10	Overview: Materials Design Field and the professional practice	Organiser	Slides/presentations
10	'Emerging materials for transition framework'		
5	Short break		
10	Material Designers in companies - Case study	Organiser	Slides/presentations
15	Small group discussions about the role of materials designers in companies. Type of companies. Skills. Role	Participants	Miro Boards Post-its and papers
15	Presentations and discussion.		
05	Conclusions and remarks	Organiser	

3. Target Audience

The workshop is for Cumulus conference participants interested in materials and design, emerging materials, materials-related issues, production, and environmental sustainability in design solutions for industry. It is especially suited for those interested in co-designing a professional figure with a vision of design and materials as a driver of innovation. It will draw on the expertise of the 'MaDe/Trans' research group from Politecnico di Milano.

4. Equipment and Space

The workshop will be in a flexible space to support active, collaborative interaction among individuals and virtual tools. Participants should use laptops for accessing Miro Boards, and paper and post-its should be available.

5. Potential Outputs

"Material Dialogues" is designed as a dynamic forum to advance the discourse in materials design, challenging traditional perceptions of materials in design practice. The workshop aims: (1) to co-define the necessary skills to develop as a professional material designer for environmental sustainability; (2) to bring together researchers; (3) to establish consideration of the current state of materials design as a design area; (4) to understand how to enrich the profession and how to give it more recognition by industry. Critical insights will be synthesised in a report/publication encapsulating recommendations for the design community.

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About the Author:

Sofia Soledad Duarte Poblete is a designer and PhD student at Politecnico di Milano. Her research focuses on the role of Materials Designers in companies and how they can foster Design for Environmental Sustainability through a materials-driven design profession.

P/REFERENCES OF DESIGN

DESIGNING THE WILDERNESS FOR YOUR P(A)LATE: A JOURNEY INTO SUSTAINABLE LIVING THROUGH FORAGING.

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DOI: 10.63442/VABW7730

KEYWORDS | FORAGING, SUSTAINABILITY, GASTRONOMY, REWILDING, EXPERIMENTAL LEARNING

ABSTRACT | “Designing the Wilderness for Your P(a)late” offers a 90-minute workshop for a dozen participants, reintroducing the art of foraging and sustainable living practices. Those who are participating explore the ecological significance of wild plants, envisioning their roles in future gastronomy. Through hands-on activities and collaborative learning, participants unlock the potential of edible plants for nutrition and culinary innovation. Emphasizing proximity and provenance, the workshop fosters a deeper connection to nature and promotes eco-responsible practices. By embracing ancestral wisdom and integrating wild plants into daily life, participants contribute to a more harmonious relationship between humanity and the natural world.

1. Workshop

In an era where the natural world often feels distant from our daily lives, the art of foraging stands as a beacon of traditional wisdom waiting to be rediscovered. "Designing the Wilderness for Your P(a)late" offers a unique opportunity for a dozen participants to embark on a 90-minute journey back to our roots, where wild plants weren't just supplements but integral parts of our existence. This workshop aims to reintroduce the lost art of foraging to a modern audience, emphasizing sustainable living practices and the importance of reconnecting with nature.

The resurgence of interest in locally sourced ingredients within culinary circles speaks volumes about our changing relationship with food. Michelin-starred chefs are leading the charge, venturing into nearby forests and fields to handpick ingredients for their masterpieces. This shift underscores a deeper understanding of the importance of proximity and provenance in haute cuisine, paving the way for a more sustainable and eco-conscious approach to gastronomy.

But it's not just about haute cuisine; it's about recognizing the ecological significance of edible plants within our ecosystems. As we struggle with the environmental consequences of industrial agriculture, edible wild plants are emerging as beacons of hope. Nutrient-rich, ecologically sustainable, and universally accessible, they offer a tantalizing glimpse into a more harmonious relationship between humanity and nature.

Through speculative design methodologies, participants in the workshop embark on a journey of exploration and imagination. They delve into the botanical intricacies of indigenous plant species, pondering their potential roles in a future where sustainable nutrition is paramount. Collaborative exercises spark creativity as participants envisions new food products and advocacy strategies centered around these wild plants.

The workshop isn't just about theoretical knowledge; it's about hands-on learning and multisensory experiences. Participants engage in experimental activities designed to unlock the hidden potential of edible plants, learning to identify them safely in nature and incorporate them into their daily lives. From practical culinary applications to medicinal uses, each plant offers a wealth of possibilities waiting to be discovered.

With a focus on experiential learning, the workshop accommodates diverse learning styles and levels of expertise. Small group discussions foster collaboration and mutual learning, ensuring that participants leave with a deeper understanding of foraging and its implications for sustainable living.

About the Authors:

Zsófia Márta Németh, a PhD student at MOME, explores the interplay between edible wild plants and nature connectivity in the Balaton Highlands. She explores navigating environmental pressures in tourism-driven areas, striving for scenarios where both nature and society mutually benefit.

P/REFERENCES OF DESIGN

WET WET WET FLUID: A COLLABORATIVE JOURNEY THROUGH ECOSYSTEMIC RIVER NARRATIVES.

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DOI: 10.63442/DBQI8390

KEYWORDS | ENVIRONMENT-CENTERED-DESIGN, ECOLOGICAL EMPATHY, COLLABORATIVE VIDEO STORYTELLING, MORE-THAN-HUMAN PERSPECTIVES, INTERACTIVE GAMEPLAY

ABSTRACT | The Format X on “Wet Wet Wet Fluid” presents an interactive game aimed at exploring the dynamics of river ecosystems beyond the traditional human-centric narratives. The game’s objective is to foster ecological empathy and a deeper understanding of river ecosystems by engaging participants in creating and sharing video narratives from the perspectives of various ecosystem actants. By using video storytelling and integrating speculative design principles, the game encourages players to assume roles of diverse ecosystem actants, such as living entities, inanimate elements, and abstract concepts, promoting an understanding of each actant’s unique perspective and role. The gameplay involves continuous interaction and narrative building, where participants can add their stories to a collective narrative, reflecting the dynamic and interconnected nature of ecosystems. Initially launched in a group workshop format, it transitions into an ongoing installation open to all, encouraging contributions that respond to the current state of the river ecosystem. The game’s design, based on non-human perspectives and fiction storytelling, allows for the creation of a layered and interconnected series of stories. “Wet Wet Wet Fluid” culminates in a narrative mosaic, showcasing the diversity and interconnectedness of ecosystem members, and encouraging players to appreciate the complex web of relationships within more-than-human ecologies. The outcome is a collective awakening to the importance of inclusive and responsible environmental stewardship. Conclusively, the game offers a novel platform for engaging with ecological narratives, bridging the gap between human and non-human entities and promoting a more harmonious coexistence through ecological education and empathy.

1. Track

Posters, Slide Decks, Workshops, Format X – Taming Entropy: Systems Design for Climate and Change.

2. Objective

'Wet Wet Wet Fluid' is an innovative interactive game designed to explore the intricate dynamics of river ecosystems, moving beyond the conventional human-centered narrative. It aims to foster ecological empathy and deepen understanding by engaging a diverse range of participants in creating and sharing video narratives from the perspectives of various ecosystem actants, fostering ongoing participation and contribution.

3. Methodology

Employing video storytelling as its core mechanism, 'Wet Wet Wet' integrates speculative design principles to engage participants creatively and empathetically with ecological challenges. Participants, playing individually or in groups, are encouraged to assume roles representing diverse ecosystem actants, including living entities like water, fish, and plants, inanimate elements such as stones, and abstract concepts like pollution or conservation efforts. This approach allows participants to step into the 'shoes' of different elements within the ecosystem, promoting a deeper understanding of each actant's unique perspective and role. The use of event and action cards, depicting various ecological scenarios, guides the narrative development, allowing for the creation of videos that embody the actants' experiences and reactions in the ecosystem.

4. Gameplay

The game facilitates continuous interaction and narrative building, where participants can view existing video narratives and add their own stories, reacting to or expanding upon previous narratives. It begins with a short group workshop format, where initial rounds are carried out by a few small groups, each given 15 minutes for their recordings and responses in each round. After recording, these narratives are added to a looped stream, creating a collective circular statement. After this phase, the game transitions into an installation open for participation to all conference attendees, both on-site and online. In this ongoing format, each participant can contribute their part in response to the current state of the 'river' through their chosen actant and the specific challenge they face. Participants view the current state of the river and draw cards that include perspectives of the actant, archetype, action, and artefact, which they then use as the basis for their contribution to the story. The cards designed for the game are based on the author's research into non-human perspectives and fiction storytelling.

Every hour, a new state of the river is presented, and then, the selected submissions are integrated into the next round of the river's state. This creates a layered and interconnected series of stories, fostering a rich tapestry of ecological perspectives. The fluid format of the game, where new narratives can be added at any point, mirrors the dynamic and interconnected nature of ecosystems.

5. Outcome and Impact

'Wet Wet Wet Fluid' culminates in an intricate narrative mosaic that showcases the diversity and interconnectedness of ecosystem members. Players experience the river ecosystem through various non-human lenses, gaining a deeper appreciation for the complex web of relationships that define more-than-human ecologies. The game challenges participants to rethink their roles within these systems and fosters an understanding of the ecological implications of human activities. The outcome is a collective awakening to the need for more inclusive and responsible environmental stewardship.

6. Conclusion

'Wet Wet Wet Fluid' offers an innovative platform for engaging with ecological narratives in a collaborative and evolving manner. Utilizing video storytelling as a tool for ecological education and empathy, the game bridges the gap between human and non-human entities, paving the way for more harmonious coexistence. It represents a step towards a more inclusive, responsible, and ecologically conscious approach to living and design.

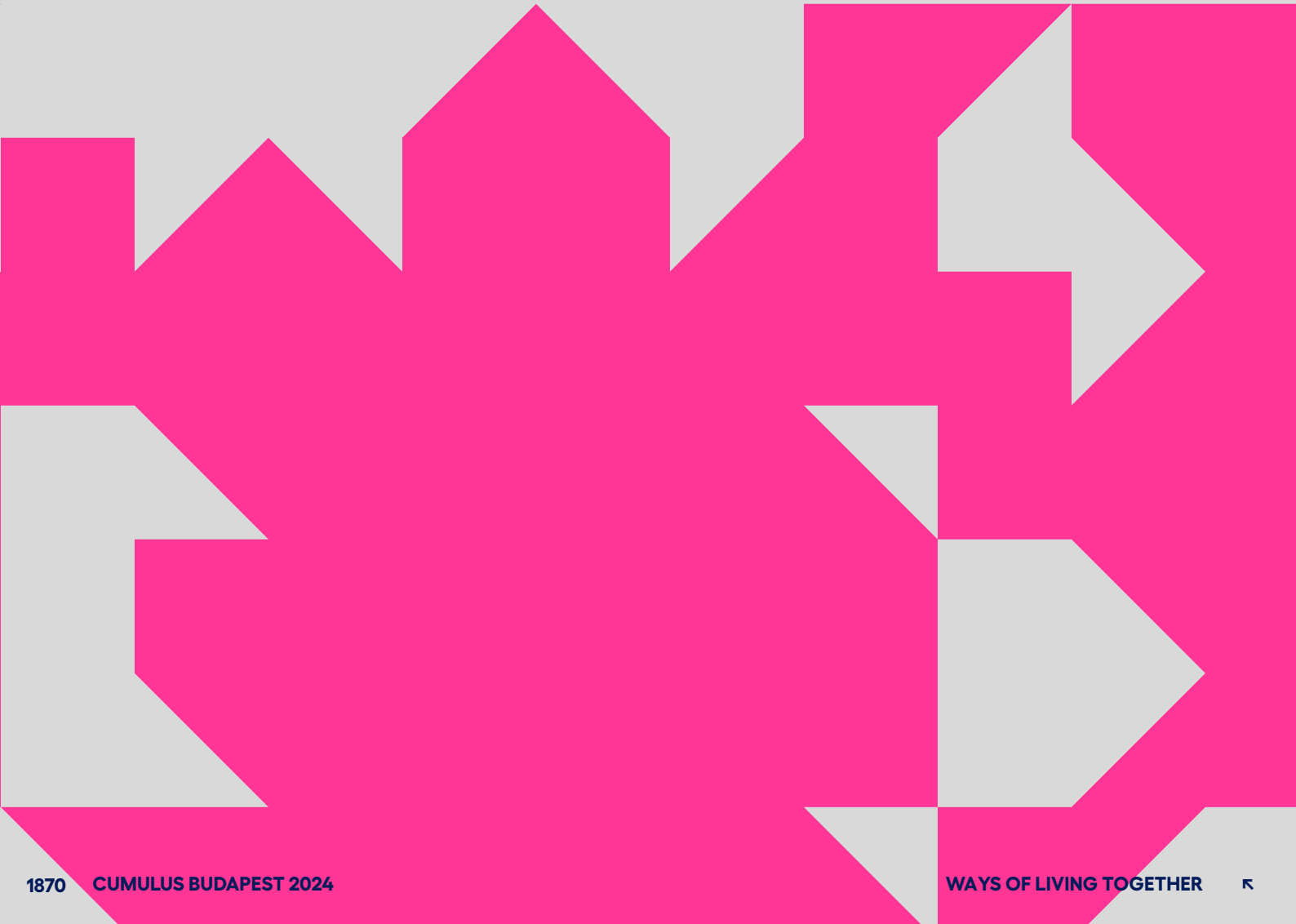
About the Author:

Katarzyna Anosowicz is a Service Designer, UX Researcher, and Innovation Strategist with a distinctive track record in developing the CX division at Player, a leading VOD platform by TVN Warner Bros Discovery. She established Player Labs and has successfully led over 100 projects that deepened immersive narrative experiences in streaming films and series. In her capacity at WBD in Poland, she conducts workshops aimed at redefining future media landscapes, prioritizing community engagement, and ecosystemic sensitivity. Educated with a Master's in Psychology and a postgraduate in Service Design from SWPS Warsaw, she is now completing a Master's in Theatre Studies at the Academy of Theatre in Warsaw, focusing on performative arts. Additionally, she is a recent graduate of Futures Studies & Strategic Foresight at the Copenhagen Institute for Futures Studies and will soon be lecturing on Critical Futures, Speculative Design, and Design Fiction at SWPS University. Her work is dedicated to advancing social and gender justice through speculative design. She is constantly developing her methodology centered around feminist futures, performative presence, and speculative design, aimed at analyzing spatiotemporal ecologies and fostering social and environmental change. Her passion lies in existential, total, and post-feminist theatre. She resides and works in Berlin.

WAYS OF LIVING TOGETHER

P/REFERENCES OF DESIGN

CUMULUS BUDAPEST 2024



WAYS OF LIVING TOGETHER.

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Design as a multifaceted discipline, is intensely intertwined with the fabric of society, shaping our environments in which we live and interact. As we move further into the 21st century, the role of design in facing systemic global and local social issues has even become more important. In this track, design's contributions to tackle pressing systemic global and local social issues were explored through addressing the various ways communities can coexist while exploring the different actors' networks, systems and roles.

The presented papers focused on topics related to urban co-habitation and impactful community work. We received methodological contributions such as explorations of scenario building and service design's potential contributions to placemaking, new methods for collaborative design research for neighborhood communities or social innovation in a post-industrial redevelopment. Design futuring approaches like projective provotype design were conceptualized and tested with communities to build alternative approaches to smart city methodologies. Also, case studies were presented, for instance, focusing on Safe School Zones, the CultiRider, a moving community space creating intercultural connections, Empowering Experiential Education in Design, a case study related to spontaneous design or the Evolution of Typography in Delhi's Historic Architectural Monuments, a research analysis which explores the development of typography and cultural influences on different buildings of India's capital.

Other works opened debates around issues of equity and diversity by overviewing gender-sensitive products or by discussing the opportunities of breaking down the stigma of medical abortion through the approaches of communication design. Also, the topic of equity and justice was debated in relation to public library design – and how it differs in different parts of the world – as well as the topic of evoking agency through ecological citizenship. Through navigating the potential of participatory practices, design-based processes and the borders between research and activism, this track opened up for future discussions, reflections and experimentations regarding different ways of living.

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BEYOND CO-PRODUCTION: DESIGN AS A MEANS OF EVOKING AUTONOMY THROUGH ECOLOGICAL CITIZENSHIP.

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KEYWORDS | CITIZEN(S), DESIGN, ECOLOGICAL CITIZENS, COMMUNITIES & NETWORKS, PARTICIPATORY DESIGN

ABSTRACT | Design (as a practice) encompasses; appropriate, contextual, and strategic interventions empowering new ways of living together. In current times of; climate change, biodiversity loss and pollution, design has a role to play. This triple planetary crisis threatens ecosystems at a global scale, necessitating contextual approaches. We (the public) are used to being designed 'to or for', with common terminology referring to people as users and consumers, not 'citizens'. Citizens are already becoming involved in 'Public Interest Technologies', a contextual design field akin to democracy and politics. Cross-disciplinary practices nurture new approaches to collectively design 'with' people, enabling public agency for sustainable action. Design propositions are not always initiated by designers, or even simply organisations, but created by people in-the-field.

Ecological Citizen(s) (EC) is an approach (and project) to create autonomy/agency and sustainable actions within contemporary times (Phillips, et al., 2022). Ecological Citizenship is a design approach intent on catalysing/inspiring/invoking a 'citizen relationship' with our natural world. We focus on citizenship as a practice rather than a 'status distinction' as it concerns the agency to mutually benefit others and the planet through sustainable means.

This positioning article includes; historic and contemporary insights, literature, up-to-date practice-based examples/projects, experiments, and proposals. It advocates for designing proposals to catalyse citizens' agency, supported by appropriate technological outputs. We define a clear distinction between 'design for citizenship' and citizen positioning, a post-participatory perspective for design. Our research question unpicks: What are the attributes and positive benchmarks of design, as a means of evoking agency through Ecological Citizenship?

The audience are not only designers, but leaders in; social innovation, social decision making, design for equity, civic engagement, communities, DIY movements and more. Our Ecological Citizen(s) framework; supports individuals, organisations, businesses to make more positive choices, impacting the planet we inhabit and are reliant upon for all life. The convergence of; the triple planetary crisis, Ecological Citizenship, public interest technologies and designing for citizen agency, offers new modalities of ways we 'live together'.

1. Introduction

This work navigates emerging domains of; design and citizenship, within the context of their interdependencies (Weber, 2010). It responds to rising typologies of work unclassified by; Action Design (Sein, et al., 2011), Participatory Design (Spinuzzi, 2005), or Co-Design (Sanders, et al., 2008) and is itself post-participatory. This nuance might seem academic, but it concerns the balances of; agency, autonomy, power, and is a catalyst for transition. Agency is the "capacity to imagine alternative possibilities", it is critical to this position as it enables agents to have 'choice' (Emirbayer, et al., 1998, p.962). The framework's purpose is to; map projects, comprehend gaps, navigate opportunities, unpick existing examples, build new models of design, and manoeuvre the creation of citizen-led briefs in this space. The design objectives of the provision of agency substantially impact conventional 'participation' and are seen as attendance without a limited voice.

Participation is "the action or state of taking part in something" rather than directing, conceiving or co-ordinating something (Merriam-Webster, 2024). Authors frame and include; historic and current literature, contemporary practice examples, projects and experiments that offer autonomy, intent on enabling citizens (thus fertilising societies), as a contemporary design position.

We navigate the intricate post-participatory terrain, harnessing design-based processes, and the potent influence of activism… all impacting 'ways we live together'. We re-align; citizenship, acts of citizenship and citizen-led design. The work documents a cross-collaborative multi-domain literature review, defining what 'citizenship' is, within design frameworks (Stephens, 2010). Our audience is creative practitioners, designers, and protagonists that desire to nurture autonomy, within interested parties they engage with and those that have, to date, not engaged (or been unable to).

Currently with Ireland considering giving nature 'Human Rights' (Luyken, 2023), governments considering 'rights for nature' (Watts, 2024), and Brazil pioneering its indigenous voice through government parliamentary representation (Phillips, 2023), it calls to action new modes of citizen voice and agency. We classify; what a citizen is (from a design perspective), alongside examples of Ecological Citizenship with our research question;

> *What are the attributes and positive benchmarks of designing with 'Ecological Citizen(s)', to create and enable acts of 'Ecological Citizenship' (EC) for more sustainable futures?*

We are in times of massive change with; austerity (Anstead, 2018), Brexit (Zoega, et al., 2018), the cost-of-living crisis (Patrick, et al., 2022) and the triple planetary crisis (climate change, biodiversity loss and pollution) – and design has a role to play (Passarelli, et al., 2021). The emerging field of sustainable futures (Nižetić, et al., 2020) offers the means to explore 'preferable worlds' (Jokinen, et al., 2022), for design practices that can help navigate climate change and community (hyper-local) responses. We also see benchmarks as a standard by which other activities are measured – a yardstick of how projects could/should be done, highlighting core merits required for Ecological Citizenship.

This contribution identifies various opportunities for living and creating together. The definition of Ecological Citizenship (EC) is "accessible activities and skills which establish sustainable practice(s) and/or address ecological inequalities. Unsustainable practices (and consequences) are not constrained to individual countries, single industries, or discrete societies" (Phillips, et al., 2023, p.265). An example of Ecological Citizen Design was, My Naturewatch (NW), The NW project (mynaturewatch.net) was designed by the Interaction Research Studio, with engagements led by The Royal College of Art Design Products programme (Phillips, et al., 2022).

The NW project featured a trail camera using; distributed design instructions, off-the-shelf tech found in schools and education, required no tools or specialist equipment to make, was repairable, and created interactions that catalysed new behaviours (Phillips, et al., 2022). NW embodies inclusive design in the

digital age, as the activity engages a wide demographic community and can be used by all. It cultivated the audience's inquiry into the natural world(s) and built on something preexisting yet was more financially accessible than its contemporaries. It was not created for a specific age group.

After deployment with wide audiences (more than three million people) it fostered and enabled 'Ecological Citizenship', as some interested parties; rewilded their gardens, captured evidence for council action, documented for scientific purposes, ecological explorations, and engagement with new audiences (Phillips, et al., 2020). NW enabled; interactions, rewilding, training schemes, youth advocacy, design-for-repair, re-skilling etc. Audiences often commented "they made it" even though they assembled it, so there was a deep sense of ownership and pride in creations. One of the defining points was the agency of use that it gave (Phillips, et al., 2020, p2110). It was brave not to have a highly controlled 'use case', as it opened a life outside the design team. This unintentionally provided a grounded legacy and appropriation by alternative audiences.

This example helps frame nuances and starts to define the design space we are cultivating. We navigate; our lens of 'citizen', agency in designing with citizens, designing citizenship, and our climate, and examples of Ecological Citizenship and how it can positively impact the way we live. Within the work we navigate two tracks of design work that rarely communicate; Track 1 Sustainable Design, Track 2 Co-Design all framed around Our Lens of Citizen.

1.1 Our Lens of 'Citizen'

The term citizen is an equalising word, it carries with it the activism of Aristotle's definition "a citizen is one who rules and is ruled in turn" (Kerber, 1997, p.834). Major social issues such as the status of "immigrants, aboriginal peoples, refugees, diasporic groups, environmental injustices, and homelessness have increasingly been expressed through the language of rights and obligations, and citizenship" (Isin, et al., 2002, p.1). Traditional definitions of citizenship are 'nation-bound', for example the UK government defines it as "confirming British nationality or applying for the Right of Abode" relating to individuals' residential status and working legalisation (GOV.UK. 2022); (GOV.UK. 2018). There is also a difference between citizenship and cultural peer-mandated scenarios. For example; in the 2022 World Cup Japanese football fans were renowned for cleaning-up stadiums after matches (Adil, 2022). Berlin residents are 'obliged' to clear snow from footpaths in front of their properties (Winterdienst BEST, 2023). Finally, in Australia municipal BBQ's are rigorously cleaned by individuals after use (Dumas, 2014). Prior examples are either culturally based, legislatively driven, or mandated by community peers.

Our lens goes against those traditional views, we believe that a citizen is empowered, accessible to all, has autonomy and acts for themselves and others. We (the public) are used to being designed 'to or for', with common terminology referring to people as users and consumers, not 'citizens' (Alexander, et al., 2022). The "concept of sustainable citizenship and its normative responsibility claim on all societal actors and institutions" is the main difference between a citizen and consumer and that we should have agency over things that impact us (Micheletti, et al., 2014, p.203).

We view citizenship as a practice, an optional right of passage that benefits individuals, the ecosystem and those around them. Citizens are becoming more engaged in elements that impact them; for example, Public Interest Technologies involve building 'with' not 'for', enabling people to have a voice in matters that impact them (Abbas, 2021). Our definition is contemporary, not reliant on geopolitical, nation-based citizenship, i.e., not framed by Home Office mandates. Our view of 'Citizen' is "claimed, enacted and performed" (Arruda, et al., 2020, p.59).

In the early curriculum for the Scouts, Lord Baden-Powell shares their view of citizenship as "Every scout ought to prepare [themselves] to be a good citizen of [their] country and of the World" (Baden-Powell, et al., 2005, p.213). I.e., highlighting the need for citizenship to protect species and environments. As Citizens, "we must develop a sense of belonging in community, cultivate relationships with one another, help heal each other, and collectively build the world that will cease to make philanthropy necessary" (Alexander, et

al., 2022, p27). Buckminster Fuller refers to Our little Spaceship Earth that is “only eight thousand miles in diameter, which is almost a negligible dimension in the great vastness of space. Our energy-supplying mother-ship, the Sun is ninety-two million miles away” (Fuller, 2008, p.15). And later highlights that “When it is realised by society that wealth is as much as everybody's is the air and sunlight, it no longer will be rated as a personal handout for anyone to accept a high standard of living in the form of an annual research and development fellowship” (Fuller, 2008, p42). Fuller illuminates that all citizens must preserve spaceship earth, i.e., we are all responsible for our role in it.

As sustainable citizens hold different “expectations about ‘good citizenship’ and whether they believe that individuals can be politically efficacious and important agents of change” in the field of sustainability (Micheletti, et al., 2014, p.203). Gandhi’s conception of citizenship is largely one concept: “Swaraj” or self-rule. In Gandhi's vision, self-rule means that “everyone is [their] own ruler,” and is a self-realised individual (Shani, 2011, p.660). A contemporary example is ‘Clean Up Svalbard’ a coastal waste-removal program (created by the governor of Svalbard) in coordination with the Association of Arctic Expedition Cruise Operators (AECO). Cruise tourists who visit sites, have responsibilities to keep it clean (Ocean Wide, 2023).

We unite these perspectives, in that citizens should also have accessible autonomy over sustainable and ecological practices that can positively (or negatively) impact them or their communities/surroundings. Agency is defined “the sense of control that you feel in your life, your capacity to influence your own thoughts and behaviour, and have faith in your ability to handle a wide range of tasks and situations” (Davidr, 2021). More deeply autonomy is access to have choice, regardless of financially ‘rich’ or time ‘rich’ backgrounds. Citizen “voice is an integral part of agency, positioning development and democracy. Both highlight opportunities and obstacles – social, institutional, and normative – that agency therefore helps in interrogating on conditions for participation” (Bifulco, 2013, p.176). We acknowledge their complexities, but (here) we do not cover subsequent issues of; design ethics or design justice. We believe that designing interventions for pro-active citizenship inspires agency and whilst interlinked with safeguarding and ethics, we cannot cover them in depth.

A particularly salient example of this empowered agency, or ‘commoning’ (Hewitt, et al., 2020), and working for the common good is found in the Norwegian practice called ‘dugnad’ (Simon, et al., 2019). Dugnad as a cultural practice is embedded in Norwegian culture with origins in small farming communities, where people were historically dependent on each other. Simon et al., defines dugnad as an in-person event with a set time frame that involves all age groups of a community uniting to tackle a specific local issue, such as a spring clean of local park or raising money for local sports team: a “cultural practice that creates an environment that nurtures prosocial and cooperative activities” (2019, p.815). The dugnad usually ends with a social gathering and is a prosocial behaviour (Simon, et al., 2019), thus creating social connection within the community. Although dugnad is voluntary (Simon, et al., 2019), it differs from the British understanding of ‘voluntary work’ (Waikayi, et al., 2012) in the sense that dugnad is undertaken for mutual support and benefit (Furunes, 2022). Similar practices of mutual support are found in rural farming communities globally (Furunes, 2022).

1.2 Our Frame of the ‘Designer’s Role’

Designers strategically intervene with ‘materials of our time’. The 1950s was the ‘age of oil’, with booming plastic and chemical production (Murphy, et al., 2011). In the ‘age of the craftsman’ Chippendale was a skilled furniture designer and maker (Kimball, et al., 1929). They pioneered the concept of publishing an “archive of furniture designs” for business marketing purposes, entitled The Cabinet-Maker’s Director, (1754), “including every piece of movable furniture a modern household might need, in different styles” (Chippendale). Openly sharing designs, in a time of non-existent Intellectual property constraint or legislation, was pioneering.

Currently we are going through the ‘age of soil’, progressing regenerative practices that are sustainably and ecologically deployed, strategically building on economic structures and paradigms. Noted economist John Maynard Keynes's epithet was "it's easier to ship recipes than cakes and biscuits", subsequently

inspiring the open-source movement, questioning wasteful manufacturing paradigms (Galilee. 2018). Open-source technologies moved us through an age of access encouraging 'citizen designers' (Resnick, 2016) and opened new perspectives on design responsibility (Heller, et al., 2003).

Our current contextual material(s) are; digital, appropriate-ness, contextual situations, and a mix of traditional or green technologies. We are now entering the age of 'the citizen' with the designer's role providing autonomy. Our current material, (we frame) is the means to create, sustainable intent as we simply cannot 'sustain' the same approaches and relationships with the natural world. In Design, When Everybody Designs (Manzini, 2015) postulates about the more contemporary approaches to designing 'with' not 'for' people exploring; 1) What and how should experienced designers act, in a society in which all persons, individual and collective, are concerned with the design? 2) What might be the reasons and the developments of design culture to promote social innovation? (2015).

2. 'Citizen Design' (Track 1)

Citizen design operates within a multifaceted context, heavily influenced by the Ladder of Citizen Participation proposed by Arnstein (1969). This model illustrates a spectrum of citizen involvement, ranging from low levels of tokenism to high levels of empowerment and control. At its core, citizen design thrives in the upper rungs of this ladder, particularly through mechanisms like citizens' assemblies and economic forums (Schwab, 2020). These platforms serve as catalysts for deliberative democracy, where citizens actively participate in decision-making processes, transcending the traditional limitations of representative democracy. Unlike conventional political systems, citizens' assemblies are designed to be apolitical, fostering an environment where diverse voices converge to address societal issues.

These assemblies frame questions collaboratively (Wilson, 2020), ensuring that discussions encapsulate multifaceted perspectives and concerns, thereby enabling inclusive and well-rounded deliberations. A citizens' assembly embodies the essence of participatory democracy. It is a representative group of individuals, randomly selected to deliberate on specific issues affecting society (Westminster City Council, 2023). Operating independently from political affiliations, these assemblies are tasked with critically analysing complex problems and proposing viable solutions. Their processes prioritise inclusivity, often employing deliberative methodologies to ensure that all voices are heard and considered. The emphasis lies not only on the participatory nature of the process but also on the potential openness of its outcomes, which are designed to be reflective of collective input rather than predetermined agendas.

In contrast to mere community action models, citizen design surpasses localised efforts by engaging a wider array of stakeholders in co-designing the future of Public Interest Technologies (PITs) (Abbas, 2021). This concept embraces 'Defuse Design' principles advocated by Ezio Manzini, promoting designs that empower and enable individuals to actively participate in shaping their environments. An example of this approach is seen in the Medellin Cable Car Project, where the inclusion of citizen input was pivotal to its success. Conversely, Brazil's failed attempt (at emulating the Cable Car Project) highlights the repercussions of excluding citizens from design processes (Santos, 2023). This stark contrast underscores the significance of citizen involvement in the success of design initiatives, setting citizen design apart from conventional approaches to community action (British Council, 2020).

2.1 Citizen Design 01 *Skateistan (skateistan.org)*

Award-winning NGO, driving a global movement in skateboarding and creative learning. *Skateistan* creates spaces where young people can learn, play, and shape their futures. Their model builds skateboarding infrastructure and schools all over the world, delivers programs and equipment, and facilitates a network of over 800 social-skate projects with funding and resources. By focusing on at-risk, BIPOC and migrant communities, they promote inclusivity, diversity, resilience, and autonomy. *Skateistan* stretches across humanity, and anybody can be a citizen. *Skateistan* has five education facilities with state-of-the-art skateparks, across Afghanistan, South Africa, and Cambodia, in some areas where learning amongst young

girls is outlawed. *Skateistan* concerns creating confidence and agency rather than just an object or service… It inspires a curriculum for life. It inspires agency as it brings choice learning, access and a safe space that builds trust, outside of conventional structures.

2.2 Citizen Design 02 *InHouse Records (inhouserecords.org)*

Having been awarded countless international and national social design and entrepreneurship awards, *InHouse* is a record label with a proven track record of creating positive change for society. Having operated in and out of UK prisons across the South East of England since 2017, the label reduces the recidivism rate and is a rehabilitative record label for change. Their work in prisons exponentially increases positive behaviour [428%] and their impact on life outside is crystallised by a re-offending rate that is less than 1%. Working with Her Majesty's Prison & Probation Service and the Ministry of Justice, they look to bring change in the most challenging circumstances. It is specifically interested in building a metaphorical 'brotherhood' through music that enables people with an established and positive return post-penal system. A grounded technological platform that enables change, not only through connections but skills, development, and business lessons. Connected citizens with new skills, new networks, new opportunities, and an economy to work in. The agency it brings to its community is vast through; learning, skills, a contemporary curriculum, and tools for individuals or for clients to share through mentorship.

2.3 Citizen Design 03 *Fixperts (fixperts.org)*

Fixperts is a learning programme uniting 'fixers' with people and filmmakers, creating accessible narratives that can be publicly shared. Conceived and run by Forth *(wegoforth.org)* – a community interest company built by award-winning researchers, designers and educators who believe in the power of creativity as a tool for social change. The premise is simple: help fix a challenge, create a film, and share the process. It is intent on equipping future change makers to build the next generation of inventors and dreamers, encouraging contemporary and traditional skills. Each Fixperts project is made real by prototyping offering social connection. It employs a wide range of materials, skills, and technologies. The exceptional power of the project is rooted in the human connections between *Fixperts* and Fix Partner. The curriculum / engagement platform enables new methods; insights that can be broadcast providing both opportunities that can scale and impacts that are local. It not only encourages learning and skills development but provides agency in those that use it, can build off it, and see it as a medium to navigate the world of fixing.

2.4 Citizen Design 04 *Empowerment Plan (empowermentplan.org)*

Empowerment Plan (EP) was about designing jobs that keep people warm and develop their skills. Born out of the celebrated Detroit Soup (Admin, 2023). EP is a working economy, upskilling, training, and development of safer communities. The product is a coat, designed to keep the homeless population of Detroit warm and provide jobs/skills to those communities. The founder committed to hiring parents from shelters across Detroit to manufacture the coats helping families break the vicious cycle of poverty and become financially secure. The Empowerment Plan has evolved into an internationally recognized workforce development organisation. By pairing full-time employment with a wide range of supportive services, they have helped dozens of individuals achieve financial stability and independence for the whole family.

The *Empowerment Plan* creates significant economic impact by serving as a stepping stone out of poverty into a state of stability. The core of their work stems from their intensive two-year employment model, focused on providing job readiness training and support services to their workforce. The model has enabled every single person to move out of shelters within the first 90 days of working with them. It provides a bridge to financial stability, agency for choice and is a true example of citizen design. It also has a circular vision that enables its employees to grow and be developed within its core business.

3. 'Ecological Citizen(s) Design' (Track 2)

In Ecologism, Smith asserts that "citizenship refers to the framework of complex interlocking relations which exist between obligations and entitlements, in any legal and moral system" (1998, p.98). The argument continues that Ecological Citizenship means that "humans need to exercise caution before embarking on any project which is likely to have the possibility of adverse effects on the ecosystems" that it operates within (Smith, 1998, p.99). Ecological Citizenship "displaces the human species from the central position that it has always had" (Smith, 1998, p.99). This approach of considering potential impacts upon your surrounding peers, ecological systems, and environments, is pivotal to Ecological Citizenship. We should not be reliant on 'acts of kindness' to navigate our burgeoning planetary crisis, but think about how we build it into systems, enabling all to make better choices.

In Ecological Justice, Weston, et al., state "human rights advocates, champion the ecological rights of future generations", i.e., our human rights and ecological justice are intertwined (2012, p.251). Simply put "our societies [and] descendants depend on achieving ecological justice for future generations" (Weston, et al., 2012, p.43). I.e., we must protect future generations through Ecological Citizenship. It also feeds into lifelong learning as Ecological Citizenship holds an "important role in social change toward sustainable development, achieving economic, social, and environmental balance through informed, cooperative, and participative citizens" (Monte, et al., 2021, p.1).

We define Ecological Citizens 'touchpoints' as interaction points where appropriate and considerate technologies can be applied to assist people in their daily lives. Due to the complexity of these situations, they are not merely 'products' in their traditional sense, but are physical, digital or system interactions. The imperative element of Ecological Citizenship is designing 'with' and not for 'for', i.e., the touchpoints give agency enabling parties to make choices. We see it as an opportunity for how design (as a discipline) can be cultivated with / within societies. This design frame purely concerns the act of Ecological Citizenship for the betterment of many, designed and created 'with', but also constantly driven by positive ecological and regenerative outputs.

4. Citizen to Ecological Citizen(s)

Co-design practices work with people in collaborative ways, being open about elements. We refer to this as 'Citizen Design'; it is inclusive, accessible, affordable, and appropriate. Ecological Design has deep considerations for the impact to the ecological surroundings and ramifications (Todd, *et al.,* 2003). Ecological Citizenship encompasses Ecological Design as it cannot exist without 'Citizen Design', as you are a citizen of the ecological environment you live within. EC projects are differentiated not only in their process but also their execution. These EC stages (Figure 1.) include;

1. **Towards Citizenship |** They map existing assets (primarily) looking for alternatives, cross-disciplinary regenerative potential in concepts, under the bracket of 'with' not 'for' citizens.
2. **Ecological Positive Action |** Build upon non-extractive or have neutral impact(s), with sustainable intent.
3. **Collective Autonomy |** Their inception is supported to achieve individual autonomy that (in time) can translate into group / collective autonomy / agency.

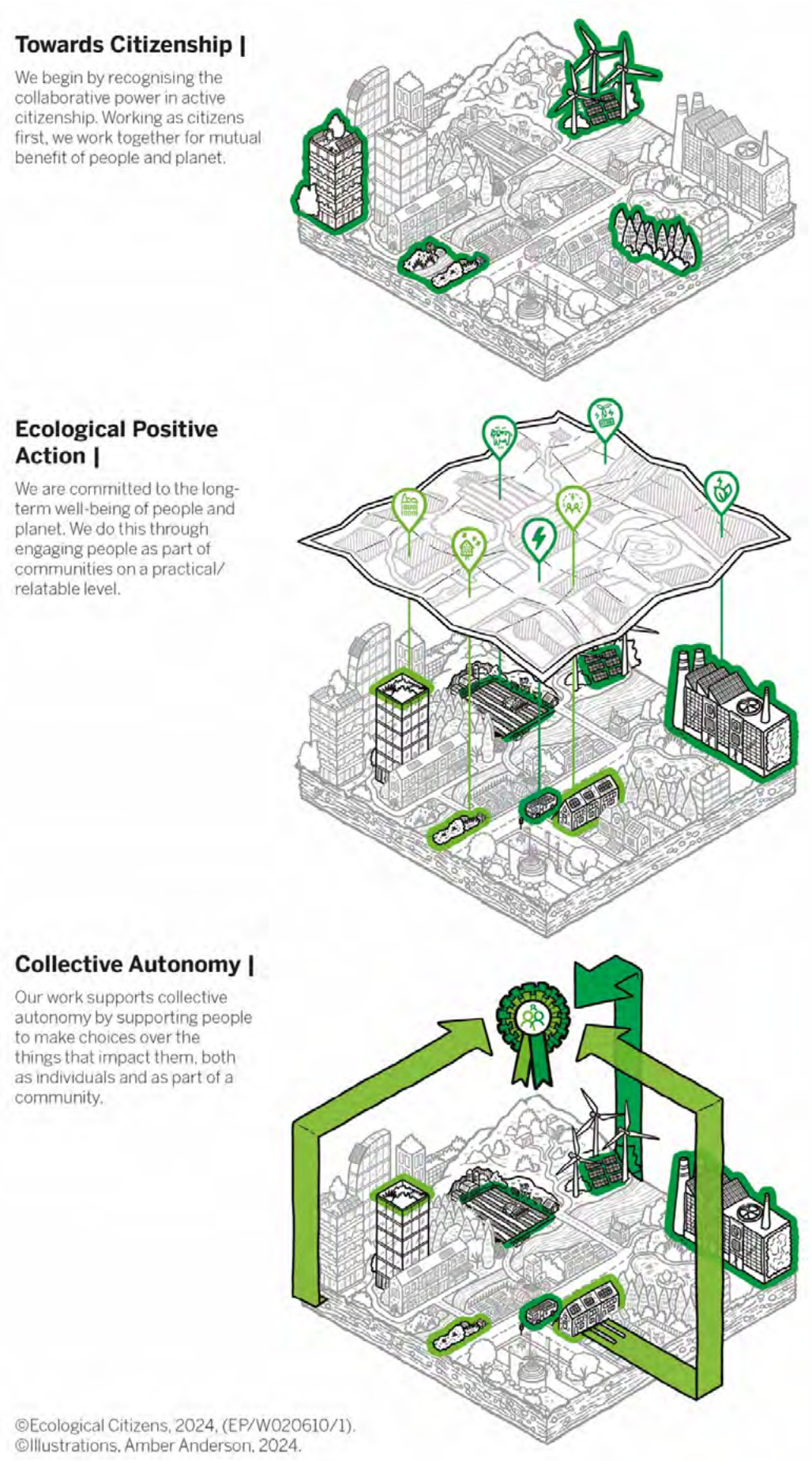


Figure 1. The steps toward Ecological Citizenship; 1) cultivating sustainable intent for ecological positive action 2) mapping existing assets, and finally 3) collective autonomy to supporting choice making over elements that impact on people.

EC projects are ethically completed, leveraging participatory design. Ideally EC projects have a life of their own creating: accountability, scaling potential and are (mostly) reproducible, if context, culture, and appropriateness allow. The following examples (01-04) are international and not solely from 'design start points', but they all end with 'designed interventions'.

4.1 Ecological Citizen 01 *Grangemead*

Grangemead offers emergency respite and daycare for learning disabled adults in East Sussex. Culture Shift brokered a connection between East Sussex County Council Adult Social Services and the University of Brighton (Community 21) to lead a three-way partnership to develop the outdoor space. They created the design for the garden in collaboration with staff (design professionals) and supported clients. Culture Shift's role was to support and evaluate the co-design process, capturing outcomes, impact, and learning (Culture shift, 2017). The multi-purpose space included: a wildlife pond, an outdoor kitchen, moveable and accessible planting boxes, a garden gallery, and a maker space.

The process was created and physically 'made' with citizens through their onsite maker space. It provided open agency over the space, upskilled clients and leveraged the use of local materials. It fostered sustainable intent through linking food growth and health in every sense with its outdoor kitchen. Elements of the *Grangemead* garden were also constructed from materials within the boundaries of the outdoor space. For example, using hand mined clay (whilst digging the foundations) that were fired in ground kilns and turned into working ceramic vessels for the kitchen. Graphical imagery was designed and deployed by residents using a pressure washer creating 'semi-permanent graffiti' etched into the gardens paving.

The intent was cultivated not only in what people could get from the space, but also what the space could provide to the clients and surrounding citizens, who lived nearby. This was evident in the projects approaches to biodiversity in the area, bringing autonomy and overall responsibility to those parties involved. *Grangemead* also shifted a boundary as conventionally these 'garden' typologies of are created and run by councils, whereas this was created by and with the citizens that occupy it.

4.2 Ecological Citizen 02 *Vertical University (VU) (belt-project.org)*

A collective organisation where the indigenous farmers are the teachers. The idea of The VU is simple. It is a "living classroom" of sorts, in the form of a 25,000-foot continuous vertical forest corridor stretching from Koshi Tappu (220 feet), Nepal's largest aquatic bird sanctuary, to Mt. Kanchenjunga (28,169 feet), the world's third tallest peak. It is a means to teach and conserve the 6,600 flowering plant species, 800 bird species and 180 mammals that are found in eastern Nepal. In a mountainous country like Nepal, where there is exceptional biological, climatic, and cultural diversity, from the tropical plains to the alpine Himalayas (Admin, 2018). The 'professors' of the VU may not have a Ph.D., but as indigenous farmers, they possess intricate, intergenerational knowledge about local fauna and flora, critical for Nepal's youth to attain.

The VU deepens place-based skills in sustainable technology, craft, and medicinal plants, and seeks to conserve and activate local knowledge while also creating sustainable livelihood opportunities. The outputs include; a curriculum, interdisciplinary learning, new economy, agency over the place and skills to nurture the opportunity. The VU explores new place-based economics that not only sustains the residential youth, but also the neighboring biodiversity. The VU is intent on creating: more sustainable communities, new job roles, citizen-led responsibilities, and contextually appropriate sustainable processes for local communities. The institution was created with the vision to improve a small community the sustainable intent has enabled many more parallel institutions across the Nepalese mountain ranges to thrive and prosper.

4.3 Ecological Citizen 03 *Nashulai (nashulai.com)*

Located in the Maasai Mara, Kenya. Notably, it is the first Maasai conservancy in the Maasai Mara to be created, governed, and managed by the people whose ancestors have inhabited that beautiful land for centuries, understand it intimately, and have sustained themselves, and their cattle herds, in harmony with the natural cycle of this globally important ecosystem. They are the first Maasai Conservancy in the Maasai Mara, living in sustainable symbiosis with wildlife for centuries. This is the opposite of traditional conservation models, where local people are displaced from their land. The "ethical grounds for displacement, whether pursued in the name of a larger national interest or a general social good, have always been specious" (Shahabuddin, *et al.,* 2014, p.8).

To counter that process in Maasai territories they talk about conservation refugees and conservation apartheid, where vast tracts of land are set aside for wildlife (and high-end tourism). Instead of leaving their land, they set out to band together and form their own conservancy. In the very genesis of this model there is a profound commitment from people most impacted to push back against a norm and mobilise to achieve positive change. The communities were desperate to see their community-led conservation process work. They were committed to making a more biodiverse sustainable wilderness for their children and future generations. That project will take years to come to fruition and is a true testament of long-term sustainable intent built 'with' communities / citizens not 'for'.

4.4 Ecological Citizen 04 *CLIMAVORE (climavore.org)*

A long-term project envisioning seasons of food production and consumption that react to human-induced climatic events and landscape alterations. CLIMAVORE critically questions the geopolitical implications behind the making of climate alterations and the pressures they enforce on humans and non-humans alike. Established on the intertidal zone at Bayfield, CLIMAVORE: On Tidal Zones explores the environmental effects of aquaculture and reacts to the changing shores of Portree, Isle of Skye. Each day at low tide, the installation emerges from the sea and functions as a dining table for humans, with free tastings of recipes featuring ocean cleaners: seaweeds, oysters, clams, and mussels. At high tide, the installation works as an underwater oyster table. The installation was activated by *Cooking Sections* (2023) in collaboration with local stakeholders, residents, politicians, and researchers. Over breakfast, lunch, or dinner (according to local tides), performative meals featured a series of CLIMAVORE ingredients responding to environmental challenges of Scottish waters. The project engaged with local restaurants that removed farmed salmon off their menu and introduced a CLIMAVORE dish instead. The outputs opened discourse with politicians, was place-based, provided dialogue and agency. CLIMAVORE's sustainable intent focused on catalyzing others to deeply consider their food, environment and how / when we should consider local communities. The interconnected approach of; redesigning local menus as food is something that binds us all, leveraging place-based intervention and centering the focus around 'inter-tidal zones' are something that will (in time) impact us all.

5. Conclusion

The work frames, navigates and positions; What are the attributes and positive benchmarks of designing with 'Ecological Citizen(s)', to create and enable acts of 'Ecological Citizenship'? Example projects were/are intent on creating autonomy as a practice. We are exceptionally aware of the complexities within this space for example; austerity (Helm, 2023), access to data (Mankin, 2024), access to sustainable means (United Nations, 2023), affluence (Gates, 2023), and this design space is exponentially complex, interconnected, and contextual. The examples have sustainable intent within different fields of; cultivating change, sustainable practices, and inclusion. The contexts are not a 'fix all' and brings into question: How is the work of design constitutively different when performed by 'non-designers'?

Within the space, it is cultivating the true means of how this can be achieved without compromising quality outputs. For example, understanding cost, production, and infrastructure challenges with the confidence of knowing a design process and that failure might unlock potential, i.e., prototyping. EC is ultimately bound by 'the bits in between' linking systems, processes, and elements. Traditional models try to mitigate impacts; carbon offsetting, recycling etc. is 'sustaining' the same behaviour and is contentious (Ghussain, 2023). The article's framework seeks to question: How is it benefiting the surrounding environment? From the onset. This moves design practice to a place where 'sustainable intent' is inclusive and accessible by all, creating situations where people have autonomy, agency and a clear steer on issues that impact their surrounding environment, peers, families, and multi-species.

6. Future Work

The positioning of this work cultivated, and provokes:

1. RQ; What should the balance be between our rights, responsibilities, and autonomy?
2. RQ; What are the wider impacts of citizens sharing their 'ecological impacts' and positive outputs publically?
3. Design opportunity: What are the 'future job centres' and career trajectories we can nurture over-time?
4. Design opportunity: Curriculum creation to nurture, foster and enable Ecological Citizenship, building and supporting future skills.

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P/REFERENCES OF DESIGN

GENERATING DESIGN BRIEFS BASED ON THE ANALYSIS OF WORKPLACE ARTIFACTS INVENTED BY INDUSTRIAL WORKERS: TOWARDS ADDRESSING GAPS OF CONTEXT AND SCOPE IN THE STUDY OF SPONTANEOUS DESIGN.

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KEYWORDS | APPROPRIATION, DESIGN RESEARCH METHODS, MANUFACTURING, SPONTANEOUS DESIGN

ABSTRACT | Research on spontaneous design presents a gap of context and a gap of scope. By 'gap of context' we refer to the territory of human workplaces, which are rich in examples of worker inventiveness, but still comparatively unexplored by design research. By 'gap of scope' we refer to how existing studies of spontaneous design have served to document, categorise, and understand design processes made by non-designers, but have fallen short on translating this knowledge into practical advice or tools for professional design practice. We present an initial approach to start addressing those gaps. First, through fieldwork in 11 industrial units in various sectors (textile, ceramics, metallurgy…), we identified and analysed 205 spontaneous design examples made by industrial workers. After analysing these artifacts, we generated design briefs, which were answered by the research team and iterated upon based on feedback from the representatives of the industrial units, as well as industrial workers. To understand whether the principles distilled from the analysis of spontaneous designs could be efficiently communicated to designers not involved in the initial research phase, we presented the same design briefs to design students as well as to design professionals, who presented their design concepts. In total, the process resulted in 15 design concepts. Through an analysis of the process and the resulting design concepts, we discuss the advantages and disadvantages of this approach, while also identifying future courses of action to continue addressing the gaps of context and scope.

1. Introduction

A metallic coat hanger being used as a TV antenna is an example of *spontaneous design*, a term defined by Loschiavo dos Santos (2000, p. 2) as "a creative practice of finding working solutions applicable to solve concrete problems, in a context of severe lack of resources". The term more often than not refers to tangible artifacts which are created by non-designers. A sign of the prevalence of this phenomenon is that it has popular terms in different languages to describe it, such as *gambiarra* (Brazil), *desenrascanço* (Portugal), *klugde* (USA), *jugaad* (India), among others.

Scholarly, the term finds home in the area of 'appropriation' research, which accommodates scholars from design, human-computer interaction, innovation studies and science and technology studies (Kohtala et al., 2020). Scholars working around appropriation are interested in understanding how non-designers create and appropriate products, including digital technology. These actions are also called *adhocism* (Jencks & Silver, 2013), *design-in-use* (Wakkary & Maestri, 2008), amongst others, or just simply *appropriation* (Akrich, 1998).

Understanding the coexisting discourses and terms around the same phenomenon, Kohtala and colleagues (2020) sought to create a unifying taxonomy. This was a significant advancement to unify and advance knowledge in this field. Another recent contribution to the field has been the call for more 'biographies of artifacts and practices' (Hyysalo et al., 2019). The authors suggested that the analysis of design-in-use would be much more informing than current analyses if it would not just focus on the artifact as it is found by the researchers, but also seek to understand its biography through strings of studies. This would allow understanding why the artefact emerged, how it changed, what functions it served in a certain context, or how it relates to how other artefacts evolved. Despite these important contributions to the field, we argue that there is still research needed in order for design to be able to operationalise the knowledge gained from studying this phenomenon. There have been attempts of defining guidelines for design that promotes or supports appropriation (Dix, 2007; Dourish, 2003; Sanders, 2006), but we are lacking research that connects the analysis of spontaneous design examples and converts it into actionable knowledge for design practice. To this we call a 'gap of scope', i.e. so far, the existing knowledge has not found its way into tools and/or information that design practitioners can use.

Furthermore, we also note a gap of context. Research on spontaneous design has mostly focused on 'snap shot' studies (Hyysalo et al., 2019) of certain environments, like domestic (Boufleur, 2013; de Bozzi & Oroza, 2002; Wakkary & Maestri, 2008) or public spaces (Boufleur, 2013; Suri & Ideo, 2005), as well as in certain domains, like healthcare (Storni, 2010) or disability (Hirsch et al., 2000; Jacobson & Pirinen, 2007). Despite signals that blue-collar workers appropriate and create their own tools (Cross, 2012; Juravich, 2017; Narimoto et al., 2020; Zhou et al., 2011; Zuboff, 1989), this is still untapped territory for design research.

However, this context of work is highly relevant for design for different reasons: 1) historically, designers have placed significant efforts in improving working conditions through workplace design (Myerson et al., 2010), which can benefit from methods that help designers understand workers' unmet needs, 2) historically, there have been tensions in the introduction of technology-led change in workplaces (Zuboff, 1989), which can be mediated by designers, and 3) currently, there are growing calls to improve working conditions for blue-collar workers, namely in Europe, where a group of experts has proposed to make Europe the "centre of gravity for good quality jobs", starting with manufacturing and engaging in human-centred design, which requires an understanding of current working conditions, challenges and opportunities (European Commission, Directorate-General for Research and Innovation, Unit G.1 et al., 2023).

Analysing spontaneous design in shopfloors could give us an understanding of how workers appropriate their workplace and this analysis could be used as a proxy to understand unmet needs, i.e., the reasons why workers appropriate tools, and the purposes thereof, can help us understand latent needs, for instance in ergonomics. Additionally, since participatory design with industrial workers is highly

challenging (Ardito et al., 2014), studying spontaneous design examples could provide a complement, or even an alternative, albeit necessarily less rich than direct interaction with workers.

In this paper, we present how we have tried to address the gaps in scope and context which we described above by proposing a design research process that draws from the analysis of spontaneous design examples to inform design briefs. Our concern was not so much on delivering prototypes to address issues on industrial shopfloors, as it was to test a method of generating design briefs based on the study of spontaneous design and ascertain whether they would be actionable by design practitioners. Although some phases of the research happened simultaneously (e.g., phases 6, 7 and 8), for the sake of readability, we present this process in chronological order of events (Figure 1), from fieldwork to assessment of design concepts, finishing with suggestions for future work.

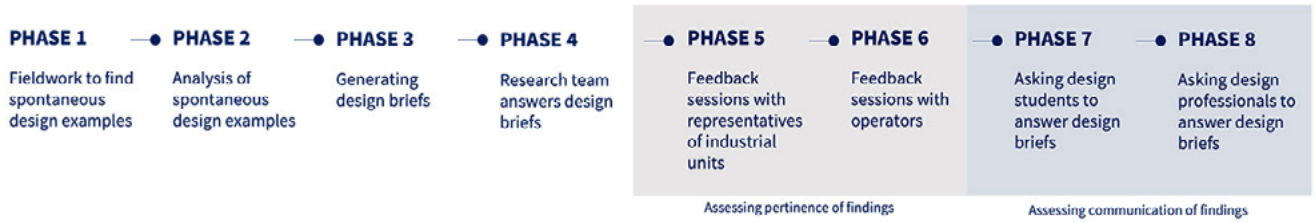


Figure 1. Phases of the research process described in the paper.

2. Building Knowledge from the Analysis of Spontaneous Design

During 2023, we visited eleven industrial units in Portugal working in the sectors of lighting, ceramics, textiles, metallurgy, polymer mould and injection, woodworking and cardboard packaging. During these visits, through factory tours using free non-participant observation and contextual inquiry, we documented examples of appropriation in the workplace by industrial workers. Figure 2 shows seven examples of spontaneous designs we found: A) adaptation to organize tools; B) Protection from machine; C) Tool handle made with tape glue; D) Levers fixed with cork stoppers; E) Tool designed to clean woven wool made from tape glue and rosemary sticks; F) Workbench with secured belongings and personal messages; G) New labels added to machine.

Each example of artifact (205 examples found in total) was catalogued according to Akrich's (1998) four categories of appropriation – *displacement*, *adaptation*, *extension*, *detour* – and analysed for function and underlying motivation for its creation. The photographic dataset of these spontaneous design examples was released in open source (containing the 696 photographs which were authorised by the industrial units for dissemination) (Correia de Barros et al., 2023). Each photograph in the dataset is accompanied by metadata categorising the type of appropriation, the purpose of the object, a description of the object (for alternative reading), the industrial sector, and the country of origin.

The main purposes we found in the sample of spontaneous designs were converted into four design briefs (Figure 3), the requirements of which were also extracted from characteristics of spontaneous designs we found in our research. A fifth brief was added in response to a direct need from one of the industrial units that were visited (Brief #5).



Figure 2. Examples of spontaneous designs found during research.

BRIEF #1

Design a solution to organize and display tools and/or materials on an industrial shopfloor environment.

It should:

- Fit a minimum of 20 tools/materials
- Have a space for each individual tool/material
- Allow the display all tools/materials at once
- Allow to hold tool/material in place if needed
- Allow for easy identification of each tool/material
- Allow labelling with user or sector name
- Provide enough space for approach and use (i.e., to easily remove or place tool/material) from different angles
- Be steady
- Be sturdy

BRIEF #2

Design a way to add information to industrial machinery to reduce errors in interaction and to protect users interacting with the machine.

It should:

- Allow for information augmentation through superimposed layers
- Allow to direct user's attention to certain details
- Allow to mark desired/safe states of machine
- Allow colour coding if needed
- Allow to use text, numbers, icons or bespoke symbols/drawings
- Allow easy removal/replacement

BRIEF #3

Design a way to protect users' hands when interacting with hand tools.

It should:

- Be comfortable
- Be portable
- Enable labelling with user or sector name
- Be adjustable to different hand tools
- Be adjustable to different hand sizes
- Be quick to place and remove
- Allow tool extension for hard-to-reach places

BRIEF #4

Design a way to protect users from particles/objects projected by working machines.

It should:

- Be adjustable in size
- Allow for flexible ways of attachment to different machines
- Be robust
- Allow to be locked in position
- Allow see through
- Allow labelling with user or sector name

BRIEF #5

Design a way for continuous cleansing of conveyor belts.

It should:

- Be adjustable in size
- Allow for flexible ways of attachment to different machines
- Be robust
- Allow to be locked in position
- Allow see through
- Allow labelling with user or sector name

Figure 3. Design briefs.

3. Designing Based on Knowledge from Spontaneous Design

During this phase, the research team worked on design concepts to answer the briefs. Figure 4 shows examples of concepts generated by the research team: A) a modular device for tool organization, which can be combined in groups of four to become table foot elevators; B) a 3D printed flexible and modular element that can be attached to different types of machinery to protect workers; C) a rod system to create storage space underneath workbenches; D) a digital tool to quantify existing material leftovers to encourage reuse and design with those materials; E) a universal tool handle.

While developing the design concepts, we led design feedback sessions with representatives of the industrial units, followed by similar sessions with shopfloor operators. A minimum of three elements from the research team was always present at the sessions. The sessions were not recorded – researchers took handwritten notes, including verbatim transcriptions when deemed relevant, and took photographs of participants' interactions with the prototypes.



Figure 4. Examples of design concepts created by the research team.

3.1 Feedback from Representatives of Industrial Units

We held sessions with nine representatives of eight of the eleven industrial units for feedback on the design concepts. The representatives varied in role, from factory directors to production engineers. The sessions were held in meeting rooms at the industrial units or online, during which the research team presented the designed concepts in paper and in tangible prototypes. During the sessions, the representatives of the industrial units commented on each concept. In the end of the session they were asked to rate the design concepts by highlighting those which they thought had more potential and/or were more useful considering their knowledge of industrial shopfloors.

The representatives of the industrial units validated some concepts, discarded others and offered ideas either to improve the concepts they were presented with or to create new ones. As an example, on the first session, one of the representatives of the industrial units looked at concept B (Figure 4) and imagined it at a different scale, suggesting that, if much larger, this element could be used as a mat for maintenance workers who often need to operate while lying on the floor and, while doing so, would welcome a way to keep their tools, screws and bolts at hand. Surprisingly for the research team, concept A's (Figure 4) secondary function as a table foot elevator was much appreciated by most representatives of the industrial units. What began as an optional function became desired as the primary one. After these feedback sessions we analysed the preferences of our participants, and continued working on the higher-ranked design concepts only: A, B and E (Figure 4).

3.2 Feedback from Shopfloor Operators

We conducted another round of feedback sessions to design concepts A, B and E. This time these sessions were held with operators of five industrial units (11 operators in total) and took place on the industrial units' shopfloors. Again, researchers presented printed images of the concepts and tangible prototypes. Without being asked to do so, most operators began manipulating the prototypes and experimenting them in their workstations and with their tools (Figure 5). This enabled operators to discover drawbacks in the design concepts as well as opportunities for application, for refinement and even new applications.

Regarding concept E, operators gave detailed suggestions on how the mouth of the device should be redesigned to accommodate different tools (e.g., from a metal file to a toothbrush), as well as how the material of the handle should be thought to absorb impact. Operators also found a new use for concept B as a tool organiser, which could be attached to the side of the workbench (Figure 5, second picture from the left) and hold the tools they use more often. Concept A used up horizontal space and this, for the workers, was a negative aspect of the design, since they often need as much free horizontal space as possible to do their work. Their new adaptation of concept B would also avoid frequent opening and closing of the tool drawer, which is what they currently do.

Upon request, the 3D CAD files of the design concepts were shared with the industrial units where these operators worked, so that they could print and use some prototypes there.

The feedback of industrial unit representatives and operators sometimes was similar, for instance, when referring to the need to keep as much clean space on workbenches as possible. However, there were also differences in the possibilities that were anticipated by each group when interacting with the prototypes. This seems to have been influenced by location: while industrial unit representatives were interacting with the prototypes in meeting rooms, operators interacted with the prototypes on the shopfloor and invariably looked around to see possibilities for the objects, and tried them out, which led to the identification of some barriers, but also to some new possibilities for the prototypes to better address their needs.



Figure 5. Photographs from the feedback sessions with operators.

4. Testing Knowledge Translation

As seen so far, the design process conducted by the research team resulted in two design concepts which appealed to operators. In order to understand how other designers not involved in the research and analysis of the spontaneous design examples would respond to the design briefs, we launched a challenge to design students, as well as a challenge to two design professionals who had no prior connection with the research team.

4.1 Design Briefs to Students

Through a partnership with the Polytechnic of Viana do Castelo (IPVC), the research team proposed a design challenge to first year students of the school's MSc in Design. The students were divided into five groups and each group received a different design brief (Figure 3). The students were given no examples of the spontaneous designs found by the research team in order to isolate the effect of having access to that information. Because not all students had visual or conceptual references of industrial shopfloors or machinery, we searched online for images of industrial environments to help students build mood boards with the following terms for each brief: Brief #1: tool organizer in workbenches; Brief #2: buttons in industrial machinery; Brief #3: industrial hand tools; Brief #4: industrial machine protection; Brief #5: cleaning conveyor belts.

Students worked on the design briefs for six weeks. One member of the research team was present at the launch of the challenge, on week four for a first presentation of the groups and feedback, and on week six when students presented the final designs. At the end of the presentation session, the researcher revealed examples of spontaneous designs found during fieldwork and how they were analysed.

Although the students were able to advance on the design concepts, they were concerned that they might be lacking relevant information from the field, since we did not share the fieldwork data with them. The presence of one of our researchers at certain points in the process was reassuring in the sense that students were able to clarify their doubts with a person who, in this case, was a subject matter expert.



Figure 6. Photos of prototypes and drawings made by students to answer the design briefs.

4.2 Design Briefs to Professionals

To understand whether there would be any differences between giving the design briefs to design students or to professionals, we sought to hire design professionals with no prior connection with the research team to answer the briefs. Answering the briefs consisted in delivering a sketch of a design concept. Similarly to Weingarten and colleagues (2020), we tried to recruit individual designers from freelance platforms. We scanned three platforms (Behance, Fiverr and Upwork) for professional services in product design and concept design from any location, who would speak English. We considered that the portfolio quality was generally higher in Behance, and so we decided for that platform. In the project, we had a budget limitation of 500€ per designer, but we understood this was not enough to reach the best-selling professionals, so we sacrificed the sample size and we used a budget of 1.000€ instead. We then took the five design briefs and we used the website random.org to attribute the briefs. We invited two designers to answer the briefs. Having no answer, we invited another two. In the end, only one designer answered and accepted to do the job. This designer got brief #2 (Figure 3).

Seeing that it was difficult to hire independent designers through this platform, and seeing that the sample was drastically reduced, the team agreed to use the remaining budget to try and hire a design studio. This would enable a comparison of approach between an individual assignment and a group assignment. We made a list of design companies operating in Portugal, and randomly selected between a list of three. The first invited company declined and the second accepted the job. This company got brief #1 (Figure 3).

The individual designer and the design company were asked to work on the design briefs independently and were not required to validate their process with the design team. However, as with the students, both felt the need for clarification and validation with the research team. The individual designer prepared a Miro board, which was shared with the research team, with the phases of research, insights/opportunities, and ideation. Throughout the process, the designer asked for comments on the work to help steer the design process. The company delivered a first file with a series of sketches as the design concept evolved, asking for feedback from the research team. The file also contained a section with questions that the company felt lacked answers which would help them improve the adequacy of their design concept to the brief. The company had doubts related to the type of industrial environment they should consider and tools in use at that environment, as well as other questions related to scale (e.g., how many users, how many factory sectors should be considered, what size would be reasonable for the artefact). The company considered that the brief alone was not enough for a good product development process.

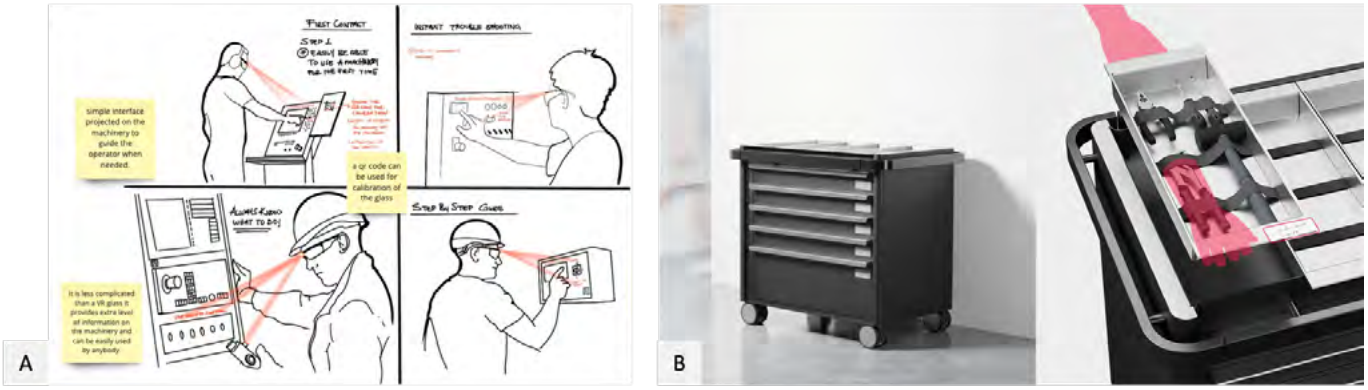


Figure 7. Design concepts by professional designers: A) Glasses answering Brief #2; B) Storage unit answering Brief #1.

5. Discussion, Conclusions and Future Work

As shown by other authors (e.g., Storni, 2010; Wakkary & Maestri, 2008), appropriation in general and spontaneous design in particular not only show in contexts of socioeconomic disadvantage, but in other contexts as well. In the case of this paper, we can also consider the notion of 'lack of resources' forwarded by Loschiavo dos Santos (2000) as time- or effort-bound, i.e., one may be impelled to engage in spontaneous design because one needs to find a working solution with some urgency, or because one does not think that asking others to provide a working solution (e.g., a supervisor on a production line) will be worth the effort. In any case, we have a person who is confronted with a problem to solve and who looks around for available resources to understand how to solve the problem most efficiently in terms of components used, time spent, and how effective the solution will be in answering the problem. In this sense, it becomes clear that the context of work is prone to these kinds of situations and, therefore, to the emergence of spontaneous design. We found multiple examples in single visits to eleven factories in Portugal, thus trying to contribute to closing the gap of context, which is often leaving the realm of work out from spontaneous design research. We hope that this research can contribute to a future 'string of studies' (Hyysalo et al., 2019) which can shed light on how processes of appropriation at work unfold, and how design research and practice can learn from them.

On the other hand, looking at examples shown in Figure 2, they seem to point towards flaws in design. For instance, a machine which requires new labels so that users can operate it denotes a product design process that was not ideal – maybe the original labels came off, maybe they were in a language that users did not understand, maybe there were no original labels, maybe the words in the labels did not have correspondence to users' jargon. There are many possible explanations, but there is an unequivocal sense that the original design did not fully meet its goals. Studying these kinds of artefacts is, therefore, a way of identifying unmet needs, as well as opportunities for better workplace design. Another way in which the research of spontaneous design examples can support design practice is to try to abstract from the concrete examples onto general needs. This is what we tried to do to address the gap of scope. We sought to do it in our research by analysing the functions served by the spontaneous design examples, the way in which they were built, and the motivations that seemed to lay behind the initiative to create the spontaneous design itself. In so doing, we understood, for instance, that often industrial workers engaged in spontaneous design because they wanted to improve ergonomics and safety at work. By analysing which characteristics improve ergonomics for workers compared to pre-existing conditions, we were able to extract general principles. Once we had these general principles, we formulated them as design briefs with which we created experiments among the team, as well as with untrained and trained designers.

Although in some cases the design concepts answering the briefs were similar (for instance, the research team and the students developed similar tool handles for Brief #3), in other cases, the approaches were quite different. For example, to answer Brief #1 (organise and display tools), students and design professionals designed their concepts based on large surfaces which could expose tools, while the research team developed a much smaller object which was designed to hold tools in almost radial format. This difference might have been due to simply different ways of thinking and approaching problems, as it might have been influenced on researchers' side by having witnessed that space is precious on an industrial shopfloor, and so artefacts should minimise the space they occupy. This reflection around space did not come until we saw external designers' concepts and it led us to thinking that maybe this should have been one of the requirements in Brief #1.

We also noted that both design students and design professionals commented that they struggled with not having any other information than the brief. Despite this lack of information, they were still able to answer the briefs and, as noted in the paragraph above, sometimes developing similar design concepts to those of the research team. All external designers knew that the research team was in possession of rich data from the field and would have preferred to have access to it. In our analysis, despite the lack of confidence that this lack of information imposed on design students and practitioners, they were still able to operationalise the principles extracted from the analysis of spontaneous design examples into new design concepts.

As future work, we would like to present these design concepts to representatives of industrial units and industrial workers to get feedback on perceived usefulness. The only significant difference we found between trained and untrained designers in answering the briefs, was that trained designers were better in formulating exactly which further information they would like to have had access to in order to improve the quality of their deliverables. In other words, they seemed more confident in identifying what they did not know.

So far, we have understood that the information we abstracted from the analysis of spontaneous design examples was enough to generate briefs which could be answered by trained and untrained external designers. As future work, we should bring the design concepts generated by students and by design professionals to the workers for feedback to learn about their perceived usefulness. Future work should also address optimal ways of conveying information to designers who were not part of fieldwork, so that design briefs become less generic and more nuanced as to reflect the specificities encountered by researchers in the real-world.

A strength of our research is that it seems to be the first in documenting, categorising and making the examples of spontaneous design available to the design research community. In this sense, although it does not yet allow a vision into biographies of these artifacts (Hyysalo et al., 2019), it can contribute to the strings of studies which can help close the gap of context in the study of spontaneous design. Our research also seems to be the first in seeking to extract design principles from spontaneous design examples to inform design practice. However, the research also has limitations. Reflecting back on the process, we understand that it would have been useful to have collected more structured feedback data to the design briefs from industrial representatives and from operators. We also did not have metrics for design quality with which we could compare work delivered by the research team, the trained designers, and the untrained ones – the fact that we obtained similar design concepts, or not very advanced ones, raises questions about the quality of the design process. This should be investigated further.

Finally, while the research was planned to resort to freelance platforms, following examples from prior research, we were faced with two issues. First, when writing the project research proposal we asked for a budget to hire five professional designers which, by the time we got to this phase of the research was already evidently insufficient – from five planned designers, we could only hire two. Second, the research team reflected about whether, by using freelance platforms, we were supporting design practitioners or rather taking advantage of – or enforcing – a system of precarious working conditions for designers.

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P/REFERENCES OF DESIGN

LISTENING TO THE SHIPYARDS: DESIGN FOR SOCIAL INNOVATION IN POST-INDUSTRIAL REDEVELOPMENT AMIDST CONTESTED HISTORIES.

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ABSTRACT | “Listening to the Shipyards” is an engaging self-guided walking tour that combines ten sound design capsules and two augmented reality (AR) visual experiences to explore Nantes’ industrial heritage, the end-result of a 3-year research project into design for social innovation (DSI). The tour centers on a former shipyard undergoing rapid transformation and disappearing from the city’s landscape and provides a unique perspective on Nantes’ post-industrial landscape, offering insights to both locals and visitors alike. Following extensive field studies, students uncovered varying and contested redevelopment objectives among civic stakeholders and historians. As the area in question transitioned into a more traditional urban setting, conflicting goals emerged between: cultural actors that were the first to invest the abandoned industrial buildings for large, rowdy and public events; the syndicated union representatives deeply affected by the closure of the industrial base and resentful of its recreational re-use; and the city authorities aspiring to repurpose the area for residential, educational, and creative industry mixed-use. In an effort to mitigate dissensus around a shared vision, a proposal for an immersive sonic walking tour was presented to and endorsed by Nantes’ tourism agency, the Voyage à Nantes. This paper delves into how social innovation and digital design played a crucial role in identifying common objectives and fostering dialogue and collaboration among stakeholders with strongly divergent interests. As part of the Innov’Art 2 research project by the Institut Français d’Argentine, “Listening to the Shipyards” (À l’écoute des chantiers) contributed to the Voyage à Nantes 2022, providing a meaningful exploration of the city’s evolving identity.

1. Introduction

1.1 Design for Social Innovation

Design for Social Innovation (DSI) has emerged as a dynamic field that seeks to deploy the creative potential of design to address complex social challenges and drive positive change within communities. Rooted in principles of collaboration, inclusivity, and sustainability, DSI emphasizes the importance of engaging stakeholders in the design process to co-create innovative solutions that are contextually relevant and impactful (Manzini 2014, Manzini & Coad 2015).

At the core of DSI lies the concept of Participatory Design (PD), a collaborative approach that places stakeholders and community members at the center of the design process. By actively involving stakeholders in decision-making and problem-solving, participatory design tries to ensure that design interventions are responsive to the needs, aspirations, and lived experiences of those they seek to serve. (Bason 2010, Andersen & Mosleh 2021) This not only enhances the relevance and effectiveness of design outcomes but also fosters a sense of ownership and empowerment among participants. PD also recognizes that stakeholders working towards "changing situations into preferred ones" are designing (Simon 1996) and have legitimacy in the design process.

Murray et al. (2010: 4-5) highlighted four critical characteristics of the new social economy facilitated by Digital Social Innovation (DSI), which are evident in this three-year project: the extensive utilization of distributed networks for maintaining and managing relationships, supported by broadband, mobile, and other communication technologies; the diminishing distinction between the roles of producers and consumers; a focus on collaboration, along with ongoing interactions, care, and maintenance, as opposed to singular acts of consumption; and a significant emphasis on underlying values and missions.

According to Manzini (2014), this project is an example of top-down, incremental innovation, since it is driven by designers and experts to achieve systemic, institutional innovation for socially sustainable development. In this case-study, we apply participatory design principles (Chick 2012) demonstrating these approaches in the pursuit of design for social innovation, showing how PD helps mitigate and structure dissensus among partners in an industrial heritage project.

> "The codesign process takes place de facto, thanks to the interactions that are not only uncoordinated but can even be conflictual." (Manzini, 2015: 50)

1.2 Innov'ART2

The Innov'Art2 cooperation program of the Ministry of Foreign Affairs, led by the French Institute of Argentina, was launched in July 2019 to develop academic, scientific, and artistic exchanges between French and Argentine universities. Our Innov'Art 2 project was part of a bilateral cooperation project between our design school's two graduate programs and two Argentine universities (and their departments of Social Communication in San Juan and Architecture in Tucuman) thematically centered around design's response to urban trauma. Each partner addressed a local issue with a shared methodology, and the French context addressed the shipyard closure in 1986, the termination of its 60,000 strong workforces, and the significant urban decline brought about by the loss of the industrial city's primary employer. This project situates itself within the broader context of international cooperation, and it underscores the global significance of addressing industrial heritage challenges and fostering interdisciplinary collaborations in urban design and heritage conservation.

1.3 Ile de Nantes and Its Post-Industrial Context

We explored the intricate interplay between industrial heritage preservation, urban redevelopment, and cultural revitalization in the new Quartier de la Création on the Island of Nantes. Against the backdrop of the island's industrial past, characterized by the presence of notable establishments like the Alstom engine factory and Dubigeon shipyards, our research delves into the multifaceted efforts aimed at preserving industrial-historical traces while fostering contemporary urban vibrancy, and the conflicts that can arise from its urban redevelopment. (Charles & als. 2016, Rapetti 2019, Renard 2018)

Central to our inquiry is an examination of the strategic decisions made by Nantes' public actors since the 1980s, which have shaped the island's landscape and identity. Emphasizing the significance of industrial heritage preservation and valorization within urban development master plans, we analyze the transformation of the Ile de Nantes into a dynamic extension of the historic city center, characterized by its dense urban fabric and burgeoning cultural scene.



Figure 1. Boat launch in the heyday of the Nantes Dubigeons shipyard. Image courtesy of the MHT.

This paper also scrutinizes the roles played by various stakeholders, ranging from governmental bodies like SAMOA and Nantes Métropole, to cultural institutions such as Stereolux, Maison des Hommes et des Techniques, and Le Voyage à Nantes, to historic preservation researchers and associations. Through case studies and empirical data, we explore how these stakeholders collaborate - and sometimes resist each other when goals diverge - to engage with the community, enhance industrial heritage appreciation, and promote tourism development.

Furthermore, this case-study sheds light on the participatory nature of heritage conservation efforts, exemplified by workshops involving representatives from academic, cultural, and governmental spheres. By examining the outcomes of such collaborative endeavors, we elucidate the challenges and opportunities inherent in the preservation, valorization, and appropriation of post-industrial urban areas, showing *how DSI can help mitigate and structure dissensus among partners in an industrial heritage project.*

2. Methodology: Multi-Phase Fieldwork and Iterative Development Phases

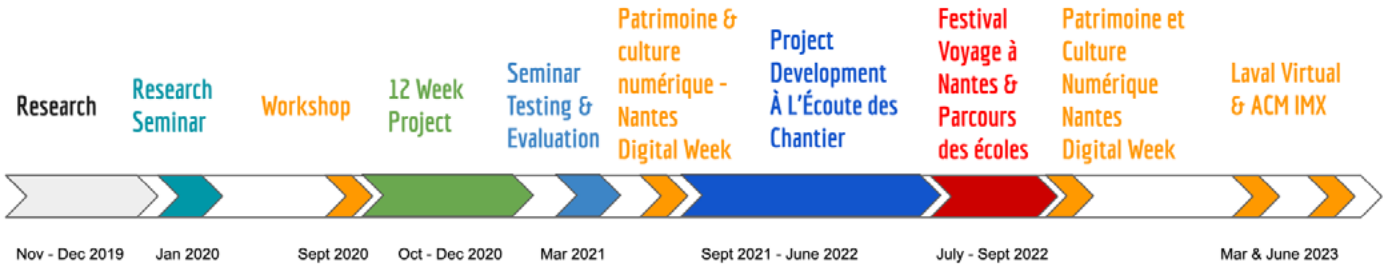


Figure 2. Project timeline from 2019 to 2023: field research seminars and participatory design workshops led to a studio course for initial design propositions, followed by nine months of production. Note: gaps are due to Covid19 lock-downs. "A l'écoute des chantiers" was launched in July 2022, and is still deployed.

2.1 Phase 1: Initial Fieldwork in Fall 2019

The initial phase of our fieldwork centered on identifying and conducting interviews with key stakeholders involved in the redevelopment of Nantes' industrial heritage. The lead researchers engaged in comprehensive interviews and site visits to delve into the area's history, map out the stakeholder networks, and clarify their goals, challenges, and any points of contention with other involved parties. These detailed interviews were crucial in pinpointing the major entities driving the redevelopment efforts on the island, culminating in the compilation of a network of essential stakeholders presented in Table 1. Drawing on Mitchell et al. (1997), we concentrated on stakeholder classes with significant influence and/or legitimate interest in the industrial heritage and urban redevelopment of Nantes, specifically focusing on Dominant, Dependent, and Definitive stakeholders. (Krupa et al. 2022) This group comprises individuals from agencies responsible for the area's redevelopment, maintenance, preservation, and enhancement (including DPARC, Samoa, and VAN), as well as civic actors engaged in historic preservation (such as MHT and Nantes University).

Table 1. Expert interviews by Innov'Art 2 research team leaders.

May 2019	SAMOA - Hangar 32 - Interview of International project manager + Commented tour of Ile de Nantes, Creation District	SAMOA, a publicly funded organization, oversees the redevelopment of the Ile de Nantes. Initially working with Dominique Perrault (architect of the Bibliothèque Nationale de France) in 1995 and later replaced by Alexandre Chemetoff who submitted the master plan after a participatory design phase.
	Director, Maison des Hommes et Techniques (MHT) - Parc des Chantiers - Commented tour of the naval industry museum	The MHT was established by a collective of former shipyard builders and workers, with its headquarters situated on the ground floor of the former Dubigeons administration building. Since its inception, the organization has undergone minimal changes. There is a strong opposition between the redevelopment goals of MHT, Samoa, Voyage à Nantes and Nantes Métropole on the notions of industrial heritage of a post-industrial site. Significant archives are located in the few remaining structures.
Dec. 2019	Director, Historic Preservation Departement, Nantes Municipality (DPARC)	Historic Preservation has forged strong connections with residents and broader civil society, encompassing concepts of architectural heritage, cultural heritage, and industrial heritage, documenting not only from public archives but also from private sources such as industries, businesses, and personal archives, cataloged within the Nantes Patrimonia website.

	Project Manager, Le Voyage à Nantes (VAN)	The VAN is a private organization that serves as Nantes' official tourism bureau and runs a large number of services and cultural events for the metropolitan area, including the maintenance of the Parc des Chantiers (PdC), a privately-run public-owned public park on the former shipyard of the Ile de Nantes. PdC is the place for festivals, cultural, sportives and leisures activities, and is a very well known leisure parc, with difficulties depending on its temporality, notably between the public nuissances and safety of its nightlife and recently-arrived local residents.
	President of the association of industrial heritage of Nantes	1985-86 : Closing of the factories on Ile de Nantes – Alstom, Dubigeons Shipyard. 1993 - 1995 : creation of the industrial historic preservation association Conflits between the first tabula rasa redevelopment plan (Perrault) and historians and union representatives in a socialist city. Chemetoff's subsequent plan is for a city rebuilt without erasing its industrial remains[1].
	Vice-President, Nantes University	The relocation of port activities to Saint Nazaire, orchestrated by Nantes' town hall and the Chamber of Commerce & Industry, marked a pivotal moment in the city's industrial landscape. As shipyard closures ensued, deindustrialization exerted profound effects on both blue-collar employment and indirectly impacted service jobs in Nantes. The election of JM Ayraud, a socialist mayor, in 1989 heralded a period of significant urban transformation. The ZAC de la Madeleine project, initiated from 1990 to 1995, saw the establishment of the Civic and Convention Center, setting the stage for the subsequent replication of this urban renewal model on the Ile of Nantes from 1995 to 2000. Key public-private entities like SAMOA, along with urban planning figures like Alexandre Chemetoff (succeeding Perrault), spearheaded efforts to reimagine the city's urban fabric, particularly around public spaces. Central to this vision was the preservation of Nantes' industrial port heritage, manifesting in the repurposing of vacated urban spaces by the town hall. The cultural and creative industries found fertile ground in refurbished old factories characterized by their distinctive metal and glass frames, symbolizing Nantes' economic rejuvenation. Question: Does Nantes' resilience come from the modernity of urban heritage policies and has been driven by cultural and artistic production? Recommendation: Insist on the relevance of heritage issues with the general public to find a link between the different actors of the Parc des Chantiers (MHT, VAN, NM, SAMOA, University of Nantes).

Our initial interviews uncovered some conflict among essential civic stakeholders, each with differing visions for the area's redevelopment. Each party clearly articulated their perspective, legitimacy, and stakes in the redevelopment process, and identified allies and points of tension with other parties. The MHT advocated for a renovation that would honor the historical integrity of the shipyard's remaining structures. In contrast, organizations such as VAN and cultural entities like Les Machines, Stereolux, and Trempolino aimed to infuse the space with vibrancy and cultural significance. DPARC and Nantes University found themselves navigating a middle path, striving to balance the preservation of the site's industrial legacy with the practical ambitions of fostering a dynamic, multifunctional community. A notable contention arose over the acknowledgement of other stakeholders' needs and ambitions, with highly polarized stakeholders and newer entrants to the redevelopment discussion often perceived as lacking legitimacy by others. This issue seemed disconnected from the actual influence or authority of the institutions involved.

[1] https://www.cilac.com/definition-histoire

2.2 Phase 2: Research Seminar: M1 level students, Jan. 2020

At the école de design, graduate research projects frequently serve as practical learning experiences, and the Innov'Art2 project was aligned with this educational approach. Tasked with exploring Nantes University's research question on public perception regarding the area's redevelopment, a weeklong research seminar was organized. During this seminar, 24 first-year Masters students engaged in comprehensive research of a specific area. Their goal was to assess its present condition and explore potential redevelopment strategies that prioritize social innovation. This involved conducting interviews with both the general public and local businesses. The students were divided into five teams, with each team assigned to delve into one of the five identified challenges, analyzing their findings accordingly:

- **Challenges**: Addressing nuisances, public space dynamics, noise, waste management, disorderliness, and criminal activities.
- **Heritage and Identity**: Exploring aspects related to industrial heritage, cultural identity, museum development, and nostalgia.
- **Community and Economy**: Delving into topics concerning urban economy, revitalization efforts, urban planning strategies, and the overarching master plan.
- **Cultural and Creative Revitalization**: Investigating the appropriation of industrial heritage by cultural and creative enterprises.
- **Patterns of Use**: Analyzing usage patterns ranging from informal to formal, spontaneous to planned activities within the designated area.

The comprehensive territory diagnosis revealed a significant gap between the current perceived state of the neighborhood and the sustainable development and cultural aspirations held by civic stakeholders and the local community. The neighborhood's minimalist high-tech architecture and deserted appearance, frequently exacerbated by ongoing construction, was highlighted, especially during the Covid lockdowns, which limited business operations to only essential services. This insight provided a foundation for future strategies aimed at bridging this gap and fostering a redevelopment process that aligns with the community's needs and aspirations. A longer student project was planned with a participatory design workshop to kick it off.

2.3 Phase 3: Participatory Kick-Off Workshop - M2 Level Students, September 2020

> "Conversation among individuals and groups who set design initiatives rolling at the networks' nodes of the networks they are part of: a social conversation in which actors interacts in different ways (from collaborating to conflicting) and at different times (in real time or off line)." (Manzini, 2015: 49)

With the student's fieldwork identifying and confirming public divergence with the civic actor's redevelopment objectives, a 12-week prospective design project was initiated with a four-hour participatory workshop that brought together graduate students and key civic stakeholders concerned with the preservation, valorization, planning, and tourism development of urban post-industrial heritage. The following "neutral" brief clearly identified every stakeholder's role and legitimacy in the discussion:

> "Since the 1980s, Nantes has prioritized the preservation and modernization of its industrial heritage as a key component of urban redevelopment. The west of Nantes Island, historically home to heavy industries like the Alstom engine factory and Dubigeon shipyards, has been targeted for development. City actors have chosen to maintain traces of Nantes' industrial past within the island's landscape, reflecting its role as a commercial and industrial port. This commitment to heritage preservation is evident in development master plans.

> Today, Nantes Island serves as an extension of the historic city center, characterized by urban density and a diverse array of services. Cultural activities, driven by creative industries and tourism, thrive on the island. Institutions like the Maison des Hommes et des Techniques, housed within the Ateliers des Chantiers Navals buildings, offer museum spaces to showcase the history of Nantes' shipyards. Le Voyage à Nantes manages public spaces like Chantiers Park, while SAMOA oversees urban planning and shares responsibility for Quartier de la Création with Nantes Métropole. The Heritage and Archaeology Department engages users through co-construction efforts via patrimonia.nantes.fr. The University of Nantes contributes to industrial heritage enhancement by investing in Hall 6, while Stereolux and Scopitone play vital roles in the cultural industries of Chantiers Park."

The workshop sought to establish a consensus regarding the challenges identified by various stake-holders during the area's redevelopment process, and identify potential solutions to be further developed by first-year master's degree students in the Care and Digital Design programs. Experts participating in this workshop included representatives from the following institutions: Maison des Hommes et des Techniques (MHT), Stereolux (major cultural venue), University of Nantes, Historical Preservation Department of the city of Nantes (DPARC), SAMOA, Le Voyage à Nantes (VAN), Territorial Management Direction of Nantes Métropole, Care Design and Digital Design Lab directors, course leaders and workshop facilitators.



Figure 3. Stakeholders collaborating during the first project's kick-off workshop (during Covid19) in one of the renovated industrial buildings managed by Nantes University.



Figure 4. Four resulting goals from the participative design workshop: reinforcing community ties, valorizing industrial heritage, mapping the new neighborhood, and opening up the MHT and the former shipyard's history to visitors.

The kick-off event took place in a spacious, repurposed industrial building, ideal for accommodating large groups while adhering to the social distancing guidelines in place following two significant Covid lockdowns. This event served as a crucial psychological break for participants, offering relief from extended periods of social isolation. Additionally, it acted as a catalyst for re-establishing communication among civic stakeholders, particularly between the MHT and the VAN, who had stopped working with each other. This "thawing" of relations led to making the VAN the leading partner in subsequent phases of the project, seeing its potential as the social lubricant to enable the MHT's cooperation with the VAN.

2.4 Phase 4: Developing Preliminary Concepts and Augmented Reality Experiences

Since InnovART'2 expected a creative production as its final deliverable, the students were separated into two interdisciplinary projects from October to December 2020. "design fiction" and "Innov-AR" with Digital and Centrale engineering masters' students. The first project named "design fiction" involving Care and Digital masters' students was a low-tech approach to imagine alternative solutions to persistent problems with the new neighborhood, while "innov-AR" was an augmented reality exploration to visualize the industrial structures that had disappeared from the area. At this stage, the projects' focus was less on structuring dissensus in Digital Social Innovation (DSI) perspectives and more on crafting unified deliverables for presentation at the conclusion of the three-year research project.

The "Design Fiction" project aimed to create alternative yet pragmatic scenarios for urban development that would enhance community engagement and preserve historical integrity. Seeking consensus rather than design fiction's usually provocation function, it involved five interdisciplinary design teams, each tackling specific objectives: creating new communal spaces on the esplanade, designing night-time illumination for the esplanade's pathways, developing a low-tech method for exploring Nantes' industrial past, devising innovative approaches to sharing industrial heritage culture, and crafting a sound design experience to celebrate industrial heritage. The project that garnered significant acclaim from both the VAN and MHT (who monitored the student projects) was a sound design walking tour (Fig. 5) that narrated the former shipyard's history, and initiated the final round of design production.



Figure 5. Images of the initial student proposal for a circular sound design walking tour on the grounds of the former shipyard.

The “Inno-AR” project consisted of five teams, each developing an Augmented Reality (AR) application designed to visually resurrect industrial structures in Nantes that had long since disappeared. These interactive smartphone applications allowed users to explore massive historical structures such as the Transborder Bridge, dismantled in 1958, and the Calle des Sous-marins, demolished in 1985. Other projects included an AR experience of the Quai des Armements, highlighting the collective bartering strike of 1955, and Boatlaunch 2, which showcased the Scandinavia ferry. Launched in 1981, the Scandinavia ferry was the largest ever constructed in Nantes and led to financial difficulties due to the scale of investment in equipment. Another application brought to life Boatlaunch 3, featuring the Grue Titan Jaune (1954) and Le Brissac (1960-61), highlighting a period when Nantes' shipbuilding industry was at its zenith.



Figure 6. Initial student proposal for the former Transborder (ferry) bridge in augmented reality on the existing bridge.

Two augmented reality projects stood out for their exceptional execution and were thus chosen for inclusion in the final walking tour project: The Transborder Bridge and the Brissac ferry featured on the Boatlaunch 3.

Due to the VAN’s encouragement, a funding request was drafted to create a walking tour with augmented reality experience for inclusion into the Voyage a Nantes summer festival, and as the proposal was winding

its way through budget comittees, another research seminar was launched to test the five low-tech “design fiction” proposals.

2.5 Phase 5: Research Methodology Seminar - Industrial Heritage, Cultural Industries and Social Appropriation - Parc des Chantiers – M1 Level Students

First-year masters design students developed research tools and deployed testing protocols like semi-directive interviews, SWOT, 5W’s + H, spider net, PESTEL, and stake-holder maps for the five design proposals in a one-week research seminar. The user testing methods deployed in field investigations included: *Interviews* (Bystanders, Professionals, Spider net), *Discreet Observer Design Ethnography* (QR code interactions, Line pathway, Sound testing), and *Mapping* (Empathy map, Commerce mapping).

Below (Tables 2-4) are screenshots of the user tests of students’ initial sound design walking tour concept; however, the final project’s user interactions, pathway, media choices and narrative design approach are very different from those proposed by the initial student project, since the mandate extended beyond the initial area to encompass the green line pathway of the Ile de Nantes over several kilometers. The test did serve to validate user interactions with QR codes and develop design questions for the final applications to consider and/or resolve.

Table 2. Examples of mapping field investigations for the initial student concept of the walking tour.

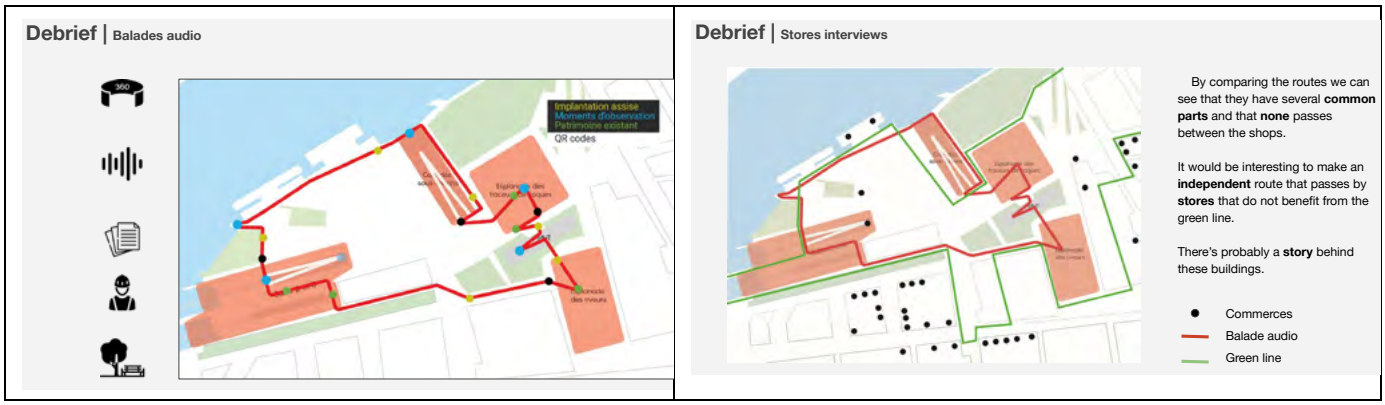


Table 3. Results of interviews with a wide variety of park visitors and local store owners.

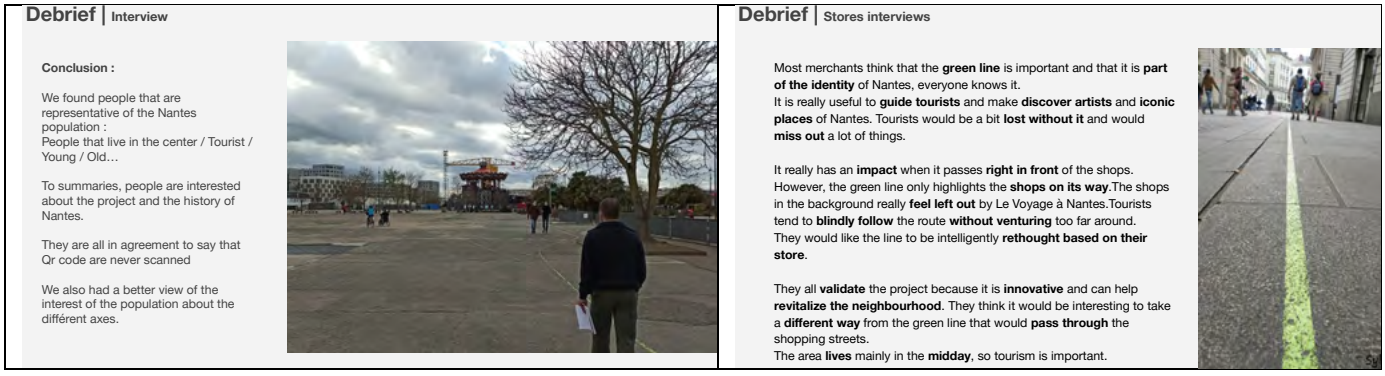
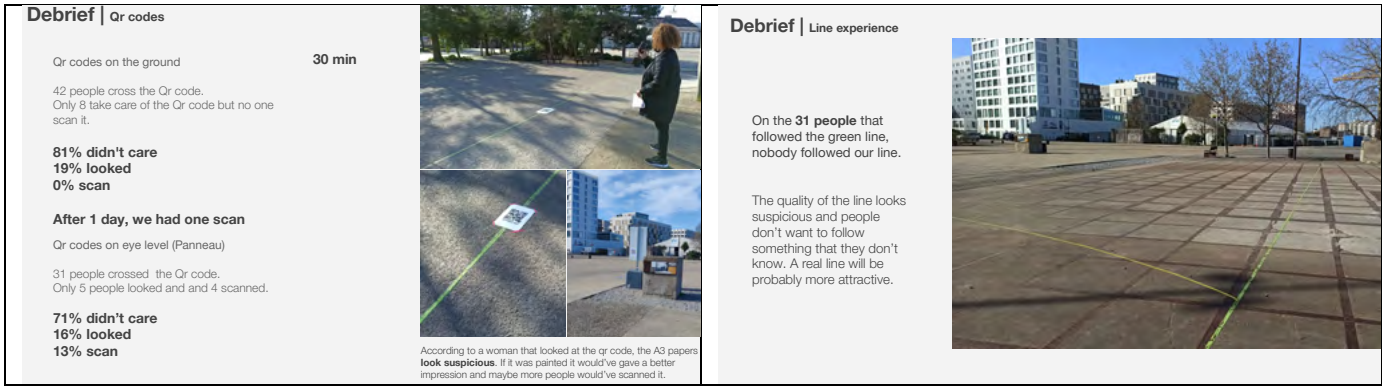


Table 4: Testing student design concepts of the walking tour through guerrilla design ethnography.



The user tests brought forth design questions for walking tour design team:

- **What sounds would be played**? Sound tools? Machinery? Long track? Ambient background vocals? Speech vocals? Ambient music? Always the same ones?
- **Route type**? Is it safe ? What's the distance ? Changes from time to time ? Public transportation ? Why not connect with the green line ?
- **Will people be interested**? Is the app accessible to everyone? Is it free (+ ad-free)?
- **What type of graphics**? Digital only? Flyer with information? Static signs?
- **Will it be eco-friendly**? Why paint such big QR codes? Eco paint? Merge QR code with green line?

The PESTEL Analysis of the sonic walking tout identified the following issues:

- **Politics**: Valorise the historical heritage of the city. Remember the obstacles Nantes had to surpass.
  Link with the Popular past of the city.
- **Economics**: Valorize the empty space with more or less 0 expenses. Bring peoples to roam the streets, and to use the proximity commerces by doing so.
- **Sociology**: Giving a good reason for people to go outside after Covid. Giving a better understanding of the context on which the city is built.
- **Technology**: 360° Photography to immerse in the past. Use of Qr code to materialize marks.
- **Environment**: No environmental dimensions, non- organic paint.
- **Legal**: Authorization for putting QR codes and putting signaletics. Rights to use the sounds and pictures.

Its SWOT Analysis identified the following issues: **Strength :** Immersion in the history of Les Chantiers Navals; **Opportunity :** Using new senses to discover Les Chantiers Navals; **Threat :** Area is dangerous at night. Not understandable without the app; and **Weakness :** Will people take time to download an app for visiting a small place like Les Chantiers?

2.6 Phase 6: Development of the Final Application: *A l'écoute des chantiers*

Once the proposal for an immersive walking tour with sound design capsules and augmented reality experiences was pitched to the VAN, they commissioned *A l'écoute des chantiers* (Listening to the shipyards) for Voyage à Nantes 2022 summer festival. This would be a smartphone app for "accidental tourists" that would stumble across its signage and for artistic patrons who followed the summer art festival. Once the project received funding for its development from Nantes Metropole, the Digital and Care design students whose proposal had been retained continued developing the project into their final year at the school. In all, 35 students, 8 instructors, 10 external partners, a software developer and three external designers were involved in its production. The archives of the Historic Preservation Department (DPARC)

and Maison des Hommes & des Techniques (MHT) were to serve for its scientific grounding, and therefore, the VAN assured that the funding request made its way through the bureaucracy.

With the VAN, MHT and DPARC each laying out their ideas for points of interest for the tour and for the sound design capsules, quite a bit of negotiating was needed to bring their number down to a manageable size. MHT wanted exclusive focus on shipbuilding and union history, while the DPARC and VAN wanted to extend the visit to the tourist hotspots beyond the shipyard, like the grey Titan Crane and banana hangar on Nantes' former merchant port. The walking tour grew to include areas beyond the former shipyard, starting at the St. Anne Bridge and following the Voyage à Nantes famous painted green line all the way to the docks (Quai des Antilles).



Figure 7. Redefined walking tour beyond the former shipyard to other touristic venues on the Ile de Nantes.

Finally, ten sound design capsules were designed and carefully crafted, incorporating archival footage, interviews with former shipyard workers, and ambient industrial sounds. These capsules were produced in MP3 format to ensure both efficiency, frugality and longevity, and are accessible via an iOS and Android applications, as well as on the web[2] and on patrimonia.nantes.fr. Additionally, two augmented reality experiences were integrated into the applications, allowing for an immersive exploration of the content. Geolocation features, when enabled, and navigation through ArcGIS Storymap further enhance the visitor's experience. The applications were developed using Unity.

To meet the Voyage à Nantes festival opening deadline of July 2, a narrative designer, a graphic designer and sound designer were enlisted, recognizing the time constraints and urgency of the task at hand.

[2] https://alecoutedeschantiers.lecolededesign.com

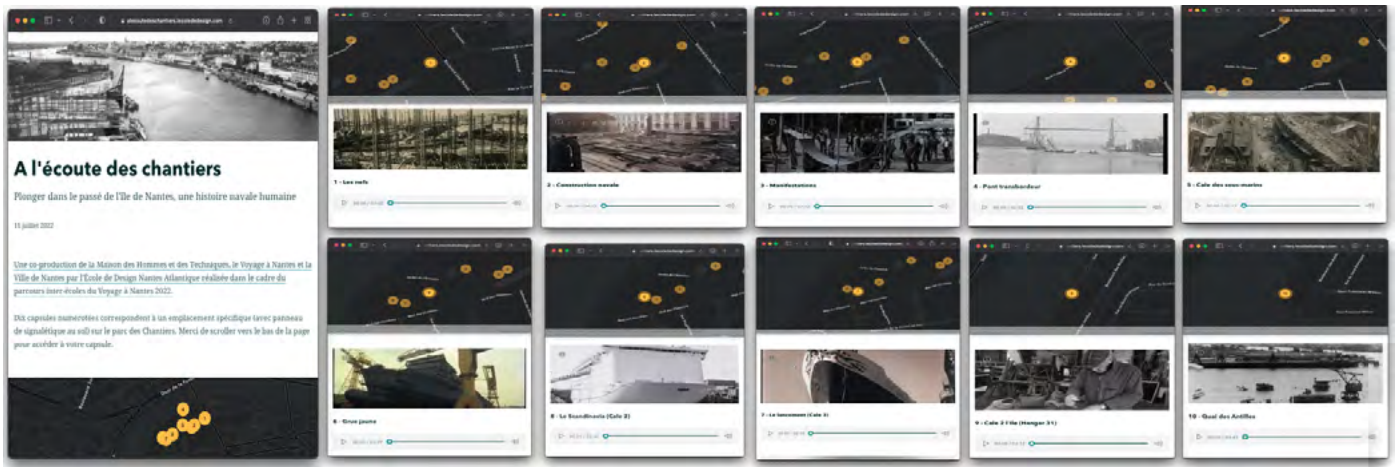


Figure 8. Ten sound design capsules were created to tell the story of the shipyard through the eyes of its workers using interviews, industrial ambient sounds and historic video soundtracks.



Figure 9. Vinyl signage installed for visitors and tourists to scan with their smartphone.

The signage, printed on tar-backed anti-skid yellow vinyl, was selected to endure Nantes' sweltering summers and heavy winter rainfall. Installed in June 2022, the signage remains in active service. Despite limited engagement with the students' initial QR code field tests, participation in the official Voyage à Nantes program, along with professional printing and installation, yielded much more satisfactory outcomes. The walking tour, initiated via the signage's QR codes, attracted over 2500 visitor sessions in July and August 2022.

The project is still in use as of 2024 and can be accessed at the following website: https://alecoutedeschantiers.lecolededesign.com.

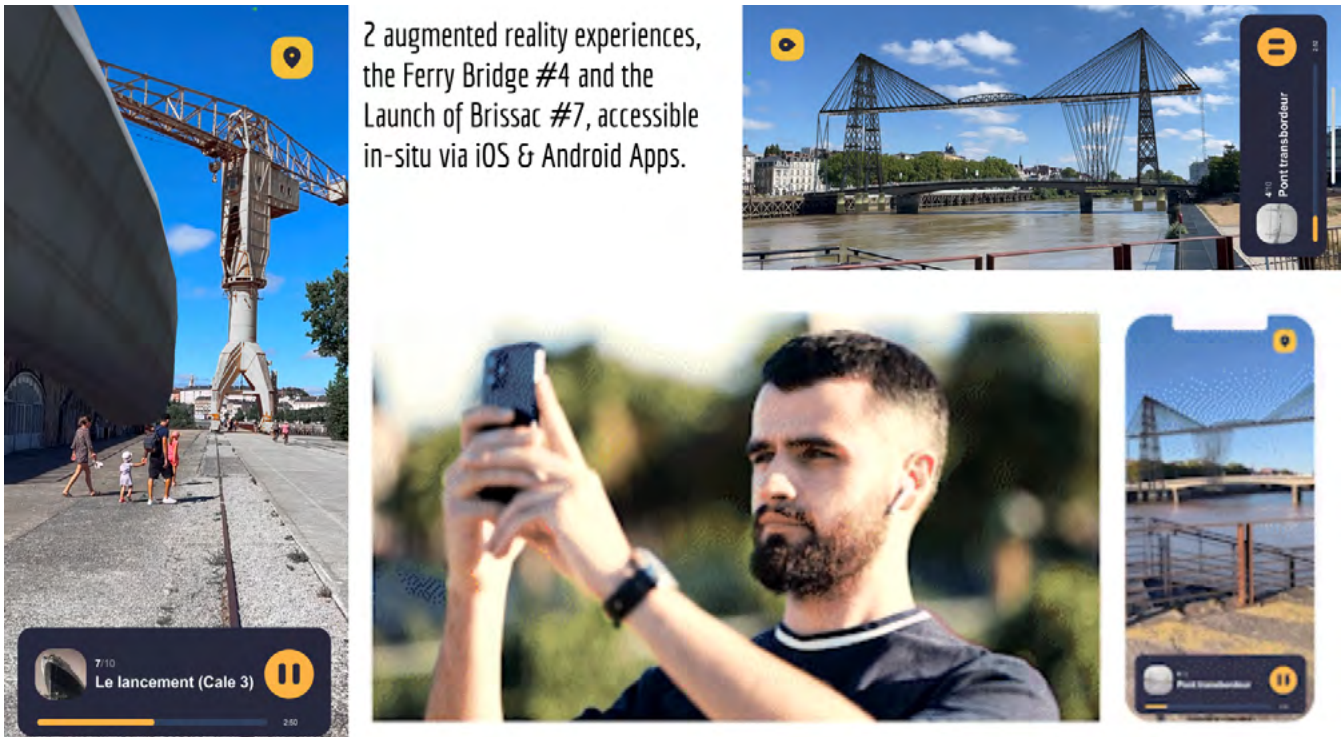


Figure 10. The two augmented reality (AR) experiences available through the iOS and Android apps when onsite.

3. Discussion

Voyage à Nantes (VAN) and the Historic Preservation Department (DPARC) recognized the potential of developing a walking tour application to enhance heritage exploration in the city. Understanding the significance of such an initiative, they jointly approached Nantes Métropole to request funding for the project, emphasizing the benefits of leveraging technology and sharing of historical archives to offer residents and visitors an engaging and informative experience of Nantes' rich historical and industrial heritage.

One of the project's most compelling features lay in its capacity to facilitate collaboration among diverse cultural and civic actors in the city, each with their own perspectives and objectives. By bringing together VAN, renowned for its innovative cultural endeavors, and the Maison des Hommes et des Techniques (MHT), focused on preserving Nantes' industrial heritage, the project aimed to reconcile previously opposing stakeholders under a unified purpose. Despite MHT's steadfast commitment to preserving the area solely as a historic testament to its industrial past, rather than for tourism or recreational purposes, this collaboration marked a significant stride in aligning efforts toward the common goal of enhancing Nantes' industrial heritage and its cultural vitality.

For DPARC and VAN, supporting this initiative held significant allure. Beyond the evident benefits of enriching tourism and cultural offerings in the city, the project presented a distinct opportunity to foster synergy between VAN and MHT. This involved integrating the MHT museum into the Voyage à Nantes summer event, effectively expanding its accessibility during previously closed periods in July, August, and weekends. This collaborative endeavor not only enhanced the content and reach of the walking tour application but also underscored Nantes' commitment to nurturing partnerships and collective efforts aimed at community betterment and a deeper understanding of its industrial heritage.

Despite being the primary sponsors of the immersive walking tour, VAN and DPARC consciously minimized their overt influence on the project, mindful of MHT's sensitivity and reluctance towards tourist-centric approaches to industrial history. To this end, measures were taken to maintain the appearance of impartiality. For instance, while DPARC held the full ArcGIS development license, the ArcGIS Storymap web

application was accessed through the school's DNS server, appearing neutral in its accessibility. Similarly, the augmented reality apps were released under the school's license on iOS and Android App Stores, rather than under the VAN, DPARC, or Nantes Métropole's licenses. Although this arrangement posed no significant issues due to the apps being free, contractual terms stipulated the delivery of the full source code and media files to DPARC.

In instances where production meetings encountered roadblocks due to strategic disagreements, concerted efforts were made to find common ground. Several meetings involving school representatives, VAN, and DPARC were convened to navigate forward despite MHT's dissenting stance. Strategies were devised to present negotiations in a manner acceptable to MHT, ensuring progress towards project common objectives while respecting diverse viewpoints as much as possible.

4. Conclusion

In summary, the three-year design process for this project exemplifies a solutions-oriented DSI project. Beyond creating a mere digital artifact, the project served as a platform for engaging diverse stakeholders in collaborative decision-making. By carefully incorporating their perspectives and insights, the design process structured dissensus among civic stakeholders towards a common goal — in this case, a valorization of the industrial heritage for tourists, residents and cultural patrons — and promoted a sense of ownership, collaboration and empowerment within the stakeholders.

Through this multi-phase participatory approach, the project not only addressed the tangible need for heritage mediation for tourists and residents, but also facilitated social cohesion and collective action by its most invested civic actors. What started as a project to get once hostile parties to share their respective archives and know-how towards a common goal has had long-lasting beneficial effects for ongoing collaborations between the MHT and the VAN, bringing much more traffic to the MHT, and visibility for Nantes' industrial and union heritage. In essence, by embracing principles of DSI, the project's lasting impact lies in the unity it has cultivated among once-divergent stakeholders, in shaping the future of Nantes' cultural landscape.

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P/REFERENCES OF DESIGN

DESIGNING FOR EQUITY AND JUSTICE: LESSONS FROM PUBLIC LIBRARIES SPACES.

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KEYWORDS | EDUCATIONAL SPACES, LIBRARY, EQUITABLE AND JUST ENVIRONMENTS, CO-DESIGN, PARTICIPATORY PLANNING

ABSTRACT | How can the design of educational spaces be changed? How can new strategies be rethought, implemented and influenced to transform educational environments into more equitable and just spaces? In recent years, there has been a gradual reassessment of the design of educational environments to better align with the dynamic changes in contemporary society. The needs arising from the COVID-19 pandemic reinforced the need to renovate educational spaces. In this process, it has been crucial to critically reassess and challenge the paradigms that have governed the design of schools for the past two centuries, particularly in conventional classrooms. The meticulous arrangement of desks in a control grid, with students seated side by side and facing the teacher, reflects an outdated model that fails to meet current educational demands. In addition to schools, various institutions contribute to an urban network aimed at providing access to knowledge. Public and community libraries have undergone a notable transformation, shifting towards prioritizing education and cultivating positive learning experiences for their users. Some libraries serve as exemplars of innovative spatial restructuring and co-design processes, demonstrating the potential for reimagining them as dynamic programmatic spaces for diverse communities.

This article analyses the evolving role of libraries in the contemporary world through three case studies: the Oodi Central Library in Helsinki (ALA Architects), the Rio de Janeiro Park Library (Architect Glauco Campello and be.bo.), and the Library of the Sichuan Fine Arts Institute (Tanghua Architect & Associates). The goal is to examine the strategies and methodologies employed in these projects and to extract practical examples of design decisions that have elevated these libraries beyond mere book repositories, turning them into social agents for interaction between information, knowledge and community. The conclusion emphasizes the emergent need to redefine educational spaces as places of memory and echoes of knowledge to dynamic hubs of circulation and knowledge creation. Public libraries are increasingly assuming a crucial role as community hubs, serving as social institutions that bring together people of all ages, backgrounds and intellectual perspectives. This paradigm shift should not only be reflected in the physical space but also in the collaborative processes that shape them. Similarly, school environments demand attention, with a growing urgency to integrate co-design practices that extend beyond the planning stages. Collective decision-making must encompass the definition of programs and guidelines prior to embarking on the design phase, ensuring that educational spaces truly meet the diverse needs and aspirations of their users.

1. Introduction

Over recent decades, a significant evolution has taken place in the design of educational environments, particularly in traditional settings such as schools. This shift has been towards prioritizing student-centred learning, which fosters active engagement in educational experiences. While classroom spaces have been extensively studied and experimented with to facilitate this approach, they are often perceived as overly structured. Consequently, there has been a trend towards utilizing the school library, which offers more flexible spatial features conducive to a variety of educational activities. The adaptability of library spaces allows for simultaneous usage by diverse individuals (Feinberg and Keller, 2010; Rankin, 2018, IFLA 2018; IFLA, 2022).

In addition to schools, various institutions including libraries and museums contribute to an urban network aimed at providing access to knowledge. It's crucial to reflect on how these spaces are being reimagined to better serve educational objectives, moving beyond mere aesthetics to consider the educational value of architectural design.

Public and community libraries, in particular, have undergone a notable transformation, shifting towards prioritizing education and cultivating positive learning experiences for users. This departure from their traditional role as mere resource repositories underscores the importance of actively contributing to enhancing learning outcomes for citizens. These libraries are now recognized as dynamic learning environments, with committed professionals and users engaging in an evolving educational atmosphere, a community's broader educational ecosystem (Krass et al., 2022; Feinberg and Keller, 2010).

These spaces play a vital role in the community by enhancing non-formal education, facilitating access to information, offering diverse learning materials, promoting digital literacy, and supporting lifelong learning. They significantly contribute to democratizing education, and ensuring accessibility to knowledge and educational opportunities for individuals from all backgrounds.

Despite decades of international research on the design of classroom learning environments, there's a gap in the literature regarding specific aspects related to the design of the public and community library learning environment. Lessons learned from these spaces can inform and enrich the design of educational environments to better align with the evolving needs of society.

This paper delves into the transformation of educational spaces, with a specific focus on public and community libraries. The goal is to comprehend how thoughtful design and new strategies can optimize these spaces, making them more equitable and supportive for all users. It discusses the adaptation of educational settings in recent years to align with contemporary society's changing dynamics, especially in the information and digital age. The paper emphasizes the significance of exploring the emerging network of educational infrastructures that complement traditional education, thereby fostering the development of essential life skills, facilitating continuous learning, and ensuring currency with knowledge.

Furthermore, the paper examines how public and community libraries have evolved into more open and equitable educational environments. While not exhaustive, it analyses a sample of three library sites located in Helsinki (Finland), Chongqing (China), and Rio de Janeiro (Brazil), showcasing them as examples of inclusive and dynamic educational spaces. This examination underscores the significance of context-sensitive design solutions and community engagement in creating environments that are equitable and just.

2. From Traditional Models to Contemporary Challenges

> “Let us start with the schools; if anything is to be done to 'reform' men, the first thing is to 'form' them.” (Bo Bardi, 1951)

In recent years, there has been a gradual reassessment of the design of educational environments to better align with the dynamic changes in contemporary society and in particular in the information/digital age (Harrison and Hutton, 2014).

The challenges exacerbated by the COVID-19 pandemic have underscored the urgency of updating educational spaces. The lockdown period has brought into clear view the disparity between traditional educational environments and the significant advancements in education made possible by technology, as well as the essential resources required to support them. The swift evolution of knowledge acquisition as shown the need to a more expansive perspective on the design of physical spaces. It is crucial to reconsider and question the traditional models that have guided the design of educational environments for the past two centuries, particularly within conventional settings.

During the 19th century, the transition from home-based to formal school learning, influenced by the hygiene movement vision, emphasized the importance of spacious, well-lit, and ventilated classrooms. It also recognized the significance of outdoor activities and the connection between physical health and cognitive development (Author, 2012). However, with the rise of mass public schooling in the 20th century, standardized strategies led to the emergence of structured, corridor-based school layouts, often referred to as the "factory model." This model prioritized passive knowledge transmission, uniformity, and conformity but no longer aligned with the evolving needs of contemporary education, that prioritize student-centred learning, critical thinking, and collaboration.

Advancements in educational research and psychology have enhanced the understanding of learning and development. While numerous theories exist regarding how people learn, there is a shared consensus regarding the significance of the social environment in which learning takes place (Calvo-sotelo, 2014). This environment involves numerous individuals, emphasizing the critical role of interaction and connectivity among learners. As the educational context continues to evolve, the spatial response must also adapt. This adaptation extends beyond the design of individual educational spaces to encompass the interaction and connectivity between spaces throughout the city and neighbourhood.

The swift progress of technology has fundamentally changed how we access information and engage in learning. Outdated educational models may fail to incorporate or leverage modern technology, impeding their effectiveness in preparing students for the digital age. These older models often lack inclusivity and fail to address the diverse needs of students from various backgrounds. In contrast, contemporary education places a strong emphasis on inclusivity, cultural sensitivity, and catering to diverse learning styles— qualities that outdated models may struggle to provide.

In this broader context, it is crucial to acknowledge that the future of education increasingly values non-formal education and underscores the importance of alternative environments in the educational ecosystem (Hoppers, 2006). This shift is viewed as a collective responsibility of the community.

Consequently, there is a need to explore various types of built spaces and urban/territorial areas, scrutinizing their potential to facilitate educational practices, disseminate knowledge, provide valuable educational opportunities.

As described by Trilla (1993), the interaction between education and the city unfold across three dimensions: the city as a context for education (learning in the city), the city as a means of education (learning with the city), and the city as an educational subject (learning about the city). This perspective prompts us to contemplate the architectural challenges and view the urban environment as a canvas for

multiple learning experiences. Consequently, public facilities, outdoor spaces, and the dynamic urban life itself are regarded as educational resources.

The physical learning environment extends beyond traditional school boundaries, including outdoor school grounds, neighbourhood surroundings, and the urban fabric. This broadened learning ecosystem incorporates multiple spaces designed to meet diverse educational needs across different age groups, benefiting not only students but also the broader community and families. This perspective encourages us to contemplate architectural challenges and view the urban environment as a place for diverse learning experiences.

In this context, public and community libraries emerge as crucial educational spaces, encouraging active participation in the creation of socially creative learning environments while emphasizing their integration within the urban community.

Over recent decades, there has been a notable transformation in the services and activities provided by public and community library buildings. The rapid evolution of digital technologies and the increased availability of online platforms for data sharing have reshaped the traditional role of printed books as the exclusive repository of knowledge and history. Today, various media and platforms share this responsibility and capacity alongside printed materials. Technology has become an indispensable tool for knowledge acquisition, leading to adaptations and diversification in the offerings, services, and spatial design of library buildings.

It has also been observed that innovative approaches to the design of public and community libraries often involve co-design processes. Through participatory planning and the collaborative creation, spaces are tailored to the needs and desires of users, especially for younger generations. In this way, libraries become catalysts for socialization and bottom-up activism. These examples offer valuable insights into shaping the educational spaces of the future, highlighting the potential of urban space to evolve into a vibrant and dynamic "macro-school."

3. Insights from Three Cases: Helsinki, Chongqing and Rio de Janeiro

The evolving role of public/community libraries is examined through three case studies: the Oodi Central Library (2018) in Helsinki (designed by ALA Architects), the Rio de Janeiro Library Parque Estadual (2014) (designed by Glauco Campello and be.bo.), and the Library of the Sichuan Fine Arts Institute (2009) (designed by Tanghua Architect & Associates) in Chongqing. The goal is to analyse design strategies employed in these projects, drawing practical insights from design decisions that have transformed these resources from mere repositories of book repositories into dynamic hubs for social interaction, information dissemination, and community engagement. Despite being situated in countries with very different socio-political and economic contexts, these case studies also illustrate how public institutions have utilised the architectural design process to foster more inclusive and egalitarian relationships within their communities.

- Oodi Central Library in Helsinki, Finland

A recent example of this transformation is the Oodi Library in Helsinki, Finland, designed by Office ALA Architects and opened in late 2018. However, the journey of this building began long before its completion, characterized by a participation process that engaged citizens and library users in the planning and design of new services and functions.



Figure 1. Oodi Library. Photo: by the author (2022).

According to Haavisto et al. (2017), important stakeholders involved in the construction of this library, the vision set forth by the City Council aimed to establish a library that the citizens would truly feel ownership of. To achieve this, they structured the Central Library planning project as a unique and inclusive city planning process. Unlike traditional approaches that merely solicit opinions through surveys, this initiative actively involved people in the planning process, fostering genuine engagement and collaboration.

> "Through the participatory budgeting project, Helsinki City Library acquired concrete directions from the citizens for what kind of public library services are anticipated and needed in the future Central Library. Also, by giving city residents, i.e., the owners of the libraries, a say in financial decision-making, Helsinki City Library fulfilled one of the public libraries' basic tasks as advancers of democracy. One of the workshop participants stated that it was actually great to see close-range democracy in action." (Haavisto et al., 2017, p.3)

An open international architecture competition was conducted to determine the design for the new Central Library. From the very beginning, transparency was maintained throughout the competition, allowing the public to review the proposals, provide feedback, and vote for their preferred designs. However, it's worth noting that while public opinion was taken into consideration, the ultimate decision rested with a jury, not solely on the public vote. Interestingly, the overall winner of the competition did not align with the top choice in the public voting. (Haavisto et al., 2017)

Another significant aspect of the project's strategy is its alignment with the new Finnish library policy, which emphasizes active user engagement rather than passive consumption. The new library offers a wide range of traditional services, spaces and amenities catering to various activities such as learning, work and leisure. Serving as a free and secure public space, it provides numerous opportunities for social interaction and networking, as well as access to books. The program includes a cinema, restaurant, lecture and workshop spaces, recording studios, gaming rooms, kitchens, 3D printing facilities, sewing spaces, meeting spaces, an amphitheatre, and also individual and group reading areas, and a book archive. According to Author (2022), the Oodi Library's diverse program serves different users, addressing diverse needs and expectations. The interior space design prioritizes accessibility, transparency and informality. It is open to

all, with glass partitions that can be easily isolated by curtains where compartmentalization is necessary. The layout encourages informal interaction, with work and meeting spaces integrated into circulation areas. Additionally, interior quality is enhanced using wood or carpeting, visual connections with the exterior, and comfortable furniture.

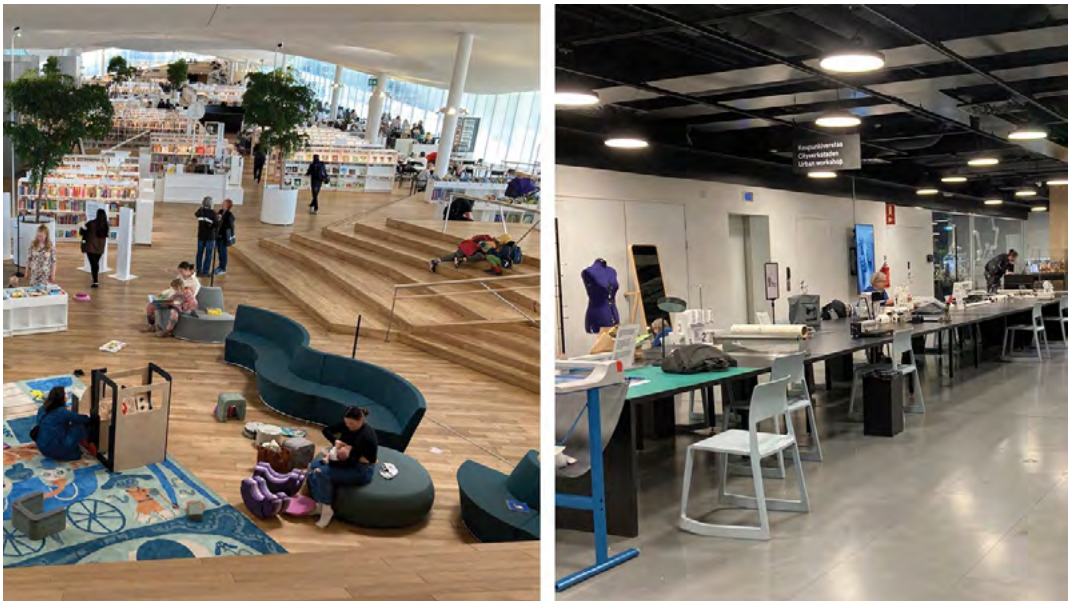


Figure 2. Interior Oodi Library. Photo: by the author (2022).

In urban context, the library forms an integral part of a cultural hub alongside the Helsinki Music Centre (LPR Architects, 2011), the Finlandia Auditorium (Alvar Aalto, 1971), Sanoma House (SARC Architects, 199), and the Kiasma Museum of Contemporary Art (Steven Holl, 1998), situated near Helsinki Central Station (Eliel Saarinen, 1919). Directly connected to the library building is the central square of this complex (Kansalaistori), creating a public space featuring sports facilities and hosting various activities such as fairs, performances and musical events. Functionally, the library's design encompasses three floors, each reflecting distinct but complementary programmes in alignment with the library's objectives. The ground floor serves as a reception area open to diverse uses, while the middle floor is dedicated to recreational, educational and community activities. At the top floor, the library offers a more traditional setting for reading and research. All floors are accessible to the public, with most spaces not requiring a library card for access. Additionally, many amenities are free to use, though reservations may be necessary through a dedicated app.



Figure 3. Aerial view Oodi Library. Photo: Baan, Iwan (2023). ALA Architects - https://ala.fi/work/helsinki-central-library/.

- Library of the Sichuan Fine Arts Institute in Chongqing, China

Shifting focus to another example, the Library of the Sichuan Fine Arts Institute, located in the city of Chongqing, situated in the province of Sichuan, in southwest China. This library serves as a part of the Sichuan Fine Arts Institute, a public university established in 1940. Renowned for its emphasis on local cultural traditions, the institute has fostered numerous generations of artists deeply rooted in regional artistic expressions. In recent years, the Institute has advocated the fusion of artistic creation with political endeavours and design practices geared toward local development, garnering global recognition for its research in this domain. Designed by the Chinese studio Tanghua Architect & Associates, the library's architectural project was completed in 2009.



Figure 4. Library of the Sichuan Fine Arts Institute. Photo: by the author (2023).

The campus is nestled within a conserved and enclosed green area situated in a former agricultural district on the western outskirts of the Chonqing urban landscape. Access to the Campus space is restricted and allowed solely for authorized people.

As per insights from the teaching community, meticulous measures were undertaken during the campus construction to minimize disruption to the native farming communities. These communities were allowed to retain their original residences and were entrusted with the upkeep of the college's verdant surroundings. Positioned at the nexus of the campus's residential and educational precincts, the library stands as a focal point, symbolizing the intersection of scholarly pursuits and communal living.



Figure 5. Aerial view Library of the Sichuan Fine Arts Institute. Photo: Chou, Mark (2022). [Online Photo Sphere]. googleearth https://shre.ink/8iWr .

The design of this building draws on regional heritage, taking inspiration from ubiquitous structures found in Chongqing, such as brickworks and warehouses. The architecture seeks to establish a meaningful dialogue with the preserved surroundings. Formally, the building is composed of a large compact volume that provides greater spatial flexibility and also pays homage and correlates with the traditional architectural compositions prevalent in the area.

The selection of materials is guided by constructive aspects, but also by reverence for historical significance. The exterior of the main structure is composed of green clay bricks, stacked from the roof to ground level, reminiscent of traditional crafts. Infused with pig iron, these bricks gradually change tone over time, demonstrating constant evolution. Internally, the concrete surfaces echo the exterior texture while asserting its distinct identity. Wooden elements adorn the staircases and facades, adding warmth and personality to the building. Overall, the library's aesthetics embody the essence of regional identity, celebrating Chongqing's cultural heritage.



Figure 6. Interior Library of the Sichuan Fine Arts Institute. Photo: by the author (2023).

The building is made up of a concrete shell that serves as both a roof and a peripheral wall. This element is strategically divided to introduce natural light into the interior of the building through openings along the ridge; strategic gaps that create uncovered interior courtyards and the sequence of windows on the sides that facilitate connectivity between the interior and exterior environments. Internally, the layout features mezzanines interconnected by a staircase that serves as a focal point, guiding visitors through the library. The public entrance hall is divided by an open café and this staircase, which not only functions as a path, but also offers seating and serves as a display area for books and works of art along its climb. Library opening hours are limited to the university community, from 9:30 am to 10 pm, Monday to Sunday. Below, we present the report of a student who frequents the library:

> "The school has set many seats by the windows, so when you are tired, you can look up and see the green trees and scenery of the school, which is very pleasant. Moreover, the overall design of the library has regional characteristics, including a lot of Chongqing culture, giving people an amiable feeling. I really like the way it looks. It is very similar to the attic and warehouse modelling and very quiet, but also gives a sense of knowledge of the treasure is hidden in it, which can stimulate my desire to explore". (Report from the student.)

- Parque Estadual Library in Rio de Janeiro, Brazil

The third case under examination is the Parque Estadual library (BPE) in Rio de Janeiro, Brazil. Established in 1873 by Pedro II, Brazil's last emperor prior to the republic's establishment, the former Public Library of the State of Rio de Janeiro has undergone significant transformations. It relocated multiple times and endured partial destruction of its building and collection due to a fire. However, it was completely remodelled and reopened as the Biblioteca Parque Estadual in March 2014.

Architect Glauco Campello led the remodelling project, who was also responsible for the library project at the end of the 1980s, under the guidance of anthropologist and then State Secretary for Culture and Deputy Governor Darcy Ribeiro. Campello's original aim was to draw in low-income youth to the library, a vision that persisted during the 2014 remodelling. For this recent renovation, the architect collaborated with be.bo., responsible for the interior design.



Figure 7. Aerial view Parque Estadual Library. Photo: Ferraz , Leonardo (2023). Aerial view [Online Photo]. Jornal Dia - https://odia.ig.com.br/rio-de-janeiro/2022/07/6443601-biblioteca-parque-estadual-no-centro-abre-inscricoes-para-colonia-de-ferias.html .

BPE is situated adjacent to a public square - Praça da República, near SAARA - Sociedade de Amigos das Adjacências da Rua da Alfândega (Society of Friends of the Adjacencies of Alfândega's Street), the city's largest open-air shopping centre. This bustling area is in the densely populated central district of Rio de Janeiro, situated near the central train station that connects to surrounding neighbourhoods and nearby cities.

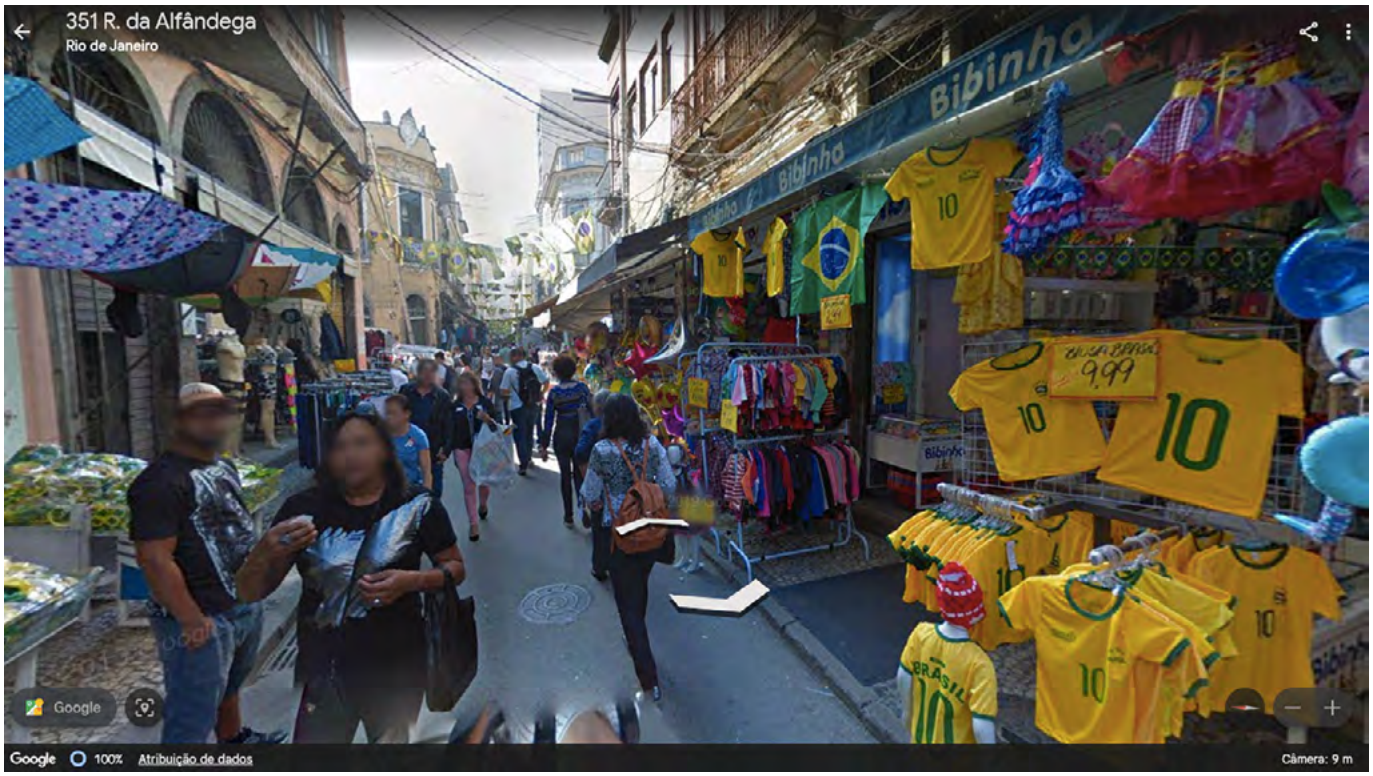


Figure 8. Saara. Photo: Screenshot (2024). Google Earth - https://shre.ink/8iWg .

The three-storey building, with one level partially submerged, is constructed using pre-cast exposed concrete components. During the refurbishment, the existing ramp was replaced with a staircase and lift, enhancing natural light and revealing the internal spaces. This adaptation also partitioned the ground floor into two areas, one more public and the other more private.

Important premises for the new design were defined by the promoters and served as a guide for the architects. these include creating meeting spaces, accommodating diversity, minimizing visual and socio-cultural access barriers, adopting an inclusive approach, offering various ways to use the space, reflecting the unique characteristics of the residents of Rio de Janeiro (Cariocas) engage with the environment and ensuring a clear understanding of the building layout.

In this way, during the remodelling project, there was a vision to create a substantial central span that would facilitate pedestrian movement between Avenida Presidente Vargas and the Saara popular market, transforming the library into an bustling urban thoroughfare. The architects imagined this intervention fostering greater openness and connectivity within the building, allowing it to serve as a hub for encounters. However, unlike the Oddi's Nordic case, this building is situated in an urban context plagued by security concerns, presenting an ambitious challenge. Given the prevalence of poverty and the growing homeless population in the vicinity, the ambitious goal of promoting fluid movement between the library and its surroundings proved unattainable. Consequently, all access points to the library are currently restricted, with limited physical interaction between the building and the urban space. It is also noteworthy that Praça da República, a nearby green space, faces similar public safety issues and is also a fenced public space.

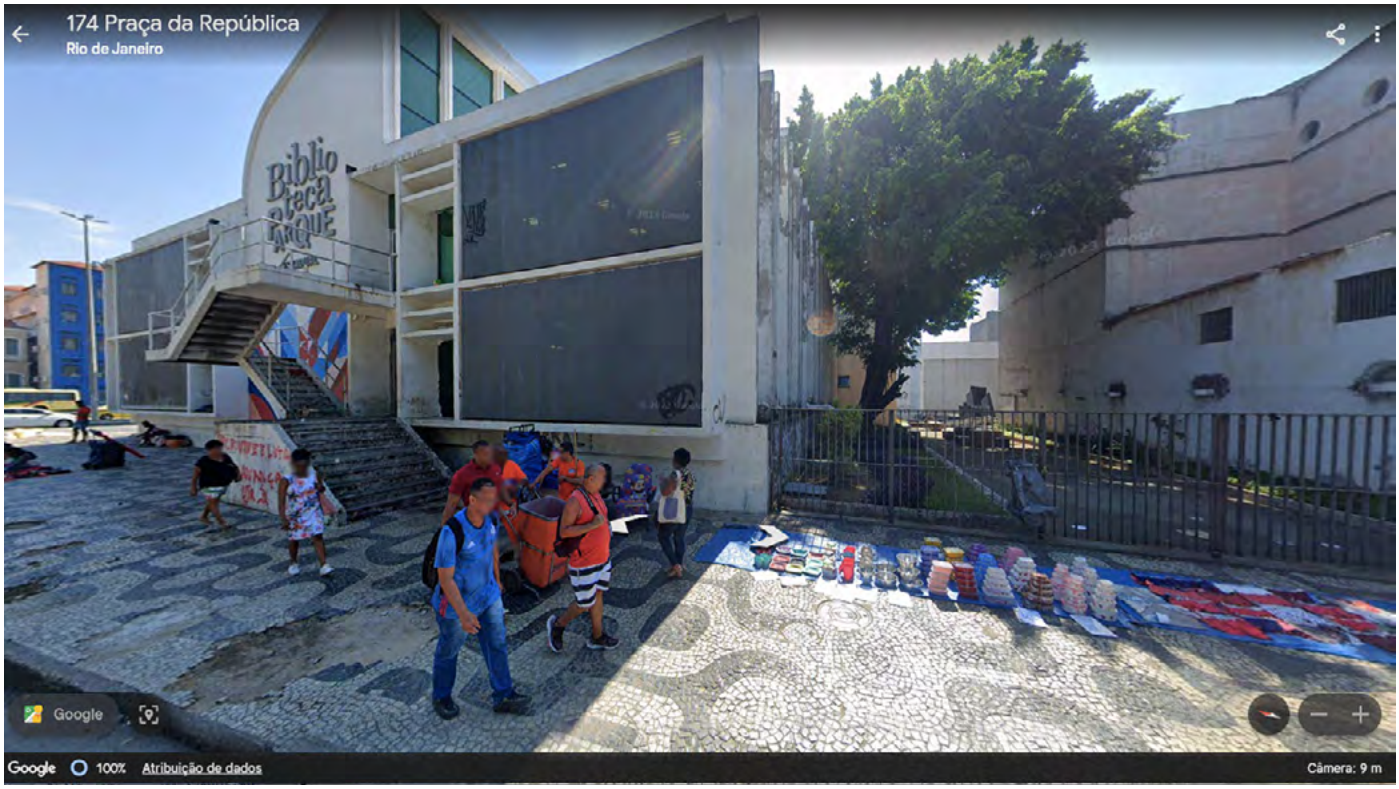


Figure 9. Parque Estadual Library. Photo: Screenshot (2024). Google Earth – https://shre.ink/8iWp .

While the building appears closed-off, it paradoxically serves as a vital cultural hub within the city. Surprisingly, its apparent isolation has become one of its most valuable attributes, transforming it into a secure refuge and oasis amidst the urban turmoil. This contradiction is illustrated in first-hand accounts shared by the employee and social mediator of the BPE, as documented by researcher De Souza (2017). One of these accounts recounts the experience of a homeless man who found solace within the library's walls. Having endured a troubled childhood and succumbed to drug addiction in adolescence, he eventually found himself living on the streets of downtown Rio de Janeiro. However, upon discovering the library, he found more than just a place of leisure; it became a shelter where he could escape the hardships of his reality. Here, he could unwind, watch movies, read books, engage with friends, and interact with the staff. Moreover, the library provided him with a sense of security and protection, offering respite from the allure of drug use. During the day, the library served as his haven, shielding him from the harsh realities of life on the streets.

Despite its location within an area characterized by socio-economic, precariousness and possessing considerably fewer resources compared to the other two examples (Oodi and Sichuan Fine Arts Institute Library), the BPE stands out as a dynamic and representative local community space. While the surrounding population grapples with extreme poverty, physical access and movement around the building are constrained. However, this limitation does not impede the flow of ideas or the democratic occupation of library spaces by diverse segments of society, representing various local expressions and cultures. Freedom and informality serve as vital compensatory factors for resources constraints. In the BPE, democracy is expressed through the fluidity and spontaneity of interactions fostered and accommodated by the library.

4. Conclusion

Social changes, technological advancements, and pedagogical shifts necessitate the reformulation of educational spaces. Embracing contemporary challenges that reflect broader cultural, political, and economic contexts moves beyond traditional models cantered on passive knowledge transmission. As defended in the “Reimagining our futures together: a new social contract for education” (UNESCO 2022),

this recognition acknowledges the diversity of educational approaches and, consequently, the spaces where they occur.

Libraries are essential venues for accessing knowledge, providing opportunities for non-formal education and lifelong education. They foster cultural development among individuals and social groups. As evidenced by the case studies, libraries play a pivotal role in fostering more equitable societies by ensuring access to and facilitating the sharing of knowledge across various domains. Consequently, the spaces that accommodate them must be devoid of any barriers, be they physical, technological or social (IFLA-UNESCO, 2022).

Analyses of case studies illustrates diverse approaches to designing educational spaces, underscoring that there are no universal solutions to the challenge of creating more equitable and just design. Each project reflects unique socio-political contexts, cultural values, and community needs, emphasizing the importance of context-sensitive design solutions. While the desire for a fairer life is universal, the paths to achieving it vary significantly. Designing for equity and justice in Finland differs from doing so in China or Brazil.

The future of education is anticipated to encompass multiple and diverse possibilities, offering a multitude of potential futures. Consequently, the design of educational spaces must also be adaptable to accommodate this variety. Their design should directly address the problem at hand rather than being a hollow response to a preconceived solution.

As such, socio-economic contexts and urban environments dictate the selection of technical solutions, tools and aesthetic vocabularies. In some cases, specific strategies may even appear contradictory. The solutions devised to promote greater equity and justice in the libraries studied diff and yield varied results. However, they do not shy away from confronting their unique challenges and seeking spatial enhancements to tangibly improve the lives of their users. While the desired values may be similar, the paths to achieving them and the reception of each proposal by society are diverse. The primary issues in each context are distinct, leading to different potential impacts for each project.

In Finland, participatory and co-design issues hold significant importance, whereas in Brazil, public safety concerns and the economic abyss between social classes create urgencent challenges, acting as barriers to the realization of fluid and freely accessible spaces. The precarious living conditions of a large part of the community surrounding the building, along with the need for secure shelter, overshadow any disruptive utilization program, such as the one proposed in Finland.

There is a lack of details concerning any participatory procedures in the development of the Library of the Sichuan Fine Arts Institute project. In contrast, access to information is considerably restricted when juxtaposed with the abundance and accessibility of data and user feedback available for the other two projects. What is perceived is that for the Chinese project, the path to establishing a connection with the community largely involved exploring the tectonic aspects of the building. Materials, forms, and existing visual references were used to forge connections with the surrounding community. The building's image served as a key attraction and link. Moreover, the seamless integration of space with the university environment and the surrounding green spaces made it a central gathering spot for the academic community.

In contrast, the Brazilian library establishes itself as a sanctuary, offering refuge and safety to the community. It connects with the community by presenting itself as a secure place, contrasting with the characteristics of its surroundings. This connection occurs through the provision of distinct services and spatial experiences rather than through continuity between the surroundings and the building.

Meanwhile, in Finland, the library is a continuum of an already well-ordered and qualified urban context. The library enhances and goes beyond the role of the city as an educational agent.

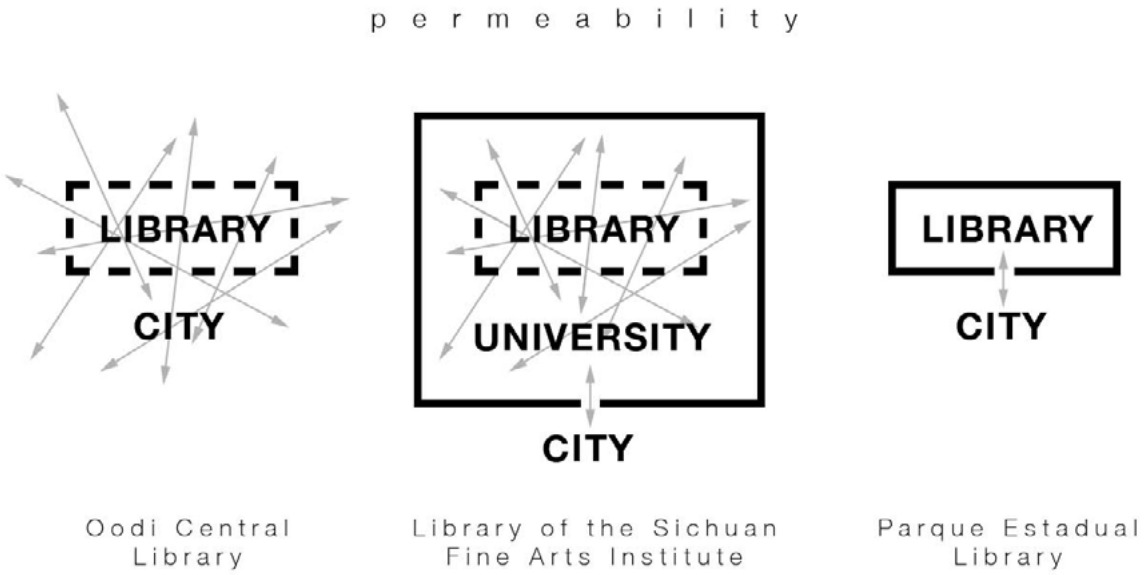


Figure 10. Permeability diagram. Image: by the author (2024).

Thus, what becomes evident is the lack of clear and unanimous points in terms of project strategies, form, or even pathways leading to the library's successful integration within the community. There is no common aesthetic, and public participation did not equally influence all three processes. Additionally, the freedom of movement varies across the projects.

On the other hand, all the studied buildings reveal how the functional program of a library has changed, how the space and range of activities have evolved, and how the community uses and seeks the library space for its other values, beyond just being a book repository.

Nevertheless, comparative analysis serves to recognise these nuances and exchange good practices. The experiences, successes and failures of others serve as starting points for reimagining and reshaping practices in each context toward creating more equitable and just educational environments.

The lesson learned is that educational spaces, whether formal or informal, must be engaging, comfortable, social and participatory to be effective. Successful educational space design involves meaningful community engagement and participation. Inclusive decision-making processes ensure that educational spaces truly reflect the needs and aspirations of their users, fostering a sense of ownership and belonging within the community. If designed to embrace diversity, exchange, and contextual needs, these spaces can truly serve communities and education. This means that the design goes beyond symbolism to become a tool for realizing social function, influencing how various social actors interact and engage with learning and teaching.

This underscores the urgent need to rethink libraries as educational spaces, shifting from repositories of knowledge to hubs of knowledge creation and circulation. Public libraries increasingly serve as vital community hubs, bringing together individuals of all ages, backgrounds, genders, and intellectual levels. This understanding should be reflected in both physical space and the generative processes shaping it, with a recognition of the importance of employing co-design tools to develop solutions that can drive social and urban change in the communities where these spaces are located.

Similar attention should be given to formal educational spaces, such as school buildings, where there is a growing demand for processes that extend beyond the design phase to incorporate co-design practices. Collective decisions should involve defining programmes and guidelines before design begins, with the socio-economic and political context of each place always guiding these actions.

The future of educational spaces lies in innovation, adaptability, and sustainability. Design solutions must anticipate and respond to emerging challenges, embrace technological advancements, and promote environmental awareness. By prioritizing holistic learning experiences, fostering community connections, and embracing diverse pedagogical approaches, educational spaces can serve as catalysts for social and cultural transformation.

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P/REFERENCES OF DESIGN

SPELLING 'GENDER-NEUTRAL': A COMPREHENSIVE OVERVIEW OF NON-GENDER-SPECIFIC PRODUCTS.

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KEYWORDS | GENDER-NEUTRAL DESIGN, INCLUSIVITY, SCOPING REVIEW, GENDER-SENSITIVE DESIGN FRAMEWORK, DESIGN CULTURE

ABSTRACT | This paper explores the evolving paradigm of gender-neutral products, a growing trend in product design, emphasising the lack of a shared understanding of their epistemological and ontological aspects. While researchers advocate for integrating gender neutrality in design practices to promote equality, achieving a consensus on defining and addressing these products remains challenging. We aim to provide a thorough overview of gender-neutral products through a scoping review methodology and the collection of a glossary of terms related to products without gender-specific connotations, outlining the semantical tensions among these. Our findings revealed that labelling practices impact product perception, thus influencing users. Affective attitudes, intricately tied to purchase intent, are shaped by aesthetic and functional perceptions. This exploration contributes to untangling the discourse around gender-neutral products through a gender-sensitive design framework. By advocating for a thoughtful and grounded approach to genderless design, our research seeks to encourage a design culture that challenges societal constraints and promotes the inclusivity of diverse identities.

1. Introduction

1.1 An Uprising Trend

A new category of products has gained a strong presence by challenging traditional gender norms: major brands and well-renowned designers have already adopted a neutral design approach to reach a broader audience, advocating for inclusivity and diversity (Esfahani, 2020). Moreover, scholars highlight the potential of non-gendered products, given their increasing popularity among consumers, who are increasingly prone to embrace them (Vieira, 2019).

Some scholars urge a shift towards a generation of products deprived of gender (Fugate & Phillips, 2010), while others cautiously advocate for a 'gender-tempered' design wave (Sandhu, 2021). More conservative and pragmatic views report gendered products as the lowest-risk option (Fugate & Phillips, 2010). Despite different positions, ubiquitous confusion about gender-neutral objects and their nature inundates the literature, potentially giving rise to unfounded statements and making the task of taking a stance seem like walking on quicksand. Numerous contradictions across publications exist. For instance, Vieira (2019) and Stilma (2010) interchange the terms 'gender-neutral1 and 1unisex1 to refer to counterparts of gendered products. On a similar view, Carpenter et al. (2005) use the word 'dual-sex' for gender-neutral brands, challenging the prevailing division between undifferentiated (i.e., without gender attributes) and androgynous (i.e., with feminine and masculine features) proposed by Bem (1981). Ehrnberger et al. (2012) imply that unisex products are susceptible to becoming aesthetically neutral, whilst Ludwig et al. (2016) declare them androgynous based on evidence of high levels of femininity and masculinity.

Domain experts broadly investigate gender perceptions and their impact on product design, education, and marketing. Still, specific guidelines on gender-neutral aesthetics and a shared glossary are lacking. We argue that the absence of a clear definition and categorisation of non-gendered products hinders the creation process, leading to unexpected and unpredictable consequences. Just as any competent chemist would not mislabel acids and bases, designers dealing with gender perceptions in products should be careful about confusing androgynous cues with gender-neutral ones, for instance. An unambiguous gender-based classification can serve as a foundation for making well-informed design decisions, preventing the unintentional marginalisation of individuals through design or the market failure of a product. Our research questions seek to analyse how the literature addresses non-gendered products, aiming to offer a comprehensive overview of this category and its implications for the design discipline and our society.

1.2 Gender Congruity to Foster Affective Attitudes

Despite the ongoing growth of the gender-neutral trend, resistance to gender neutrality is still nurtured by the need for gender congruity, i.e. the alignment between a product's gender connotations and the user's gender identity. For example, evidence suggests that male users are less receptive to products not targeted specifically for them than women and non-binary individuals (Avery, 2012; Fugate & Phillips, 2010). They are most likely to reject unisex-labelled products or those containing female connotations, fighting against any transformation of typically masculine cues (Avery, 2012; Ehrnberger et al., 2012; Esfahani, 2020).To preserve the male market share, Fugate and Phillips (2010) proposed relying solely on male cues, a solution that, in our view, may perpetuate the traditional gender hierarchy and fuel a masculinity culture not aligned with the social and cultural principles of the Sustainable Development Goals. Instead, Prochner (2018), from a feminist and queer perspective, advocated for gender-fair products by considering users' needs and adding diversity to design teams to increase the chances of all identities being represented. However, as an alternative to a reductionist view where men design for men and women design for women, the focus should be instead on a shared and widespread education on gender sensitivity.

It is undeniable that the preference for products not targeted at a specific social group is becoming more diffused across the entire gender spectrum, including the normative men-women binary (Canning, 2012). Still, the one-size-fits-all approach may be a long shot regarding market acceptance, potentially neglecting a significant portion of consumers based on gender. As part of the design community, we must carefully acknowledge and accommodate the diverse and wide range of femininities and masculinities. Tilburg et al. (2015) highlighted the role of affective attitude in increasing purchase intent, with a focus on products used for self-expression and with regard to gender considerations. They defined a positive affective attitude as the result of a seamless translation of the product's (gender) identity and as a trigger for aesthetic value and functionality perceptions. The practical translation of a product's embedded meaning relies on "error-free processing of stimuli" (Tilburg et al., 2015, p. 426), determined by how easily and quickly the user perceives and identifies themselves with the product, i.e. how efficiently the gender congruity phenomenon takes place. Our goal is to create tools that promote gender identity congruity across the gender spectrum by facilitating the relationship between non-conforming identities and products.

2. Methodology: A Scoping Review

The discussion around gender-sensitive products, and especially non-gendered products, is still ongoing and calls for a more in-depth investigation. When the state of a research topic urges further development, resourceful researchers can choose to conduct a scoping procedure to examine these less-researched topics (Arksey & O'Malley, 2005). Therefore, we adopted this methodological framework to make sense of and create a coherent structure of the data we extracted and collected for further analysis. A scoping review consists of five consecutive steps and a sixth optional step (ibid.):

1. Identifying the research question;
2. Identifying relevant studies;
3. Study selection;
4. Charting the data;
5. Collating, summarising, and reporting the results;
6. Expert consultation.

2.1 Identifying the Research Questions

Our research aimed to discover how non-gendered products are called in the literature. The significance and urge to answer this question lie in the importance for designers of all kinds to develop a sensitive language to enter and contribute to the conversation on design and gender issues (Van Boeijen, 2022). Our scope was to unveil gaps and contradictions in the literature and pave the way for a shared approach within the product design field.

2.2 Identifying Relevant Studies

The second step of the scoping review was "identifying primary studies (published and unpublished) and reviews suitable for answering the central research question" (Arksey & O'Malley, 2005, p. 10). The answer to our research inquiry should provide a general overview and common ground around non-gendered design and stir up the conversation about gender issues within the design community. Hence, we aimed at studies discussing genderless cues across different disciplines, focusing on product design. We relied on electronic databases, reference lists, and hand-searching to collect an insightful yet manageable data sample.

Table 1. Scopus search query history.

N. Step	Scopus Query String	N. Results	Collected (Yes/No)
1	TITLE-ABS-KEY ("genderless object*" OR "genderless product*" OR "neutral gender product*" OR "unisex product*" OR "non-gender trend" OR "unisex design" OR "genderless market")	15	N
2	TITLE-ABS-KEY(("genderless object*" OR "genderless product*" OR "neutral gender product*" OR "unisex product*"OR" non-gender trend" OR "unisex design" OR "genderless market" OR "gendered object*" OR "gendered product*" OR "gender typ*" OR "gendering cue*" OR "gender polarisation" OR "gender operationalisation" OR "gender suitab*" OR "gendering" OR "gender-based")) AND EXACTSRCTITLE ("Design Issues" OR "Design Studies" OR "CoDesign" OR "International Journal of Design" OR "Design Journal" OR "She Ji")	3	Y
3	TITLE-ABS-KEY (("unisex" OR "*gender*") AND ("industrial design" OR "product design"))	474	N
4	TITLE (("unisex" OR "*gender*") AND ("industrial design" OR "product design")) OR KEY (("unisex" OR "*gender*") AND ("industrial design" OR "product design")	109	Y

We conducted a query search with Scopus, introducing gender-related terminology gathered in Table 1. We began with a simple query, feeding non-gendered terms such as ‘unisex’ or ‘genderless’. However, our search yielded just a few publications, thus suggesting a literature gap. Consequently, we continued with a more thorough second search, extending the range of gender-related vocabulary and including as input some of the Scopus-indexed design-focused journals (i.e., Design Issues, Design Studies, CoDesign, International Journal of Design, Design Journal, She Ji). As a result, we collected a small but relevant data set of three publications, confirming the scarcity of publication in these design journals mentioning (i.e., in the title, abstract or keywords) non-gender-specific terminology.

Given the relatively low number of documents in our previous searches, we broadened our following query by looking for publications involving gendered and non-gender-specific design discussions. In addition, we juxtaposed the gender-derived terms with ‘industrial design’ and ‘product design’ to draw the focus towards literature dealing with design issues, discarding other knowledge fields out of our scope. As a result, we obtained a substantially broader group of data, which made evident the predominance of the discourse around gendered design over non-gendered design. After further limiting our scope, we gathered a data collection of 112 publications. Then, scouring through our publications sample, we extracted new words such as ‘sex-typed’, ‘masculine’, and ‘feminine’. We enhanced our data collection by looking at the reference lists and expanding the inventory of documents to be analysed to 126.

2.3 Study Selection

Starting with a list of 126 publications, we established selection criteria to narrow it down to a more insightful and topic-focused data set. We examined each title, abstract, and keyword and applied the following necessary conditions for further and more thorough analysis:

- The publication focused on a specific consumption product or a category of products;
- The publication discussed the influence of gender within the design discipline;
- The publication referenced the lack or presence of gender connotations within products and related processes, from creation to advertising.

The outcome consisted of a data sample of 64 documents, subdivided into 33 academic articles, 27 conference papers, three dissertations, and a technical report, all dating from 1981 to 2023. Figure 1 represents the sharp increase in publications about gender and product design over time.

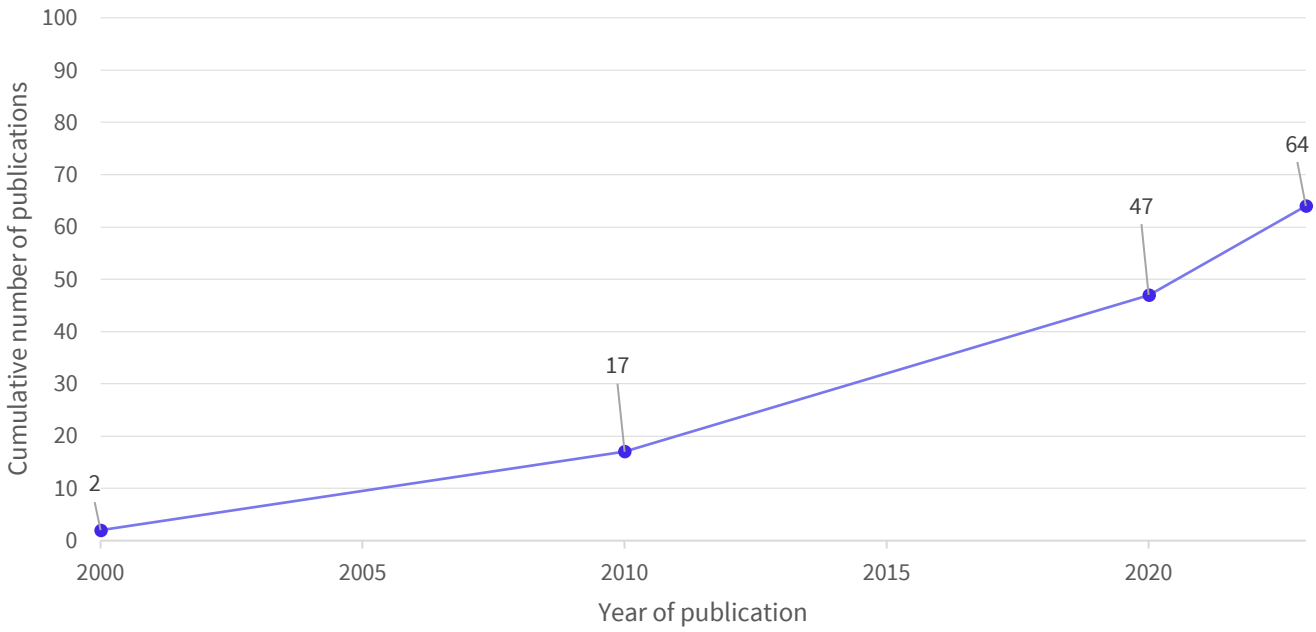


Figure 1. Graph displays the growth of publications related to non-gender-specific and gender-specific products. It indicates the cumulative number of publications for each decade until 2023.

2.4 Charting the Data

In charting the data gathered so far, we intended to create an organised and systematic structure that would enable us to identify emerging themes and patterns within the literature (Levac et al., 2010). Following the multiple-cycle-based coding process described by Saldaña (2013), we first arranged our data corpus aiming at specific gender categorisations of products. This way, we discovered a set of different clusters:

- Masculine, Feminine, Androgynous, or Undifferentiated;
- Masculine, Feminine, Gender-neutral, or Unisex;
- Female, Male, or Gender-neutral;
- Sex-typed or Cross-typed;
- Sex-congruent or Sex-incongruent;
- Non-gendered or Gendered.

The resulting sorting system gave us a clear insight into the various existing approaches to non-gender-specific products.

Next, we used our preliminary category system as a starting point for finding out specific terms and their potential synonyms. We created a glossary of 38 terms found in 42 documents referring to non-traditional gendered products and their inherent processes, continuously updating it during our scoping procedure. We reduced the glossary count to 16 by grouping semantically identical terms (e.g., 'gender neutral', 'neutral gender', and 'gender-neutral') to simplify our analysis. Moreover, some of our initial terms were re-categorised as 'gender-sensitive practices' widely employed by designers and other stakeholders, such as advertisers (i.e. 'universal design', 'pluralist design', 'transparent approach', 'mute gender', 'neutral design', 'de-gendering', 'gender-bending', and 'gender contamination').

2.5 Collating, Summarising and Reporting the Results

The concluding phase of our scoping review involved synthesising and identifying thematic and conceptual categories for our glossary. Our analysis of gender-neutral products extended beyond establishing clear categories and delved into their respective attributes and interconnected processes. We created a framework, the Gender-Sensitive Design Framework, that outlines the interpretation of the overall findings. We built our framework on three pivotal pillars, each connected to a different product outcome in terms of gender traits and acceptance. These pillars are the product's attributes, the product's alignment with the user's gender identity, and the product's response to social expectations. Our framework can assist designers and practitioners in assigning or removing gender attributes from products while raising awareness of such complexities.

3. Findings

3.1 A Non-Gender-Specific Glossary

By approaching our work through the scoping review methodology, we identified contradictions and tensions across our data corpus and gained a glance at the gender-based climate in product design over the past decades. This section unveils the literature's wide variety of gendered vocabulary, emphasising the prevailing terminology.

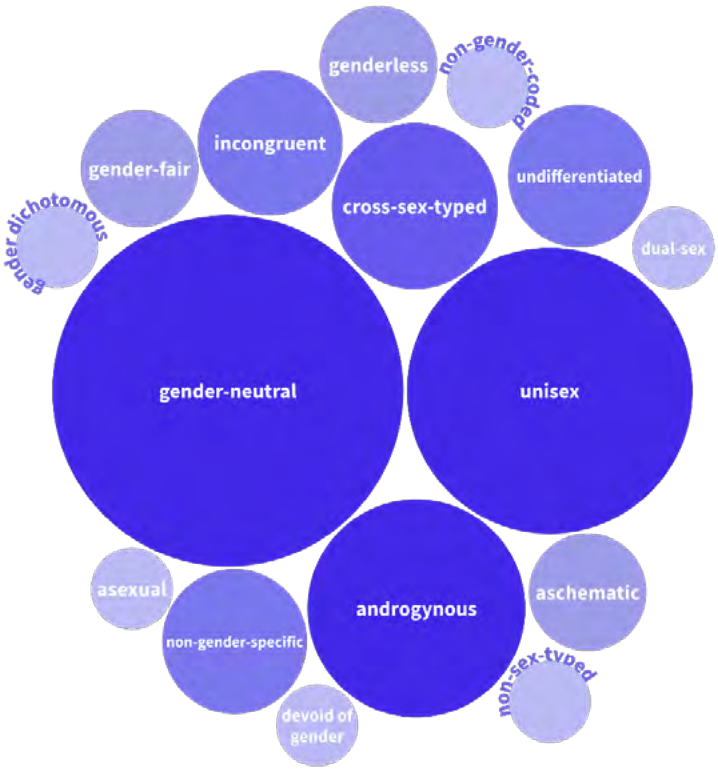


Figure 2. The Word Cloud displays the most common keywords in the literature. ‘Gender-neutral’, ‘unisex’, and ‘androgynous’ are the most frequent, represented by the most prominent circles. The size of each circle is directly proportional to the occurrence of each keyword per number of publications.

From our scoping review, we assembled a collection of 16 words symbolising and conveying non-conventional gendered attributes. Our findings revealed a preference for a small group of terms, illustrated in Figure 2, and three of them arose as predominant for sorting products from a non-gender-specific perspective: ‘gender-neutral’, ‘unisex’, and ‘androgynous’. We observed that the defining aspect is whether

gender-specific aesthetic connotations are present or absent. However, in the case of unisex products, concerns about gender biases affecting usability emerged as well.

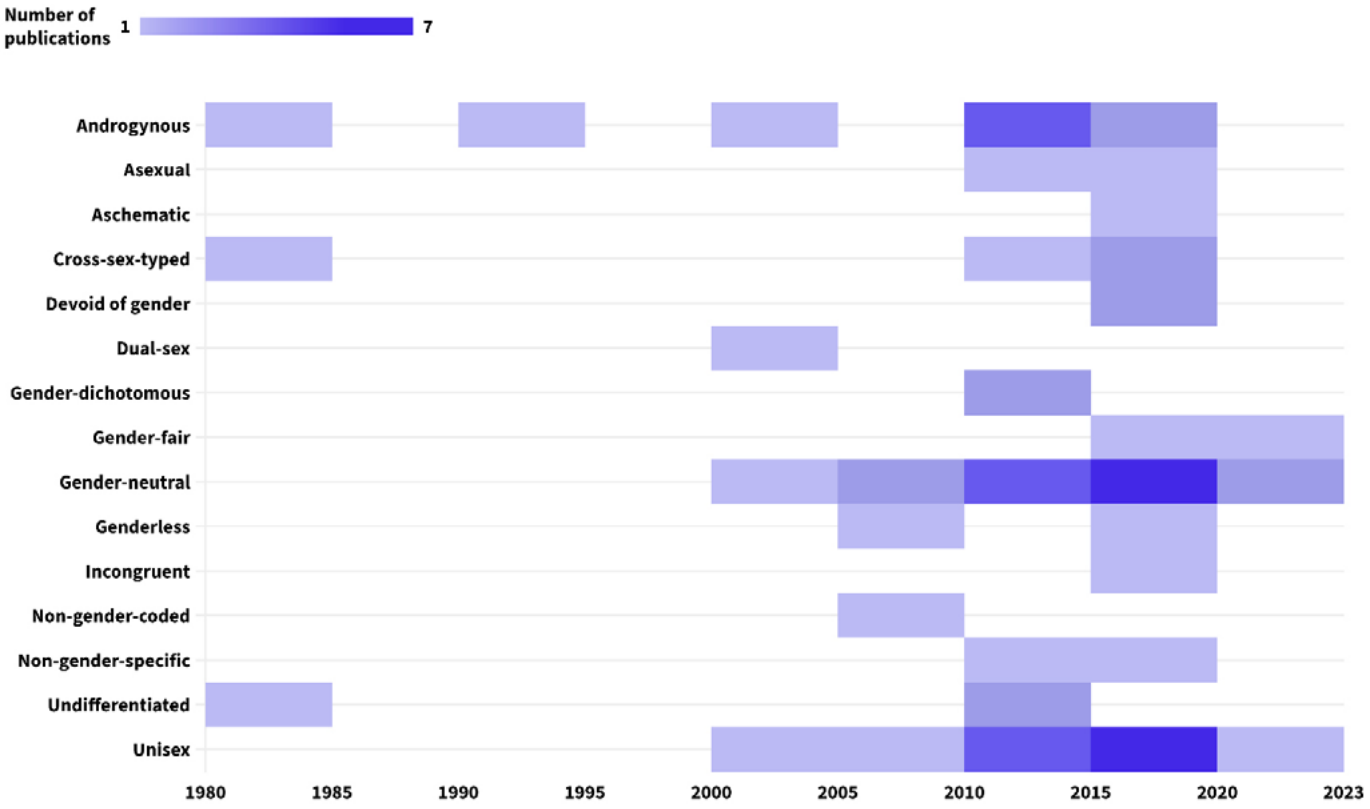


Figure 3. The graph illustrates the emergence and prevalence of non-gender-specific terminology across time, with darker hues representing a higher number of publications containing a particular term.

By analysing the historical evolution of terminology describing artefacts with no specific gender (Figure 3), we discovered how certain terms consistently appear across time while others became obscure and how newer terms have gained popularity in recent years. The aforementioned widespread categories (i.e., androgynous, unisex, and gender-neutral) have proven persistent since their first appearance and have become widely diffused ever since, with androgynous being the most enduring. On the other hand, we hypothesised that due to an explicitly binary cue, ‘dual-sex’ did not stick within the discourse on non-gender-specific products. The remaining terms, such as 'devoid of gender', ‘gender-fair’, or ‘incongruent’, encompass a broader range of meanings, providing little information on the specific gender connotations they convey, which might justify their lower frequency.

Our findings revealed that both androgynous and gender-neutral associations are well-defined and can be easily identified regarding aesthetic values and gender connotations. They are depicted as an unmistakable and straightforward dichotomy, where binary gender cues are either constantly present or missing. On the other hand, unisex products appear to exist somewhere in between. Unisex products target both men and women, resembling androgynous products yet displaying a genderless and anonymous formal language that is similar to gender-neutral products. If we aim to provide a comprehensive framework for characterising products within the controversial and complex topic of gender, we suggest letting go of ambiguous terms. Next, we delve into the aforementioned predominant terms (i.e., ‘gender-neutral’, ‘unisex’, and ‘androgynous’).

Gender-Neutral: With No Masculine and No Feminine Attributes

A gender-neutral product is described in the literature as “devoid of gender” (Prochner, 2018, p. 243) or ‘genderless’ (Bardzell, 2010; Vieira, 2019), i.e. neither masculine nor feminine (Oudshoorn et al., 2002;

Stilma, 2010; Vieira, 2019). Moreover, when referring to gender traits, we intend more than mere aesthetic appearance. Oudshoorn et al. (2002) implicitly suggested that functionality that does not distinguish between men's and women's capabilities is also gender-neutral. However, Stilma (2006) has expressed certain scepticism, claiming that achieving complete and pure gender neutrality is unattainable and criticising it as an approach for potentially safeguarding hegemonic masculinity.

A more realistic and conservative approach towards gender-neutral products could consist of minimising gender differences rather than eliminating them to target both men and women equally. According to Esfahani (2020), this solution might nevertheless generate the risk of reinforcing traditional feminine and masculine values based on stereotypical norms and biased ideologies. Supporting this viewpoint, Kaygan (2014) drew attention to the fact that normative masculinity and femininity still surface in objects presented as gender-neutral. A product's attributes should be considered neutral "where the gender of design is invisible" (Esfahani, 2020, p. 825), as demonstrated in Figure 4. In addition, as anticipated, some authors have briefly referred to the term 'undifferentiated' to address those products that lack a well-defined gender identity (Fugate & Phillips, 2010; Tilburg et al., 2015).



Figure 4. Georganics bamboo toothbrush embodies gender neutrality. The product's function is indifferent to gender, and we do not identify specific stereotypical gender cues. The toothbrush is available in different colour options to appeal to a broader audience. Photo by Toa Heftiba on Unsplash.

Many scholars have investigated the social implications of gender-neutral design, and it is a widespread stance that gender-neutral products can play a significant role in advancing the cause of gender equality (Oudshoorn et al., 2002; Prochner, 2018; Spain, 1995; Stilma, 2010; Vieira, 2019; Vorvoreanu et al., 2019). Their design strives to eliminate traditional roles based on what socio-cultural norms dictate as appropriate and take down ill gender stereotypes (Prochner, 2018; Spain, 1995; Stilma, 2010). Contrary to what we might expect from a categorical and unique solution, gender neutrality can open a broader range of behaviours and characteristics (Avery, 2012) and serve as a valuable asset to the unified and inclusive design cause that refuses the exclusion of non-conforming identities and bodies (Canlı, 2018).

Unisex: With Feminine, Masculine, and Neutral Attributes

The category of unisex products is often challenging due to its ambiguous nature. Drake & Radford (2018) outlined that the primary scope of unisex design is to provide an alternative and separate version from the men's and women's categories. In this respect, they can be considered equivalent to androgynous products, as they target both men and women, allowing for an alternative and more flexible range of behaviours (Ludwig et al., 2016). In addition, Carpenter et al. (2005) introduced the term 'dual-sex' to refer to products that carry both-gender-specific connotations. However, it may not have gained widespread acceptance as it implies a gender division rather than promoting unity like 'unisex' aims to do.



Figure 5. Prototype of a unisex ski boot designed by students from the Luleå University of Technology. The authors categorised it as unisex for its lack of traditional feminine or masculine colours and its versatility in sizing (Öhrling et al., 2018).

Regarding aesthetic aspects, the general approach to unisex design is to unify the choice of colours and shapes to fit everyone's preferences (Esfahani, 2020), as exemplified in Figure 5. In addition, to convey the perception of unisex through product representation, there is a common tendency to display it on both men and women (Rasmussen & Petersen, 2011). Ehrnberger et al. (2012) pointed out that choosing pale and bland aesthetics to appeal to a broader audience may be counterproductive and lead to a weakened product identity with low quality in terms of aesthetic value.

Our findings revealed more concerning drawbacks of unisex design. G. J. M. Read et al. (2022) discovered how developing unisex Personal Protective Equipment (PPE), primarily designed around the standard Western male body, can negatively affect women's performance, potentially endangering their lives. We could state that the key to successful, conscious, and thoughtful unisex design is to blend many preferences while acknowledging gender differences strictly in terms of biological and ergonomic requirements (Drake & Radford, 2018).

Androgynous: With Masculine and Feminine Attributes

Despite some authors drawing similarities between androgyny and gender neutrality (Carpenter et al., 2005), most agree to disagree. Androgynous-designed products are distinctive for evoking augmented perceptions of femininity and masculinity, enhanced by their unambiguous, simultaneous, and equitable representation of typically male and female traits (Bem, 1981; Ludwig et al., 2016; Tilburg et al., 2015).



Figure 6. E-bike Tour Pro Wave by Advanced® CC BY-ND 4.0 DEED. The e-bike embodies both traditionally masculine and feminine cues. In terms of morphology, the open frame geometry has historically been related to female riders, whereas, in terms of formal design language, the aesthetic attributes (e.g., colour, shapes, and finishes) can be identified as masculine.

From a social perspective, and just like gender neutrality, androgyny contributes to transcending traditional gender boundaries (Avery, 2012; Drake & Radford, 2018) and “is associated with a larger repertoire of behavioural options” (Tilburg et al., 2015, p. 427). Furthermore, researchers like Blythe and Monk (2002) advocated for an ‘androgynous society’ with no inequitable division of labour, urging product designers to challenge established patterns of gender roles, particularly those related to the domestic environment. For example, Fugate and Phillips (2010) exposed the microwave's case, which shifted from an undifferentiated to an androgynous product after the alignment of men's and women's lifestyles, with women increasingly joining the workforce. They also exemplified how toothpaste went from masculine to androgynous after being associated with cosmetic aspects, which were more commonly related to women in the past. In Figure 6, we present an example of a product embodying an androgynous character. The e-bike represented is constituted by a wave frame, historically associated with female riders (Wong & Wu, 2010), and an overall masculine aesthetics characterised by dark colours and primary sharp shapes, hence coupling traditionally masculine and feminine attributes.

3.2 Existing Gender-Based Categorisation

After identifying how the literature addresses non-gendered products according to their distinctive traits and gender character, we looked at the bigger picture by investigating how these products are typically categorised and grouped.

Eriksson & Jerregård (2010) opposed non-gender-coded toys to gender-labelled toys, and Prochner (2018) polarised gendered design and design with no gender. While one might assume that all products not explicitly labelled as gendered fall into the category of non-gendered, this simplistic dichotomy falls short of grasping the nuanced aspects of identifying and conferring gender identity onto products. The term ‘non-gendered’ suggests that an object lacks gender cues and is not embedded with masculine or feminine attributes. Supporting that viewpoint, Ehrnberger et al. (2012) defined non-gender-specific categories as those not specifically targeted at a particular gender identity or whose function does not rely on the gender attributes of the user. However, the debate appears to be more complex.

On a more in-depth exploration of gender perceptions, Bem (1981) navigated the concept of ‘sex congruity’, referring to the alignment between an individual's sex identity and an external stimuli's gender markers. Extending this taxonomy to consumption products, Drake & Radford (2018) identified ‘sex congruity’ when a product aligns with stereotypical expectations and ‘sex incongruity’ when it deviates from the user's socially or self-assigned gender identity.

Shifting the focus to the inherent gender associations of individuals, Bem (1981) enhanced her contribution with a four-category framework according to the level of femininity or masculinity conveyed:

- ‘Sex-typed’ (i.e. male with high levels of masculinity and female with high levels of femininity);
- ‘Cross-sex-typed’ (i.e. male with high levels of femininity and female with high levels of masculinity);
- ‘Androgynous’ (i.e. high levels of masculinity and high levels of femininity);
- ‘Undifferentiated’ (i.e. low levels of masculinity and low levels of femininity).

Therefore, products displaying high levels of femininity or masculinity with little ambiguity are considered ‘sex-typed’ and defined as feminine or masculine (Fugate & Phillips, 2010). Moreover, we could argue that ‘cross-sex-typed’ products are born as the result of actively seeking sex incongruity. On the other hand, ‘androgynous’ products can represent both spectrums of gender simultaneously, nevertheless following pre-established stereotypes (Fugate & Phillips, 2010; Ludwig et al., 2016). Last, ‘undifferentiated’ products are impermeable to social impositions and expectations of gender behaviour and preferences and deprived of any typically feminine or masculine connotation (Fugate & Phillips, 2010; Tilburg et al., 2015). Nevertheless, discerning between androgynous and undifferentiated products—the latter being a less diffused term analogous to gender-neutral—from one another remains somewhat unclear.

3.3 Gender-Sensitive Design Practices

Designers should establish a specific design strategy based on the direction for translating, perceiving, and interpreting gender characteristics in products. During the scoping process for new product alternatives that disrupt gendered design, we identified a group of widespread design approaches to re-thinking conventional methods. The gender-sensitive techniques collected can be employed to react to unjustifiably gendered products or as a first approach to creating gender-fair designs. As per Figure 7, we clustered them into ‘cue-free design’, ‘gender-shift design’, and ‘flexible design’.

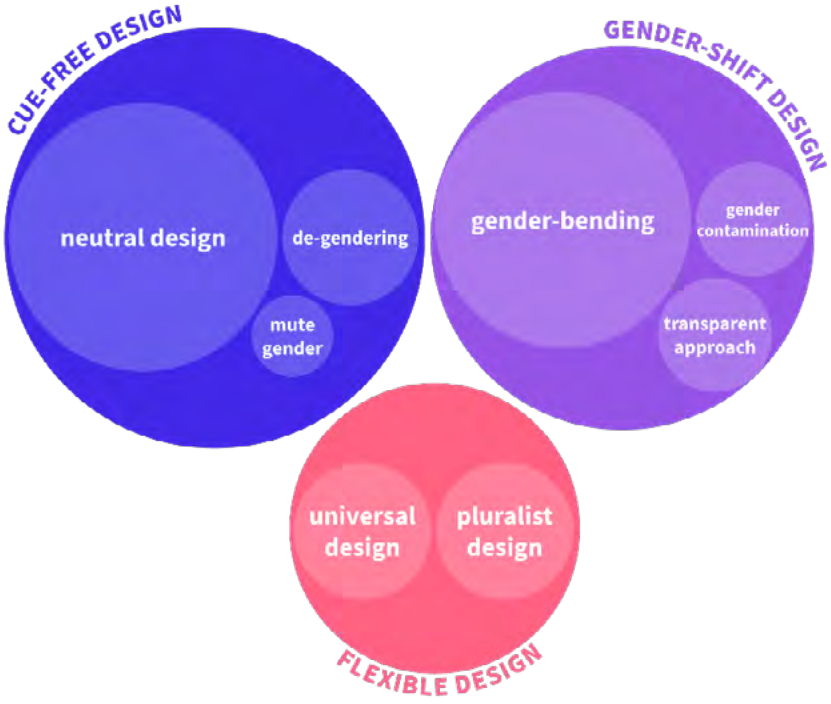


Figure 7. The three clusters contain specific practices challenging gendered design. The circle area size depends on the prevalence within the literature, assigning greater areas to the most widespread practices.

Cue-Free Design

When the goal is creating gender-neutral products free from gender markers, earlier research suggested ‘de-genderising’ or ‘re-genderising’ their attributes (Stuteville, 1971, as cited in Fugate & Phillips, 2010) or designing cue-free products. In certain instances, when an object is perceived as illicitly gendered, the unconscious response is to ‘mute gender’, i.e. ignore any gender connotations (Drake & Radford, 2018). However, de-constructing a design archetype takes time to unfold.

Our research revealed that the specific cultural lens applied throughout the design process influences the promotion of diversity. DaMaren & Olechowski (2022) emphasised that an open-culture environment fosters inclusivity more than a closed-group culture. De-gendering practices provide a second chance to start from scratch, bringing into the fold those usually neglected—women and non-binary—and assembling more diverse design teams, enhancing creativity (ibid.).



Figure 8. Unisex wristwatch Once Again by Swatch. Photo by the authors (2024).

The idea of 'neutrality' in design is pivotal in the conversation on de-gendering practices. Vieira (2019) claimed that neutral design can meet multiple personalities and needs, aligning with gender-neutral and unisex outcomes. However, it likely leads to anonymous aesthetics with no character (Prochner, 2018), typical of unisex products. Furthermore, colours and shapes are commonly referred to as neutral (Rajapakse et al., 2012; Rasmussen & Petersen, 2011) when we cannot identify traditional gender associations (Canlı, 2018). For instance, Ehrnberger et al. (2012) exemplified this approach by referring to the wristwatch Once Again by Swatch (Figure 8), whose function—timekeeping—is indifferent to gender and whose appearance is aesthetically neutral. Nevertheless, it is essential to acknowledge that apparently neutral things can contain cultural and social biases. This is necessary to avoid propagating traditional and prevailing stereotypes with a new uniform solution that takes a single standard pattern as a rule, e.g. white colour as the neutral option in Western cultures (Öhrling et al., 2018).

Gender-Shift Design

'Gender-shift' practices are intended to focus solely on connecting with men and women, not considering the non-normative gender identities. Hence, we believe this approach requires an evolution towards including alternative realities.

One of these practices is 'gender-bending', where a typically masculine or feminine typed product is reversed in its formal language to match the opposite sex's (Avery, 2012). Gender-bending unlocks the experimentation with self-expression and the exploration of "new understandings of gender through humour and provocation in design" (Prochner, 2018, p. 161), disobeying normative constrictions (Canlı, 2018). Figure 9 depicts an illustrative example of gender-bending.

'Gender contamination' emerged as another term indicating the appropriation of typically feminine or masculine brands by the opposite sex. The gender contamination phenomenon gives rise to products imbued with opposite gender cues to attract a broader public (Avery, 2012). It is worth noting that, statistically, women are more inclined towards gender contamination than men, who often feel threatened and perceive their gender schema performances as affected (ibid.). The term 'gender contamination' itself conveys a negative connotation, viewing gender inclusivity as an invasion rather than positive progress towards gender equality. In response, a more transparent approach proposes addressing gender blending practices without stigmatising marginalised identities, connecting with men and women and drawing inspiration from women's needs (Enga & Diana, 2019). We acknowledge that the ever-changing social and cultural gender matrix requires a comprehensive approach that addresses the needs of both women and non-binary individuals.



Figure 9. Students from the Luleå University of Technology re-designed weight training equipment with a 'Gender-bending' approach, challenging gender stereotypes at gyms. The degree of stereotypical feminine cues increases as the weight increases (Öhrling et al., 2018).

Flexible Design

We have coined the ‘flexible design’ category as a collection of design practices that understand gender as blind, meaning that the primary objective is to include everyone, regardless of gender identity. Universal design (Figure 10), for example, challenges normativity through a zero-tolerance to discriminating markers (Öhrling et al., 2018) and by designing artefacts that “are more equitable, intuitive, and thoughtful in anticipating collective and individual needs” (Vostral & McDonagh, 2010, p. 114). On the other hand, pluralist design disputes the idea of artefacts adhering “to a single, totalising, and universal point of view” (Bardzell, 2010, p. 1305). Bardzell (2010) explained how pluralism focuses on cultural differences, promotes constructive interaction with diversity, and utilises marginalised elements as resources for design solutions. In other words, this approach aims to create a more inclusive design that benefits from diversity rather than ignoring it.



Figure 10. OXO Good Grip Potato Peeler was initially designed to ease peeling for people with arthrosis—an example of universal product design © Charlie Sorrel on Wired. CC BY-NC-SA 3.0 DEED.

4. Discussion

Here, we present the interpretation of our findings and offer a conceptual and holistic Gender-Sensitive Design Framework to help navigate gender considerations throughout the product design process. As a disclaimer, our research faced some limitations. Firstly, due to limited time and resources, the sixth step of the scoping review procedure (i.e., the validation and further insights from an external domain expert) is missing (Arksey & O'Malley, 2005; Levac et al., 2010). Moreover, a more in-depth literature review by collecting a more significant number of publications could have provided more soundly proven results. However, we are confident that our work provides a reasonable overview of our main focus on non-gender-specific products.

4.1 Interpretative Framework of the Finding: Advancing Gender Sensitivity in Design

To guide the discussion and our interpretation of the results, we developed a comprehensive gender characterisation framework, namely the Gender-Sensitive Design Framework (Figure 11), to shed light on the dilemma of gender product vocabulary. We argue that products can be systematically classified considering three critical aspects: the product's gender attributes, its alignment with the user's gender identity, and its response to societal gender expectations.

Product's Attributes

Products' aesthetic and functional values highly depend on their gender character, and vice versa. Our research revealed three subcategories that suggest non-traditional gender-related implications: ‘gender-neutral’, ‘androgynous’, and ‘unisex’. However, the term 'unisex' proved quite ambiguous, displaying a neutral design but being associated with androgynous cues and potentially leading to dangerous inequalities (G. Read et al., 2022). For this reason, we propose a more straightforward and updated division which distinguishes between ‘androgynous’, ‘gender-neutral’, and ‘gender-specific’.

Our research uncovered how tangible traits (i.e. form, colours, shapes, and finishes) are crucial in embedding gender meanings into objects. A specific colour choice can drastically change gender perceptions of products since we attach values to aesthetic features based on personal experience, preferences, and socio-cultural biases. An androgynous product blends high levels of typically feminine and masculine cues (Tilburg et al., 2015). On the opposite perspective, gender-neutral products should not express any stereotypical constructs of femininity or masculinity, targeting a broader audience rather than the limited gender binary.

Product's Alignment with the User's Gender Identity

The gender characterisation of products is intrinsically linked to the user seeking self-expression (Oudshoorn et al., 2002; Prochner, 2014; Rasmussen & Petersen, 2011). The interpretation of a product's gender can dramatically change once it enters the ‘naïve realm’ (Prochner, 2014), where the reasoning, motivations, and justifications behind every design choice are not always explicitly communicated to users. Therefore, products serve as a means for self-expression (Oudshoorn et al., 2002; Prochner, 2014; Rasmussen & Petersen, 2011), and users have the power to change their gender script through creativity and critical thinking (Avery, 2012; Prochner, 2014). However, misaligning gender connotations can hinder the re-interpretation process (Bem, 1981; Tilburg et al., 2015). The synchronisation between self-identity and product gender character can either be a seamless and smooth activity or a challenging and unattainable task. A congruent product will instantly pair with the target user's gender identity, whereas an incongruent item will result in utter frustration and unfulfillment (Bem, 1981).

Tilburg et al. (2015) introduced the concept of positive affective attitude as a determining factor in encouraging gender congruity between individuals and products. However, experts emphasised how particular social groups—generally males—are more rigid than others regarding openness to alternative gender associations (Avery, 2012; Ehrnberger et al., 2012; Esfahani, 2020) and, therefore, tend to be prioritised over those who are more flexible. By considering gender congruity within the Gender-Sensitive Design Framework, we aim to extend a positive affective attitude across the whole gender spectrum and seek to manoeuvre the possible resistance from dominant groups without neglecting others.

Product's Response to Societal Expectations

The dynamic system built around products leverages the interaction among users, objects, and socio-cultural considerations. Gender associations are imbued and instilled in us since birth based on historic social standards, cultural beliefs, and doctrines. Individuals are expected to follow the predefined path regarding their socially assigned roles and identity. These associations are not exclusively found within the human dimension but are also transferred onto objects. Technology is often influenced by biased gender assumptions about the appropriate behaviour for specific social groups (Whalen, 2000).

When responding to societal expectations, products fall into a specific categorisation depending on the extent to which they follow predetermined rules. A sex-typed product represents normative constraints of what is socially accepted as masculine or feminine. Conversely, a cross-sex-typed product willingly challenges societal rules by defying the established meanings of femininity or masculinity. Last, a non-sex-typed product ignores any relation to traditional concepts of femininity and masculinity, exploring the whole spectrum of gender.

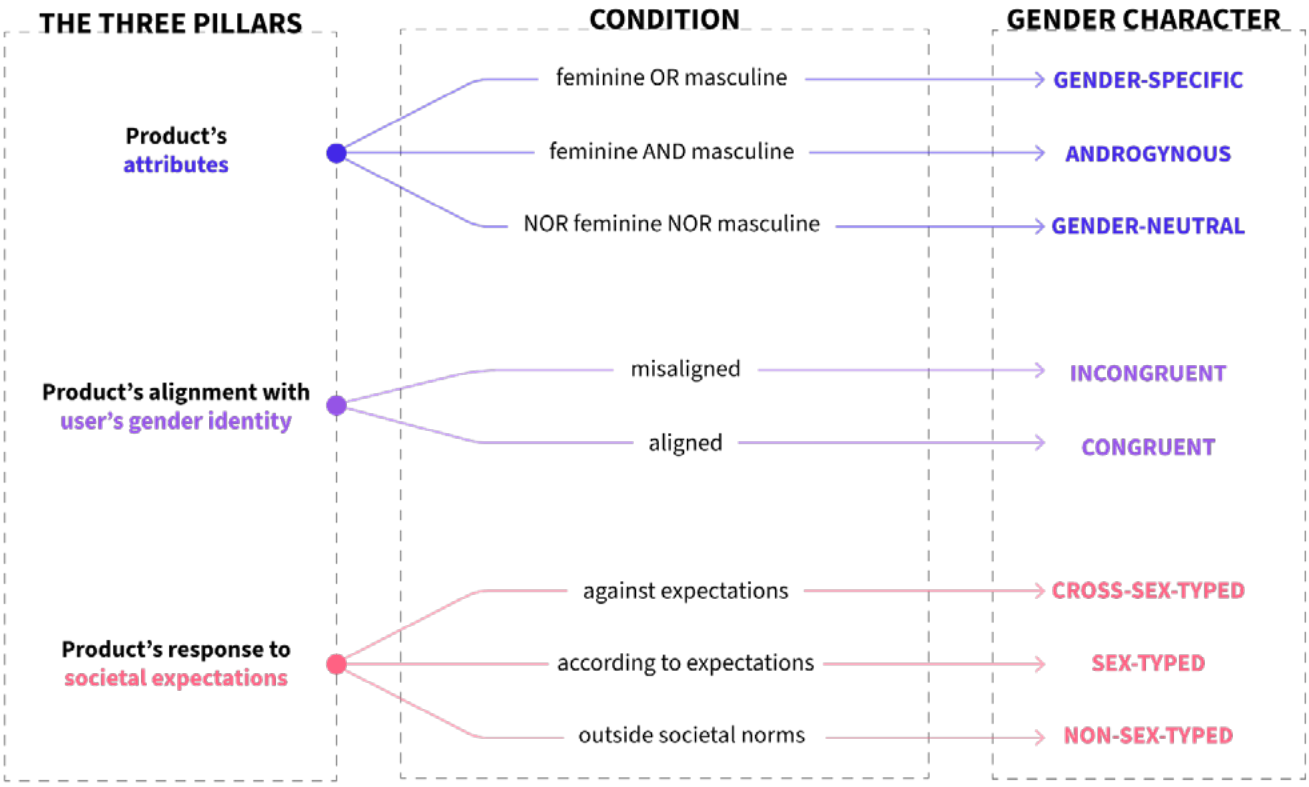


Figure 11. Conceptual Framework for Gender-Sensitive Design. Each pillar is connected to the predominant gender-related terms from our analysis.

4.2 Framework Application to the Design Process

Designers possess the skills and ability to shape “the initial forms, functions and meaning of objects” (Oudshoorn et al., 2002, p. 417). Their perceptions can directly influence the aesthetical value that designed objects evoke. However, designers often project their assumptions, experiences, and biases onto products, drifting away from an inclusive approach (Ehrnberger et al., 2012).

Our framework offers designers insights to make informed choices on gender-sensitive issues. We advise proactively implementing our framework from the beginning of the design journey. We argue that defining and understanding the context and empathising with the target user's needs and desires is essential for a successful outcome. Only after identifying the social and cultural context and the user's demands based on their gender identity can designers start defining the product's general requirements and attributes. A second approach to our framework could involve challenging already designed products and validating their compliance and coherence within the three pivotal pillars (i.e., attributes, alignment with the user's gender identity, and response to societal expectations). By proposing these two approaches, we aim to guide designers through a comprehensive process, ensuring gender sensitivity from the initial stages of design conception to the evaluation of existing products.

Table 2. Design strategies evaluated through the Gender-Sensitive Design framework.

Gender-sensitive design strategy	Product's attributes	Product's alignment with user's gender identity	Product's response to social expectations
Cue-free design	Gender-neutral	Congruent	Non-sex-typed
Gender-shift design	Androgynous	Congruent/Incongruent	Cross-sex-typed
Flexible design	Gender-neutral/Androgynous	Congruent	Non-sex-typed

The Gender-Sensitive Design Framework provides a new perspective for analysing the previously introduced gender-sensitive design approaches and assessing their influence on product outcomes within the context of the three main pillars (Table 2). These emerging design practices aim to promote gender sensitivity in product design and development, each taking a unique approach. First, cue-free design favours gender-neutral products to empower users to express themselves freely without subscribing to traditional gender rules. Furthermore, gender-shift methods intentionally include cross-sex-typed features, creating an androgynous mixture that may align or conflict with users' gender identities, hence making visible the invisible and taking down barriers to gender equality (Ehrnberger et al., 2012). Finally, incorporating flexible design practices that are non-sex-typed provides a safe and inclusive environment for users to explore and express their gender identity.

5. Conclusion and Future Research

Our research results in a deeper understanding of how non-gender-specific products and their distinctive features are addressed within the design discipline. We unveiled contradictions regarding the terminology and classification of these products, proposing a standardised and concise organisation that will hopefully pave the way for a more gender-sensitive design culture. Designers are called to get involved in and kindle the conversation surrounding gender issues, take a step towards bringing to life profitable products in terms of revenues and improving life conditions, and navigate the environmental and social realms thoughtfully and respectfully. As design professionals, we bear the ethical agency and responsibility of creating artefacts engineered to disrupt, challenge, and reshape unfair, unwritten cultural and social rules. A detailed analysis and visual research should be conducted on non-gendered product categories to identify their varying environmental and social implications based on their material, aesthetic, and morphological differences

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P/REFERENCES OF DESIGN

BREAK DOWN THE STIGMA THROUGH COMMUNICATION DESIGN: A PARTICIPATORY DESIGN PROJECT FOR A CAMPAIGN ON MEDICAL ABORTION.

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KEYWORDS | COMMUNICATION DESIGN, PARTICIPATIVE DESIGN, DESIGN ACTIVISM, STIGMA, MEDICAL ABORTION

ABSTRACT | Medical abortion, is a safe and effective method for terminating pregnancies. Despite its widespread use and legal availability in many countries, stigma and misinformation persist, hindering access and comprehensive understanding. Stigma related to abortion can have significant consequences: it can discourage individuals from seeking safe and legal healthcare options, leading to potential health risks. Therefore, addressing this stigma is critical to ensuring the well-being and autonomy of individuals seeking medical abortion.

One of the most powerful tools that can be used to help break down these ideological barriers is communication design: it is crucial in shaping societal debates and influencing public views on complex, contemporary issues. It serves as a vital medium for disseminating information, presenting options, and evoking emotions. When dealing with sensitive and intricate subjects like abortion, the intersection between ethical considerations and design research and practices becomes evident.

This paper presents a project for a communication campaign on medical abortion created through a participatory design process which saw, in addition to the figure of the designer, the participation of stakeholders, activists, individuals with personal experiences of medical abortion, anthropologists, experts in reproductive health and users. The idea behind the project is to move away from the standard narrative on these issues, exploiting the language of animated communication to convey information on the topic in a clear, engaging, empathetic and effective way. The collaborative and user-centered approach of the project highlights the potential for communication design to create meaningful change in public perception and policy surrounding reproductive health.

1. Introduction

Abortion is a simple medical intervention that can be effectively managed by a wide range of healthcare providers using medications or a surgical procedure. In the first twelve weeks of pregnancy, medical abortion can also be safely self-managed by the pregnant person outside of a healthcare facility (e.g., at home), in whole or in part (WHO, 2021). Despite being a common healthcare practice, it also constitutes one of the leading causes, if not performed safely, of maternal deaths and morbidity. Each year, approximately 73 million induced abortions occur worldwide (Bearak et al., 2020), and 4.7–13.2% of maternal deaths can be attributed to unsafe abortions: in developed regions, it is estimated that 30 women die per 100,000 unsafe abortions. In developing regions, this number rises to 220 deaths per 100,000 unsafe abortions (Say et al., 2014).

The lack of access to safe, affordable, timely, and respectful abortion care, along with the stigma associated with abortion, jeopardizes the physical and mental well-being of women throughout their lifetimes. Therefore, access to safe abortion is a fundamental component of sexual and reproductive health and rights. It is a complex issue that concerns public health, a fundamental human right, and a valid indicator of social and gender inequalities (Torrisi, 2023).

Despite the legalization of abortion in most Western countries between the mid-1960s and the mid-1970s, the legitimacy of the practice in hospital settings has not become a point of agreement among all social parties, and even less so, societies in which abortion has been legalized have been affected by processes of full moral legitimation of the practice (Lalli, 2013). Although abortion is now a universally recognized practice (Boltanski, 2007), it continues to be the focus of heated debates involving political, moral, social, and religious spheres; the discussions on the topic often oscillate between indignation and tolerance (Ferrero, 2021).

This is mainly due to the fact that, as philosopher Chiara Lalli writes, “many issues are concentrated around abortion: nature, pain, the conception of women, the morality of manipulations, the inexhaustible discussion on the status of the embryo, motherhood as destiny or as the only true desire of women” (Lalli, 2013, p.34).

The social stigmatization of abortion is a societal phenomenon that varies depending on the country and culture; it is constructed and reproduced locally through different paths. In the article “Conceptualising abortion stigma,” the authors propose a definition of abortion stigma as a negative attribute attributed to women seeking to terminate a pregnancy that marks them, internally or externally, as inferior to the ideals of femininity. Choosing to avoid a specific birth, counters the prevailing view of women as perpetual life-givers and asserts women's moral autonomy in a way that can be deeply threatening (Kumar, Hessini, and Mitchell, 2009).

The stigma built around abortion is not only a tactic of activism for pro-life advocates; it is also enabled, and sometimes perpetuated, by the discourse of those who declare themselves pro-choice. At best, the dominant messages of abortion rights advocates - that abortion is a woman's choice and that reproductive rights are a legacy of enlightenment liberalism - remain silent on the issue of abortion stigma. At worst, the political and activist work of abortion rights advocates reinforces the idea, shared by patients who have had abortions, their supporters, healthcare providers, and the general public, that abortion is shameful and frightening (Ludlow, 2012). Therefore, although abortion is now a common, tested, and safe procedure, attitudes towards it, accompanied by propaganda and hostility from the pro-life movement, increase the stigma surrounding it. These negative attitudes have an impact on the lives and mental health of both those seeking abortion and those providing it.

In this highly stigmatized space, communication design plays a key role: communicative artifacts on the topic convey messages of great importance, both obviously for the theme addressed, and because in many cases the audience consists of individuals who find themselves in a condition of fear, uncertainty, and loneliness. When the narrative surrounding abortion changes, the possibility of a new mentality and different behaviors towards individuals facing voluntary pregnancy termination will arise. Where politics

imposes restrictions on the most private aspects of women's lives, design has the opportunity and the tools to address the imperfect system, increase awareness, and make urgent the need for a more diversified political system.

Starting from these premises, how can the design and communication tools available to the designer be decisive in de-stigmatizing the narrative surrounding abortion? What are the factors contributing to the realization of a communication project on these issues that can be defined as ethical and fair? An attempt to answer these questions is proposed through the story of a participatory communication campaign on medical abortion project carried out for the NGO IPPF (International Planned Parenthood Federation). One of the most important objectives of the campaign presented in the following paragraphs, in addition to the informative one, is precisely to subvert, through communication, hostile narratives, build a network of individuals whose testimonies help eradicate the stigma of abortion, and activate a new generation of politically engaged supporters.

To achieve this, the working methodology, based on a participatory design process articulated in six phases, involved a plurality of actors, including designers, experts on the subject, activists, and target users. The articulated and complex participatory design process has proven to be the fundamental key to constructing communication capable of engaging and informing the audience without instilling fear and feelings of guilt.

2. Participatory Design: Context and Tools

The involvement of end users in the design process has undergone significant and profound evolution in the field of design over the past sixty years. Participatory design is characterized as an approach to involve users in the design phase; thus, participatory design is seen as a way to address the unattainable design challenge of fully anticipating or imagining the use of a product, service, or communicative artifact before actual use occurs by people (Redström, 2008).

The approach to design by designers has changed radically over the years. There has been a shift from a total focus on designed artifacts and their functions to usability, through various methods of user testing, studying their usage, and involving potential users in the design process (Ehn, 2008). Examples of such approaches range from user-centered design focused on use and usability, as in User Centered Design (Ritter et al., 2014; Chilana et al., 2015; Gasson, 1999; Norman and Draper, 1986), to contextual design focused on the context of use (Holtzblatt and Beyer, 1997; Wixon et al., 1990), to contemporary experience design approaches focused on creating user experience (Sanders and Dandavate, 1999; Sikorski and Garnik, 2010; Quiñones and Rusu, 2019).

User-centered design, which originated in North America in response to usability issues in interaction with information systems, represented the first attempt to shift focus from technologies to people. From this point onwards, ordinary people have increasingly gained space and different roles in the design process. Since the 1990s, UCD has evolved, especially following the results obtained from its application in research and design projects, it has expanded its goals, developed new user study techniques, and changed the perspective through which to guide the user's role in the design process (Rizzo, 2009).

The most recent approach is that of co-design, which is based on the active participation of people as designers through intensive workshops with participants, focusing on visual activities and direct manipulation. For these activities, co-design develops specific toolkits based on pre-determined objectives. Therefore these tools differ from those used in participatory design which can be identified in interviews, focus groups, and questionnaires. All these approaches somehow seek to meet the challenge of anticipating, or at least predicting, and designing for use before it actually takes place – design for use before use. (Redström 2008).

Participatory design, which is the methodology used for the production process of this campaign, is placed in this design context with particular attention to people participating in the design process as active users. Studying what people think, what they do, the uses they manifest, and especially how they narrate what they have experienced, allows understanding experiences and placing this knowledge at the basis of generating design ideas.

Since the 1970s, design has felt the need to observe people and their behaviors more closely, placing them in their context. In this initial phase, which saw the field of application mainly in home informatics, the observation talked about was a one-way activity: the designer was the observer, while the user was only the object of observation. Subsequently, this strongly asymmetric relationship between active observer and passive observed was questioned. It was realized that relationships with the context, given their complexity, could not be understood without some form of active involvement of the user. This reflection led to the definition of a new user figure: the user as an "expert actor." That is, as an active subject and bearer of knowledge that only he, thanks to his direct experience, can truly have. User experience as a new field of analysis, and the design experiments based on this, thus became a much-debated topic in the design community (Manzini, 2009).

The tradition of participatory design (Bjerknes, Ehn, and Kyng 1987); (P. Ehn 2006) has been to ensure that end users of a product or design service are involved in the design; it has its roots in movements for the democratization of work in Scandinavian countries. In the 1970s, participation and joint decision-making became important factors in relation to jobs and the introduction of new technologies. Participatory design began from the simple point of view that those involved in using a product should have a say in the design process. A political belief that did not anticipate consensus, but also controversies and conflicts around an emerging design object. Therefore, participatory design sided with weak stakeholders in terms of resources (typically local unions) and developed project strategies for their effectiveness and legitimate participation (Ehn, 2008). The Norwegian Union of Iron and Metal Workers (NJW) initiated one of the first participate design projects in collaboration with researchers from the Norwegian Computing Center from 1970 to 1973. The goal was to involve workers in designing a computer-based planning and control system for their workplace. A plan was devised, based on a participatory approach and inclusion of workers' knowledge, with various activities for unions, including work groups to discuss and find solutions through action programs, evaluations of existing information systems, and proposals for change. Researchers participated with conferences and support in developing project outcomes. In addition, educational material was developed, in the form of a textbook, to support these activities (Van der Velden and Mörtberg, 2015).

Building on these early experiences, the subsequent decades saw the creation of numerous tools aimed at capturing the motivations and meanings behind people's actions in their context. The designer first became an observer and then a mediator, capable of interpreting people's active narratives. Today, in participatory design, in addition to the already mentioned standard tools, a series of remote collaboration tools made available by web technologies and open and peer-to-peer architectures (P2P) are also used. All these tools are increasingly being used to test the initial hypotheses of a project. To allow the involved actors to map the space of possibilities and verify the existence of alternative hypotheses. As is quite evident, their use, if done consistently, implies a profound innovation in the design process. But not only that. It also implies, and above all, a profound change in the role of designers (Manzini, 2009).

A complementary reason for using the participatory methodology, and in the long run probably the strongest motivation for its use in many contexts, has been to ensure that existing skills could be valued and all useful resources used in the design processes. In summary, it could be said that two types of values strategically guide participatory design. One is the social and rational idea of democracy as a value that leads to considering the conditions for adequate and legitimate user participation. The other value could be described as the importance of involving the "tacit knowledge" of participants in the design process, not just their formal and explicit competence.

In the following paragraphs, it will be illustrate how, through a participatory design process that involved a large number of expert actors and target users, a communication campaign on the topic of medical abortion was designed.

3. The Campaign: Abortion Pills

The idea behind the communication campaign commissioned by the non-governmental organization IPPF is to create an international digital informational campaign on the topic of medical abortion. The purpose is to communicate medical practice-related information to users, departing from standard narratives on the topic, through the effective and captivating language of animation.

As anticipated in the introduction, the issues surrounding the topic of voluntary termination of pregnancy are delicate, and often the communication built around them is influenced by political, cultural, religious, and social suggestions. Aggressive communication on the subject can lead to terrible consequences.

The central theme of the campaign is medical abortion in all its complexity: history, global usage, medical procedures, information on support networks, explanation of the procedure and bodily reactions after administration, and an overview of how it works in different parts of the world. All these topics create a comprehensive narrative, which, starting from historical references on the use of misoprostol, the drug used in combination with mifepristone is used in the medical abortion procedure, initially used as a medicine to treat gastric ulcers and then informally used as an abortifacient drug, offers an overview not only of the purely clinical aspect of the procedure but also, and above all, of the support network and psychological aspects of facing a voluntary termination of pregnancy.

Due to the presence of medical, psychological, legislative, and civic-related themes, the support of a plurality of actors was fundamental. Indeed, at the project's core, it was decided to integrate the normal workflow of producing a standard communication campaign with a participatory design process that involved collaboration between various figures internal and external to the NGO: in addition to the designer, anthropologists, copywriters, activists, target users, and experts in abortion practices from a medical and legislative perspective also collaborated on the project. These different actors worked synergistically throughout the project, contributing to different phases of the project according to their expertise.

The target audience chosen to work on is young adults, including people aged between 25 and 40 years old: research has shown that the highest percentages of voluntary pregnancy termination mainly occur in this age group. From the analysis conducted on personas, it emerged that the target primarily seeks information on social media using smartphones; therefore, two social media platforms were chosen for distributing the campaign: TikTok for the younger age group (25-32) and Instagram for the older age group (33-40). Both social media platforms, despite presenting different characteristics and purposes, share common elements, the most macroscopic of which is the use of video to communicate, whether it be a reel, a story, or a live stream.

The choice of distribution platforms influenced the definition of the campaign's output type; specifically, based on the typical consumption pattern of these social media, a series of short vertical format videos were chosen. The vertical format is conditioned by the choice of smartphones, allowing the video to be viewed in full screen, since these social media platforms currently do not allow for rotating the viewing mode. The choice to make a series of short videos, in total ten videos were made with a duration varying between one and two minutes, rather than a single video is dictated by several factors: firstly, for ease of viewing, single-topic consumption is simpler and more manageable than a long single video; secondly, given the increasingly reduced attention spans and the shrinking space dedicated to learning a subject (Iotti 2020), the brief single video is certainly more appealing to the identified target.

The concept behind these videos is to create ten individual stories, each on a specific theme, with a beginning and an end, but ensuring that these ten elements are linked by the style of the illustrations and

the character of animations. In practice, each video is conceived as a micro theme within the macro theme of medical abortion: it can be viewed individually without following a specific order, but when put together with all the others, it forms a complete picture on the topic. The style of illustrations, typographic choices, and color palette constitute the distinctive character of the campaign: although the subject brings to mind a decidedly "medical" cold color palette often seen in campaigns on similar topics, the desire to position oneself in a certain contrast with what already exists is manifested precisely by the chromatic, font, and representation choices, as will be illustrated in the following paragraph.

4. Methodology

The production of this campaign involved six phases of work (Fig.1) , which saw the involvement of various actors and the use of multiple design tools and methodologies depending on the needs presented by each stage of the project. All contributions from the professionals involved, alongside the work of the designer, significantly contributed to the development of the project in every aspect: thanks to the variety of skills brought to the table, it was possible to enrich the design process with contributions that offered a composite view from different perspectives.

Among the figures involved, the work of anthropologists, experts in voluntary termination of pregnancy, copywriters, and communication consultants led to the production of the scripts for the ten videos; the synergy of these figures ensured that the narrative was always positive and as clear and effective as possible. Interviews with activists, who are already involved in communicating information, testimonies, and resources on the topic through various means, building important support networks in the area, were crucial in the concept phase to steer the project in the right direction. Finally, focus groups and questionnaires provided the opportunity to test the artifacts and correct some images and words to ensure that the concept expressed by the voiceover was represented in the best possible way.

Although the campaign was primarily designed for the Italian territory, an English version was also produced and then subtitled in six other languages. The internationality of the campaign provided an opportunity to create moments of comparison and focus groups for participatory design both in Italy and abroad, in this case within the European territory.

The design methodology involved pre-production, production, and post-production phases accompanied by three phases of participatory design: each production phase corresponded to a feedback phase, focus groups, and comments that led to the next phase.

Below, we will outline the main co-design phases grouped into three paragraphs, each of which presents two work phases that coincide with the three production steps of the project.



Figure 1. Diagram of the project methodology: steps, phases and actors involved in participatory process. Photo: © Giulia Panadisi.

4.1 Step 1: Interviews + Pre-Production

Starting from the brief provided by the client, the first phase of the project addressed the pre-production and the narrative construction. The work began with exploratory discussions between the NGO consultants, who were responsible for the scriptwriting, and the designer, who produced concepts, schematic illustrations, storyboards, and style frames. The initial discussions served to deepen the understanding of the topic, identify potential strengths and weaknesses of the project through the SWOT analysis, define the number and the characteristics of the project outputs, identify the target audience, and select the main distribution platforms.

From these early creative moments, it was decided to initiate an open dialogue with a broader audience of potential users and abortion activists. Through two days of interviews, conducted before the definition of the project concept, forty-eight people, including activists and potential user-viewers, expressed ideas, feelings, fears, and desires regarding the project brief. This involvement was immediately very useful and appreciated by both sides. In this way, stakeholders had the opportunity, in the initial phase of the project, to gain an "outside" perspective from a group of people working in the field, the activists, who provided a very broad and knowledgeable view on the topic, collecting references and materials useful for a more effective understanding. The viewpoint of some potential campaign viewers was also very useful, both to capture their expectations and to understand the level of knowledge about the topic among the audience: this ensured the use of a scientific language understandable even to a non-specialized audience. From the involvement of the activists, moreover, a relationship of openness and the possibility of sharing and sponsoring the campaign on their channels immediately emerged. This factor also proved to be very important because it ensured a first part of the campaign's promotion free of charge and widespread through different media including various social, web, and print.

The collection of these numerous inputs led to the definition of a creative and strategic concept: the style chosen for the campaign is two-dimensional vector illustration, characterized by a pop color palette; characters are depicted with skin and hair colors completely outside of normality to avoid any association with races and ethnicities and to distance themselves from any stereotypes of women and femininity narrated in mainstream communication artifacts (Fig.2). The script avoids direct dialogue and features a lively female voice-over; in the early stages of the project, voices generated with artificial intelligence tools are used to allow for quick audio and text modifications after feedback and focus group stages with the target users. The production of storyboards progresses in the direction of the concept, with nothing directly referencing the medical environment (such as internal organs, fetuses, surgery, etc.), but everything is abstracted into highly dynamic and colorful animated geometries.



Figure 2. Some style frames of the campaign. Photo: © Giulia Panadisi.

4.2 Step 2: Collaborative Review + Production

The pre-production phase was followed by a verification and feedback phase on the produced material (Phase 3): consultants, experts in abortion practices, and activists had the opportunity, through online work-sharing tools, to comment on the texts and storyboards, identifying inaccuracies, unclear elements, or potentially ambiguous aspects. This review was very important to refine the texts and perfect the storyboards, allowing for a smoother transition to the next phase, avoiding excessive changes during production, which would have been much more problematic to implement.

The fourth phase corresponds to the production phase of the animated artifacts. The workflow is organized into two production blocks, each comprising five videos, allowing for an initial review between consultants and the client of the first five, while the production of the second block takes place, followed by modifications during the review of the second block of five video. The production phase first involved preparing assets for animation and then the animation process for the ten videos. Although the animated artifacts can be viewed individually, they all share the same style and dynamics to give a unique and recognizable character to the entire campaign. The chosen animation technique is 2D because, from the initial interviews, it was found to be the closest animation tecnique to the chosen target audience.

4.3 Step 3: Focus Group + Post-Production

After the production phase of the artifacts and an initial internal review within the stakeholder group, a survey is circulated online with the dual objective of gathering information on the perception of abortion by a broad, non-specialized audience and recruiting volunteers within the target demographic to participate in focus groups. With approximately 500 responses to the survey, 100 participants are selected, further divided into ten groups; each group of ten individuals participates in a focus group. The online focus groups are organized on different days, with each group presented with a combination of three videos, divided into overarching topics, along with a questionnaire to be completed for each video.

From the focus group sessions, a wealth of data emerges, systematically organized through questionnaire responses, providing valuable feedback on the campaign. The focus groups are generally successful, with users giving positive feedback on the comprehensibility, engagement, and aesthetics of the animated products. The most significant finding is that at the end of viewing, medical abortion is perceived by viewers for what it actually is: a medical procedure one is free to choose. Questionnaires completed during the focus groups and verbal testimonies reveal that the video narratives are perceived as rigorous and impartial, yet the colorful and positive imagery, divergent from stereotypes on the topic, elicit positive reactions from viewers.

The main areas for improvement involve minor text modifications, the choice of one word or verb over another, or the use of a complete word rather than an abbreviated acronym. This fifth phase represents a crucial juncture for the project: it allows for necessary text modifications and yields a more reasoned and comprehensible version of the videos.

Following subsequent revisions after the focus groups, the project enters the final phase of work before the campaign launch: post-production. Since the artifacts are entirely digital, without live-action imagery, post-production primarily involves recording the final speaker in both Italian and English, performed by a professional, and finalizing the audio mix with the new speaker for all videos.

During this phase, distribution and promotion strategies for the campaign materials are also defined, including video launch plans, creation of social media profiles and corresponding editorial plans, marketing and communication strategies, and plans for engaging the audience through stories, interviews, and live testimonials.

5. Conclusions

In conclusion, the project presented in this paper has shed light on the potential of communication design in addressing highly complex and delicate issues. It has been demonstrated how participatory approaches can help to break down the stigma surrounding medical abortion. By actively involving stakeholders and the target audience throughout the design process, a campaign has been developed that not only educates and informs the public on the topic in a transversal manner, but also promotes empathy, understanding, and solidarity.

It is well-known that designers wield powerful design and communication tools; they can steer their work towards an ethical dimension of the profession by serving the community. This practice should not be entirely subservient to the commercial logic of consumerist society but should rediscover project areas relevant to improving human life quality and redefine new priorities in the scale of professional values. To achieve this, the designer cannot act alone in project development. Storytelling designed for a campaign alone cannot change a segment of society's view on a particular issue, but when integrated into a participatory project, it can be enriched, refined, and shaped around people, thereby becoming effective and engaging.

Throughout all stages of work, complexities related to addressing sensitive issues concerning abortion were encountered. The participation of various actors in different parts of the project ensured that the campaign reflected diverse perspectives, conveying real experiences and collective sentiments. It has already emerged from the data collected following the focus groups that initiating participatory design from the early stages of work has brought tangible benefits in all subsequent phases, making the workflow more agile and effective. By approaching creative work with inclusivity, accessibility, and openness in design decisions, an effort was made to create a campaign that resonates with a wide audience, challenging misconceptions and prevailing stereotypes on the topic.

The main difficulties encountered in the development of the pre-production and production phase were mainly linked to the use of terminology and the updating of the legislative rules that regulate the subject in the various countries of the world. The final text of the videos has seen many revisions, both to make the text understandable to non-specialist users and to ensure inclusive and positive language. Furthermore, some rules have changed in a few weeks and this has made it necessary to remove some scenes and add new ones.

At the time of writing this paper, the last phase of the project, the sixth, has been completed, and the campaign launch is awaited in the coming weeks. It will be crucial to conclude the work with an evaluation phase, where the actual results of the campaign can be determined: assessing its effectiveness and impact, both in terms of changing attitudes and behaviors related to medical abortion and reducing stigma within communities and healthcare systems.

Furthermore, this project serves as a good starting point for envisioning future research to evaluate the scalability and adaptability of participatory design approaches in addressing other complex issues on similar themes, where stigma prevents an informal view on the subject, thus contributing to the broader discourse on the role of communication design in promoting social change and equity in public health.

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P/REFERENCES OF DESIGN

INTEGRATING DESIGN THINKING WITH VALUE SENSITIVE DESIGN THROUGH A SYSTEMS THINKING APPROACH.

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KEYWORDS | DESIGN THINKING, VALUE SENSITIVE DESIGN, SYSTEMS THINKING

ABSTRACT | The Value Sensitive Design Thinking model (VSDT) is a hybrid conceptual model proposed in this research paper. It integrates the Design Thinking (DT) and Value Sensitive Design (VSD) frameworks by adopting a Systems Thinking (ST) perspective. DT is a human-centered design approach that emphasizes users' needs through empathy, ideation, prototyping and testing. VSD focuses on discovering and addressing value tensions that arise in complex design scenarios. With this proposed hybrid approach, we address some of the shortcomings of the two frameworks, by viewing their differences as an opportunity for VSDT to be informed and complemented by both. VSDT relies on a systemic perspective for uncovering relationships, feedback loops and emergent properties of systems which, for which and within which we design. We argue that both DT and VSD are systemic in nature, albeit implicitly. By making the importance of ST more explicit, DT and VSD can be combined using ST as a common ground. Based on the fundamentals of systems theory, our suggested model expands upon the current knowledge and toolkits of these two frameworks. We suggest a structured approach for VSDT as a design process, with defined stages and tools, achieved through a comparative analysis and integration of DT and VSD. The potential of VSDT in addressing complex issues is discussed, especially in relation to abstract concepts such as wellbeing, sustainability, and ethics. Finally, we explore the applicability of VSDT offering guidance for researchers and design practitioners who might incorporate our model into their practices.

1. Introduction

The world is confronted with a multitude of complex issues in all aspects of life, from the global challenges of our era to the intricacies of individual wellbeing and societal progress. These are often characterized as “wicked problems” (Coyne, 2005; Rittel & Webber, 1973), as their complexity makes them unresolvable using traditional epistemological and analytical approaches relying on a modernist/positivist view, which has been the mainstream way of thinking in the western world for the last two centuries. Our position is that most of these wicked problems are in fact challenges that are the result of human action. They are the consequences (whether intended or unintended) of planned and goal-oriented human action. Design, in the broad sense of the word, as the creation of plans for new things, plays a pivotal role in this. The role of design in contributing to the onset of the Anthropocene has gained mainstream momentum in recent years (Chan, 2018), although it has been recognised throughout the modern history of the design discipline. A design mindset is often presented as a useful approach to tackling wicked problems for people who design referring both to professional designers and to people of other professions who end up designing/planning, such as policy-makers, managers, and engineers. Various tools and methods have been developed to assist designers in doing so. This paper focuses on two design approaches related to tackling complex issues: Design Thinking and Value Sensitive Design.

Design Thinking (DT) is a human-centered design methodology that emphasizes understanding user needs through empathy, redefinition of problems, ideation, prototyping and testing. Its origins can be traced back to the 1950s and 60s, stemming from research on design methods. It encompasses an effort to lay out “designerly ways of knowing and thinking” (Cross, 1982, 2012), meaning tools, methods and mental models that designers typically use in their practice. Over the years, DT has proven to be adaptable to various contexts, making it relevant not only in design but also in other fields, embracing the zeitgeist of each era. Its capacity in dealing with complex issues and wicked problems has been noted (Buchanan, 1992; Cross, 1982; Matthews et al., 2023), and its application extends beyond design domains.

Value Sensitive Design (VSD), on the other hand, is an approach to design that puts values in the forefront of the design process. Similarly to DT, it offers a methodology with three stages of conceptual, empirical, and technical investigations (Friedman et al., 2008), supplemented by a rich set of methodological tools (Friedman et al., 2017). With its roots in technology development and human-computer interaction (HCI), over the years VSD has matured and has proven itself as a versatile design tool in various use cases across the broader design discipline. VSD, as a tool for taking values into account in design, is faced with what is arguably one of the most complex issues of design; the question of design ethics (Fenn & Hobbs, 2015; Sweeting, 2018).

We recognize the significance of both these design approaches in advancing design and empowering designers with new tools, however both have received varied valid criticism. In this paper, we claim that a Systems Thinking approach both to VSD and DT can help alleviate some of the issues highlighted by such criticism. We present our case for synthesizing VSD and DT into a new hybrid model we call Value Sensitive Design Thinking (VSDT), building upon foundations of Systems Thinking and systems theory.

2. DT and VSD Explored

Design Thinking (DT) has become increasingly popular in management and business over the past two decades. It is often pitched as a corporate tool for harnessing innovation and creativity. Several flavours of DT have been proposed (Dam & Siang, 2020), which are typically intended for individuals in leadership and management roles rather than design professionals. According to a relevant literature review (Micheli et al., 2019, p. 131), the most notable of these applied models of design thinking are IDEO’s design thinking approach (Kelley & Littman, 2001), d.school’s 5-step design thinking process (Hasso Plattner Institute of Design, 2010) and IBM’s Enterprise Design Thinking (Lucena et al., 2017). This has led to a fork/schism in the design thinking discourse, one maintaining its roots in design process, practice and academic design research/theory, and another embracing its business-oriented direction. Some argue that there are three or

four types of design thinking (Dell'Era et al., 2020; Love, 2021), but for the intents of this paper, we focus on this diptych approach of academic/designerly design thinking versus a technocratic/managerial Design Thinking (see Cross, 2023).

Corporate Design Thinking indicates design processes and methods to be used by non-designers, such as managers, consultants, and educators. It aims to help companies design better products, gain a competitive advantage, and increase business revenue, prioritising efficiency, scalability, and business outcomes (Liedtka, 2018). Designerly thinking, on the other hand, is a practice-based approach to problem-solving, making sense of things, and developing new knowledge. It is rooted in understanding design practice and establishing itself as a discipline focused on solving problems and improving people's wellbeing. The two concepts, design thinking and designerly thinking, have different focuses, but they also influence each other. The design community cannot ignore the interrelatedness of these two fields (Laursen & Haase, 2019).

Despite its widespread adoption, Design Thinking faces several criticisms (Kolko, 2018). First, it tends to oversimplify complex challenges by focusing solely on users' experiences without considering the situational context dynamics. Furthermore, corporate Design Thinking lacks a clear theoretical foundation, leading critics to view it as superficial compared to its academic / designerly theory-based counterpart (Johansson-Sköldberg et al., 2013). Design Thinking seems to foster homogenous solutionism in the form of a one-size-fits-all managerial toolkit (Woudhuysen, 2011) based on a western philosophical perspective (Gordley-Smith & Hackett, 2023). DT seems to be emphasizing a checkbox mentality, iteration and rapid prototyping that appeals as a go-to tool for innovation (Hernández-Ramírez, 2018), at the expense of diverse perspectives, meaningful empathizing, and consideration for social systems (Lee, 2021). DT, portrayed as a tool that can offer a competitive advantage to companies, can lead to situations where the ethical considerations and societal impacts of the solutions and ideas generated is overlooked (or at least not prioritized), potentially contributing to unintended and/or unanticipated consequences (Parvin & Pollock, 2020).

In the grand scheme of things, design tools like Design Thinking, intended for non-designers, are valuable in that they provide a more accessible and practical approach to design that can be applied by a wider range of people. However, these tools often oversimplify complex design issues and prioritize efficiency and scalability over empathy and reflection. On the other hand, designerly thinking provides a more comprehensive and nuanced approach to design, but it can be criticized for being too abstract and out-of-sync with practical realities of designing for the modern era. Nevertheless, we believe that these two directions of DT have the capacity to complement each other, and knowledge and tools from both should be used in design undogmatically.

Value Sensitive Design, on the other hand, is a widely recognized framework for integrating ethics in the design process of technology. Despite its widespread use, VSD has faced several criticisms. One major concern is the lack of a normative, ethical commitment, making it challenging to justify the implementation of values in design (Manders-Huits & Zimmer, 2009). Additionally, VSD has been criticized for its "positivist problem," which presupposes a connection between the design and use contexts (Albrechtslund, 2007). Furthermore, VSD's lack of commitment to a specific ethical philosophy has led to the proposal of complementary theories and approaches, such as virtue ethics (Reijers & Gordijn, 2019), norms-based approaches (Martin et al., 2023), and procedural ethics fostering wellbeing (Cenci & Cawthorne, 2020).

The criticisms of VSD's theoretical grounding could be interpreted as indicators of crucial ontological issues within the framework. However, we interpret them as an indicator that VSD has the ability to take in new ideas and alternative approaches both to its theory and to its methodologies, making it easily adaptable to new needs. As such, VSD as a framework is meant to be flexible and open to change, which allows it to grow and evolve over time. The incorporation of various theories as ethical lenses is a good example of how VSD can be adapted to address complex design challenges.

2.1 DT and Complex World Issues

Researchers have investigated the application of design thinking in diverse domains dealing with complex issues such as improving well-being and sustainability. Dorst and Tietz (2011) explore an original approach to analysis within the context of design for social wellbeing, aiming to enrich the traditional focus on the creative and generative elements of design thinking. ElSayary (2023) investigates the impact of incorporating design thinking processes in interdisciplinary courses to improve students' wellbeing, employing a modified PERMA-PH model. Thomas et al. (2020) explore the application of design thinking techniques in addressing organizational factors and individual needs to improve the wellbeing of residents, yet the effectiveness of these approaches in complex organizational contexts remains uncertain. Kreitzer et al. (2019) discuss the integration of design thinking and systems thinking to develop strategies for addressing stress and burnout among health professionals, highlighting the potential synergy but also the complexities in implementation. Buhl et al. (2019) explore the potential of design thinking in promoting sustainability-oriented innovation development. By examining key principles of design thinking and proposing a research framework, the research highlights the applicability of design thinking in addressing complex socio-ecological problems and driving sustainable innovation. Shapira et al. (2017) examine the integration of design thinking and strategic sustainable development to achieve more strategic and sustainable outcomes. Through action research and expert feedback, their study proposes a prototype for Sustainable Design Thinking (SDT) aimed at addressing complex socio-ecological challenges. Wilkerson and Trellevik (2021) present a combined methodology that integrates design thinking with systems mapping to improve problem definition in sustainability-oriented innovation processes. By employing systems mapping in problem definition, the study aims to provide a holistic understanding of sustainability challenges and enhance empathetic design thinking approaches. Kagan et al. (2020) analyze the potentials and limitations of design thinking in sustainability jams through an in-depth case study. They explore how design thinking, when applied within sustainability jams, can generate solutions for sustainable futures. However, the study also identifies limitations such as user-orientation and insufficient complexity, suggesting directions for improving the effectiveness of sustainability jams in addressing complicated sustainability problems. While these studies emphasize the potential benefits of DT for complex global issues, challenges still arise regarding the subjective interpretation of values and the scalability of interventions throughout the design process.

2.2 VSD and Complex World Issues

Furthermore, various researchers have attempted to address ethical implications and plural values in technological development within the field of Value Sensitive Design (VSD). In their work, Friedman and Kahn (2000) introduce VSD to assess the ethical implications of augmented reality (AR). They examine seven core values—psychological well-being, physical well-being, privacy, deception, informed consent, ownership and property, and trust—in the context of AR. Additionally, they outline their application of VSD to AR technology focused on natural environments. Ballard et al. (2019) introduce Judgment Call, a game for industry product teams to surface ethical concerns using VSD and design fiction, demonstrating its effectiveness in considering technology from multiple perspectives. Cenci and Cawthorne (2020) discuss the challenges of integrating ethical ideals and values in high-tech product design, proposing refining VSD with a capability-based procedural approach to ethics, highlighting the need for a more resilient ethical framework. Mok and Hyysalo (2018) illustrate how conflicting values involved in advancing solar photovoltaics in heritage can be addressed using the VSD framework, emphasizing the importance of finding a working compromise among conflicting values. B. Barn and R. Barn (2016) introduce a refinement of the Value-sensitive Action-reflection model used in co-design to address the tension between values and resilience, acknowledging the ambiguity created during the co-design process and its impact on resilience building. Cawthorne and Cenci (2019) describe the application of VSD methods to the technological development of a specific drone platform, demonstrating how VSD can be used to develop ethical drones but also highlighting the complexity of balancing human welfare and environmental sustainability. Through a VSD approach, Prieto et al. (2023) investigate how technology can support doctoral students' progress, well-being, and persistence, revealing promising insights but also underscoring the need for effective evaluative frameworks. Finally, Ishmaev et al. (2023) focus on ethical design frameworks for self-

sovereign identity (SSI) solutions, presenting a case study of VSD applied to the uNLock medical credential sharing platform. They evaluate VSD's applicability and quality, revealing challenges such as “value branching” in SSI solutions and the need for context-specific evaluative frameworks in ethical design. While all these studies offer valuable insights, they fall short in fully assessing the validity of all components of the VSD approach in practice, conveying the need for a systematic approach that includes tools for stakeholders to reflect on their own values during the design process.

2.3 DT and VSD Tools

Both DT and VSD offer a rich toolbox of methods that can be used in the design process, each tailored for a particular design stage (Friedman et al., 2017; Friedman & Hendry, 2019; Hasso Plattner Institute of Design, 2018; IDEO, 2003; Lewrick et al., 2020; Liedtka & Ogilvie, 2017). DT has a set of tools for each design stage. Some of the most widespread are: 30 shapes, What? How? Why?, Use Scenarios, How Could We, Route Map, Powers of 10, 2x2 Matrix, Point of View (POV), Five “Whys?”, Affinity Diagrams, Interviews aimed at Empathy, Interviews with Extreme Users, Photo Diary, Card Sorting, User Personas, Fly on the Wall, 6-3-5, Questions “How could we...”, Brainstorming, I like it - I would like it - What if, Prototyping for Empathy, Wizard of Oz prototyping, and Video Prototyping (Hasso Plattner Institute of Design, 2018; IDEO, 2003; Lewrick et al., 2020). VSD’s tools include: Stakeholder Analysis, Stakeholder Tokens, Value Source Analysis, Co-evolution of Technology and Social Structure, Value Scenario, Value Sketch, Value-oriented Semi-structured Interview, Scalable Information Dimensions, Value-oriented Coding Manual, Value-oriented Mockup, Prototype or Field Deployment, Ethnographically Informed Inquiry regarding Values and Technology, Model for Informed Consent Online, Value Dams and Flows, Value Sensitive Action-Reflection Model, Multi-lifespan timeline, Multi-lifespan co-design, and Envisioning Cards (Friedman & Hendry, 2019)

Comparing some indicative tools from the two frameworks (see Table 1) will help us decide which toolboxes to recommend for practical application of our new model. Tools of DT and VSD each complement the respective framework and attempt to fulfil its goals. More specifically, DT tools are more focused on the user and their experiences, while VSD tools are centered around the values of different stakeholders. However, both sets of tools share a common goal of understanding and addressing complex design scenarios. Their complementarity allows for the creation of hybrid tools in the intersection of both, that take into account both the user's needs and the values of diverse stakeholders.

Table 1. Comparative presentation of DT and VSD tools. Sources: 1) Hasso Plattner Institute of Design (2018), 2) IDEO (2003), 3 Lewrick et al. (2020), 4) Friedman and Hendry (2019).

Design Thinking tools	Value Sensitive Design tools	Comparison
Journey map (1)	Value Scenario (4)	Both of these tools build a narrative of the user journey, as a means to gain insight on the contexts of use of the design in question.
Five Whys (2)	Scalable Information Dimensions (4)	In these tools, a series of prying questions are used as a method to peel through the layers of complexity and understand core issues pertaining to the design context.
Interviews for empathy (1)	Value-oriented Semi-structured Interview (4)	Interviewing is a common tool for involving users and other stakeholders in the design process, used by both VSD and DT. In each of these cases, the orientation of the interview is being steered to better serve the needs of each methodology.
Card sorting (2)	Envisioning Cards (4)	Physical tools are often useful for the design process. Cards, in this case, offer a tactile, versatile and gamified method to steer the design process. Tools involving cards and other props can be used either during user research or as tools for the designers.
Prototyping for empathy (1)	Value-oriented Mockup, Prototype or Field Deployment (4)	Rapid prototyping of ideas is invaluable for gaining quick insight that can uncover aspects that could not be foreseen just with interviews and drawings of concepts.
Stakeholder map (3)	Stakeholder Analysis (4)	Having a clear overview of the involved stakeholders in a design project is a crucial step and both methodologies use such tools to map the design context and pin-point direct and indirect stakeholders.
Empathy map (3)	Value Source Analysis (4)	Both methodologies employ tools that specialize in a specific aspect that they focus on; empathy for DT and values for VSD. Such analyses at the early stages of a design process are critical both for gaining insight on the project itself, and for steering the next steps of the design process effectively, picking tools and methods that best fit the situation.

3. Systems Thinking for Design

Systems Thinking (ST) is a well-established way of understanding and analyzing complex systems and their interactions (Checkland, 1999; Kim, 1999; Meadows & Wright, 2011). It is a perspective that views the world as a set of interconnected systems, rather than as a collection of individual parts, based on the principles of systems theories such as the general systems theory, complex systems and second-order cybernetics (Laszlo, 1972; Luhmann et al., 2013; Thurner et al., 2018). ST posits that all systems, whether natural or human-made, share certain fundamental characteristics, such as interconnectedness, feedback loops, and emergence. By utilizing various tools and methods, like system mapping, causal loop diagrams, and system dynamics modeling, to analyze and understand complex systems, ST offers an alternative perspective to approaching and tackling wicked problems (Wang & Song, 2023; Zellner & Campbell, 2015).

ST and systems theory have found application in the field of design, offering a comprehensive approach to understanding and addressing complex design issues (Banathy, 1996; Johnson et al., 2010; Norman & Stappers, 2015), leading to the proposal of approaches such as systems oriented design (Sevaldson, 2013) and systemic design (Jones, 2014, 2020; Peruccio, 2017). Academic platforms dedicated to exploring the relationship between ST and design, such as the Systemic Design Association and their annual Relating Systems Thinking and Design Symposium, alongside the rich bibliography on the topic indicate that this combination has proven compatible with and helpful for the design discipline. By adopting a systems perspective, the interconnectedness and interdependencies between various stakeholders, systems, and

contexts become more easily detectable. Understanding the importance of a complex systems perspective for ensuring better design outcomes has been recognized as a necessity for ensuring better outcomes for the world (Escobar, 2018).

Following a similar line of thought, the integration of ST and DT is an existing idea that has been suggested by several academics (Buchanan, 2019; Jonas, 2018; Li, 2002; Mononen, 2017; Pourdehnad et al., 2011b, 2011a) and has been operationalized in design practice (Pohl et al., 2020; Sevaldson, 2019). This combination offers the key benefit of balancing analysis and synthesis for effective problem-solving. Design thinking is used for generating new ideas and solutions through experimentation, iteration, and prototyping, while systems thinking focuses on the importance of understanding the system and its interactions as a whole. These combined benefits have been identified and harnessed by the Design Council, proponents of the Double Diamond design thinking tool (Design Council, 2019; Elmansy, 2021), in their most recent publications on systemic design (Design Council, 2021; Design Council & The Point People, 2021).

Furthermore, a systemic approach appears to be a valid approach for gaining stronger insight on one of the most complex philosophical issues of humanity; that of ethics (Tuan & Shaw, 2016). The field of design ethics deals with the ethical implications of design, both pertaining to its outcomes and to design as a process. A systemic perspective to design ethics offers a promising new direction for design (Pappas, 2023), especially considering design as a discipline that is faced with wicked problems (Sweeting, 2018). VSD, as one of the most impactful methodologies of design ethics (Donia & Shaw, 2021), can benefit from such a systemic perspective. Such an integration has been hinted at in previous works (Pappas, 2023; Umbrello & Gambelin, 2023) but has not been fully implemented yet.

A systemic approach, as offered by ST, seems to have a significant impact in giving design a new holistic perspective and equipping it with tools for tackling complex issues and wicked problems that it often faces. We have indicated that DT and VSD, separately, can have benefits from such an approach. The integration of DT and VSD is a new idea that has been framed as a “design thinking perspective on human rights'' (van Zeeland-van der Holst, 2023). Taking all this into consideration, and in order to address the limitations of DT and VSD, we propose the integration of these two frameworks through a ST perspective. Such an approach can equip designers with tools to better understand the complex relationships and feedback loops that exist within the systems in hand. Potential unintended consequences can be better anticipated, and more informed decisions about the trade-offs and value tensions that arise in complex design scenarios can be made (Miller et al., 2007).

4. VSDT: A Hybrid Conceptual Model

In this section, we present the Value-Sensitive Design Thinking (VSDT) model, our proposal for a hybrid conceptual model that integrates the Design Thinking and Value Sensitive Design approaches based on a Systems Thinking perspective (Figure 1). The design process that led to the development of the VSDT model started with the comparative analysis and critique presented above. It was then followed by brainstorming sessions amongst our research team, in order to conceptualize the direction which VSDT should follow. As a starting point, we view the following points as main principles of VSDT, which also act as design requirements for our proposed model.

- Communication - VSDT should emphasize effective communication between all stakeholders throughout the design process. This includes fostering empathy and understanding of diversity. The designer gets a facilitator role in the design process.
- Documentation - VSDT should recognize the importance of documenting the design process, such as research findings, design decisions, justifying the rationale and decision-making processes behind those decisions.
- Iterative process - VSDT should adopt an iterative design process based on user feedback and emerging insights as the design process progresses. The design process should not be rigid, but

flexible and responsive to these new insights, seeking better understanding towards achieving good design outcomes.

- Systemic approach - VSDT should be based on a systems perspective that acknowledges relationships, feedback loops, interconnectedness and emergence in the design process and the complex systems involved.
- Focus on values - VSDT should consider values and value tensions throughout the design process, ensuring that the final design outcomes align with the stakeholders' diverse conceptualization of ethical values, offering an ethically balanced and acceptable outcome, while potential unintended consequences are better anticipated.
- Human-centered and Humanity-centered approach - VSDT should focus on understanding and addressing the needs and wants of users and other stakeholders, while at the same time adopting a humanity-centered perspective that considers the broader social, cultural, and environmental contexts within which the design is situated.
- Collaborative mindset - VSDT should promote a collaborative mindset that encourages everyone involved to work together throughout the design process, building upon co-design and participatory design practices.

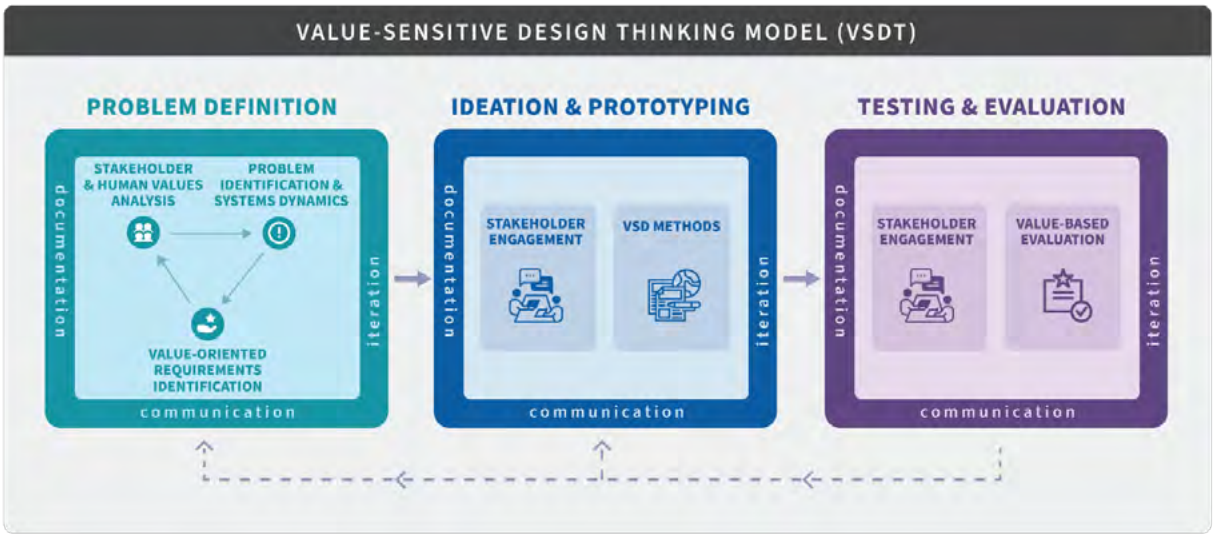


Figure 1. The VSDT conceptual model.

The suggested structure of the VSDT model, resulting from the previous insight and design requirements, involves the following design phases:

1. Problem Definition
   - Clearly articulate the design problem, understanding context, end users, and stakeholders.
   - Identify and prioritize human values as part of the design brief, considering cultural and ethical dimensions
   - Identify value-oriented user requirements

2. Ideation and Prototyping
   - Engage in ideation and rapid prototyping. / participatory elements
   - Extend ideation and prototyping techniques to visualize and test ethical considerations within the design, iteratively refining the integration of ethical principles.
   - Involve stakeholders for comprehensive insights.
   - Implement an iterative design process, adapting to evolving needs and dynamics while continually refining the integration of ethical principles.

3. Testing and Evaluation
    - Involve stakeholders and end users in a value-based evaluation process.
    - Document design decisions and ethical integrations.
    - Communicate the process and outcomes to stakeholders.
    - Continuously evaluate and iterate based on feedback.

Subsequently, we examine each phase of the model in greater detail, developing the VSDT model by offering practical guidance on how to apply it, through indicative examples of how designers can combine the tools that these two approaches have already used. The rationale behind providing the recommended combinations of Value-Sensitive Design (VSD) and Design Thinking (DT) tools lies in their complementary nature and their ability to address different aspects of the design process, while prioritizing ethical considerations and stakeholder values. In order to achieve a systemic perspective, we posit that it is a prerequisite for each combination to take into consideration both the users and stakeholders, and the broader design context, as per the design requirements mentioned above.

4.1 Problem Definition

During the initial phase of Problem definition, thorough analysis is conducted by engaging with stakeholders directly to identify their needs and human values at play. Through grounding problem definition in stakeholder perspectives, systemic analysis, and value-driven criteria, designers can acquire a deeper understanding of the wider context within which the issues are situated. Furthermore, understanding systems dynamics allows designers to better comprehend the interdependencies and complexities present in the problem space. Finally, value-oriented requirements identification ensures that the design process is consistent with the overarching goals and values of stakeholders.

Practical Examples:

- Stakeholder Analysis (VSD) paired with Point of View (DT)
  Designers begin by conducting a stakeholder analysis to identify all parties affected by a proposed design solution.Then, they make use of the Point of View tool to empathize more deeply with users and stakeholders, understanding their needs, desires, and concerns. After gaining an understanding of the wide range of stakeholders and their values, designers can inform the identification of value-oriented requirements.

- Stakeholder Analysis (VSD) and User Personas (DT)
  Designers start by conducting stakeholder analysis to identify key individuals or groups affected by the design. Then, they can create User personas based on the Stakeholder Analysis in order to develop a deeper understanding of the diverse needs, values, and perspectives present within the stakeholder community.

- Stakeholder Tokens (VSD) with Affinity Diagrams (DT)
  Designers use Stakeholder Tokens as a versatile toolkit for identifying stakeholders and their interactions. These tokens are then used in sessions of Affinity Diagrams where stakeholders collectively group and categorize their concerns, aspirations, and values regarding the system's functionalities and features. Through this process, designers can gain insights into the diverse perspectives and priorities of stakeholders and ensure that the design process is grounded in the real-world needs and values of those impacted by the system.

4.2 Ideation and Prototyping

In the ideation and prototyping phase, designers collaborate closely with stakeholders to generate and refine potential solutions iteratively. This participatory approach ensures that diverse perspectives are incorporated into the design process, leading to more inclusive and contextually relevant solutions.

Moreover, VSD methods are integrated into ideation and prototyping techniques to incorporate ethical considerations from the outset. Thus, designers can visualize and test the implications of design decisions on various stakeholders. This process allows for the refinement of systems ensuring that the final solution is ethically sound.

Practical Examples:

- Value Sketch (VSD) integrated with Prototyping for Empathy (DT)
  Value sketches can be used to visually represent design concepts while also taking into account ethical considerations and values. Then, Prototyping for Empathy can be used to create tangible prototypes that allow stakeholders to experience and interact with the design firsthand. By combining those tools, designers can elicit feedback from stakeholders on the ethical implications of design decisions, leading to a better understanding of value trade-offs and preferences.

- Brainstorming (DT) paired with Value Dams and Flows (VSD)
  During the ideation phase, designers facilitate Brainstorming sessions where multidisciplinary teams generate innovative ideas and solutions. Afterwards, they use the Value Dams and Flows method to make design decisions in terms of value tensions. Value tensions may arise when different conceptualizations of values or their design implications conflict among the various stakeholders. Once a tension has been identified, designers have the option to investigate it or report it for further consideration later in the design process.

- Multi-lifespan Co-design (VSD) alongside Bodystorming (DT)
  Designers apply the Multi-lifespan Co-design approach, which considers the long-term implications of technology across multiple generations, involving stakeholders. After gaining insights from this participatory process, designers can then conduct Bodystorming sessions as a roleplaying technique among researchers. By integrating these tools, designers can explore how different value perspectives evolve over time, ensuring that the resulting design solutions are sustainable and culturally sensitive across generations.

- Envisioning Cards (VSD) with Fly on the Wall (DT)
  Designers use Envisioning Cards to depict future scenarios and demonstrate how the proposed design aligns with different stakeholder values and societal goals. This tool acts as an initiator for participatory ideation sessions, prompting designers and stakeholders to imagine and discuss potential features, functionalities, and implications. Additionally, designers can adopt a Fly on the Wall approach, observing users' interactions and reactions on the proposed designs, especially pertaining to the issues identified by the envisioning cards.

4.3 Testing and Evaluation

In the phase of Testing and Evaluation, stakeholders and end users actively engage in a value-based assessment of the proposed design. This participatory process ensures that the opinions of those affected by the design are heard and taken into account. Designers can identify areas of strength, weakness, and improvement that are in line with the values and broader goals of stakeholders by prioritizing value-driven criteria. Through this ongoing engagement and iterative refinement, designers can ensure that the proposed design solutions are ethically and socially responsible. In the VSDT framework, we suggest that the iterative evaluation process should continue until the system meets the predefined value-oriented requirements, and stakeholders are satisfied with the design outcomes.

Practical Examples:

- Prototyping for Empathy (DT) paired with Ethnographically Informed Inquiry on Values and Technology (VSD), followed up by a Cognitive Walkthrough
  Designers simulate user tasks and scenarios using the Prototyping for Empathy tool. Then they employ the Ethnographically Informed Inquiry on Values and Technology method to collect data about emergent complex relationships between various stakeholders. Additionally, designers use the Cognitive walkthrough method (Wharton et al., 1994), following step-by-step procedures and interacting with the prototypes as users would, in order to understand the cognitive processes involved in task completion. Based on the findings from both the Ethnographically Informed Inquiry on Values and Technology and the Cognitive walkthrough, designers iteratively refine the prototypes to address identified cognitive barriers and improve the overall user experience. Design adjustments are made to streamline task flows, enhance clarity and comprehension, and reduce cognitive load on users.

- Value-oriented Mockup, Prototype, or Field Deployment (VSD) paired with In-Person Focus Groups, followed up by a Think-Aloud Protocol
  Designers create mockups, prototypes, or deploy the system in real-world settings using the Value-oriented Mockup, Prototype, or Field Deployment method, focusing on incorporating value-oriented design features and addressing stakeholder values and ethical considerations. Additionally, they moderate in-person focus group sessions with a diverse group of stakeholders who represent different perspectives and interests relevant to the project. During these sessions, participants are presented with the Value-oriented mockups, prototypes, or the deployed system and engage in group discussions, facilitated by a moderator, to share their opinions, insights, and suggestions. Finally, designers organize Usability testing sessions following the Think-Aloud Protocol (Jääskeläinen, 2010), where participants are asked to verbalize their thoughts, feelings, and reactions as they interact with the prototypes.

5. Discussion

VSDT can benefit from the examination of its applicability in real-world use cases. As we have pointed out, VSDT is geared towards complex socio-technological challenges, some examples of which would be the design of equitable healthcare systems, the introduction of inclusive educational technologies, urban sustainability, social media and online community design, and so on. Future research into the practical applicability of the VSDT model must be conducted, with the aim to evaluate the model's performance in such practical settings, comparing its outcomes to those achieved through more typical DT and VSD approaches. To achieve this, potential users of VSDT should be identified and included in further testing and validation of the model. A comparative empirical analysis and field research between VSDT and other competing and/or complementary design frameworks should also be conducted, in order to further assess VSDT's capacity to deal with real world issues. During these further studies, values and value tensions that might arise should also be explicitly investigated and recorded. These further investigations and use cases will demonstrate the versatility of the VSDT model and its potential for application in diverse contexts.

The integration of the systemic thinking perspective is implemented in all of the key phases of the Value-Sensitive Design Thinking (VSDT) model. In defining the problem, understanding users, and prioritizing ethical values of stakeholders, designers are prompted to adopt a holistic viewpoint, recognizing the complex relationships, feedback loops, and potential emergent properties of systems. During ideation consideration of interconnected ideas is encouraged, while prototyping extends beyond visualizing concepts to actively integrating and testing ethical considerations iteratively. Stakeholder engagement emphasizes insights that transcend individual preferences exploring greater impacts, especially in relation to abstract concepts such as wellbeing, sustainability, and ethics. The iterative evaluation process ensures that design outcomes align with the broader context and ethical principles based on stakeholder feedback. Our research indicates that the Documentation - Communication - Iteration tripartite proposed throughout

the design process can significantly enhance the efficacy of VSDT as a tool for addressing the challenges of conflicting, dynamically changing, and ambiguous values encountered when designing systems for humanitarian, social, and environmental change and innovation.

Furthermore, while DT and VSD are tools that envision to be applicable to design as widely as possible, being global frameworks of design, the ability of both to be informed by varied design and philosophical theories, and to accommodate local, situational and cultural sensibilities is a feature that we believe is passed on to VSDT. To further enhance the responsiveness of VSDT towards such questions of locality and inclusion, VSDT can be informed by relevant approaches such as defuturing (Fry, 2020), pluriversal design (Escobar, 2018) and design justice (Costanza-Chock, 2020). We also recognize that VSDT could further benefit from the inclusion of non-western philosophies and from the examination of values beyond their typical human-centredness towards more-than-human perspectives, as a point for further development and expansion VSDT's philosophical foundation in the future.

6. Conclusions

The Value Sensitive Design Thinking framework advances the field of design by integrating Design Thinking and Value Sensitive Design through a Systems Thinking perspective. This approach equips designers with a tool for addressing complex socio-technological challenges, by prioritizing stakeholder values and fostering a collaborative mindset. Grounded on the design theories of DT, VSD and systems theory, the VSDT model remains adaptable and versatile for practical application in diverse contexts, demonstrating its potential to promote more responsible and sustainable design outcomes. The versatility of the VSDT model and its ability to accommodate local or regional preferences of design creates a capacity for more inclusive, contextually relevant and ethical design outcomes.

Future research should continue to further enhance VSDT's theoretical grounding, to explore the effectiveness of VSDT in real-world design scenarios, to evaluate its strength compared to other design tools and frameworks, and to refine the recommended combinations of DT and VSD tools. Still, the current state of the VSDT framework already offers a valuable resource for designers and researchers alike, becoming an available tool for designers dealing with complexity. As the design profession continues to evolve and confront complex challenges, the VSDT model stands as a testament to the potential of interdisciplinary collaboration and shared understanding in promoting more responsible and sustainable design outcomes, through the adaptation of existing and well-established methodologies for the needs of today and tomorrow.

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P/REFERENCES OF DESIGN

PROJECTIVE PROVOTYPE DESIGN: A COLLABORATIVE DESIGN RESEARCH METHOD FOR CO-ANTICIPATING NEIGHBOURHOOD COMMUNITIES' PREFERRED FUTURE URBAN PLACES.

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KEYWORDS | DESIGN RESEARCH, SMART URBAN FUTURES, PROJECTIVE RESEARCH, HUMAN-CENTRED DESIGN

ABSTRACT | This study describes projective provotype design, a novel method for design research which helps address the shortfall between bottom-up, community-centred approaches and the top-down, technology-centred approaches typical of smart city design. As such, projective provotype design utilises the unique knowledge tradition of human-centred design to generate a neighbourhood community's preferences for their smart urban futures and, subsequently, communicates these preferences to a design audience in a manner that is informative, thought provoking and if necessary capable of challenging existing assumptions. Towards this outcome, the study utlises the method of design ethnography to outline key theoretical concerns that impacted the design of the method. This outline is followed by a reflective narrative attesting to the relevance of the method in the applied contexts of co-design project with community members of Westbury, an urban neighbourhood in Johannesburg, South Africa. While the unique method of projective provotype design suggests a robust strategy for the design of smart urban places, responding to the theme of 'ways of living together' the study further suggest how projective provotype design, and design research methods with similar intentions, provide an alternative role for human-centred design; one that bypasses the limitation of human-centred design current emphasis on users, and product development to instead focus on communities and futures research.

1. Introduction

Human-centred design (HCD) has over the last 50 years made significant contributions to the design and implementation of technology into the social world. Of late, HCD practices that leverage human experience to optimise consumption and commercial advantage have become the foci of timeous critique, with numerous voices calling for more nuanced, systemic views of design to emerge (van Velsen, et al., 2022) outside the dominant paradigm of neo-liberal agenda (Escobar, 2018). In this paper, these themes, and a revaluation of HCD are addressed in the context of smart urban futures.

In urban communities in the Global South, tensions emerge between macro-forces of change such as mass urbanisation, rapidly increasing populations, economic stagnation, and climate change (Khatoun & Zeadally, 2016, p. 46); that for many the city remains a colonial construct; and the emergence of technological concepts such as smart cities, and the Industrial Revolution 4.0, which have the potential to improve or worsen these communities' urban futures. Following Fry's recognition of the critical importance of design in constituting a viable future for humanity (2019, p. 159), this paper takes the position that emergent smart urban technologies have the potential to contribute positively to urban transformation in the cities of the Global South. However, for this transformation to occur, it is critical that the design and subsequent implementation of these technologies is considered from the social perspectives of the communities that will live with, and within them.

Smart urban technologies within the construct of Smart Cites are typically conceptualised from the perspective of 'top-down' implementation closely associated with technically inspired innovation and entrepreneurship (Kitchin, 2014, p. 131). There is a growing body of literature and practices that critiques the framing of smart cities as purely technological sites, while offering an alternative 'bottom-up' or citizen-led approach (Cardullo, et al., 2019, p. 55).[1] Problematically, as bottom-up smart city design (SCD) primarily addresses the needs of citizens, interventions can clash with city planning and organisation and ignore the brute reality of macro-forces such as national politics, global economics, and climate concerns (Walravens, 2016, p. 131). The result is that multiple bottom-up projects may occur across a city without any shared goals and potentially conflicting with city planning, each other.

The limitations of an overtly human-centric approach are not unique to bottom-up SCD. In design fields fundamentally concerned with objects and services, a societal agenda is associated with the paradigm of HCD an interrelated set of philosophical, epistemological, and methodological approaches geared towards a consideration of the people who perceive, interpret, use, and live with designed artefacts (Krippendorff, 2000, p. 4). In a similar manner to the relationship between bottom-up and top-down SCD, HCD evolved from, and in contrast to a predominant technological-centred (Giacomin, 2014, p. 607) mindset emphasising technical novelty and performance. However, as evident in its conceptual centrality in fields, such as user-experience, industrial, and service design, HCD has become a dominant design mindset both in terms of practice and education.

While, HCD has proven highly effective for enabling design-led transformation to occur, it is not immune to criticism. First, while HCD often claims to understand and respond to the lived experience of people, in practice HCD is often characterised by poor application and understanding of ethnographic methods (Baskerville & Myers, 2015, p. 28). Second, while advocating a people-first mantra, HCD practices are often deployed towards the manipulation of end-user's emotions and motivations for purely economic concerns. These neo-liberal practices often come at the cost of local knowledge, practices, and culture (Escobar, 2018). Third, HCD's emphasis on human experience as the primary criteria for evaluating the validity of design has become a growing concern as the harrowing effects of climate change become apparent (Russel & Lyndon, 2020, p. 3). Fourth, outside of objects and services deployed in limited user-contexts, HCD struggles to adequately address complex, large-scale systemic problems (Mani-Kandt, 2021). In the

[1] Contributing design fields include urban informatics (McCullough, 2015), community informatics (Day, 2011) and blended spaces design (Benyon, 2014).

remainder of this paper, 'bottom-up' is understood as a HCD approach to SCD, while top-down SCD while highly technological in outlook (Fernández-Añez, 2016, p. 163) also includes priorities such as planning (Dustdar, et al., 2017, p. 249), and delivering services at scale (Khatoun & Zeadally, 2016, pp. 46-47).

Within this broad framing of the relationship between bottom-up SCD, top-down SCD, HCD and technology-centred design, the aim of this paper is to contribute a rich description of an enacted, novel design research method referred to hence forth as projective provotype design (PPD). The intention of PPD is to reflect both a human-centric sensitisation of the aspirational needs of an urban Johannesburg community regarding smart urban technology deployment in their neighbourhood places, and a subsequent meaningful communication of these aspirations to a range of professional designers involved or likely to involved in the design of digitally infused urban environments. In this manner, this research following Walravens' suggestion that focusing on either bottom-up or top-down approaches seldom results in change (2016, p. 132) adopts instead a complementary strategy in which the understandings of HCD inquiry has the potential to inform top-down SCD.

2. Related Work

This strategy is informed by Fry's (2017, p. 175) conceptualisation of metrofitting, which can be understood as utilising "design fictions" grounded in "real imperatives" orientated towards "thinking and projecting with a longer view of the city". Importantly, Metrofitting's design fictions are not directed towards solutioning but rather for anticipating future states and conditions in a relatable and non-abstract manner (Fry, 2017, p. 181). As such, fictional activities of metrofitting are not predictive but rather aim to evoke, through creative design, "discussion, correction, and strategic evaluation", with the primary purpose to "identify the needs and opportunity for redirective urban action" (Fry, 2017, p. 176). From a theoretical position, metrofitting engages with the unsustainable structure of our human world and engages with concerns such as "climate change, population pressures, geopolitical instabilities, resource stress, and social and individual technology linked cultural transformations" (Fry, 2017, p. vii) to inform material, operational and socio-cultural relationships. Within this broader agenda, this study utilises the methodological concerns of metrofitting more narrowly to anticipate the preferable social technology-linked cultural transformations that the inclusion of smart urban technologies may bring into an urban community.

In the metrofitting literature (Fry, 2017), 'design fictions' is applied in a very generic sense to describe creative, material projections representing alternative conceptualisations of being in the world. Furthermore, Fry tends to focus on the theoretical rationale for metrofitting and does not directly detail particular methods for application. Consequently, to think and project with a longer view of the city, this study incorporates the speculative approach of projective research (Geldof & Janssens, 2014; De Figueiredo, 2017). Projective research refers to a set of related research practices that employ design fictions or 'provotypes' to inquire into "putative and contingent" future states to "reach for tomorrow's worlds today" (Morrison, 2018, p. 125). Central to projective research is the notion of anticipation (De Smet & Janssens, 2016, p. 2762) and is typically applied in the context of systemic changes (economic, environmental, social) in order not only to "learn from the future'" but to also to recognize "important points of attention" and reflect on "directions for change" (Geldof & Janssens, 2014, p. 8). Projective research differentiates itself from typical discursive approaches in two fundamental ways.[2] First, its speculations are informed by data and facts, as well as design's capacity to operate "in conditions of complexity, uncertainty, and dynamics of continuous transformations that involve people and their environment" (De Smet & Janssens, 2016, p. 2763). Second, projective research employs a transformative mindset that indicates both a hope that things can be different, as well as the nature of change that needs to occur to bring about the desired change (De Smet & Janssens, 2016, p. 2765). Synthesizing, the above referenced texts, and other notable descriptions (Lindley, et al., 2014; Morrison, 2018; Hunt, 2019) the principles of projective research are reflected in Table 1.

[2] Typical discursive approaches include speculative design and design fiction.

Table 1. The principles of projective research.

1.	Maintains an anticipatory focus placed on real imperatives, which are framed through knowledge pertaining to data and facts.
2.	Anticipatory outcomes are generated as fictional provotypes that allow people to make sense of and give significance to their environments.
3.	Involves timeframes with a longer view but within touching distance of the present.
4.	Explicates the value and nature of transformation.
5.	Final provotypes communicate future scenarios, research findings, and suggested occurrences that lead to the envisioned future.
6.	Applies the persuasive abilities of design fictions to communicate directly to routine design audiences.

3. Methodology

The method of the study is Baskerville and Myers's (2015) Design Ethnography (DE) that advocates an interventionist and engaged approach to participating with people in the field to study the process and contexts of design. Consequently, DE moves beyond observation to respond iteratively and creatively in settings "where people are designing artefacts, producing artefacts, or introducing artefacts into a social and cultural context" (Baskerville & Myers, 2015, p. 29). In this manner, DE extends traditional ethnography as it is concerned not only with a description of situations, but also acts of synthesis and intervention that are recognised as contributing not only to improved understanding of peoples' life-worlds but to also explore their potential reaction to new situations (Baskerville & Myers, 2015, p. 27). While DE is primarily utilised in the field of Information Systems, this study, informed by Kilbourn's (2013, p. 69) description of design ethnography in Design Anthropology, applied three primary 'action' phases. Phase 1: Rigour refers to the conceptual framing of the proposed PPD method. Phase 2: Relevance describes the practical application of PPD in co-design workshop involving community members from Westbury, an urban neighbourhood in Johannesburg. Phase 3: Reflection critically reviews the previous two phases to establish whether the proposed method of PPD had achieved its intended goals or if further amendments and 'relevancy' evaluations were required. During the study these three phases were iterated in cycles over the course of four full day co-design workshops involving 26 participants in total. The criterion for selecting participants was that they were residents of or work in Westbury.

4. Limitations of This Study

This study is primarily concerned with the methodological development of PPD as an approach to bridging bottom-up and top-down SCD, and ultimately provide an alternative consideration of the role of HCD. As such, it primarily reflects the authors experience of the design practice. While the community is introduced to provide context, the intention of this DE is not to provide an ethnographic study of the community. Rather, the DE suggest how the proposed PPD method is capable, within the context of a design agenda, to generate and communicate an appropriate ethnographic understanding of a community aspirational relationship to an emergent technology.

5. Co-projecting with the Westbury Community

Westbury a densely populated, economically deprived suburb in close proximity to the Johannesburg City Centre. The suburb is a result of Apartheid era racial segregation during which the neighbourhood was

allocated to 'Coloured' residents, who were forcible moved there from other areas.[3] The community remains predominantly Coloured. The urban landscape of Westbury is characterised by small standalone properties and multiple multi-storey flats, includes parks, sports fields, a library, a large community hall and a youth recreational centre. However, many of the buildings and open land are characterised by urban degradation. There are numerous social problems that characterise Westbury. Foremost is its long history of criminal and gang-related activities (Klug, 2016, p. 58), organised around control of the drug trade. Westbury, like many communities in South Africa, is affected by high youth, and a strong distrust of government initiatives (Klug, 2016, p. 58).

5.1 Projective Provotype Design

The primary objectives of PPD are twofold. The first relates to the eliciting of insights relevant to a community's preferences for the future smart neighbourhood places, through a range of co-design research activities. The second objective is to communicate the generated insights effectively to practitioners working in technological contexts related to smart urban design. As such PPD is not concerned with technical plausibility nor city-wide solutions. Rather, its focus is neighbourhood placemaking. Accordingly, the design of the PPD consisted of two key phases. The first phase consisted of four co-design workshops involving neighbourhood participants, while the second phase involved the design of a projective research provotype. The essential connection between the two phases is that the ethnographic insights and understanding gained in the first phase directly informed the design considerations of the second.

5.2 The Co-Design Workshops

The co-design workshop primarily employed the design research method of generative tools (Visser, et al., 2005, p. 4). In generative tools, participants apply art and design techniques to creatively reflect on their experience of a given context. These generative activities are constructed with the belief that experiences are often determined by latent needs or tacit knowledge, which are often difficult to directly express verbally and consequently difficult to obtain from conventional research techniques. From a theoretical perspective, the three activities of the co-design workshop were guided by Inayatullah's (2008, pp. 7-8) conceptualisations of futures as inherently connected to the present and past.

Technique 1: Inquiry into the Past
The first two activities of the workshops focused on past and present contexts and were applied to both generate contextual data descriptive of the community, their activities, and technological environments, and to sensitise participants and researchers to each other and the research project. Technique 1 was conceptualised as an introduction for the participants to the more detailed activities of the following two techniques.

The critical activities of Technique 1 are outlined below.

1. Secondary research on the history of the subject neighbourhood is conducted, which is then synthesised and presented to participants;
2. Participants provide feedback, clarifying or adding aspects to the historical analysis.

In the workshops, Technique 1 was a devised as a digital timeline showing key historical activities as annotated images and supported with an oral explanation. The timeline was also presented schematically on a large print, which participants could write on and, thereby, edit and add content.

[3] In South Africa 'Coloured' inoffensively refers to a distinct racial group with a mixed-race heritage.

Technique 2: Inquiry into the Present
For the second technique, the intention was to elicit participants' everyday experiences of their environments, both physical and digital.

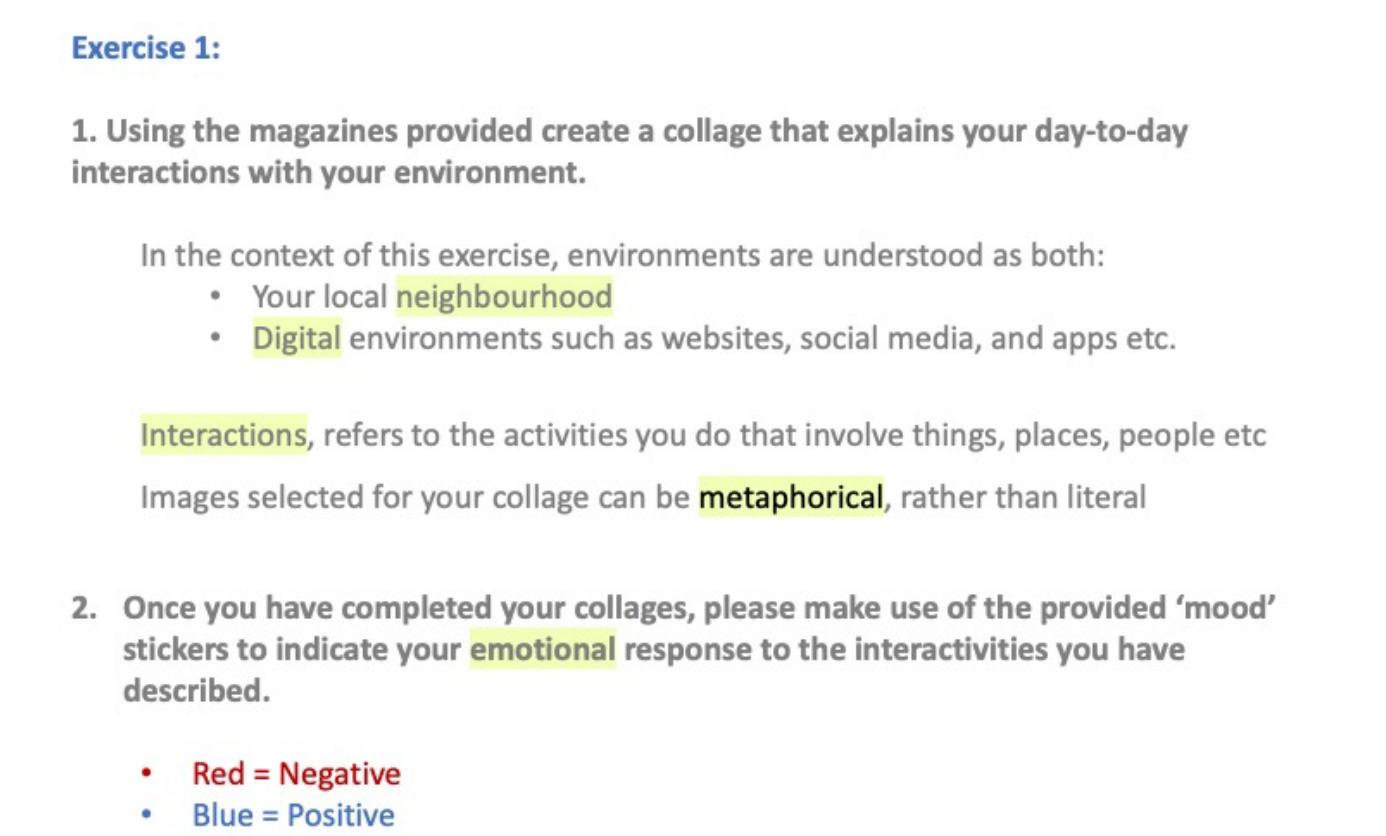


Figure 1. Participant brief for Technique 2. (all images T Fenn, 2023).

As described in Figure 1, and exemplified in Figure 2, the primary requirement for Technique 2 was for participants to create a collage reflecting their experience of their surrounding socio-technological environments. The purpose of the activity is three-fold. First, as earlier indicated, it sensitised participants to their urban and digital environments allowing them to become at ease with both creative activities and discussing their work. Second, to elicit a rich understanding of participants' everyday experiences of their 'on' and 'off-line' environments. Lastly, the exploration of present-day experience was an essential element for juxtaposing potential future experiences, the focus of the third technique (Kilbourn, 2013, p. 76).

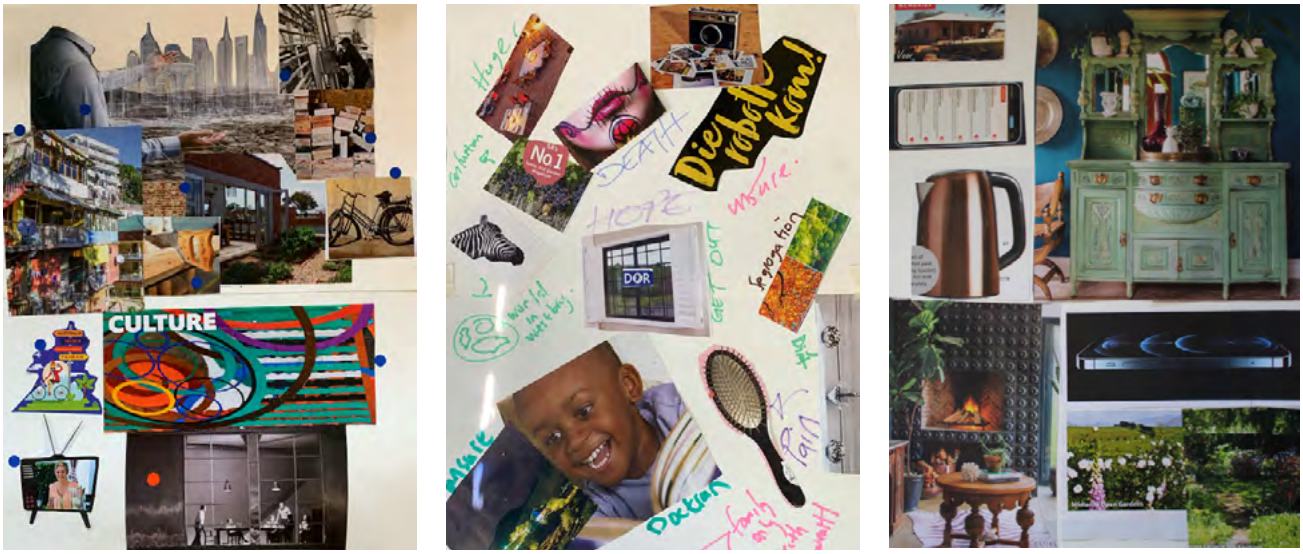


Figure 2. Three examples of participant collages.

In Technique 2, the involved acts of making and reflections on the making, facilitated very natural and unguarded accounts by the participants of their everyday neighbourhood experiences. The oral narratives encouraged other participants to add further details.

Technique 3: Mapping the Future

Technique 3 involved participants using generative techniques to imagine, model, and articulate everyday activities within a prescribed context of a future neighbourhood place.

The design requirements of Technique 3 were the following:

1. Ensure communities participate in creatively articulating their preference for their neighbourhood places;
2. Informed by Dörrenbächer, et al.'s (2020) positive utopian approach, focus was placed on the positive impact smart urban technologies could have on neighbourhood places;
3. Recognition that smart urban neighbourhood places are fictional spaces and accordingly are represented as design fictions, set in long-term futures;
4. Articulations of futures are developed to highlight everyday activities in line with several conceptualisations of placemaking (Benyon, 2014, p. 33; McCullough, 2005, p. 57).

In support of these requirements, Candy and Dunagan's (2017, p. 149) Experiential Futures Ladder (EFL) approach to scenario development was implemented. The EFL consists of four phases described below.

First, the Setting defines the scope or context of an inquiry into futures taking the form of a generic image of the future. The Setting for Technique 3 is the participating community's neighbourhood in a future setting, which in the workshops was conceptualised as 'New Westbury 2072'. Ideally, the projected context should be set far enough away from the present to break with the community's normative expectations for their near future but not too far into the future as to break entirely with plausibility, particularly from the perspective of involving technological-orientated speculation.

Second, the Scenario describes the future of the Setting, highlighting specific "narrative proposition and sequence of events" (Candy & Dunagan, 2017, p. 148).

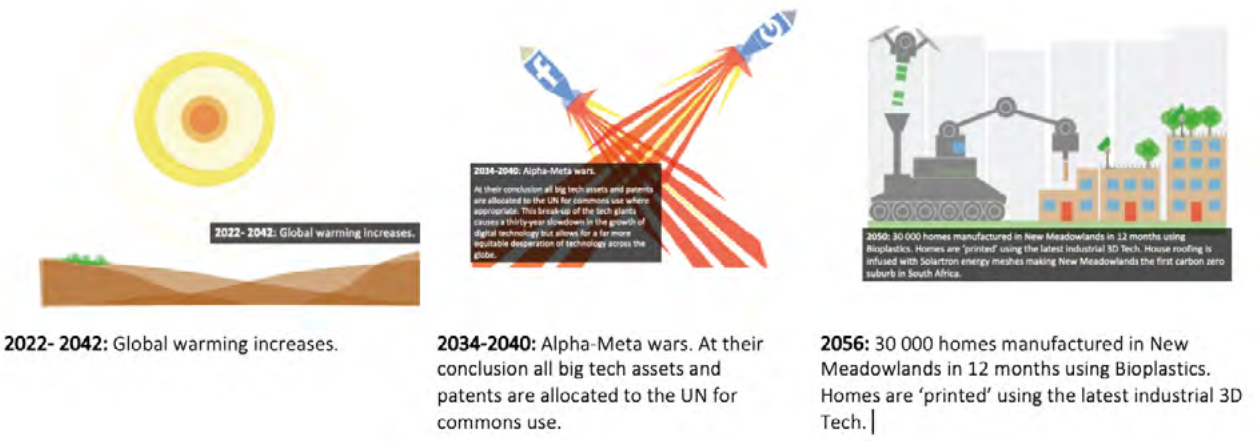


Figure 3. Three of the 18 visuals form the Westbury Scenario.

Figure 3 illustrates a section of the scenario for the New Westbury 2072 project, which continues the motif of the timeline used in Technique 1 to imply a direct continuum with the 'real' past of the suburb. The following narrative concepts informed the Scenario. First, this future is impacted by the primary macro forces of climate change and intensified urbanisation. However, the Scenario suggests these issues are resolvable as inferred by the 'emergent' green technologies of printable buildings, highly effective solar power, and progressive governance. Second, the rationale as to why Westbury can be redeveloped is suggested through the financial windfall of platinum mining, responsible governance, and construction ability. Third, the narrative is primarily focused on technological and political change and purposefully does not address social impact. The intention is that the participants will provide these aspects. Fourth, elements, like the 'Alpha-Meta' wars and the tank-like house 3-D printer are purposely fantastical to reinforce the alternative reality and, remove any continuum with the reality of the present.

Third, the Situation ensures that the techno-spatial concerns of smart technologies are focused within the larger context of the Scenario. In terms of the New Westbury 2072 project, the Situation was articulated as follows. First, as presented in Figure 4, the Scenario was extended into a description of a fictional city-wide design initiative, which involves 'citizen design teams' leveraging emergent technologies in the co-creation of their neighbourhoods. These technologies include the highly speculative, for example, 3-D printing of buildings, in combination with other plausible smart technologies. The presentation and accompanying discussion highlighted in lay terms the resulting behaviours afforded by these technologies.



Figure 4. Three of the visual describing smart urban place.

The second aspect of the situation was the design brief (Figure 5) that outlined the fictional role of the participants, as citizen-designers in 2062.



Figure 5. Design instructions for the fictional project.

The Stuff phase involves the generative design activity undertaken by the participants in response to the brief presented in the Situation. In this manner, participants create design fictions suggestive of their preferences for their neighbourhood futures. In the Westbury workshops, participants worked in groups of six and were supplied with materials and tools. Overall, all groups coped well with the technical aspect of the task and created detailed artefacts (see Figure 6).

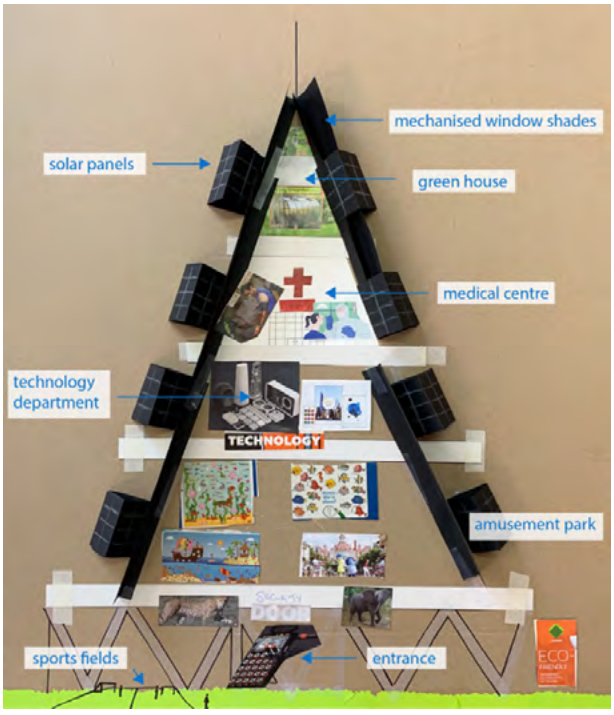


Figure 6. One group's cardboard model solution for the site.

On completion, groups were asked to explain the places they had designed, Overall, groups produced in-depth and detailed explanations of their models, enjoyed the task, and engaged with the design activity within the Scenario setting of the brief.

Synthesis of data sets into design frameworks

For both, Technique 2 and 3, the participants oral explanations were recorded, transcribed, and qualitatively analysed using ATLAS.ti software (2022). As depicted in Figure 7, during the analysis, data was first organised in primary categories of the Present and the Future, derived respectively from Technique 2 and Technique 3. Thereafter, secondary categories were coded in two seven data sets conceptualised in terms of Hassenzahl's Three-level Hierarchy of Needs (2010, pp. 12, 44), and Engeström's (2001) consideration of activity as embedded in social practices. Lastly, following Benyon (2014, pp. 4, 5), the seven data sets were considered as thematic structuring agents orientating a fluid highly complex system rather than as a 'rigid' analytical deconstruction.

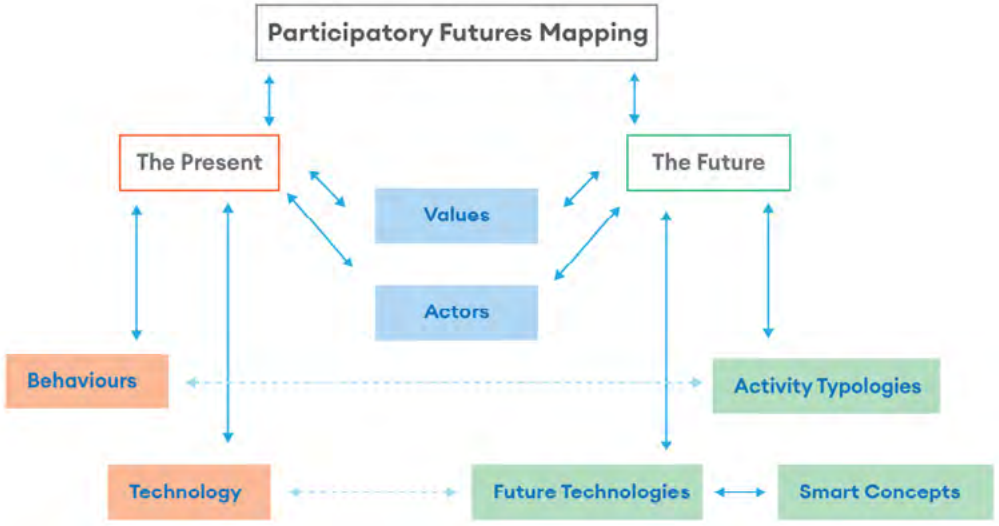


Figure 7. Model of the Westbury coding model indicating the seven subcategories. 'Participatory Futures Mapping' refers collectively to three techniques of the co-design workshop.

In the Westbury project, the seven data sets were creatively synthesised into a series of six design schemas (Figures 8-13), which reflected the key insights generated from the co-design workshops and consequently formed the conceptual foundation for the second phase of the PPD. The notion of design schemas is comparable to Alexander et al.'s (1977) design patterns, articulating the fundamentals of a type of design solution rather than a specific implementation of a solution. These design schemas while directly emerging from the data are projective and ultimately fallible considerations of how best to act.

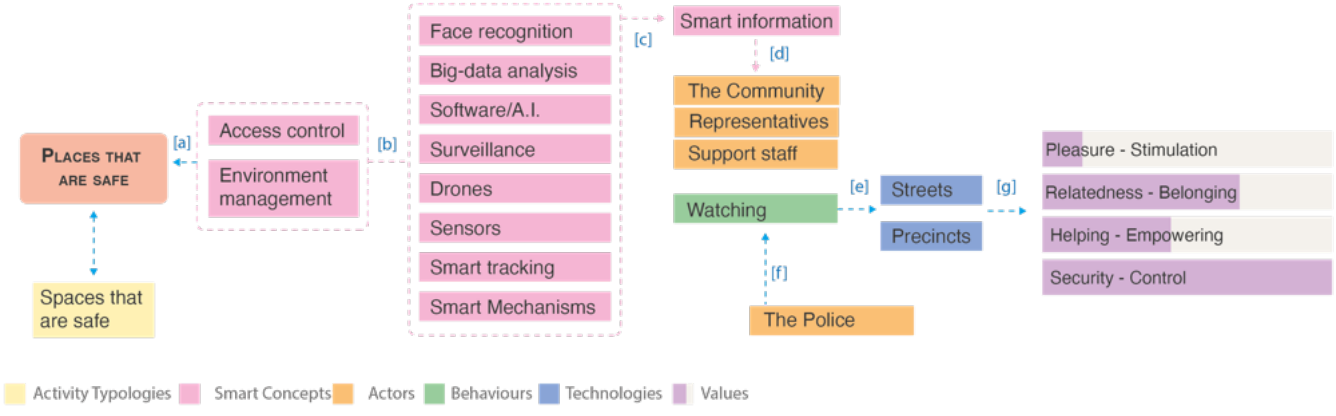


Figure 8. Design schema 1: *Places that are safe* are created through [a] controlling access and environmental management. Towards these outcomes, [b] smart surveillance networks [c] support community [d] representatives to monitor public neighbourhood spaces such as [e] streets, parks, and precincts, and if necessary, enact a response [f].

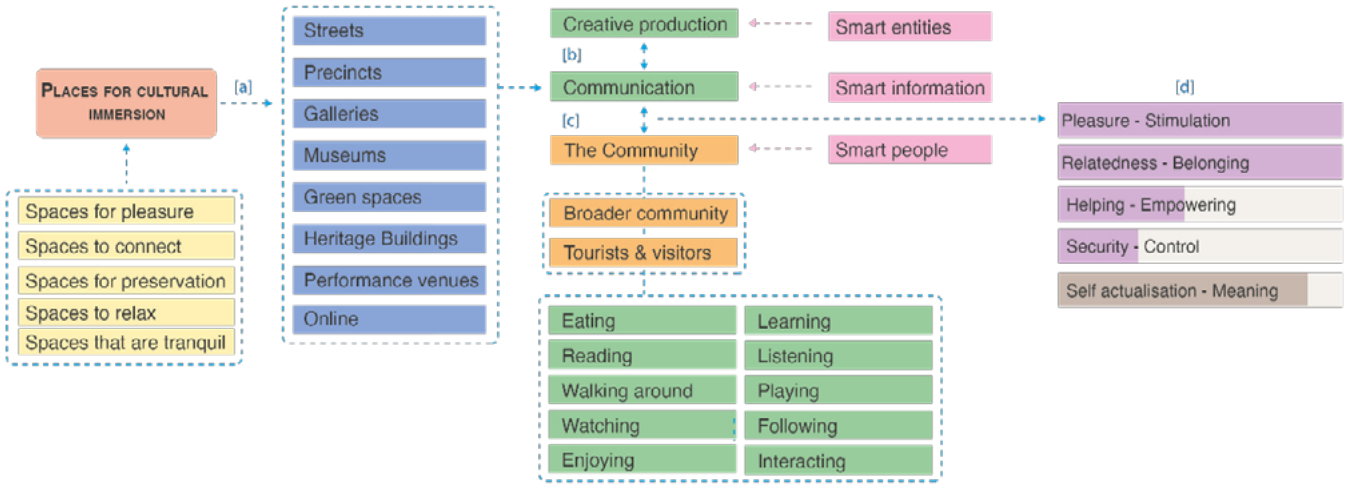


Figure 9. Design schema 2: *Places for cultural immersion* include typologies such as [a] streets, heritage sites, museums, art galleries, parks, and performance venues, as well as online environments. Locally generated creative productions [b] strengthens the community's shared identity as well as [c] attracting visitors and tourists. Cultural immersion allows for the community to experience [d] a more meaningful, pleasurable, and engaging environment.

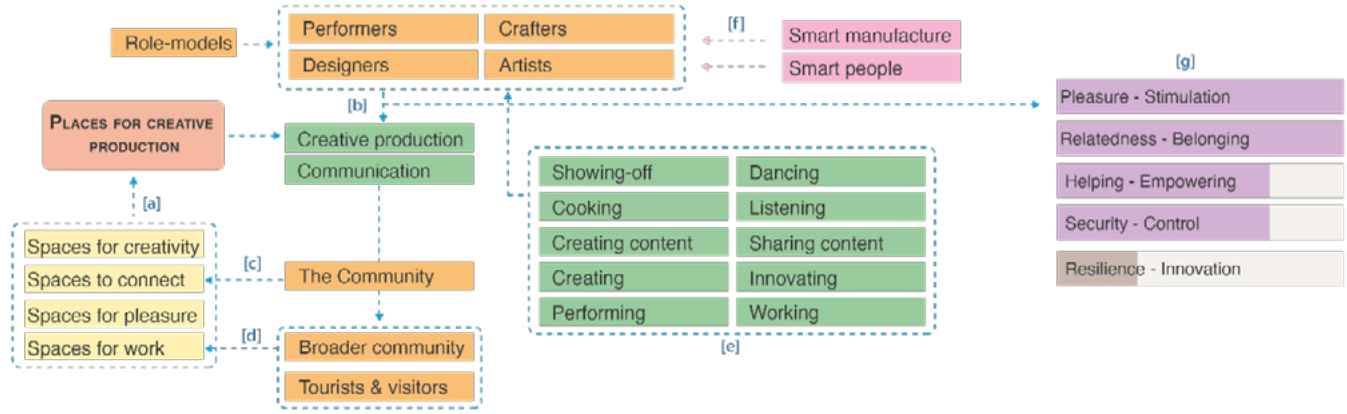


Figure 10. Design schema 3: Spaces for creating stimulating, pleasure, and connection [a] converge in *places for creative production*. In these places, performers, designers, crafters, and artists [b] produce content that engages both [c] the local community and [d] visitors. Cultural production is enhanced by [f] smart manufacturing abilities. However, cultural production is a [f] smart capacity that beyond the individual's pleasure in the act of creativity builds resilient and innovative communities [e].

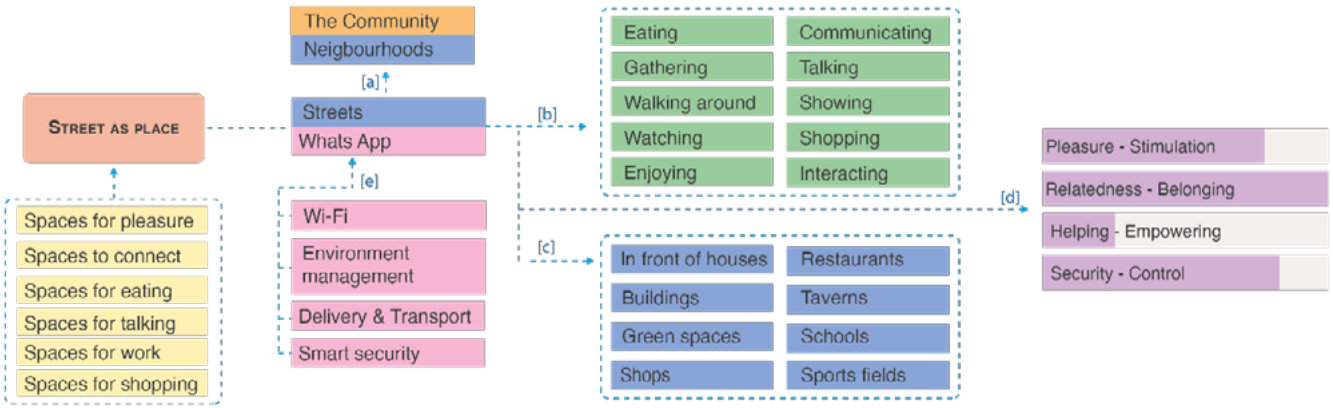


Figure 11. Design schema 4: *Street as space* recognises that the [a] primary neighbourhood place is the street, which has physical and digital layers. Accordingly, the street is the site of a wide range of social exchanges [b] linking to other parochial-public spaces [c]. In the community, the street is a place to enjoy and connect with others [d] (but can also be dangerous). Smart technologies [e] provide the opportunity to lessen the threatening aspects while ambiently enhancing the positives.

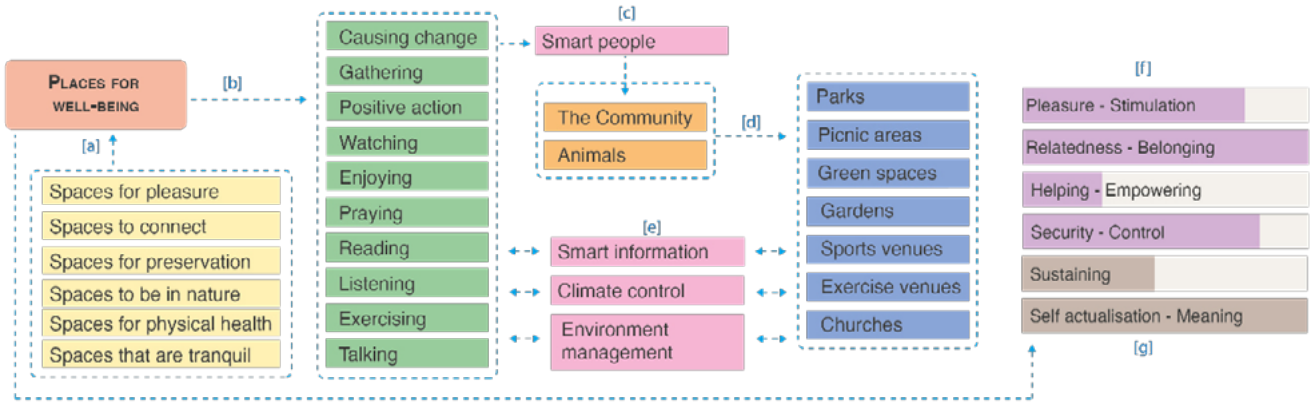


Figure 12. Design schema 5: *Places for well-being* are [a] tranquil spaces, often in nature, that focus on physical and mental health. In these spaces, a wide range of activities occurs, including [b] exercising, talking, praying, reading and interacting with nature [d]. In these spaces, individuals seek to connect more meaningfully with their experiences of the world [g], seeking to sustain both mind and body [f]. Places for well-being are supported by ambient smart technologies that ensure a tranquil and well-managed environment [e].

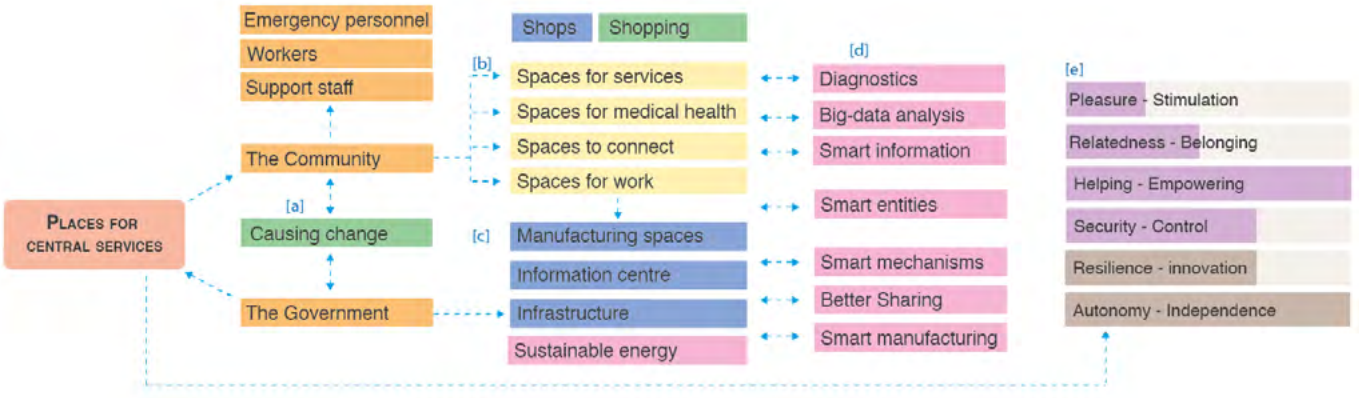


Figure 13. Design schema 6: *Places for central services* are partnerships between [a] Government and communities with the aim to deliver smart, accessible, and accountable services. Key aspects of these services are [b] health and [c] energy, which have the potential to be supported by [d] smart diagnostics and energy grids. Collectively, these services would directly improve the quality of life for residents as well as lessen their reliance on municipal infrastructure [e].

5.3 The Projective Research Phase

Responding to the fundamental principles of projective research, set out in Table 1, the second phase of PPD involved the design of a provotype. This phase focused on two key communicative aspects fundamental to discursive design, namely, the message-form and message-content (Tharp & Tharp, 2018, p. 166). Respectively, the message-content embodied in the provotype responded to the six design schemas, while the message-form focused on the mode of product rhetoric – the communicating, packaging, and presenting of the message-content.

For the message-content, the initial rounds of ideation indexed the design schemas as well as referencing fundamental placemaking design principles (Kent, 2012, p. 117). Once I was satisfied with the range of ideas, I began to consider how I could integrate the various ideas into the provotype. Here, I aimed to emphasise interconnected neighbourhood places within an encapsulating urban context, and ultimately communicate a systemic sense of Westbury. This intention, coupled with the insight that street space was the essential neighbourhood place for the Westbury community, led me to focus on producing a streetscape as the central illustrative image. The future-time of the provotype was set at 2052, 30-years from the year of the workshops. In terms of message-form, I intended for final provotype to be easily distributable, both in terms of product and cost. I also required it to have a strong visual impact and to have a tangible quality, to be something architects or designers would hopefully stick up on the walls of their

offices. Consequently, due to the horizontal nature of the streetscape, I opted for the format of a leporello concertina book displaying on one-side an extended streetscape of Westbury in 2052, and, on the other, a fictitious research report with written narrative, citations, reference list and technical diagrams (see Figures 14-16). In this text, I presented a set of 'community values' and six 'design frames'. These link directly to the six design schemas and the Values that emerged during the analysis of the workshops. The written narrative explained how each design frame played out systemically in the context of the suburb, city, and regional legislation of a future 2052.



Figure 15. The provotype's streetscape (1200mm x 220mm). See Appendix A, Figure A for enlarged diagram. Image: T Fenn, 2023.



Figure 16. The provotype's 'research' report. See Appendix A, Figure B for enlarged sections. Image: T Fenn, 2023.



Figure 17. Outer (L) and inner (R) cover sleeves of the provotype. The text on the cover describes the research project and acknowledges the input of each participant. Image: T Fenn, 2023.

On completion, the provotype, was presented for feedback in two sessions. The first involved a sample of participants from the workshops, who were guided through the analyses and design activities. The consensus was the provotype accurately reflected the aspirations of the community for their future neighbourhood places. However, one key insight from the sessions was that any given technology should not be completely autonomous, but should be ultimately controlled by a human, preferably a member of the community.

The second feedback session involved five design 'experts' with professional and academic knowledge of smart urban design, urban design or digital ecosystems design. Each expert was interviewed separately and was provided with the provotype to examine before the interviews took place. From the analysis of the interviews, seven key themes emerged.

Theme 1: Plausible Futures
All five experts identified the provotype as a fictional, futures representation of an existing neighbourhood. They identified the presented fiction as plausible and, as such, potentially achievable.

Theme 2: Correspondence
It was evident to the experts that the provotype corresponded to a preferred future of a neighbourhood community. This was indicated both in terms of a sense of historical and existing community identity, as well as a shared vision for the future.

Theme 3: Emphasises on the role of smart urban places
The notion that the provotype was particularly concerned with articulating the potential roles that smart urban technologies could play in the everyday experiences of neighbourhood places was clear.

Theme 4: A primary aim of generating discourse
Experts recognised that the provotype was not attempting to communicate literal and implementable design product concepts, but rather was discursive, raising issues, stimulating, and guiding thinking and challenging assumptions as well as provoking critical reflection and creative imagining.

> "It's a very focused, very stimulating fresh view on, which makes people rethink their assumptions about what they do, as designers in relation to a city". (D.E 'C')

Theme 5: Conceptual openness
The conceptual openness of the provotype was noted. This theme reflects that, while the provotype was highly detailed in terms of its storytelling, the illustrative and written details were primarily foregrounding a set of abstract concepts in the 'logic' of an imagined 'reality'. Crucially, however, the abstract concepts could be applied in numerous, different ways.

> "It's your experience of the fiction that makes it so compelling. It's getting lost in it. That bottom level of detail is so important… Because getting lost in it is when is when I can start to take ownership of what I see in it". (D.E 'B').

Theme 6: Direct contribution of principles and values specific to Westbury
Experts recognised that, while the visual and written content of the provotype provided a range of potentially useful design concepts, the primary message-content communicated was the six design strategies and four key Values.

Theme 7: Contributed an example of traceable synthesis
The provotype was described as contributing a 'traceable synthesis', referring to the value of making the connection between generated concepts and the research that informed their conceptualisation explicit, so that they, and the larger design proposition could be critiqued.

6. Discussion

In the context of urban futures, neighbourhoods are likely to be extensively mediated by digital technologies. As Dourish and Bell (2007, p. 15) remind us, space is organized both physically and culturally, and "cultural understandings provide a frame for encountering space as meaningful and coherent". Consequently, while the dawning age of the smart urbanity suggests significant approaches for managing the predicted hyper-growth of urban cities, there is also a strong chance that purely technologically orientated or 'one-solution for all cities' implementation of these technologies may lead to an exacerbation of poor urban conditions, particularly for the citizens of cities in the Global South, which have historically been excluded from having a representative voice in the development of the spaces they inhabit.

Responding to these concerns, PPD provides a relevant example of how design research practices can be applied to co-anticipate with urban communities their preferences for their smart urban futures and

potentially other metrofitting concerns. The three techniques employed in the co-design workshop enabled a rich and meaningful sharing of experiences by the participants. Including community members was valuable as their involvement directly guided the subsequent design of the Westbury 2052 provotype, and ultimately its communication to the design experts. For the participants, their involvement in the project was often transformative on a personal level. In this regard, two strong themes emerged from participant's feedback on of the workshops. First, as exemplified in the following quote, they highlighted the framing of 'futures' as undetermined and open to multiple outcomes which they potential could influence, as a significant realisation. Second, participants often felt a strong appreciation for been included in a discussion on the futures of Westbury. This appreciation ranged from those who felt that the community should be key stakeholder in all municipal planning to others who were just relieved to be part of a stimulating exercise and not have to spend another day in the lull of unemployment.

> "I think we need to know where we come from in order to know where we are going, so we know what we want- to better in our communities, to know what we have had before, and what we haven't had. This is now an opportunity for us to decide and choose what we actually want for our future (community participant)."

From the design perspective of gaining a better understanding of the suburb, the six design schemas articulate a range of nuanced considerations capable of positively impacting the urban design of Westbury. While a full discussion of each schema is not within the scope of this paper, it is evident that a key desire of the community is to overcome the failings of the state and municipality in terms of basic service delivery. This is seen clearly in the need for better security, employment, infrastructure, and health services. While the community viewed emerging digital technologies as important for transcending their current conditions, it was insightful to recognise that they identified these technologies as deployed preferentially by and for the community, rather than at the unit of the discrete individual user.

Beyond the usefulness of the three techniques for generating ethnographic understandings in line with Inayatullah's (2008, pp. 7-8) conceptualisations of futures as inherently connected to the present and past, combing the explicit flow of research findings from the workshop phase into the projective research phase, ensuring that 'data and facts' fundamental for anticipating futures has a strong ethnographic quality. As such, this approach contributes a novel practice in an emerging field of projective research, which is at present characterised by methodological uncertainty (Lindley, et al., 2014, p. 243; Morrison, 2018, p. 130). Lastly, and addressing the limitations that bottom-up approaches can present, the projective research provotype suggest the value that HCD can bring value to design practices that operate at the scale of emerging, highly complex technological systems, such as, for example, SCs, Smart Regions, IR 4.0, and artificial intelligence. As noted in the introduction, contemporary HCD struggles to resolve complex, large-scale systemic problems (Mani-Kandt, 2021). The consequence of this disconnection is that in national, regional, and metropolitan infrastructural projects, people are often treated as a "weak force and minor elements of the systems supposedly designed for their benefit" (Herriot, 2019, p. 704). In SC literature, this clash is evident in the tension between bottom-up and top-down design.

In response, PPD presents an approach that while recognising the value of the people who live, work, and actively engage with their neighbourhoods as drivers of change, is conceived primarily for informing, provoking, or challenging the thinking of professionals involved in top-down design and planning. Consequently, the alternative strategy of PPD is not to predict the design of the neighbourhood places of tomorrow but rather to sensitise designers and planners, likely to be working on large-scale smart urban developments, to a range of different considerations that might inform, alter, or confirm their design approaches.

Thus, as outlined in Section 5.3, and evident in the seven themes that emerged from the design experts' engagement with the Westbury 2052 provotype, practices such as PPD that contribute future scenarios premised in considered ethnographic inquiry can result in several valuable outcomes. First, these methods are capable of sensitising city planners and urban practitioners to the broad opportunities that smart technologies can offer in terms of delivering services and generally enhancing residents' experience of their

urban environments. Second, they can expose technologists and planners to the broad concerns of urban neighbourhoods as complex entanglements of activities, desires, experiences, places, cultures, and interactions. In this manner, this type of research locates smart urban development firmly with in the construct of the 'ordinary' city (Robinson, 2002, p.532) as opposed to visions of techno-futurist utopias often associated with the smart city. Third, they can share with top-down SC planners a sense of a community's preferences for their smart urban environments. Fourth, they can sensitise urban planners, practitioners, and technologists to the value of engaging with communities to heighten the likelihood that future technological interventions are designed in an ethical and empathetic manner. Lastly, they can assist human-centred designers to engage with highly complex technological systems in an impactful manner and, in this way, complement other design practices more accustomed to working within primarily technological and legislative systems.

7. Conclusion

This design ethnography introduces the novel PPD method which helps address the shortfall between bottom-up, community-centred approaches and the top-down approaches typical of SCD. As such, PPD utilises the unique knowledge tradition of HCD to generate a neighbourhood community's preferences for their smart urban futures and, subsequently, communicates these preferences to a design audience in a manner that is informative, thought provoking and if necessary capable of challenging existing assumptions. In this manner, and the central argument of this study, approaches such as PPD provide compelling rationale and directions for application of HCD that extend beyond its typical user/product focus.

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Appendix A: The Westbury 2052 Provotype



Figure A. Enlarged Figure 13 showing the streetscape illustration. The Floating textboxes are users' digital messages. (image: T Fenn, 2023).

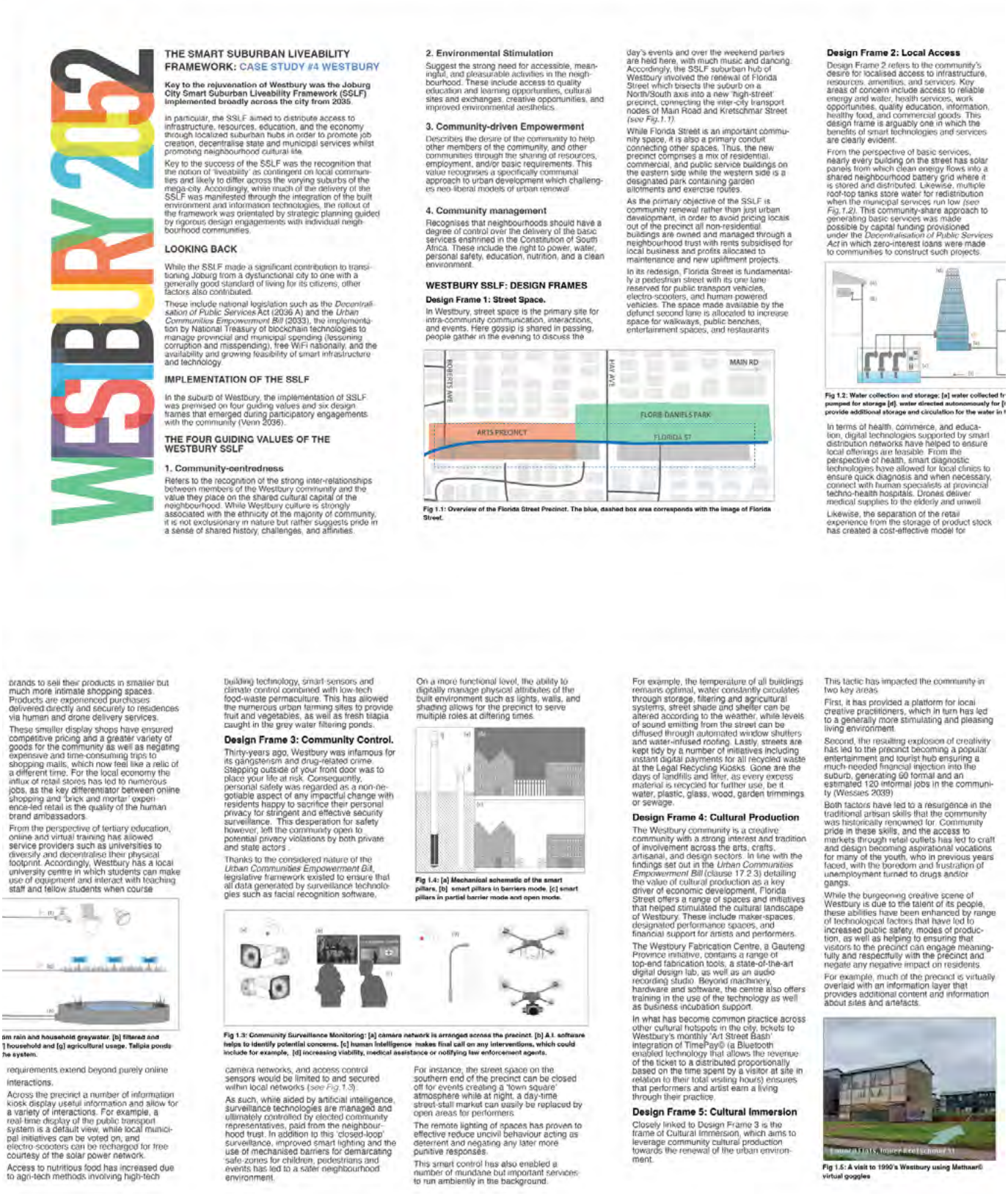


Figure B. Enlarged section of 14 displaying the research report with technical diagrams. The 'Guiding Values' and first 5 Design Frames are shown. (image: T Fenn, 2023).

P/REFERENCES OF DESIGN

EMPOWERING EXPERIENTIAL EDUCATION IN DESIGN: INTEGRATIVE MODEL AND PILOT APPLICATION IN AN UNDERGRADUATE EXPERIENCE DESIGN COURSE.

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KEYWORDS | EMPOWERMENT, DESIGN EDUCATION, EXPERIENTIAL LEARNING, COMMUNITY ENGAGEMENT, PROFESSIONAL IDENTITY

ABSTRACT | This paper presents a model of empowerment integrated to experiential education in Design. Experiential learning programs provide opportunities for students to empower themselves and develop competencies, attitudes, and maturity to make a successful transition from school to work. Students are prompted to actively engage as designers in their communities and envision themselves as agents of change for the common good. The paper contributes to the track “Ways of Living Together” by presenting an approach embedded to Design Education that advances individual and community empowerment, helps students to constitute identity and community engagement, and expands their awareness of the eco-social responsibilities associated with professional practices. Experiential learning is considered an ideal approach to achieving the tenets of empowering education, because the results of direct experience are often concrete, identifiable, and applicable. To construct and advance their professional identities, Design students need exposure to processes that help developing internally while also having opportunities to enact abilities and skills in the real world. Empowerment is increasingly essential for Design students to develop their professional identities in a changing context requiring reflection, awareness, self-direction, and creativity. The paper also reports a case study on a pilot application of the model in the context of a project-based undergraduate course in Experience Design. Empowering experiential learning supports reflection on sense of purpose, provides exchanges with diverse mentors, participation in community as opportunities to develop confidence in real-world contexts and help to address complex socio-ecological problems.

1. Introduction

Experiential learning programs have the potential to provide opportunities for Design students to empower themselves and develop competencies, attitudes, and maturity to make a successful transition to adulthood as they move from school to work. Because of their involvement in such programs, students may experience opportunities to actively engage as designers in the life of their communities and envision themselves as agents of positive change for the common good.

In this paper, we present a model of empowerment integrated to experiential education in Design. The paper seeks to contribute to the track “Ways of Living Together” by presenting an approach which, embedded to design education, fosters processes of individual and community empowerment, help students to constitute identity and community engagement, and expands their awareness of the eco-social responsibilities associated with professional practices. A case study presents a pilot application in the context of an undergraduate course in Experience Design.

2. Empowerment in the Transition to Adulthood

Typically-aged college students are entering adulthood and dealing with a range of developmental tasks to constitute competencies, attitudes, values, and maturity necessary for a successful transition. Completing education and entering the job market are major milestones to be attained in this phase. Early adulthood might be considered a key turning point in the life span (Schwartz, 2016).

In adolescence and early adulthood, young people ‘construct’ their own selves through a cycle of experimentation and reflection (Erikson, 1968; Steinberg, 2007). The transition to adulthood is marked by a shift from relying on external authority to taking ownership and responsibility for one's life, therefore they need to be exposed to experiences and receive support to develop mature meaning-making and capacity for their own decisions (Baxter-Magolda & Taylor, 2015). For many of them, universities play a significant role in this transition, providing opportunities to improve cognitive and psychosocial development, constituting identity through role experimentation, choice, meaningful achievement, and reflection (Erikson, 1968).

Promoting empowerment in this period has significant benefits, including healthy identity experimentation, gains in confidence, critical awareness, self-efficacy, and self-esteem (Chinman & Linney, 1998). Empowerment is a strengths-based multi-level construct, pointing both to a process of social change and to the outcomes of this change (Rappaport, 1995; Maton et al., 2011). The concept was first defined as an intentional, active, ongoing process through which individuals and groups gain greater control over their lives (Rappaport, 1981; Cornell Empowerment Group, 1989).

Foundational work on youth empowerment (Cargo et al., 2003; Chinman & Linney, 1998; Jennings et al., 2006) highlights the importance of essential elements: welcoming and safe environments; meaningful participation and engagement; equitable power-sharing; engagement in critical reflection; participation in sociopolitical processes to affect change; integrated individual- and community-level empowerment. Focusing on specific contexts and challenges of early adulthood, Mouchrek and Benson (2023) extended previous theoretical propositions and built a comprehensive model of *integrated empowerment in the transition to adulthood*. Their theory informed the work presented in this paper and will be described next.

2.1 Integrated Empowerment Model

In this model, focused on early adults between 18 and 25 years-old (primarily from Western societies, including developed and developing countries), empowerment is understood as a process of capacity building for the transition to adulthood, leading to positive developmental outcomes. The model emphasizes the nature of empowerment as an interactive, gradual, and multifaceted interplay among developmental experiences at the internal and the external contexts (Figure 1), as follows:

> "Empowerment emerges as the interplay between two foundational dimensions. Representing internal processes of development, the key catalysts personal agency and sense of purpose interact to produce the first empowerment dimension: the constitution of self-direction. Since internal development needs a 'stage', a concrete space for enacting and consolidating developmental gains, a necessary counterpart would be external experiences of development. In these, the key catalysts mentoring experiences and engagement in community come together to form the second dimension of empowerment: developing a meaningful role in society. These two dimensions combine and emerge as the overarching construct of empowerment" (Mouchrek & Benson, 2023, p. 6-7)

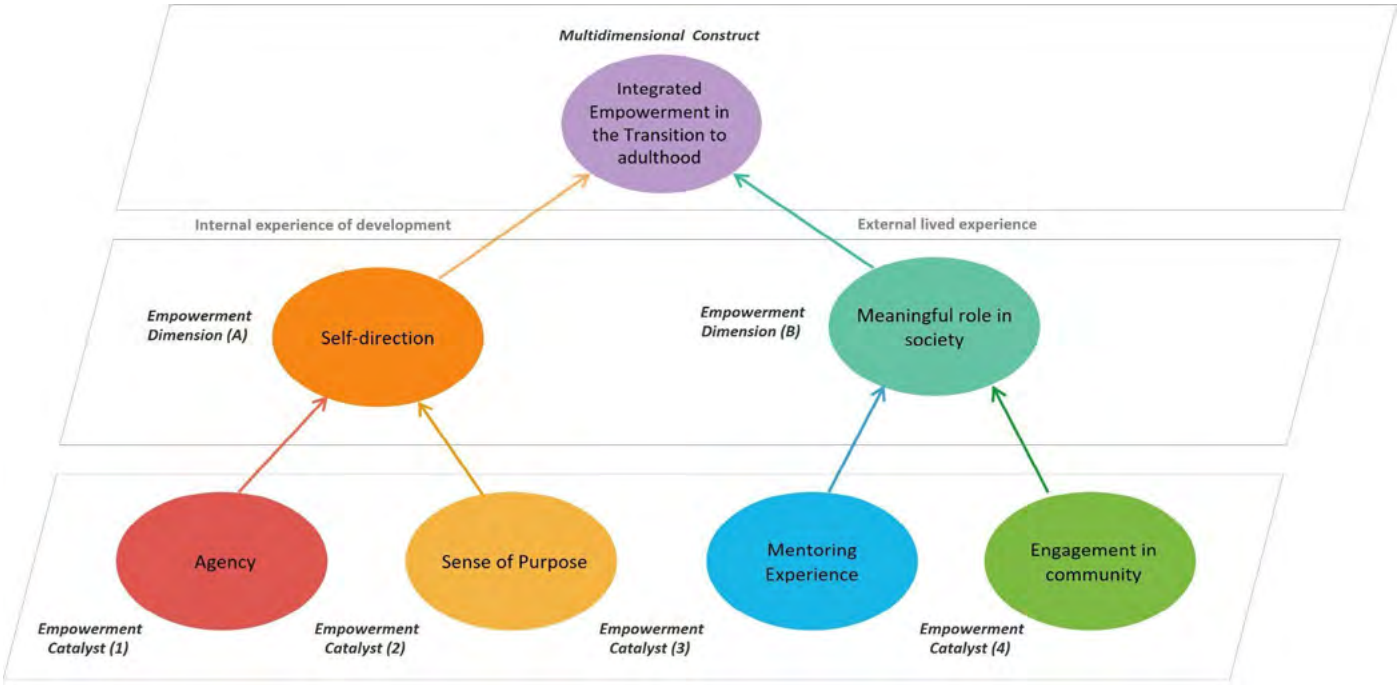


Figure 1. Model of Integrated Empowerment in the Transition to Adulthood (Mouchrek & Benson, 2023).

The empowerment catalysts in the model are described as: (a) *personal agency*, including self-understanding, sense of control, critical consciousness, autonomy in decision making; (b) *sense of purpose*, encompassing a perception of meaning in life and desire to make a positive difference to help solve problems beyond the self; (c) *mentoring experiences,* pointing to experiences with mentors providing guidance, support, appreciation, balance of power, and healthy collaboration; (d) *engagement in community*, when there is a sense of belonging, intrinsic motivation, meaningful participation, space and support to use talents and potential for the success of the community.

The authors suggest potential applications in the form of a model they called CAMP, which posits that interventions aimed at supporting developmental empowerment in emerging adulthood have strongest potential when *combining all four catalysts*: stimulating agency, fostering reflection on purpose, offering opportunities for shared dialogue and action with older adults, and positioning youths as potential active members in their communities (Mouchrek & Benson, 2023). Special consideration is recommended to apply the model to college students, because universities have great potential to be empowering settings supporting youth's self-orientation and future plans, through intentional design of environments for development.

3. Empowering Settings in College: Role of Experiential Learning

Higher Education may play a significant role, constituting positive environments for students' growth and empowerment -- hence the importance of designing the college experience having in mind youth's developmental needs. Colleges may provide a wide range of new experiences while also requiring an increasing complexity in reasoning, executive and reflective skills. Supporting the students' development in this period has important repercussions on their personal and intellectual trajectory, helping them to become active, self-regulated and engaged learners. It matters to capture students' perspectives during these years and understand what makes an empowering experience for them.

Reviews of theory and evidence from research indicate that empowering settings are those that: (a)promote a sense of community, encouraging cooperation and collective decision making (Lakin & Mahoney, 2006); (b) take into consideration young people's needs, interest and abilities (Frandsen & Petersen, 2012); (c) frame their participation as autonomous, responsible social actors (Chaskin, 2009); (d)have both an empowering process (participatory, developmental) and an empowering outcome (enhanced control, capacity, and access to resources) (Maton et al., 2011); (e) foster a critical understanding of their sociopolitical context (Zimmerman, 1995). Based on these concepts, the present paper proposes the following reflection*: How might we create structures and dynamics for empowering settings for emerging adults in college?* Experiential education emerges as a privileged context for this type of developmental setting, for Higher Education in general and for Design Education in particular.

Experiential education is an approach to learning through hands-on, real-world experiences. It follows the conception of learning by doing, in which experience and learning are inseparable (Dewey, 2007). Essential elements of experiential learning are: experiences are chosen by their learning potential; students are actively engaged intellectually, creatively, emotionally, socially, or physically; critical thinking, problem solving, and decision making are present; reflection on and after the experience are integral components; the learning task is perceived as authentic and allows learning directly from real situations; relationships are developed and nurtured (AEE, 2014). Diverse modalities of experiential learning are considered as high-impact practices in Higher Education (AAC&U, 2012): community-based service learning, internships, global learning, undergraduate research, professional work experiences, among others.

4. A Model of Empowering Experiential Learning

Experiential education encourages college students to develop fundamental dimensions of empowerment: personal agency, sense of purpose, mentoring experiences, and engagement in community (Mouchrek & Benson, 2023). The process of youth empowerment is considered as interplay among multiple factors including internal and external processes. In this paper, we propose an application of the empowerment model integrated to experiential education in Design. While the model was derived from theory and evidence from research, it is developed as a potential application[1]. In this section, we present the model of experiential learning that promotes student empowerment by addressing several catalysts. These processes are described as follows, in experiential education in general and applied to Design Education.

4.1 Fostering Agency and Purpose

By addressing needs for experimentation for construction of self and fostering reflection and critical consciousness, experiential learning encourages the development of internal processes such as personal agency. Additionally, by focusing on purpose-driven experiences, this modality promotes a sense of meaning and purpose.

[1] In line also with recommendations from the Education Advisory Board (EAB): Integrating Academic and Career Development (2017).

Experimentation and reflection. In adolescence and early adulthood, construction of self happens through experimentation: there is a richness of experience as the brain presents great plasticity and is extremely sensible to experiences (Erikson, 1968; Steinberg 2007). Since experiential learning focuses on direct experience and in-context action and reflection, this modality may address the students' need for diverse lived experiences that offer room for them to make sense of the knowledge, relating it to their personal way of understanding the world and building connections with their own trajectory. Experiential education fosters skills needed for students to become their own agents of change (Shellman, 2014). The reflective process in experiential learning broadens students' perspectives, addressing important developmental aspects: in this period, the young person develops advanced cognitive processes, including abilities of practical, flexible, and dialectical thinking, greater processing of emotions, perspective taking, and capacity for self-reflection (Berger, 2008; Arnett, 2014). Reflection in context potentially fosters a more complex meaning making process, providing novel options for interpreting experiences and navigating environments (Baxter-Magolda & Taylor, 2015). In Experiential Education, learners are purposefully engaged in direct experience and focused reflection (AEE, 2013).

Purpose-driven experiences. In the college years, cognitive and social transitions lead to the development of personal values and the political principles that will guide the person throughout adult life (Santrock, 2014). Purpose plays a powerful generative role in youth development (Damon et al., 2003), as a sense of purpose assigns meaning to and connects the experiences toward integration and fulfillment of potential when students ask themselves about their own values and goals in life – and how important are concerns that go beyond their selves. A purpose-driven approach to experiential learning promotes developing real-world projects that students can connect to their own aspirations to contribute to and being actively engaged in processes of social change. Empowering educational experiences should look for intentional ways to foster a process of awareness and encouraging intrinsic motivations allows students to explore states of flow and possibility development for the future.

Experiential Modalities Fostering Agency and Purpose in Design Education. Design is fundamentally a discipline of learning by making and doing (Davis et al., 2004), requiring active participation through problem solving, modeling, creativity, critical thinking, and self-construction of knowledge (Fontoura, 2002). Experiential learning opportunities fostering agency and purpose may include project-based learning using studio pedagogy, internships and professional work settings, global learning opportunities, among others. Project-based learning activities embedded in courses allow for studio-like experiences that introduce students to real-world work projects and to how collaborative work in workplace settings may function (Strait & Sauer, 2004). In design education, studios are recognized as the signature pedagogy and provide an engaging mode of learning by making them reflect on ongoing development (Chamorro-Koc & Kurimasuriyar, 2020; Desai et al, 2021). Studio pedagogy might include direct contact with professionals and/or community partners. Those are empowering also because they promote self-directed learning and increase student comfort with uncertainty (Davis, 2004).

Internships and professional work experiences are particularly important to advance the development of students' professional identities. Designers' professional identity is complex and encompasses both developing a range of personal attributes and advancing several design skills. During their academic formation, students start to gradually construct their professional identity as designers, which grows intertwined with their personal identity. To construct and advance their professional identities, students need exposure to processes that help developing internally while also having opportunities to enact abilities and skills in the real world. Opportunities for global education are also excellent to help develop direct experimentation and nurture a sense of purpose by observing and reflecting on the role of design and designers and reflecting on their values and purposeful life goals.

In order to prepare students to face contemporary complex challenges, learning must provide opportunities to develop an emergent in-context skill set, including critical thinking, communication, collaboration, and creativity, among others (Finn et al., 2012). Students need to acquire knowledge and work skills, but also have opportunities for reflection, critical thinking, and systemic competences, to be prepared to participate fully and actively in a changing society (Delors, 1998; Fontoura, 2002). Empowering

experiential learning in Design Education has the potential to support the development of consciousness and required competences, but also to create structures for participation, spaces for students to express their own vision, perspectives, and design ideas for the future.

4.2 Cultivating Mentorships and Engaging in Community

Fundamentally focusing on learning in touch with the concrete realities and lived experiences, experiential learning activities have the potential to address external processes feeding youth empowerment: development of healthy partnerships among youth and adults and opportunities for students to have a meaningful participation in the local and global communities.
Mentoring experiences. Professionals, community members, instructors, and students engage in positive, productive partnerships. We highlight the importance of mentoring and apprenticeship in experiential education: these programs are a promising environment to foster a multi-generational shared leadership and decision-making. Balanced mentoring partnerships in the transition to adulthood are an essential element of empowerment, in which equitable power sharing, opportunities to express their voice, and positive support are considered essential (Cargo et al., 2003; Wong et al., 2010; Krauss et al., 2014). Dialogical experiential learning models, defined by a co-constructed, relational, and holistic approach to learning (Desmond & Jowitt, 2012), are highly beneficial for youth development.

Participation in community. Engaging youth in community issues has important implications leading to developmental outcomes such as independence, problem-solving, hands-on learning, leadership, increased sense of control and personal responsibility, and overall well-being (Browne et al., 2011; Morton & Montgomery, 2013). Active community participation also brings more proactive and healthy behaviors (Cargo et al., 2003) and gains in agency and confidence (Krauss et al, 2014). Empowering settings in community-based projects frame the participation of young people as active, autonomous, responsible social actors and agents of change in their own right (Chaskin, 2009). Experiential learning may offer opportunities for students to develop awareness of multicultural realities and diversity, to participate in a meaningful way, and to work alongside with community partners, at local and global scale. ‘Develop people's capacity to contribute to their communities’ is one of the main goals of experiential education (AEE, 2013). Research shows that, because of their involvement in experiential programs, students experience increased feelings of empowerment and make positive changes in their life and the community (Shellman, 2014).

Experiential Modalities Cultivating Mentorships and Engaging in Community in Design Education. Experiential learning opportunities fostering mentoring and community may include relationships with a diverse set of mentors, community design studios, community-based service learning, among others. A diverse array of mentoring relationships in experiential learning opportunities are beneficial for Design students as they learn about the intricacies of the profession and several aspects of professional activity. Besides their instructors, mentors might include work or internship supervisors, peers, and even local industry professionals. In Design Education, community-focused experiences might include the involvement of community partners as mentors in the learning process as students engage with communities to design solutions (Desai et al., 2021). In community design studios, students learn while doing projects to address issues for real demands in the community. Cameron and colleagues (2001) point that, in this learning modality, students learn about political, cultural, and economic problems faced by designers, besides their inherent responsibilities: "in dealing with the diverse backgrounds, agendas, and schedules of community members, students can learn communication skills, collaboration, and leadership qualities that they would not learn in a traditional studio" (Cameron et al., 2001, p. 106). In community-based service-learning projects, there is great potential to support developing empathic dispositions and skill sets in Design education.

Engaging with communities, student designers act as facilitators and need radical empathy beyond basic understanding of people’s challenges, considering their cultural positioning, engaging in respectful collaboration and ethical practices based in interdependence (Noel et al., 2023). Complex issues regarding the current global eco-social crisis will require designers to work alongside communities to redirect lifestyles towards an active well-being based on the quality of life, infused with a sense of action and

common purpose (Manzini, 2007; Brown, 1981). Collective engagement and problem solving, capacities for self-determination and community-oriented action based on care will be key (Meroni, 2007; Manzini, 2007). Engaging design students in community efforts helps understanding of eco-social responsibilities associated with professional practices, cultivates responsible citizens, and applies learning to their everyday lives.

In this section, we explained the model components and reported on how they apply to experiential learning in Design Education. In the next section, we present an early application of the model combining the four catalysts applied to experiential education in Design.

5. Case Study: Project Designing to Improve Human Experience

In this section, we present a pilot application of the empowering experiential learning model in a project-based undergraduate course in Experience Design at Northeastern University (U.S.). Following recommendations for empowering interventions based on the CAMP model (Mouchrek & Benson, 2023), the project was designed with the four empowerment catalysts in mind – agency, purpose, mentoring, and engagement in community – in a studio setting in which students worked in teams on a seven-week long design process.

Building upon previous higher education experiences with living labs for design, innovation and sustainability (Mouchrek & Krucken, 2018), open innovation co-create labs (Mouchrek, Baum, & McNair, 2016), and participatory design workshops for empowering undergraduate students (Mouchrek, 2023), we build this project-based course to provide opportunities for students to learn how to select and apply design methods, integrate experience design principles to their practice, and work collaboratively in an autonomous, hands-on project geared towards creative approaches to designing for social responsibility.

Context. The undergraduate course, ARTG3462 - Experience Design Principles, includes students in different years, enrolled in majors like Design, Graphic Design, Experience Design, Interaction Design, and majors that combine Design with Behavioral Neuroscience, Business Administration, Mechanical Engineering, or Computer Science. The course was taught throughout four consecutive semesters in 2023-24, involving six cohorts of 12 to 16 students each. After an introduction to principles of Experience Design (including technology as experience, sense making, storytelling, emotions, human needs, engagement, flow, and Design for social impact) and practice of several methods and tools of Design research and development, students set to apply the course concepts on an experiential learning project. The project explores the potential of Experience Design to develop concrete and action-oriented interventions, offering opportunities for students to go through a structured process to collaboratively reflect and work to envision possible futures in a multiparty team (Figure 2).



Figure 2. Students interpret findings from field design research in the Project *Designing to Improve Human Experience*.

Prompt. The project prompts students to research and design to help improve the human experience on a topic of their choice. Applying course materials, students identify real-world needs in the local community,

undertake field research, ideate design concepts, develop prototypes, and evaluate the developed solution. Interventions can be objects, services, information systems, installations, events, exhibits, programs, or campaigns. The Sustainable Development Goals (SDGs) are used as a tool to define the topics and teams for the Experience Design Project.

The SDGs were proposed by the United Nations in 2017 as a blueprint to achieve a better and more sustainable future for all (Spencer, 2021); they are considered one of the best opportunities to frame design for social responsibility (Cooper & Koo, 2021). The goals address the global challenges faced in our current society, including poverty, inequality, climate change, environmental degradation, need for peace and justice (Figure 3). Students are prompted to reflect on how they can design to improve the human experience in ways that address some of these challenges. Participants identify their goals of interest, perform research about them, refine their choice and form teams around the same topic. Each team will then work on one of the Sustainable Development Goals, identifying a need at a local/regional level linked to one or more targets in that SDG. The overall design challenge is: "How might we improve the human experience regarding [specific goal/target]?"



Figure 3. Sustainable Development Goals. Source: United Nations Development Program (2017).

Development. Students progress through a structured process involving project ideas, field research and data collection, interpretation, ideation, prototyping, and initial ideas for implementation. Teams work in a studio-based structure for seven weeks. Several participatory design activities are developed in class and outside class. At each step, students submit documentation of progress (text and design artifacts) and present a summarized update in class to receive feedback from instructor and peers. The five main deliverables are shown in Figure 4. The project constituted an opportunity for students to: learn skills in teamwork, planning, communication, and others; perform research on themes of interest; envision practical applications of experience design in contributing to solve world problems that they care about.



Figure 4. Project Designing to Improve Human Experience - Steps and Deliverables.

5.1 Application of the Model

The multilevel project embedded the four empowerment catalysts (agency, purpose, mentoring, community), as described in the next paragraphs.

Agency. While following a structured method, student teams had autonomy to decide the aims, the audience, the scope and reach of their project. Students received feedback from instructor and peers along the research and development process, but ultimately, they had autonomy to experiment, define and pivot the direction and boundaries of their project, and were responsible for decisions and overall project development. Embedded opportunities to reflect on their practice were helpful to advance and mature their decision-making process. Examples of student projects notable in developing agency, experimentation, and autonomy (Figure 5) were:

- *NUFood community recipe sharing app*[2], in which students started off looking to fight food waste on campus. Their research and analysis led them to uncover a negative loop cycle: students on campus do not have good cooking skills, end up buying more groceries than they actually use to cook, and that generates a sheer amount of food waste. By developing a community recipe sharing app, this team addressed the issue through an innovative angle.
- *ShellYeah! youth educational beach camp*[3], in which students had an initial goal to protect marine life in the Boston region. After surveys and interviews, they pivoted and decided that developing an engaging, fun approach to environmental education for children was the best strategy to indirectly attain the goal. The team developed a creative intervention that included designing a summer camp and pedagogical curriculum for it.

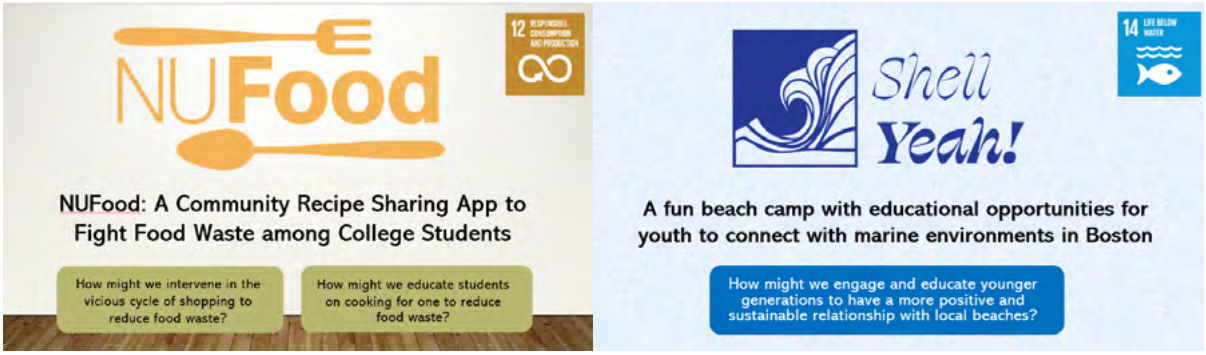


Figure 5. Projects displaying high levels of agency, experimentation, and autonomy: *NUFood* & *ShellYeah!*.

Sense of Purpose. The project intentionally prompted students to select goals aligned with their values and personal aspirations. Being able to choose to design towards a socially relevant goal that was meaningful for them and forming teams with people sharing the same values infused a strong sense of purpose into the projects. This prompted reflections about how potential career trajectories may connect with their willingness to contribute and make a difference to help solving complex contemporary challenges. Examples of student projects that displayed prominent sense of purpose (Figure 6) were:

[2] The NUFood project authors are undergraduate students Beyer Bullard, Caitlin McGuire, Marsha Angkasa, Mollie Harreys (Spring 2023).

[3] The ShellYeah! project was authored by students Brendan Ditullio, Karlee Malcolm, Greg Gold, Caleb Nyhart (Summer 2023).

- *NICE - Northeastern Intervention Care & Education program*[4], in which team members felt very strongly about the need for more intervention and care related to drug prevention and support for students dealing with drug addiction on campus. They developed a full program dedicated to that and wrote at length about how important it was for them to research and design on a topic that was felt was intensely purposeful.
- *Pawrents - Student Parents Club*[5], another example of a highly purposeful project in which students empathized with fellow colleagues going through a difficult time when discovering they were pregnant or would become parents – and how this might affect their college trajectory (and life as a whole). The team developed a thoughtful approach by creating a student parents club with several features.



Figure 6. Projects with a prominent sense of purpose and reflection: *NICE* and *Pawrents.*

Mentoring experiences. Because continuous feedback and collaborative progress were central features, the project provided several opportunities for mentorship. It included intense mentoring from the instructor at the team level, which worked as facilitation, consultancy, and overall support for project management. Relevant experts and community members interviewed become informal mentors for specific groups as well. The project is structured to incentivize peer feedback and collaboration along the project development, which generated interesting peer mentorship dynamics. Examples of student projects with active peer mentoring partnerships (Figure 7) were:

- *Sexual Health for Huskies website*[6], a project developed for a team in an all-female student class that was inspired by needs directly felt by the students, including the lack of ample and integrated conversation and support regarding sexual health on campus. Because some of their classmates were intensely involved with sexual health advocacy on campus, they ended by establishing a strong peer mentorship alliance that helped inform the approach and tone of their project.
- *YouHCS app*[7], a project developed in the same class environment attending to similar needs, this time focusing on increasing on-campus knowledge and support about reproductive health. Once more, intense exchange and feedback from colleagues who were also student activists around the topic generated strong peer mentoring experiences.

[4] The NICE project was proposed by Ila Jagannath, Miles Chun, Matt Downing, Max Spencer (undergraduate students, Spring 2023).

[5] The Pawrents project was authored by students Luci Lobo, Catherine Kennedy, and Juliana LaPara (Spring 2023).

[6] The Sexual Health for Huskies project was created by Bryn Grespan, Natalie Walsh, Deefah He, and Nabaa Lafta (undergrads, Fall 2023).

[7] The YouHCS project authors are Ally Xu, Maya Haney, Sraghvi Anchaliya, Tori Simmons (undergraduate students, Fall 2023).



Figure 7. Projects with active peer mentoring partnerships: *Sexual Health for Huskies* and *YouHCS*.

Community. Being clearly oriented to research and design for a community-centered goal made students envision possibilities to act as "citizen designers", opening perspectives about how designers may intervene with skills and talents towards the common good. This fostered a sense of belonging, besides activating intrinsic motivation and willingness to meaningfully participate. Examples of student projects with increased engagement in community (Figure 8) were:

- *Nubian Station Local Market*[8], a project that started by focusing on improving infrastructure for a neighborhood close to campus that faces increased gentrification. After in-depth research and contact with residents, they developed an open, inclusive strategy to stimulate economic development and community relationships around a local market in a strategic location. The team was particularly concerned with the impacts of the university in the surrounding areas and their resulting designs showed intense involvement in the life of these communities.
- *Boston Hunger Helpers*[9], a project that also had concerns regarding the surrounding neighborhoods, this time focusing on needs related to food insecurity. They developed a dynamic donation-based program connecting food vendors and community members. In this case, student teams also displayed an intense call to contribute to the community inspired by a citizen design approach.



Figure 8. Projects with increased engagement in community: Nubian Station Market and Boston Hunger Helpers.

6. Recommendations

From our study and practice with the model, we derived a set of recommendations. Experiential learning opportunities are well suited to support empowerment for students to the extent that they may:

- provide youth with a wide range of experiences while also requiring an increasing complexity in reasoning, executive and reflective skills.

[8] The Nubian Local Market was proposed by students Bella Stone, Naseem Mohideen, Finn Cuccia-Fenton, Maddy Mckee (Fall 2023).

[9] The Boston Hunger Helpers project was authored by undergraduates Ashley Newell, Alia Alsaie, Aleena Narula (Fall 2023).

- offer opportunities for students to understand and practice competencies leading to autonomy, self-direction, and independence through exercises of problem-solving and decision-making.
- offer opportunities to engage in meaningful roles, and to develop collective work that is authentic, interesting, fun, and relevant to the real world.
- offer stimulating and rich environments for positive and healthy interaction with peers and the extended community, improving students' well-being and supporting their processes of socialization and identity formation in emerging adulthood.
- provide rich environments and social contexts to encourage students to express their values and inspire the development of prosocial values such as social justice, ecology, human rights, sustainability, diversity, and inclusion, among others.

On the other hand, it matters to avoid learning experiences that are ill-suited to support youth empowerment at the extent that they:

- maintain rigid curriculum structures that don't allow for experimentation or active learning experiences.
- offer limited autonomy for students to co-create interesting and authentic learning experiences.
- overlook the fact that students need to develop as a whole person and as a future professional at the same time – hence the importance of integrating academic and professional goals with their personal characteristics and trajectories.

7. Conclusion

Empowerment is increasingly essential for Design students to develop their professional identities in a changing context requiring ongoing reflection, awareness of content, self-direction, and creativity. Empowering experiential learning also supports reflection on sense of purpose and priorities, while providing exchanges with diverse mentors, participation in teams and communities as opportunities to develop confidence and an understanding of who the student can be as a professional in real-world contexts, helping to address the complex socio-ecological problems we currently face.

Experiential education is then seen as an opportunity for students to develop identity and agency, foster critical consciousness and empower themselves to meaningfully participate and be actively involved in their communities. Experiential learning is considered an ideal approach to achieving the tenets of empowering education, because the results of direct experience are often concrete, easily identifiable, and applicable (Perrin, 2014). A consistent framework for experiential learning in college education would consider its potential to positively impact youth development, working intentionally to promote empowering experiences and transformative outcomes for students during the transition to adulthood.

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P/REFERENCES OF DESIGN

SAFE SCHOOL ZONES: URBAN RESEARCH FOR THE DEVELOPMENT OF CHILDREN'S VISIBILITY USING CO-DESIGN AND PLACEMAKING METHODS.

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ABSTRACT | Although children are a large user group of the city and its public transportation, their challenges are not equally handled in the Hungarian context when speaking about urban planning. While there are countless examples in the Western literature of children's involvement in urban planning processes (Derr et al. 2013, Krishnamurthy 2019, Lovrić 2023), in Hungary we are only at the beginning of the discourse. The paper is going to introduce an ongoing research and development project started 1,5 years ago including both research and implementation phases and its results as a case study aiming to adapt the already existing Western know-how into the Hungarian context.

The work-in-progress research aims to explore how social design might facilitate children's physical and mental safety regarding the inclusivity of public places and mobility formats through placemaking. It has been conducted in collaboration with the Innovation Center of a Hungary-based design university, the Budapest Public Transport Center, the ELTE Institute of People–Environment Transaction and the Municipality of the 7th district of Budapest, aiming to tackle the needs of children (age group 10-13) in lights of public transportation, micro and active mobility intensively focusing on the usage and opportunities of public places around their school. To unfold the needs of the target group the research used process-based co-creational data collection, methodological tools of social design, action research, observatory research, and interviews, resulting in the creation of a design prototype focusing on the specific challenges raised by the target group. The research led to finalising a ready-made product with scalable and transferable potential and providing a set of options (installative and regulative) to Municipalities for alternative ways of traffic calming through placemaking in school areas. This prototype is not a result, but rather a research tool to observe and analyse the children's behaviour and discover the adaptation potential. Besides being a research tool, the intervention aims to cause traffic calming and to affect drivers' behaviour through visual stimulation.

The paper introduces the results of the research by illustrating what are the main challenges and obstacles children face when using public spaces in a big city (especially in school zones) and what type of interventions can help to ensure their physical and mental safety while using these spaces. Assessing the usability and impact of the tangible prototype is not the last methodological part of the research project: currently, the research is focusing on a new school environment integrating the findings of the first stage of the project as well as new stakeholders. Concluding the findings of our case study about urban child protection, public place awareness, and liminal spaces, it opens the argument of transferability and paradigm changes in the context of Budapest and has potential relevance in other big cities as well as in the CEE region.

1. Introduction

Children's urban environments play a crucial role in shaping their physical health, social connections, and identity development, especially after their kindergarten years. While much attention has been given to physical health aspects, like air quality and safety standards (Tamburlini et al., 2002), there is a growing recognition of the importance of considering children's emotional connections to their surroundings (Dúll, 2009). Understanding the diverse needs of children in urban environments requires consideration of various factors, including their need for security, exploration, socialisation, and privacy which vary according to their age (Day, 2007; Altman et al., 1978). Balancing these needs can be challenging, particularly as children transition between home, school, and public spaces in their primary school years (Freeman & Tranter, 2011). Given the complexity of children's needs, involving them in the design process is essential for creating inclusive communities (Davis & Jones, 1996). Placemaking, a participatory approach to urban design, offers a valuable opportunity to engage children in shaping their surroundings (Marshall & Bishop, 2015). By actively involving children in community workshops and design charrettes, urban planners can create vibrant and child-friendly spaces that foster a sense of ownership and belonging from a young age (Ellery & Ellery, 2019). Placemaking in urban planning involves a multitude of factors, including the level of involvement of end users, the methods employed, the scale of interventions, and the diverse stakeholders engaged in the process. This paper delves into the intricate interplay of these factors by examining existing examples from around the world.

Building upon these insights, an intersectional collaborative research project was initiated in Budapest's 7th district, involving multiple stakeholders such as the Budapest Public Transport Center, the ELTE Institute of People–Environment Transaction, a Hungary-based design university and the 7th-grade (12-13 years old) children community of a primary school, based in the 7th district of Budapest. The project aimed to address the needs of children regarding public transportation, micro and active mobility, and the usage of public spaces around their schools. Through a comprehensive research and co-creation-based design process, the project sought to enhance children's visibility and safety in urban environments.

2. Children's Urban Environments: Understanding Needs and Promoting Inclusive Design

When speaking about the connection between children and their physical environment, sources highlight mainly the role of places in the context of physical health (Tamburlini et al., 2002; Day, 2007) instead of healthy social connections and the development of their identity. The negative impact of harmful environments on children's physical health cannot be questioned when speaking about poor indoor air quality, hazardous building materials and unsafe building standards, chemical or biological contamination of furniture, arts-and-crafts material and playgrounds, radiation and noise (Tamburlini et al., 2002). But to understand the complex role of children’s environment, we also need to understand the importance of place attachment and place identity. Results of environmental psychology show that people form emotional bonds with the environment they live in and use (place attachment). These meaningful places over time become part of the person's self-definition (place identity) (Dúll, 2009). It has different dimensions since an emotional relationship can develop to a corner of a room, to a house, to the neighbourhood, to the city, or even to imagined or mythical places (Mazumdar - Mazumdar, 1993 cited by Dúll, 2009). With Dúll's literature summary, we learn that attachment to a place develops because the control of the place enables "the manifestation of action and competence" (Dúll 2009, 133). Attachment to a meaningful place has countless advantages, such as the sense of security, belonging, control and ownership as well as experiencing social connections.

Several studies (Altman et al., 1978; Day, 2007; Freeman & Tranter, 2011) examined the connection between the needs of children and the opportunities offered by their physical scenes as well as the significant role of place attachment in the ongoing development of children’s identity (Day, 2007; Gordon, 2010). According to

different ages, children need a place to feel security, integrity, magic, sensory exploration, creative intervention and inspiration (Day, 2007), they need to learn, play, socialise and explore but on the other hand they need to experience privacy (Altman et al., 1978) and quiet reflection (Woolley & Spencer, 2000) as well. According to these conflicting needs and tension between the known and the unknown, Day (2007) also articulated that the environment should serve the children's journey of development by offering enough flexibility and opportunity for adaptation. To serve these diverse needs children need scenes such as their home and their school, cultural spaces, outdoor environments like playgrounds and nature as well as their whole neighbourhood (Christensen & O'Brien, 2003; Freeman & Tranter, 2011; Campos & Luceño, 2020). While the most important of all seems to be the children's home (Altman et al., 1978; Dúll, 2009, Freeman & Tranter, 2011) still it needs to be clarified that different environments can support different needs. 'For children "indoors" is a private domain, the source of physical shelter, social security, and psychic support - and also the locus of adult dominance and the limiting effects of "family" and "school." "Outdoors" is a necessary counterbalance, an explorable public domain providing engagement with living systems and the prevailing culture locus of volitional learning' (Altman et al., 1978, 88). It also seems that after the kindergarten years, during their primary school years, children need to explore more and learn responsibilities and by that, outdoor environments get a bigger role in their development and school environments can play a leading role in being available for these needs (Day, 2007).

The school is a psychologically significant environment, which has a wide range of socio-physical effects on the users of its environment, which is not only educationally important, but the school is also a key socialisation medium (Altman et al., 1978; Day, 2007; Dúll, 2007), a safe environment for unstructured play (Freeman & Tranter, 2011) and an opportunity for informal learning (Day, 2007; Freeman & Tranter, 2011; Alegre, 2023). When talking about school environments, research is mainly focused on the indoor school environment (Altman et al., 1978; Day, 2007), much less on school yards (Day, 2007; Kyriakou, 2014; Green, 2021) and even less on the public areas of school fronts (Krajnović, M. et al., 2023). In this sense, it is also worth examining literature about smaller-scale urban contexts such as liminal spaces in the context of childhood (Christensen & O'Brien, 2003). School fronts, just like liminal spaces, are "at the boundary of two dominant spaces, which is not fully part of either" (Dale and Burrell, 2008: 238), their function is not easily defined just like its ownership by a specific group and these are the spaces where anything can happen (Turner, 1974 cited by Shortt, 2015). Following Day's (2007) explanation about linking spaces, school fronts are territories of arrivals and departures, of welcoming and saying goodbye: this environment should give space for children to reset their mind from outside to inside, from unknown to safety, from liberty to expectations and vice versa. These scenes should offer space for children, to release their tension after a long day at school and to manage their conflicts in a wide-open space which is still close to the safety of the well-known school.

Based on the complexity of children's needs in their urban environment, involving them in the design process of urban planning is essential for creating cities and communities that are truly inclusive, dynamic, and responsive to the needs of all residents (Altman et al., 1978; Davis & Jones, 1996; Bakar, 2002; Day, 2007; Simonsen & Robertson, 2013) and placemaking seems to be a valuable method of involvement. Children bring a unique perspective, often noticing details and aspects of their environment that adults may overlook. By actively engaging children in the planning process of public spaces, decision-makers can gain valuable insights into what makes an area appealing, safe, and functional for younger members of the community (Freeman & Tranter, 2011). Moreover, including children in the process empowers them to have a voice in shaping the places where they live, play, and learn, fostering a sense of ownership and belonging from a young age. Placemaking serves as an excellent tool for involving children in the urban design process due to its focus on community engagement and participatory approaches (Ellery & Ellery, 2019). Placemaking encourages residents, including children, to actively contribute their ideas, creativity, and insights to the development of public spaces. By organising activities such as community workshops, art installations, and design charrettes specifically tailored to children, urban planners and designers can harness their imagination and enthusiasm to co-create vibrant and child-friendly environments. This collaborative approach not only ensures that children's needs and preferences are taken into account but also cultivates important life skills such as teamwork, problem-solving, and civic engagement as well as the development of place attachment (Marshall & Bishop, 2015).

3. Exploring Factors in Urban Placemaking: Tools, Scales, and Stakeholders

When talking about placemaking and the involvement of end users in the urban planning process, many variable factors have to be considered: the level of involvement of the children, the methods used, the type and the scale of the planned intervention as well as the participating stakeholders. In the following section, the paper is going to investigate these factors through already existing examples from around the world.

3.1 Tools of Involvement

As we discussed above, the involvement of children in urban interventions and decision-making is undoubtedly essential in today's urban design process: still involvement has different tools for different aims, which can lead us to reach different depths of participation. When speaking about tools, we can apply introductory but also informal meetings, observations, questionnaires, interviews and participative workshops - also we group these tools depending if there is a direct connection to the target group or not, or depending on what kind of activities they are including. We cannot state that these tools are used in general in most of the examined cases, but indeed these tools can give a real depth when speaking about involvement and by that, they are very commonly used.

Even if we collect examples of participation and collaboration, there are still tools which are not meant to bring new people together but they are still serving placemaking from behind: these are the research methods of observations and questionnaires. Placemaking projects often involve observation as a tool, to collect data about the target group. It can happen in an indirect way when the participants are observed in their natural habitat, where they are not directly involved, as it happened in the project of the Jai Vakeel School (JVS) in Mumbai, where the design team visited the school and studied the children's behaviour during the school hours (NIUA, 2019). Besides observations, questionnaires are classical tools to gather information from a larger group. It can be used in different project phases: getting to know the target group's behaviour before the deeper involvement and used to starting a discussion, and also assessing the results and rapidly evaluating (Danenberg et al., 2018). In the case of children, these questionnaires can also get a more playful form such as the form of a booklet, to get to know the children's point of view about their dislikes, street activities and outdoor playing habits in a playful way (Slingerland et al., 2020).

Verbal tools such as interviews, group discussions and other formal and informal meetings play a significant role in placemaking projects by providing invaluable insights into community needs, aspirations and preferences, thus informing the design process and ensuring the creation of spaces that truly resonate with and serve their intended users. Introductory meetings have to happen to define the roles and expectations of each participant, which are key elements in the process (Sutton, 2002), just like in the case of the research project led by TU Delft in the Tarwewijk neighbourhood in Rotterdam (Slingerland et al., 2020). Besides meetings, interviews are also key elements of placemaking research projects, which can be conducted by the target group itself. In the project of "The Walking Neighbourhood" in Chiang Mai (Thailand), the children conducted interviews with local people (such as shopkeepers, local 'icons' and habitants), who oversee the everyday happenings as constant observers (NIUA, 2019). Another informal verbal tool might be community walks, just like in the project of the Bernard van Leer Foundation in Bogota, where community walks were organised to involve the neighbourhood and to identify possible danger spots (NIAU, 2019).

Participatory workshops represent a cornerstone in placemaking projects, serving as platforms for engaging children, and stakeholders and fostering collaborative decision-making processes aimed at enhancing the quality of public spaces. These workshops encompass a variety of formats and methodologies tailored to specific project objectives and community dynamics. Common workshop types include community visioning sessions and collaborative brainstorming exercises, each offering distinct advantages in eliciting diverse perspectives and co-creating inclusive environments. These participatory

approaches have the potential to facilitate meaningful dialogue, foster social cohesion, and engender sustainable urban development. In urban placemaking research projects different types of workshops appear: Ana Vargas, a Venezuelan architect in her project called ‘Tracing Public Space’ conducts photographic mapping excursions with the children to understand their needs and discover potential opportunities for transformation (Danenberg et al., 2018). Community-engaged co-creational workshops develop a sense of belonging to a community and create stronger connections amongst the locals as seen in the project called ‘Hack Our Play’, which was implemented in the St. James’ Church Kindergarten in Singapore (Danenberg et al., 2018).

3.2 Scales

Urban placemaking projects can be also categorised by the different scales of the interventions such as micro-level scale, public space scale, neighbourhood scale and city scale (Danenberg et al., 2018). Even if it is important to add, that in many cases scales are not necessarily final and they often grow into adaptable solutions (NIUA, 2019), still the paper is going to introduce examples according to these four categories including different types of interventions such as pieces of street furniture, climbable objects, sidewalk games, playful pedestrian street crossings, opened schoolyards and child routes (Krishnamurthy, 2019) as well as built constructions, permanent installations, and also simple visual gestures, occasional solutions, which are more like an event or an activity.

The micro-level scale is the most supervisable setup since it can offer the opportunity to be completely overseen by its users, which results on the one hand parents and guardians immediately acting on unexpected events and on the other hand children reading the environment. The space has well-defined functions and borders and the most common solutions of micro-level scale are street furniture installations. Since the same street furniture can target different user groups, it can play an important role in building a connection between children and other local people sharing the same neighbourhood, just like in the case of the Darling Quarter Playscape in Sydney, Australia (NIUA, 2019). Street furniture can also function as a transitional environment between the children’s home and school, functioning as a liminal space which helps them mentally both to prepare for challenges and to calm down after them (Krishnamurthy et al., 2018). The FURNISH-KIDS research project was realised in Barcelona and is a good example of how street furniture can respond to different challenges while transforming urban space (Furnish Tech, 2020).

In the public space scale, the opportunity to explore appears in different forms of playing and learning, which can happen in the forms of playgrounds, sidewalks, and schoolyards. It happens in the presence of a parent or caretaker but at a broader distance from them. These are often part of parks, shopping centres and other built environments. The Hammarby Sjöstad neighbourhood in Stockholm became a famous model (‘Hammarby Model') since many sustainable design elements are involved, like the example of the overhanging balconies around a public space, offering parents the opportunity to look after their children without bothering their free play (NIUA, 2019). The public parks of Amsterdam designed by Aldo van Eyck (NIUA, 2019) were created with the idea that children prefer places for playing, which are not perfectly organised, but rather places to discover (Han et al., 2018). The main concept was to create a minimalistic place from only a few variables, and climbable elements and let the children explore the space while encouraging them to use their creativity. Climbing helps children improve their decision-making skills, gives them courage and makes them feel and become more independent (Malone K. et al., 2014). The outside world might seem intimidating for a child, but making these functional places more playful might help children feel more connection and security using their urban environment. As an example, creating sidewalk games can create the expression of an extended playground (Muasaroh et al., 2020), just like the playful solution of the Sidewalk trampolines in Copenhagen (ArchDaily, 2022). The closeness of the roadway might be a threat to the children in the case of these sidewalk games, which means that safety measures also need to be implemented, just like in the case of the School Zone Improvement Project in Seoul, where they developed clear separation with the help of small fences (NIUA, 2019). Besides children, playful street crossings can also affect the driver’s behaviour and by that, it can be a tool to increase the

visibility of vulnerable road users and support road safety. After getting the legal permission, an intervention like this can be implemented by the community, involving local schools or artists, either way, it can create a special place for the locals from the neighbourhood. While public playgrounds and sidewalks are available constantly, some places in a city are open only in a certain timeframe for the public, such as schoolyards. Extending the opening hours of these yards can give another venue for local children to play as well as for the local community to organise events and social gatherings (Kyriakou, 2014). The St. Lawrence Neighbourhood in Toronto illustrates the same example: the playground next to the school belongs to the school itself and during school hours it is used exclusively by the students, but after those hours it is opened for the local community (NIUA, 2019).

The neighbourhood scale encourages the children to move forward in independent and playful exploration such as different routes, networks and the riverbank. The Cantinho do Céu Complex in Sao Paulo illustrates how a riverbank can be turned into an inclusive, green urban environment beneficial for all the locals of a neighbourhood: it brings closer the waterfront to the children through accessible pathways, designed for exploration with many playable objects and spaces alongside (NIUA, 2019). Another neighbourhood-scale placemaking intervention can be a network, connecting different sites of the city, such as the 'Playing out' project (NIUA, 2019), showing how a micro-scale bottom-up project can grow into a neighbourhood-scale solution. Its core idea first came from two local parents aiming to create a small outdoor space for children, but through community engagement today the project involves 150 streets in the city. (NIUA, 2019). When discussing a network of child-specific places, we also need to consider their connecting routes to become child-friendly: they can create awareness to help children feel safe and support their independent urban mobility (Corsi, 2002). In Maggie Daley Park in Chicago, the routes are enriched by interactive and climbable objects on their sides (NIUA, 2019). A project realised in Bogota, created routes to develop a sense of safety in children. The project aimed to assess the danger spots by mapping them with the children and the local community and then creating smaller tactical interventions to target the problems (NIUA, 2019).

3.3 Dividing Roles

Urban placemaking projects can be realised with the involvement of different stakeholders, such as educational and research institutions, designers, the state or a local municipality, NGOs or civic organisations, and organisations of the private sector. Each potential stakeholder has a different role and can contribute to a project in different ways by bringing their own experiences, knowledge and power to the table, which means that responsibility can be shared but also that the different expectations of the stakeholders need to be articulated to avoid disappointments and conflicts. Schools might have a significant role in creating a bridge between the design team, the children and other stakeholders too. The school community can realise and articulate a problem and ask for support to solve it just like it happened in Mumbai, where the Jai Vakeel School and the Victoria Memorial School for the Blind have invited a team of designers to transform the campus' outdoor space into a play area, which would fit the needs of the disabled children (NIUA, 2019). The school realised that it is unused and could be turned into an intermingling space, for children from different local schools to meet and play together. Municipalities can support a placemaking project with local funding, they also have the authority to give permissions for occupying public spaces and realise constructions last but not least, municipalities can be the target group of policy recommendations, since they can influence local regulations. The power of civic organisations comes from knowing the local communities directly through public actions which is clearly illustrated by the Smart Park Redevelopment Project in Bhubaneswar, India, where the local NGO had a significant role in the realisation process (NIUA, 2019).

In conclusion, the involvement of end users, particularly children, in the urban planning process through placemaking initiatives necessitates consideration of various factors such as the level and methods of involvement, the scale of interventions, and the roles of participating stakeholders. The depth of participation can vary based on the tools utilised, ranging from introductory meetings and observations to participatory workshops and informal verbal tools like interviews and group discussions. These tools provide invaluable insights into community needs and preferences, informing the design process and fostering collaborative decision-making. Moreover, placemaking projects encompass different scales of

interventions, from micro-level installations like street furniture to neighbourhood-scale initiatives such as creating networks of child-friendly places and routes. Different stakeholders, including educational institutions, designers, municipalities, NGOs, and civic organisations, play crucial roles in these projects, contributing their expertise and resources to create inclusive and vibrant urban spaces that cater to the needs of children and the broader community. Through a comprehensive examination of these factors and examples, an urban placemaking project was realised in Budapest, as presented by this paper.

4. A Collaborative Research Project in Budapest's 7th District

Built upon the introduced learnings, a research project was developed by the Innovation Center of a Hungarian-based design university, the Budapest Public Transport Center, the Institute for Human–Environment Transaction of Eötvös Loránd University and the Municipality of the 7th district of Budapest, aiming to tackle the needs of children (age group 8-13) in lights of public transportation, micro and active mobility, focusing on the usage and opportunities of public places around their school. The main research question was how design might facilitate children's physical and mental visibility and safety regarding the inclusivity of public places and mobility formats using placemaking to mitigate traffic through innovative research and a co-creation-based design development process.

The first chapter of the research project ended in December of 2022 and it had five different stages: (1) observations by the researchers focusing on the current situation of the street of the school, (2) questionnaires for the students focusing on their mobility and socialising habits, (3) problem mapping workshops involving four classes (with 30 students each) of four different schools of the 7th district, (4) participatory design workshops, involving 30 students from one of the previous schools and (5) testing the usage of the already installed prototype through observations and questionnaires among student and teachers.

By the observations and the questionnaires, we could understand the general conditions of the school front environment as well as the general usage of it. During the observations field notes were taken focusing on the behaviour of arriving and leaving students and teachers, accompanying parents, drivers, and pedestrians as well as physical circumstances and social interactions between the different groups. We have learnt that students use micro-mobility vehicles and the matter of their storage is unsolved. Neither students nor parents socialise in front of the school. Pavements are narrow and parking cars are filled up on both sides of the street. Many students are dropped off by car in the morning but in the afternoon students leave in groups by walking. Most of the students leave closer than 10 minutes of travel but some students have to travel more than 30 minutes to get to school.

The problem mapping workshops included four workshops (45 minutes each) for 4x30 students of four different elementary schools, situated in the 7th district of Budapest. The four occasions had four different focuses. During the first workshop, the students created a common cognitive map (Altman et al. 1978) about the urban environment of their school. They had to involve not only its physical conditions (with parking sports, green areas, traffic lights and so on) but also they had to place their emotions (fear, happiness, loneliness, togetherness etc.) on this commonly created map to help the researchers to understand the advantages and limitations of the place in its fullness. In the second workshop, students got involved in small, facilitated group discussions about their mobility habits and most commonly used routes. During the discussions, we used different visual aids to help the conversation. With the third workshop, we created "parent personas" with the students to understand their families' habits and preconceptions about mobility, public space and the built environment. The persona creation was supported first with more general (such as: What does this person look like? What does this person wear? How does this person travel in the city? What is the daily routine of this person) and after with more specific questions (such as: What does this person think of the safety of the street? How does this person feel about the efficiency of public transportation? What does this person suggest us in an urban environment?). During the last (fourth) workshop, students created their common collage based on their needs, including given and desired activities related to public space in the school environment, which helped us to understand both the current and the wished use of the space.

The structure of the following participatory design workshops was developed based on the results of the problem mapping workshops: it included a group brainstorming and modelling session, engaging one class of students, organised into small groups. These sessions aimed to ideate with the students, addressing the challenges identified during the prior examinations (observations, questionnaires and problem-mapping workshops). The brainstorming phase focused on four topics: greening and sustainability, mobility, safety and the usage of the current school front area. To warm up the groups we used different rapid creative games like story cubes, activity and visual prompts. The main activities of the brainstorming phase were situational exercises, where the groups of students got different rapid situations to solve. The situations included examples like: “You are waiting for a public transport service to get home and you need to fill in the time left at the stop. What does an ideal bus stop look like?” and “We need to designate and build a safe way home for our 4-year-old little brother.” In each situation, the students got different tools to work with. We aimed to use child-friendly and playful tools, such as cardboards, blind maps, speech bubbles, printed street view screenshots, colourful tapes and sticky papers, pictures, maps drawn on the floor and life-sized projected photos. After the situational exercises, each group had 45 minutes to model their ideas as detailed as possible, including all the solutions and functions they collected during the brainstorming.

Based on the collected data, a prototype was designed to tackle the challenges raised by the target group. The results of the participatory design workshops gave a significant imprint on the development of the final implementation: aiming to develop an inclusive, child-friendly, sustainable and adaptable urban intervention which supports children’s visibility and traffic calming as well. Assessing the usability and impact of the tangible prototype was the last methodological part of the research. This involved different observation methods such as narrative impact assessment among the target group and quantitative tools like speed measurements using a speedometer. Speedometers were executed twice, approximately one month apart by the Budapest Közút Zrt. The first happened before the installation and the second was one week after it. Both happened on the same four days of the week, from Monday to Thursday measuring the traffic of the entire day. The created and installed prototype at a pilot location is a research tool which combines modular, alone-standing steel structures, asphalt painting and plantain. This research tool provides real-life opportunities to collect and analyse data and start a conversation with different stakeholders (children, parents, teachers, neighbours) in a co-creational manner. The prototype is an experimental small-scale installative intervention that aims to react upon the insights coming from the children such as dedicated space to gather and wait, being visible, having a chance to experience place attachment and having a more recognisable school area. Besides these aspects, the prototype also tests the utilisation of scooter storage to respond to the emerging usage of different micro-mobility tools among children. Another goal of this placemaking tool is to make the school more visible and affect the traffic surrounding it. The intervention aims to cause traffic calming and to affect drivers’ behaviour through visual stimulation.

After collecting and analysing the results of the first project, the collaboration started a second chapter last November, involving a new school from the same neighbourhood aiming to move forward with the learnings of the already closed project. The methodology is built upon the previous one including some changes based on the feedback and takeaways.

5. Results

During the whole research project, we collected (1) qualitative data through observations, questionnaires as well as problem mapping and co-creational workshops and (2) quantitative data by speed measurement tools.

Both the prior examinations (observations, questionnaires and problem mapping workshops) and the co-creational workshops resulted in a deeper understanding of the challenges children face in the specific urban environment of school front areas. Regarding the built environment we have learnt that the involved students face a high level of placelessness: there is no dedicated place for them to gather and socialise after school or to wait for each other. And even more, they feel unwanted in this environment resulting in

them being unable to develop an attachment to this place which should have a major role in their development. They also articulated the need for greening, alternatives for playgrounds, colours, bright bus stops, seating areas, storage spaces for rollers and bikes, litter bins, and larger visible spaces but also smaller spaces for more privacy. They also have different levels of knowledge about the school environment, they could not (or hardly) point out favourite places, although they mentioned parks, squares and places for sport and sitting close by. Students' physical and mental safety also turned out to be a main concern: they feel that they are not visible and their sense of security is disturbed by traffic and strangers. Regarding the children's physical safety, speed measurements proved that drivers not only avoid slowing down in the close environment of the school, but we recorded a significant amount of speeding as well. The speed limit was 50 km/h, and the maximum velocity was over 90 km/h.

Besides learning about the needs of the involved children, we also gained a deeper understanding of the perspectives of their teachers, parents and locals through observations, interviews and questionnaires. Parents are a large group, who frequently spend some time in front of the school waiting for their children, mostly during mornings and afternoons also. They were often leaning against the safety barrier while talking to each other. Also, there were occasions, when they met with a teacher for a brief discussion or just handed over a paper. The school front area turned out to be a meeting point for the school's whole community as well as for some locals, even if it was not established in its planned form.

Based on the prior examinations and the co-creational workshops, a prototype was created and installed in the form of an experimental small-scale and modular intervention, to react upon the insights listed above coming from the children and their teachers as well as to use it as a research tool for more data collection. After the installation of the prototype we applied different observation methods such as narrative impact assessment among the target group, questionnaires as well as speed measurement tools. The most beneficial functions offered by the prototype seemed to be the leaning components placed on the safety barrier, the bag holder surfaces, the bench and also the place itself created by the installation. According to our new observations (one year after the installation), we can see that the placed modular system is widely used by the school's community for a shorter period during the mornings and for a longer time during the afternoons according to the observatory research. The prototype tested the utilisation of scooter storage to respond to the emerging usage of different micro-mobility tools among children, but it does not offer a permanent solution, however, it draws attention to this question. According to the suggestions of teachers and students, the installation should involve even more sitting surfaces and more opportunities to store bicycles, also teachers had suggestions to strengthen the structure of the installation to make it more resistant and thus safe. Besides these suggestions, only one main criticism was formulated by the school community about the painting of the asphalt around the installation, which means it needs more structured preparation and more involvement of the target groups in its design process. The goal of targeting traffic calming is partially reached, since the average velocity compared to the starting setup decreased by 3 km/h, after the installation.

Receiving feedback from the children and teachers through questionnaires (repeated one year after the installation) and group discussions, we learned that many children enjoy the colourful and playful solutions as well as the plants and seatings, we could also learn that in the case of both students and teachers, the installation is popular and it became the centre of social interactions in the school front area for both teachers and students as well as their parents. Since the children also articulated their new ideas according to the size and setup of the installation, it means that the participatory process was successful in involving the students in the design process: they started to feel engagement, ownership and control. Although on their first visit after the implementation, students hardly stepped into the new installation to explore it, a few months later during observations we learnt that it has become an often-used space, not only by the children, but the whole school community as well.

6. Conclusions

The involvement of students in co-creational workshops presented both challenges and opportunities in the design process. Despite initial difficulties in expressing their opinions, a few participatory workshops effectively engaged the students, emphasising the importance of their inclusion in urban interventions. This research highlighted systemic issues such as the general placelessness of the target group and their invisibility. Moreover, the findings regarding public place awareness, liminal spaces, and traffic calming suggest potential paradigm changes in Budapest and other cities in the CEE region. The research methodology provided valuable real-life opportunities to collect and analyse data and initiate meaningful conversations with various stakeholders, including children, parents, teachers, and neighbours. Moving forward, the research aims to integrate the findings into a new school environment, involving additional stakeholders more directly and focusing on more diverse groups of users besides children. While the traffic calming installation showed some improvement in traffic speed, there is still room for bolder solutions, and concerns about children's safety near intense car traffic persist among teachers. Observations revealed consistent use of the installation during after-school hours, indicating its potential impact despite cold weather conditions. The next steps involve extending the scope of traffic calming through placemaking by further developing tested prototypes and creating new, ambitious small-scale interventions in collaboration with intersectoral actors to provide scalable and transferable solutions for Municipalities in school areas.

6.1 Images



Figure 1. Co-creational workshop of the case study with the involved students. Photo by Máté Lakos. 2022. 06. 08.



Figure 2. Neighbourhood mapping workshop of the case study with the involved students. Photo taken by: Máté Lakos. 2022. 06. 08.



Figure 3. The installation of the case study in front of the school. Photo taken by: Balázs Turós. 2023. 06. 03.



Figure 4. Prototype evaluating workshop of the case study with the involved students. Photo taken by: Balázs Turós. 2023. 03. 28.

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P/REFERENCES OF DESIGN

ECONOMIES OF ENTREPRENEURIALISM AND POLITICAL AGENCY: URBAN INFORMALITY AS A DESIGN PARADIGM FOR RESILIENT FUTURE CITIES.

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KEYWORDS | DESIGN WITH PERIPHERIES, URBAN INFORMALITY, RESILIENT CITIES, SOCIAL DESIGN, DESIGN FOR AGENCY

ABSTRACT | Today, the world faces a multitude of complex societal issues, that need urgent attention for enhanced quality of life and resilient futures. With the help of a study on the daily mobilities of urban marginalised women (UMW) supported by state-of-the-art literature, this paper presents insights into the aspects of urban informality that can inform the design and planning of future cities capable of surviving the situations of crises. By adopting a combination of new technologies along with mobile methods and ethnography, this research centres around the everyday travel experiences of the urban marginalized women from the peri-urban areas of New Delhi who contest their right to access stationery and mobile public spaces. Following the elements of qualitative research, this study examines the socio-spatial environment comprising the daily mobilities of UMW to reveal certain conditions of informality that enable their access and participation in socio-economic activities. In doing so, the paper highlights the significance of various infrastructures emerging from the social conditions of doing things together (social interdependence), belonging to a community and the aspects of self-organisation that are crucial for the sustained functioning of cities. Moreover, it presents a perspective for designers to identify and embrace temporary ways of existing and operating towards resilient cities of the future. With the help of the findings from this study, this paper presents urban informality as a design paradigm for various systems and services of future resilient cities that are more equitable and inclusive, and at the same time adapt to the dynamic uncertain situations of crises by being flexible, adaptable and leaving spaces for the emergence of bottom-up citizen-led initiatives.

1. Introduction

In recent years, there have been several incidents of crisis where informal arrangements constituted by the actors or people have been able to mitigate uncertain situations, such as during the coronavirus pandemic[1] or in case of issues related to migration (Ukraine, Syria), where the existing formal structures or the national governments have been unsuccessful. This questions the proper functioning and sustenance of formal service systems within the cities established by the policymakers, and at the same time brings attention to the potential of informal, bottom-up processes initiated by the inhabitants for their survival. This phenomenon where citizens act together to make use of the available resources to address their needs can be linked to 'subaltern urbanism' or urban informality. According to Roy (2011), subaltern urbanism provides a perspective focused on the habitation, ways of life and politics within slums or peripheral areas of megacities. In recent studies, the notion of peripheries signifies the physical space on the fringe of the megacities, the in-between, that is constantly evolving and lies between the urban and the rural, also referred to as the peri-urban interface that presents the space for making and remaking of urban life (Simone, 2010a). This implies that the notion of peripheries goes beyond the topographical space and also reflects the various discontinuities, hinges or relationships that emerge within the socio-urban territories (Simone, 2010a). These peripheral areas or regions of megacities also known as Third World slums, from the Global South are considered to be outside the notions of developmentalism (Robinson, 2002) but at the same time reflect their various survival abilities (Roy, 2011) where the inhabitants have devised their own creative ways to function as a response to the negligence of the state (Roy, 2011). It is emphasised by Roy that subaltern urbanism reflects two main subjects of attention, namely, economies of entrepreneurialism and political agency (Roy, 2011). Through the study of everyday mobilities of urban marginalized women (UMW), in the peri-urban areas of New Delhi, characterized by aspects of exclusion, this paper presents insights that would enable the design and planning of future resilient cities through equitable and inclusive service systems that provide spaces for emergence of alternate bottom-up processes to meet the needs of people. This paper presents urban informality as a value for the design and planning processes and brings debates on spaces of poverty, access, agency and politics to the forefront.

2. Understanding Informality (Subaltern Urbanism)

Within the context of modern Indian historiography, the notion of subaltern emphasised to depict power, domination and relationships signifying inferiority and dependency (Sarkar, 1984) along with a space of indifference (Spivak, 2005). However, Guha (2005) argues that the concept of subaltern represents the politics of the inhabitants and should be understood as an agent of change. The survival actions explored by people of the Third World megacities are described by architect Rem Koolhaas as inventive measures characterised by experimental responses and reflect a 'culture of make-do' (Patteeuw, 2003, p. 116) that engender significant systems based on alternative ways of functioning, aspects of self-organisation and provide spaces of deregulated actions (Godlewski, 2010). Similarly, for De Soto (2001) the Third World slum reflects an economy of the people, rich in assets that represent many of such self-organised mechanisms that could be understood as valiant entrepreneurial experiments. Several scholars argue that the urban peripheries present settings for critical contestation of citizenship and practices of hegemony (Holston & Caldeira, 2008; Roy, 2011; Simone, 2007). Within the context of political agency, Gidwani (2006) repudiates the argument on probable connections emerging between the different vulnerable inhabitants of the urban peripheries.

The informal sector is most prevalent in cities of developing countries since these cities are experiencing huge urban growth (Roy, 2005). These cities are reminiscent of complex machines that comprise interwoven layers of human beings and physical materials that further produce social, cultural, political, economic and environmental relations (Simone, 2010b). In developing an alternate way to understand

[1] In early 2021, during a major Covid break out in India, most government-run and other formal systems in healthcare and other logistics sectors collapsed at the time of an unexpected situation of crisis. During this time, several informal and non-hierarchical systems emerged that were formed by the people and for the people to support one another.

cities, Castells (1985) relates it to urban social change where he emphasises the notion of collective actions signifying the presence of multiple acting forces in its production. In doing so, Castells (1985) presents a critique of the Marxist theory that fails to consider important issues, for instance, related to feminism and culture, that may help to understand the urban as a critical element related to aspects of urban social change. Castells (1985) presents a definition of urban social change as contemporary social and urban movements that are characterised by a culture representing communities and that lay emphasis on political self-determination (Mayer, 2006). It is further elaborated by Castells that the existing hierarchical structures that comprise the urban, undergo transformation leading towards a kind of reorganisation of the society based on values signifying democratic participation and decentralisation as its critical elements (Mayer, 2006).

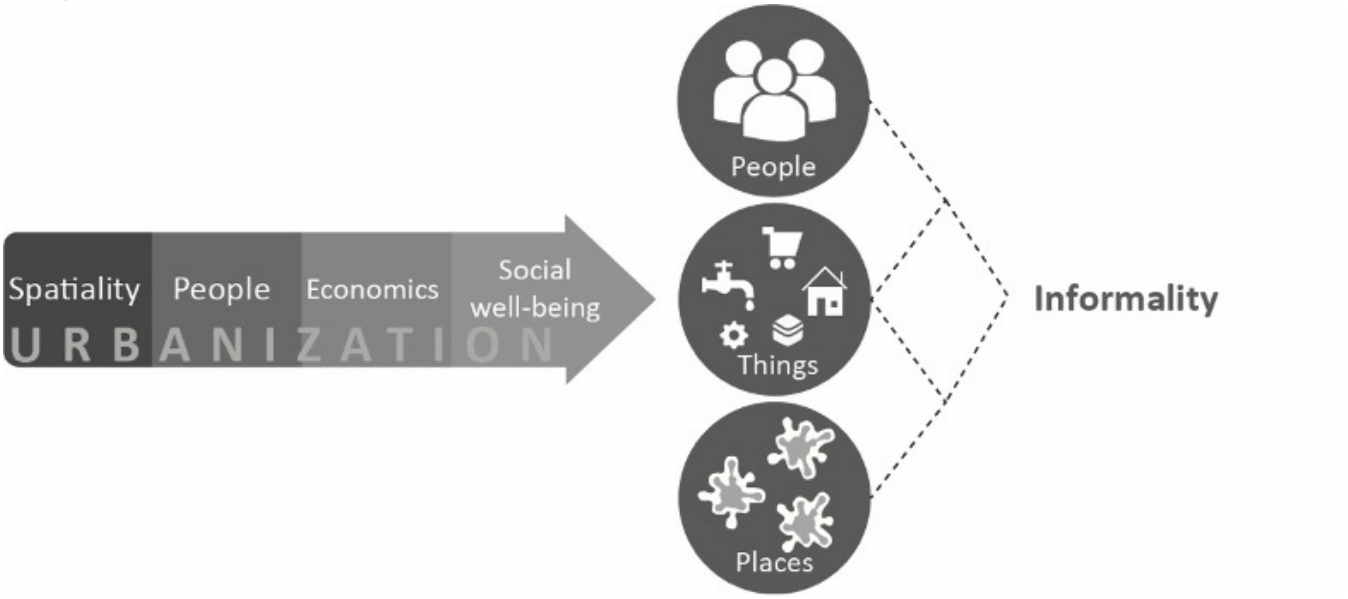


Figure 1. The socio-technical aspect of urbanization produces productive relationships among people, things and places. This inter-relationship gives rise to 'informality' which is an integral component of urbanisation. Source: Adapted from Simone (2010b).

In the case of developing countries, a flexible model of governance, signifying the concept of political agency (Guha, 2005; Roy, 2011) is based on self-initiatives of the individuals and gives rise to bottom-up solutions addressing various issues of the society. However, the recognition of such informal self-organised models as a comprehensive social or political force is often doubtful, yet such actions present opportunities to the inhabitants of the city for negotiations, collaborations, exchanges and strategic planning (Brown et al., 2010; Grant, 2009; Lewinson, 2007; Lindell, 2010; Mohan, 2008). The daily work or activities allow the inhabitants to be actively engaged in each other's lives to create and sustain relationships with their neighbours, co-workers and extended family members. These relationships with the city and other people enable the inhabitants to create a map of their own whereby they identify and categorise safe and unsafe places, the belongingness to those spaces and the connection between different spaces (Simone, 2010b).

Often, the survival techniques, which emerge from socio-economic or geographical reasons, give the cities an alternative mechanism to co-exist and maintain a balance in urban city life. These solutions to urgent or otherwise unsolved problems of urban cities are defined as idiosyncratic innovative paths, that is, a structural or behavioural characteristic unique to an individual or group (Srinivas & Sutz, 2008). In such contexts, the relationships of individuals with one another and with their social, economic, and political environments are of utmost importance. Most cities of developing countries generate a conglomeration of social activities that either align themselves or strive their way through city governance and policies. The deficiencies of certain kinds of infrastructure in cities give way to other possibilities relating to policy interventions and governance that are more flexible (Simone, 2010b). In these contexts, flexibility and uncertainty are considered inherent parts that transform into crucial resources for survival. Adding to this,

Bayat (2007) asserts that besides flexibility, the informal life is signified by aspects of 'doing things on your own', negotiations and describes it as a continuous process that involves a struggle for the vulnerable to survive and for self-development.

The concept of informality is also supported through understanding 'resilience'. The cities characterised by adaptive and flexible systems through the capacities emerging from the constantly evolving social learnings (knowledge of people) enhance their chances of being more resilient in situations of crises comprising complex societal issues (such as social inequalities, migration, climate change etc.) (Davoudi et al., 2013). Holling (2001) argues that (identifying) human capacity(ies) is an important characteristic of social systems specifically for foresight and intentionality. This is supported by different ways and means (or appropriation) to enhance their ability to strategise and plan. Identifying potential vulnerabilities and 'other' ways to function (opportunities) within the social learning processes enhances the likelihood of societal transformation (Davoudi et al., 2013). Thus, resilience is more than resisting the forces. It includes focusing on critical issues such as the intentionality of human actions, the purpose of resilience, the non-linear approach that diffuses the boundaries imposed by existing systems and the questions of power and politics (Davoudi et al., 2012, 2013). This paper presents the findings of a study from the Global South (New Delhi) to discuss the concept of informality as a significant design paradigm through the daily mobilities of urban marginalised women.

3. Self-Organisation through Available Infrastructure

Most peripheral areas of the cities of the Global South lack resources, political will and technical capacity, but they demonstrate the ability to build a connection between individual households and other economic, cultural and religious activities to support their livelihoods (Simone, 2010b). To perform these activities, the participation of individuals is important within the larger networks. According to Piermay and Schler (2003), as cited in Simone (2014), such arrangements give rise to unique, but dynamic interaction patterns including exchange and socialising. Roy (2011) emphasises two main themes of focus in relation to informality, namely, economies of entrepreneurialism and political agency. These attributes contribute towards new possibilities of citizen participation for bottom-up urban governance practices, and is termed by Botero and Saad-Sulonen (2010) as 'infrastructuring'. According to Simone (2004), the social infrastructure that comprises the inhabitants of territories forms an important core of cities. Blommaert and Klinenberg argue that social infrastructure enables different connections within the groups, and it can facilitate various interactions, including contrasting thoughts (Blommaert, 2014; Klinenberg, 2018). Emerging from everyday economies, behaviours such as reciprocation, negotiation and cooperation highlight the bottom-up initiatives of participation in contrast to an unintentional dominant top-down design approach (signifying colonialism, capitalism or heteropatriarchy) (Costanza-Chock, 2020). According to De Soto (2001), the insurgence of the grassroots against the state power epitomises the informal and signifies bold and risky ways of doing things on your own. This aspect can be related to community-led design that focuses on civic participation leading towards democratic outcomes (Alexiou et al., 2013).

Several social aspects like social norms, social trust and social networks comprise what is known as social capital (Durlauf & Fafchamps, 2003) which has characteristics like flexibility and openness as critical components (Star & Bowker, 2006) and grows with every act of participation and sharing of acquired knowledge (Star & Ruhleder, 1994). It is understood that in the case of informal economies, social networks and personal relations help in the formation of several mini and micro-economic activities. Moreover, in some cases, these social networks aid in providing access to certain favourable resources for entrepreneurs (Meagher, 2005). The collaborative initiatives involving different users is explained by Bollier and Helfrich (2014) as an act of design, which paves the way for a 'commons culture' (Bollier & Helfrich, 2014), that is, through social relationships and shared knowledge. Botero et al. (2010) discuss 'infrastructuring' as a shared resource where it is crucial to consider 'when' something is being considered as an infrastructure or a resource by its users. It is not just the resources and context that are important; it is crucial to consider the right time and use of these resources by its users (Marttila et al., 2014). Different kinds of infrastructures, including social, physical and institutional, affect the emergence of bottom-up initiatives

and how these can be appropriated under different situations or contexts (Pipek & Wulf, 2009). Several studies (Star & Bowker, 2006; Star & Ruhleder, 1994) have highlighted significant features of these informal emerging resources, such as the inter-relationship and connectedness with other social, spatial and technological structures, their spatial and temporal reach and the non-obvious arrangements between people, spaces and things that go unnoticed. The formation of new infrastructures does not take place from nothing; it results from acts of negotiations and contestation (Star & Ruhleder, 1994) between different entities involved.

4. Context of the Study

This study focuses on urban marginalized women (UMW) living in the peri-urban areas, also known as, informal settlements, of New Delhi in India. Most people living in the informal settlements of these peri-urban areas are migrant poor who have travelled from neighbouring states of Delhi in search of work. Among the various groups of women in India, the most vulnerable are the UMW. This group of women are marginalized from two perspectives. First, because they belong to the socio-economically weaker section of society and second, they are women. Besides experiencing exclusions at a household level, women from marginalized communities also face several other challenges at the city level. These women are primarily employed in the semi-formal or informal sector[2] and often cannot afford to use any transport mode but walking. A study conducted by Bostock (2001) on low-income women also presents the numerous problems women face while walking, including fatigue, stress and psycho-social effects. According to Uteng (2012), the cultural aspect plays a crucial role in the positioning of gender with respect to mobility, namely, access to outer space and kinds of activities. Several studies highlight the impact of risks associated with travelling on public transport modes, such as sexual harassment and travel behaviour of women, where women tend to self-exclude themselves from certain activities hence limiting access to social, leisure and economic activities (Anand & Tiwari, 2006; Murray, 2016). Fear of space is one aspect of risk aversion that is related to the interaction of women with urban space (Pain, 1994). Due to this reason, they tend to return home early and thus lose out on employment opportunities (Tanzarn, 2008). However, Tulloch (2000) states that many factors contribute to risk experience and depend on spatial and social contexts.

5. Methods

This study uses a combination of new technologies along with mobile methods and ethnography to focus on the daily mobilities of UMW. The participants for the study were recruited by establishing contacts with two NGOs in Delhi that work with issues related to women or women empowerment[3]. The study is divided into two main phases. The first part of Study I requires understanding the socio-demographic conditions of the participants through the means of unstructured interviews. The second part of this study shifts the focus of the interviews towards developing a cohesive understanding of their daily routines. In-depth interviews are used as a preliminary method to understand the socio-demographic characteristics of the participants living in urban peripheral settlements of New Delhi. Subjective and experience-related questions, such as the description of their daily routines and travel experiences were asked during the ethnographic interviews. It was ensured that the interviews were conducted one-on-one and in private to make the participants feel comfortable so that they could share their experiences freely. These interviews also included a detailed explanation of their daily travel patterns. Through this description, information regarding their travel patterns was extracted for further inquiry.

[2] The formal economy is marked by regular work, is legally sanctioned and is regulated through state intervention (Hart, 2006; Portes & Schauffler, 1992). Institutions that do not fall in the formal policy regulated environments and are more ephemeral and, not easy to categorise or define (Demant Frederiksen, 2015; Kelsall, 2011) may be called the informal sector, informal arrangements or informal economy.

[3] Azad Foundation is an NGO that mainly works towards the capacity building by providing driving training to women from resource-poor communities. It has its centres in north, south and east Delhi. The other NGO is CEQUIN India, located in southeast Delhi in Jamia Nagar and promotes equal rights for women and girls.

Further, in Study II, mobile methodology is used for collecting information about the participants' daily movement through GPS path tracking. The second part of the study collected data focusing on the path travelled by the participants for a period of two weeks. This study adopted the use of phone GPS and Google Maps timeline. To identify underlying themes and categories abductive approach to constant comparative analysis is applied for unstructured interviews. Mapping is used as an interpretive analysis method for GPS travel path data. This study adopted the use of phone GPS and Google maps timeline. This study was conducted during the Pandemic, with restrictions on mobility and social gathering. Thus, based on the availability and knowledge of the participants, appropriate tools (WhatsApp and Google Maps Timeline) are used during the field study[4]. Interviews are conducted through both face-to-face interviews and voice calls using WhatsApp[5]. The researcher educated the participants with the help of screenshots and voice calls on how to turn on the GPS location on their smartphones and how to share their current location on WhatsApp. Along with this, travel diaries are also filled out for each participant[6]. These methods helped to identify the characteristics, motivations and barriers that affected the movement patterns of the participants. This process gave the researcher a broad idea of the different journeys performed by the participants.

Travel diary, along with the GPS tracking method, helped in the data triangulation that allowed the study to investigate small but important factors related to the daily travel routines of the participants.
To identify underlying themes and categories abductive approach (where codes emerge gradually) to constant comparative analysis or coding is applied for unstructured interviews. However, manual mapping is integrated into the analysis method to avoid overshadowing of the computer software, which could missed finer details of the data (Silverman, 2015). Mapping is used as an interpretive analysis method for GPS travel path data.

A group of 20 women participants were interviewed for this study. The data relating to travel patterns were gathered for 14 participants through their Google Maps Timeline[7]. All participants reside in informal settlements towards the outer periphery of Delhi and belong to the lower-income section of the society. Their age varies from 19–46 years. In terms of occupation, 17 participants are employed full-time, and the rest are involved in either part-time or informal jobs or are pursuing education or some other course or training. Few other women are associated with the NGOs where some of them work as ‘mobilisers’ (social workers) and others are taking driving lessons. Besides travelling for these purposes, for some women, their daily travel also includes attending to daily reproductive responsibilities such as picking up or dropping children at school, grocery shopping, etc. The daily mobility of these UMW is characterised by travelling long distances and therefore is accompanied by increased travel time and travel cost. In absence of direct connectivity between their home location and workplace, they need to include multi-modal trips within a single journey to accommodate for spending less money on travel-related activities. In most cases, the last mile of their journeys is completed with the help of informal modes of transport and walking.

[4] While conducting preliminary research it was found that not all UMW owned a smartphone. Thus, the selection of participants was based on the availability and access to smartphones (with Internet and WhatsApp).
[5] The data collection process began in February 2020 through face-to-face interviews. After interviewing fourteen participants and obtaining GPS data for five participants, the field study came to a halt in the second week of March 2020. During the total lockdown in New Delhi, India, people’s mobility was affected the most and thus it was difficult to pursue data collection with the existing approach involving face-to-face interactions.
[6] In this case, there were limitations concerning the literacy level of the participants and thus the researcher filled out the travel diary during face-to-face interaction with the participants.
[7] Due to lack of technical knowledge and issues related to availability of smartphones, the GPS data could not be collected for all the participants.

6. Findings

This study focuses on the daily mobilities of UMW to highlight emerging aspects of informality towards future resilient cities.

6.1 Social Interdependence

The study reveals that social interdependence is one of the main characteristics of informal settlements (also see sections 2 and 3). It means that people within these societies consider themselves dependent on others for various reasons without any economic benefits to any person or group. Specifically, it is observed that UMW appropriate their ability to engender social interdependence as a means to evade incidents of sexual harassment to carry out their daily mobility.

It is mentioned by many participants that they find walking one of the most unsafe travel options. The study shows that it is quite common for women to experience incidents related to sexual harassment or eve-teasing while walking. Moreover, these incidents take place mainly on the inner streets and are more common after dark, where there is presence of fewer people on the streets and inadequate lighting on the streets. To cater to this issue, UMW prefer travelling in groups of two or more. Thus, social interdependence forms a critical component that impacts the accessibility of UMW to public spaces.

> “I have a friend who goes with me. She lives nearby and we work in the same office.”
> Daksha, 20, tele-caller

> “Two of us go from this area. We meet in the morning at the nearby junction to travel ahead.”
> Rima, 24, social worker

Besides addressing other tangible travel-related issues such as cost, these informal arrangements act as safety nets for their travel journeys. These safety nets are formed through temporary collaboration between known and unknown female co-passengers who need to travel in the same direction (see interview quotes above). This highlights that the aspect of interdependence is not limited to their enclosed social network but expands to include other unknown women co-travellers to form groups while performing the act of travel.

The study also reveals that the women from these communities often make use of their social connections. For example, in absence of support from their families, many women depend on their neighbours to help them with basic but necessary tasks, such as childcare, which enable them to participate in the socio-economic activities to contribute to the finances of their respective families (see interview quotes below).

> “If I could not get back by 1.30, I’d tell my neighbour and she’d pick my daughter from the school transport.”
> Bitti, 33, taking driving lessons

> “I tell ma’am at work that I have to pick my child, then I am able to leave a bit early.”
> Tanu, 28, healthcare worker

> “I have such wonderful neighbours. He is like my brother who has a tailor shop. He keeps my shop’s keys. So, whenever he opens his shop in the morning, he also opens my shop by 12 pm. If there’s a customer, he puts me in touch on the call. Otherwise, he tells them that I will be available in the evening. So, I come by 3–4pm. as my kids return from school at 2 pm.”
> Rubi, 34, entrepreneur

Thus, these women try to get the maximum out of the available resources to put to advantage their capacities to facilitate social capital (see section 3) through spontaneous yet systemic informal networks to carry out their daily mobilities and thus participation in socio-economic activities.

6.2 Self-Organisation

The findings highlight that certain formal mobility systems, such as radio taxis and *auto-rickshaws*, are used as informal mobility arrangements by UMW, especially during their return journeys from work. This system emerges within the formal urban context and is driven by informal collaborations between women and acts as an option that meets their travel needs.

> "We travel together as it gets late (dark) and then we feel safe to travel together. We didn't know each other earlier. It is through our daily travel on the same route that we got to know each other. At times, when we are four-five of us together then we hire a private auto and share the cost. Sometimes we also get into these idle Ola or Uber cabs that make a halt at the bus stop."
> Pulki, 30, beautician

The above interview quote highlights that the women get acquainted with each other through their daily travel routines and enter into unvoiced informal arrangements with each other to self-organise safe and low-cost travel options for themselves. They make use of available resources such as their cumulative physical presence along with the social and collaborative forces that are guided by informality. It is also observed that in the realisation of these alternate options, a significant role is played by modern resources accessible to them through ICT, such as smartphones and instant messaging applications to coordinate and self-organise into groups.

> "We don't even need to stop them, if they see any girl or woman standing and waiting on the road (for a bus or rickshaw), these cab drivers stop on their own and start calling out if she needs to go in that direction. These cabs stop for both men and women. And in the morning sometimes there are auto-rickshaws that are available on sharing basis."
> Madhu, 46, social worker

It is understood that when off-duty (or when the taxis are unoccupied), the drivers of the app-based taxis halt at specific transit points where they usually find passengers travelling in the same direction as theirs. Although anyone waiting at the transit point can make use of this informal system, yet because of safety concerns this system is availed by UMW when they are travelling in a group. It is observed that these decisions need to be quick and spontaneous because they are being taken 'on the move'. This informal arrangement gives UMW an alternate way to travel in a specific direction by spending less money. It is noted that an informal agreement is formed between the driver of the radio taxi and passengers waiting at the transit nodes and is based on aspects of mutual understanding of each other's needs (such as earning extra money for the driver and low-cost travel mode for UMW). These collective capacities enable UMW to plan and make decisions (agency) for their travel journeys on a daily basis. These arrangements demonstrate unsaid rules of cooperation and trust among women who initiate these services for themselves by having empathy and care towards one another. More importantly, these arrangements allow them to plan and design their travel journey with the ability to exercise decision-making for themselves.

6.3 Sense of Community Guided by Socio-Spatial Infrastructure

UMW also shared different experiences while travelling within their home settlements, i.e., informal settlements. The findings from the study highlight that the internal streets of the informal settlements represent a diffused territory through the amalgamation of public and private spaces (Figure 2) that support the daily activities within these settlements. The weekly markets (similar to pop-up kiosks) within the informal settlements that support commercial transactions also help to stimulate a range of social activities, thus transforming the street into a vibrant public space – making it comfortable for UMW to walk through. Specifically, the daily needs shops or activities that mainly involve women's participation, such as buying vegetables and groceries, enhance women's involvement in various socio-economic activities.

> “I feel safe walking back home on Fridays because there is a Friday market on the way, and there are many people around.”
> Neelu, 23, beautician



Figure 2. The streets are an extension of household and other social activities. Source: Participants.

Additionally, the built environment and socio-cultural aspects of the informal settlements create 'in-between' spaces (between the public and the private) and make the presence of many people evident on the streets, ensuring the appropriate conduct of everyday activities within these settlements. The access to walking within the neighbourhood is greatly supported by the urban infrastructure of the informal settlements and thus enables women to perform their complex daily activities (Jurczyk, 1998).

> “From there I have to take the alleyways, so I walk from there. Because I have to pick my son from his school, do some shopping, buy stuff for the house and then come home - I always prefer taking the alleyways (short-cut).”
> Naina, 30, healthcare worker

Many women use the interconnected street network of the informal settlements for walking because of issues related to time as well as safety. The presence of people acts as ‘eyes on the streets’ and ensures a sense of everyday security to these UMW while walking. This draws attention to the significance of the social infrastructure that arises from the density of the informal settlements and reflects on an environment where things (people, spaces, activities, objects) are always acting on one another to create various permutation and combination of infrastructures. It is also highlighted through the findings that mixed land use within these informal settlements enables the participation of women in various socio-economic activities and their access to public space (encouraging other women) without any fear and hesitation. The next section discusses the findings to highlight the elements of informality that inform design practices towards resilient cities of the future.

7. Discussion

The findings of the study present 1) social interdependence, 2) self-organisation and 3) a sense of community guided by socio-spatial infrastructure as significant elements of informality. Informality as a concept is not limited to the physical infrastructure but also builds through the sociality of the urban. The findings reveal that the various connections that are formed among women and other infrastructures bring focus towards the importance of the affordances and capabilities emerging from social interdependence, adaptability, flexibility, trust, reciprocity and offering unstated support to each other. These foster mechanisms that can help to take care of the void left in the (formal) services of the cities (in this case public transportation system). This findings from this study focus on infrastructures managed and organised by actors themselves (Botero & Saad-Sulonen, 2010), that is, facilitated by elements of adaptation, negotiations and rules that are created by the actors for themselves. These are critical factors that align with the concept of evolutionary resilience (Davoudi et al., 2013).

Moreover, the aspect of participating in the decision-making process and designing their own services (mobility) provides confidence and sense of ownership to the people. Such informal arrangements are not fixed in any way but are rather fluid and emerge in uncertain situations and with presence of different kinds of available resources. Marttila et al. (2014) discuss these as critical elements towards participatory design practices signifying importance of tangible and intangible common resources. Thus, from a design perspective, the idea is not to integrate any specific arrangement into the existing formal systems or services of the city. We recommend that the existing (formal) systems should be flexible (not rigid and top-down) and leave space for the actors to design their own temporary services based on their collective needs. This approach would provide autonomy to the actors and enable democratic decision-making processes. The findings highlight the role of city infrastructure should be to support and enhance the formation of social connections and interactions between actors so that alternative options for different services can emerge. The existing urban infrastructure and services (of mobility) need to be adaptive to provide room for mediation of different kinds of social spaces that may emerge during everyday routines of actors. A flexible approach to the design and planning of (mobility) service-systems will aid towards the possibility of the emergence of in-between arrangements that are citizen-driven and thus equitable.

Through this study, we also point towards the changing role of designers to the one that focuses on creating conditions for emergence of bottom-up citizen-led initiatives. That is, instead of designing rigid systems and services within a city, the focus should be on leaving space for dialogue and negotiations to take place (Nthubu et al., 2022) for unimagined, unidentifiable infrastructures to emerge. Thus, this paper presents the need to identify, acknowledge and embrace bottom-up collaborations and non-hierarchical arrangements to be resilient towards the complex societal issues the world is facing today.

8. Conclusion

With the help of a study on the daily mobilities of urban marginalised women (UMW) supported by state-of-the-art literature, this paper presents insights into the aspects of informality to inform the design and planning of future cities capable of surviving the situations of crises. Sense of community, social interdependence and self-organisation emerge as significant elements of informality that enable citizen agency, flexibility and adaptation in uncertain situations (or such as due to lack of resources). The study also highlights the significance of appropriating available (tangible and intangible) infrastructure (as discussed in section 2) which leads towards community-led design and democratic outcomes (Alexiou et al., 2013). This paper highlights the significance of citizen agency to be considered within the design of future cities. Moreover, it presents a perspective for designers and planners to identify and embrace temporary ways of existing and functioning for more resilient cities of the future.

This research focuses on New Delhi as one case example for the study on socio-spatial mobility of UMW, however, it opens up further avenues of conducting similar research in other metropolitan cities where urban informality forms a significant aspect of everyday life of its inhabitants, such as, within the metropolitan regions of South Africa, Bangladesh, Pakistan, Sri Lanka, Nepal, Argentina, Colombia, Brazil and other Latin American cities, to name a few. The findings of the study that highlight informality as a design paradigm open up a broader discussion around access to resources for more open and equitable service systems other than mobility, such as food, education and housing.

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P/REFERENCES OF DESIGN

ACROSS TIME AND STONE: EVOLUTION OF TYPOGRAPHY IN DELHI'S HISTORIC ARCHITECTURAL MONUMENTS.

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KEYWORDS | TYPOGRAPHY, MONUMENTS, ARCHITECTURE, DELHI, TYPE DESIGN, DESIGN HISTORY

ABSTRACT | This paper delves into the symbiotic relationship between type design and the built environment, focusing on typographic inscriptions on monuments in Delhi. Delhi's rich architectural and urban history, which serves as a hub for various cultural influences and historical eras, is the driving force behind the choice of the city as a case study. Three iconic monuments—Humayun's Tomb, India Gate, and the Indian War Memorial - are selected for their temporal diversity and the common thread of grief and loss of individuals or soldiers in wars, reflected in their typographic content. The study meticulously documents and analyzes typographic elements, including inscription methods, script styles, content presentation, and spatial integration, while also considering the materiality of the inscriptions, such as the use of different types of stones and forms. Findings reveal a dynamic evolution in typography across different eras and materials, highlighting the resilience and adaptability of type design in conveying messages of remembrance and loss within the urban landscape. This research contributes to understanding the evolution of type design, particularly within the context of memorial inscriptions in Delhi, addressing a literature gap. Aligning with the conference's theme of civic engagement through art and design, the paper explores the intersection between typography and materiality in urban artifacts. Ultimately, this study deepens our appreciation of typography's role in shaping cultural heritage and commemorating moments of significance in the built environment.

1. Introduction

Communication has undergone significant evolution throughout history, with typography emerging as a powerful tool that leaves a lasting impact due to its documented nature. In the diverse culture of India, characterised by languages, scripts, and typefaces, typography has played a pivotal role across various historical epochs. Looking at historical monuments, where we see great application and use of typography in their architectural spaces, raises a question! Does this typographic inscription in architectural monuments have any impact on users? How are these typographic inscriptions and their use evolving in and around the same geography? Thus, this study delves into the intricate dynamics of typographic evolution, exploring the changes in its application across different temporal periods. By scrutinising various factors influencing typography, including advancements in tools, technology, craftsmanship, materials, and colour palettes, this research endeavours to unravel the complexities surrounding its implementation in architectural monuments. Through meticulous analysis and examination, we seek insights into the nuanced evolution of typographic expression within India's rich cultural and historical context.

2. The Object of Study: Typography

2.1 Typography and Communication

Typography has played a crucial role in human communication and expression throughout history. From the earliest forms of written language to the intricate designs of modern digital fonts, typography has evolved to convey not just information but also emotion and aesthetic appeal. Typography is more than just arranging letters; it is an art form that merges artistry and technology to convey meaning and emotion (Lim, 2022).

Today, typography permeates print and digital media and physical spaces like urban environments and architectural designs. Its evolution from handwritten scripts to digital typefaces has transformed how we interact with written language in various contexts. Moreover, the diversity of scripts and styles across different cultures and periods underscores the dynamic nature of typography and its impact on visual communication (Haveman, 1997).

The evolution of typography has paralleled advancements in architectural and urban design (Haveman, Andrea. *Typography: Visual Connections to Art and Architecture through the Ages*.). As human activities have diversified, so too have the spaces we inhabit, ranging from intimate domestic settings to sprawling urban landscapes. Typography is crucial in shaping these environments, serving functional purposes like signage and wayfinding while contributing to a space's aesthetic and identity. Integrating typography into architectural design reflects a symbiotic relationship between written language and built environments. Whether it is the nameplates on residential buildings, the signage in commercial areas, or the monumental inscriptions on public structures, typography enhances architectural spaces' usability and visual appeal. Moreover, the historical evolution of typography can be traced through the diverse array of scripts and styles found in different architectural contexts worldwide (Smith, 2011).

2.2 Typography and Architectural Monuments

Architectural monuments serve as tangible manifestations of cultural heritage and historical narratives, often adorned with inscriptions and decorative elements that reflect the aesthetics and values of their respective periods. Famous landmarks that witness centuries of cultural exchange and political upheaval dot the architectural landscape of Delhi, a city with a rich and varied history. Delhi's monuments represent a tapestry of architectural styles and typographic expressions, from the towering Qutub Minar to the stately Rashtrapati Bhavan. These structures serve as landmarks and repositories of collective memory,

embodying the stories and aspirations of past civilizations. By examining the typography adorning these monuments, we can gain insights into the socio-cultural dynamics and historical narratives that have shaped the built environment of Delhi and its surrounding regions (Chernyh & Raspopova, 2020).

3. The Context: The City of Delhi

3.1 Delhi’s Architectural History

Delhi, as the capital of India, epitomizes the nation's cultural, political, and historical significance. Its secular ethos has fostered a harmonious coexistence of diverse religions, beliefs, and ideologies throughout history. Known as Indraprastha in ancient epics, Delhi has evolved into a modern metropolis of global importance, bearing the imprints of various dynasties and empires. The city's architectural landmarks, such as the Qutub complex and Rashtrapati Bhavan, narrate conquest and cultural exchange tales. These monuments symbolize Delhi's rich history and cultural heritage, showcasing architectural prowess from the Delhi Sultanate to the Mughal era. Each structure, from majestic forts to intricate tombs, reflects the social, political, and religious dynamics that have shaped Delhi's identity over centuries. Delhi's monuments are a living testament to its enduring legacy, inviting visitors to explore its diverse architectural heritage. From ancient ruins to modern marvels, they offer glimpses into the past while celebrating the diversity of human achievement. In essence, Delhi's architectural landmarks are symbols of resilience, cultural richness, and the timeless allure of architectural excellence. Selecting Delhi as the focal point for research provides a rich landscape for exploring the intricate interplay between architecture, urban development, and cultural heritage. With a history spanning over a millennium, Delhi is a testament to the enduring legacies of multiple civilizations and dynasties. From its ancient origins, including the legendary city of Indraprastha mentioned in Hindu epics, to its prominence as the capital of the Delhi Sultanate and later the Mughal Empire, the city's architectural heritage is imbued with a wealth of historical narratives and artistic achievements (Singh, 2019).

Delhi's architectural and urban history offers a captivating narrative of the city's evolution from ancient times to the present. This journey is etched into the city's built environment, showcasing various architectural styles and urban landscapes. Delhi's architectural legacy is a testament to the city's cultural richness and historical significance. From ancient settlements to Mughal-era monuments, the city's landmarks, such as the Qutub Minar and the Red Fort, reflect a blend of indigenous craftsmanship, Islamic influences, and colonial architecture. Delhi's urban history also highlights its role as a center of commerce, culture, and power. The city has been a hub of trade and cultural exchange through the centuries, resulting in vibrant urban centers like Shahjahanabad and Lutyens' Delhi. Despite rapid modernization, preserving Delhi's architectural heritage remains a challenge. Balancing urban development with heritage conservation requires innovative strategies and community engagement. Researchers gain insights into urban dynamics, cultural identity, and heritage preservation by studying Delhi's architectural and urban history. This understanding informs discussions on urban planning, sustainable development, and the adaptive reuse of historic buildings. In essence, Delhi's rich architectural and urban history provides a lens through which to explore the complex interplay between cities, societies, and the built environment, enriching our understanding of urban life and cultural heritage (Chernyh & Raspopova, 2020).



a. b. c.

Figure 1. a. Humayun’s Tomb (elevational front view from the entrance) (Author, 2024). b. Light show at India Gate (view from east during the night) (Author, 2024). c. National War Memorial (view from the entrance) (Author, 2024).

3.2 Diverse Cultural Influence in Delhi

As India's capital, Delhi encapsulates the country's rich cultural diversity, drawing people from varied regions, religions, and backgrounds. This amalgamation fosters a vibrant urban landscape where different traditions coexist harmoniously. Throughout the year, the city pulsates with a myriad of festivals and events, spanning religious and cultural spectrums. Diwali, Eid, Holi, and Christmas are just a few examples, each offering opportunities for cultural exchange and mutual celebration. Delhi's cultural vibrancy also extends to its thriving arts scene, with numerous workshops, exhibitions, and performances held regularly. These events showcase various artistic expressions, from traditional forms like classical music and dance to contemporary innovations in theater and the visual arts. Such platforms promote cultural exchange and foster a sense of community and an appreciation for diverse artistic traditions (Singh, 2019).

Delhi's cultural diversity serves as a source of enrichment for residents and visitors, embodying India's ethos of unity in diversity. By embracing its multicultural heritage, Delhi exemplifies the inclusivity and tolerance that define the nation. The city's diverse cultural influences underscore its role as a dynamic cultural hub, where myriad voices come together to create a vibrant tapestry of shared experiences and traditions.

3.3 Historical Eras

Delhi's historical significance spans millennia, with remnants of ancient settlements dating back to antiquity. However, during the Mughal and Colonial ruling eras, the city witnessed the construction of many iconic architectural monuments that continue to define its urban landscape today. The Mughal era, in particular, left an indelible mark on Delhi's architecture, characterized by grandeur, symmetry, and intricate ornamentation. During the Mughal rule, the emperors and nobility commissioned the construction of numerous architectural marvels, including forts, palaces, tombs, and mosques. These structures, such as the Red Fort, Humayun's Tomb, and Jama Masjid, are enduring symbols of Mughal architectural prowess and cultural patronage. One notable aspect of Mughal architecture was the integration of typography, mainly Arabic and Persian calligraphy, as a decorative element in their monuments.

4. The Subject of Study: Typography in Delhi's Architectural Monuments

4.1 The Purpose of Typography in Delhi's Architectural Monuments

Typography shapes society, and as discussed, the monuments that integrate typography into their architecture have their role in making a certain impact on people. During the Mughal period, architecture was not merely ornamental but conveyed profound spiritual and poetic messages. Arabic inscriptions from the Quran, Persian poetry, and royal decrees adorned the walls and gateways of Mughal buildings, imbuing them with a sense of divine beauty and cultural sophistication. The elegant curves and fluid lines of calligraphic script added a layer of visual richness to the architectural ensemble, enhancing the overall aesthetic experience for viewers. Moreover, the integration of typography in Mughal architecture reflected the empire's cosmopolitan ethos and cultural synthesis. The Mughals created a distinct visual language that transcended linguistic and cultural boundaries by incorporating elements of Islamic art and Persian aesthetics into their architectural designs. This fusion of artistic traditions enriched Mughal architecture and facilitated cultural exchange and dialogue among diverse communities. In essence, the integration of typography in Mughal architecture exemplifies the intersection of art, culture, and religion in the built environment. Through skillful calligraphy, Mughal architects transformed stone and marble into expressions of spiritual devotion and aesthetic beauty, leaving behind a legacy that inspires awe and admiration in Delhi's architectural landscape (Baydoun & Kamarudin, 2020).

Many iconic monuments built during different periods in Delhi share similar purposes and functions despite variations in architectural styles, materials, construction techniques, and technological advancements. While the aesthetics and design elements may differ, the underlying agendas behind their construction often remain consistent throughout history. Most monuments built simultaneously share similar aesthetics in the typography incorporated into their spaces. Whether celebrating victory, honoring sacrifice, or asserting authority, these monuments serve as tangible expressions of human creativity, resilience, and aspiration, connecting past, present, and future generations in a shared cultural narrative (Canepa et al., 2019).



a. b. c.

Figure 2. a. Lodhi Garden, 15th century (inscriptions on the tomb's entry) (Author, 2024). b. Humayun's Tomb, 15th century (inscriptions in the grave) (Author, 2024). c. Safdarjung Tomb, 17th century (inscriptions on the entrance to the staircase) (Author, 2024).

In the examples shown above (Fig. 2. a, 2. b, and 2. c), all the monuments were built during the Mughal era. However, the material used in the Safdarjung Tomb changed as it was built more recently (~200 years later than the other two monuments). In contrast, in Lodhi Garden and Humayun's Tomb, the inscriptions depict similar visual language, even though the intention with which both monuments were built was drastically different.

4.2 The Role of Typography in these Monuments

Typography has significantly influenced the design and ornamentation of monuments across Delhi's historical landscape. Virtually every iconic monument in the city features typographic inscriptions, showcasing a diverse range of writing styles, scripts, and languages. These inscriptions serve multiple purposes, from conveying historical narratives and religious teachings to commemorating significant events and honouring individuals. For example, with its towering height and intricate architectural details, the Qutub Minar is adorned with Arabic calligraphy inscribed in the Kufic script. These inscriptions, primarily verses from the Quran and the names of the patron rulers, serve to glorify the achievements of the Delhi Sultanate and proclaim the supremacy of Islam. Similarly, the Red Fort, a UNESCO World Heritage site, features Persian inscriptions that adorn its walls and gateways, highlighting the grandeur and authority of the Mughal Empire (Berger, 2014).

Rashtrapati Bhavan, the official residence of the President of India, features Sanskrit inscriptions from ancient Indian texts, symbolising the continuity of Indian civilisation and the principles of governance. Despite the diversity of writing styles and scripts, typographic inscriptions in different monuments across Delhi often have similarities. For instance, Arabic calligraphy is prevalent in both Mughal-era monuments and Islamic religious structures, reflecting the influence of Islamic art and culture in the region. Similarly, Sanskrit inscriptions can be observed in Hindu temples and colonial-era buildings, underscoring the enduring legacy of India's linguistic and cultural heritage. In essence, including typography in Delhi's monuments serves as a visual expression of cultural identity, religious symbolism, and historical continuity. These inscriptions not only enhance the aesthetic appeal of the monuments but also imbue them with deeper layers of meaning and significance. By studying the typography used in different monuments, researchers can gain insights into the socio-cultural context, religious beliefs, and artistic traditions that have shaped Delhi's architectural heritage over the centuries (Arora, 2014).

5. Case Study: Three Architectural Monuments from Delhi

The choice of three monuments from Delhi, namely the Humayun Tomb, India Gate, and Indian War Memorial, presents a fascinating opportunity to explore the temporal evolution of perceptions towards similar structures across different eras. Each monument embodies distinct historical contexts and cultural significance, offering insights into how societal values and attitudes towards commemoration and remembrance have evolved. Studying these three monuments in tandem provides a comprehensive understanding of how temporal evolution influences the perception of similar structures. From the imperial legacy of the Humayun Tomb to the nationalist sentiment embodied by India Gate and the contemporary reverence of the Indian War Memorial, each monument reflects the nation's changing socio-cultural dynamics and collective memory. The evolution of these monuments in the eyes of beholders underscores the enduring significance of commemoration and the power of architecture to shape historical narratives.

5.1 Humayun’s Tomb

Humayun's Tomb, located in Delhi, is a UNESCO World Heritage Site. Built in the 16th century, it serves as the final resting place of Emperor Humayun. The tomb's symmetrical design, char bagh (four-part) layout, and intricate decorative elements, including intricate calligraphy and ornate carvings, exemplify the grandeur of Mughal craftsmanship. It is renowned for its elegant Persian-influenced architecture and its role in inspiring the design of later Mughal monuments, including the Taj Mahal.

5.2 India Gate

Situated in the heart of New Delhi, India Gate is a monument commemorating the Indian soldiers who lost their lives in World War I and the Third Anglo-Afghan War. The towering archway, inscribed with the names of over 13,000 soldiers, serves as a poignant reminder of India's contribution to the Allied forces and the price paid for freedom. Surrounded by lush lawns and ornamental fountains, India Gate is a popular destination for locals and tourists, especially during commemorative events.

5.3 War Memorial

The National War Memorial, inaugurated in 2019, is dedicated to honoring the sacrifices of Indian soldiers who have fallen in the line of duty since independence. Located near India Gate, it comprises several elements, including the Amar Chakra (Circle of Immortality), the Veerta Chakra (Circle of Bravery), and the Tyag Chakra (Circle of Sacrifice), each representing different facets of valor and sacrifice. The central obelisk, known as the "eternal flame," symbolizes the undying spirit of the soldiers.

6. Comparative Analysis

Among the three structures, built in different eras from 1571 to 2019, the oldest structure, Humayun's Tomb, took the longest to build. While the most recent structure, the National War Memorial, was built in the shortest time, the size of the structures also varies greatly, with Humayun's Tomb being the largest and the India Gate being the smallest. The materials used to build the structures also vary, with Humayun's Tomb made of red sandstone, marble, and quartzite, the India Gate built in beige sandstone, and the National War Memorial prominently made of granite.

Table 1. Selected three monuments and their information.

	Humayun's Tomb	**India Gate**	**National War Memorial**
Year Built	1571	1931	2019
Construction Time (Years)	9	10	3
Architect	Mirak Mirza Ghiyas	Sir Edwin Lutyens	Yogesh Chandrahasan
Area (Acres)	66.8	10.56	40
Materials	Red sandstone and marble	Red & yellow sandstone	Granite
Religious Elements	Quranic quotes	-	Eternal Flame (Amar Jyoti)
Inscription	Persian, calligraphic	English, serif	English, sans serif
Events	Heritage walks	Light shows, marathons	Retreat ceremony, flag down
Colour	Natural	Natural	Gold
Estimated Daily Visitors	5000	10000	3000

As we can see, the three structures have been built over a long period, from 1571 to 2019. The oldest structure, Humayun's Tomb, took the longest to build, while the newest structure, the National War Memorial, was built in the shortest time. The size of the structures also varies greatly, with Humayun's Tomb being the largest and the India Gate being the smallest. The materials used to build the structures also vary, with Humayun's Tomb being made of red sandstone, marble, and quartzite, the India Gate being made of red and yellow sandstone, and the National War Memorial being made of granite.

The three structures also have different religious elements. Humayun's Tomb is decorated with Quranic quotes, while the India Gate has an eternal flame (Amar Jyoti). The National War Memorial does not have any religious elements. The inscriptions on the structures are also different. Humayun's Tomb has inscriptions in Persian calligraphy, while the India Gate has inscriptions in English serif script. The National War Memorial has inscriptions in English sans serif script. Finally, the three structures have different events that take place at them. Humayun's Tomb hosts heritage walks, while India Gate is a popular spot for light shows, protests, and marathons. The National War Memorial hosts retreat ceremonies, flag-down events, and family events.

All three monuments today have created their unique perceptions among visitors. Humayun’s tomb today represents the majestic architecture. The scale of structure overpowers other elements; typography is integrated into the built form; it adds to the aesthetic, never becoming the point of attraction. This is different in the case of the war memorial, where the events are hosted every day. The emphasis is on the names of the *Shahid Jawans*, as well as the fact that the events that caused their loss are recent and are fresh in the minds of the visitors compared to those of the other two monuments, making the use of type more impactful.

Table 2. Typographic inscription and its execution on the selected sites.

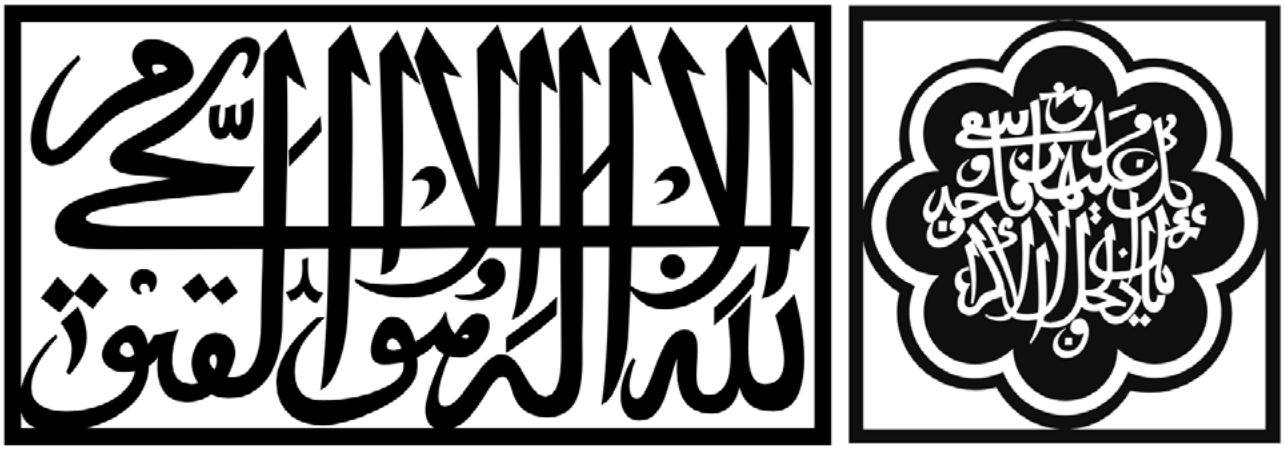
Structure	Inscription	Color	Materials	Tools
Humayun's Tomb	Persian, caligraphy	Natural	Marble	Hammers & Handheld chisels
India Gate	English, serif	Natural	Sand Stone	Hammers & Handheld chisels
National War Memorial	English, sans serif	Gold	Granite	Granite engraving machine

6.1 Humayun's Tomb

- **Typeface:** Not a single, identifiable typeface, as the inscription uses calligraphy, specifically Nastaliq script. This script emphasizes flowing lines, exaggerated curves, and contrasting stroke thicknesses.
- **Style:** Formal, ornate, and elegant. The use of calligraphy reflects the artistic traditions of the Mughal era and adds a sense of grandeur and religious significance.



a.



b.



c.

Figure 3. a. Typographic engraving from Humayun's Tomb on white marble (quote from the Quran) (Author, 2024). b. Digitally made typographic art from Humayun's Tomb (Author, 2024). c. Cross section of the levels of engraving on Humayun's Tomb typographic art (Author, 2024).

اللهُ لَا إِلٰهَ إِلَّا هُوَ الْحَيُّ الْقَيُّومُ

1. *"Allahu la ilaha illa huwa alhayyul qayyum."*
   The translation of this verse from the Quran is:
   "Allah! There is no deity except Him, the Ever-Living, the Sustainer of Existence."

" كُلُّ مَنْ عَلَيْهَا فَانٍ ۖ وَيَبْقَىٰ وَجْهُ رَبِّكَ ذُو الْجَلَالِ وَالْإِكْرَامِ"

2. *"Kullu man alaiha faann. Wa yabqa wajhu Rabbika zul jalaali wal ikraam."*
   Is a part of verses 26-27 of Surah Ar-Rahman in the Quran.
   These verses are translated as follows:
   "Everything on earth will perish,
   And there will remain the face of your Lord, owner of Majesty and Honor."

Several factors impact the legibility (Lieberman, 1977), which is based on the ease with which one letter can be told from the other, of Arabic calligraphy on Humayun's tomb. Firstly, the intricate nature of the script and its elaborate carvings pose challenges for readers unfamiliar with the style. Secondly, weathering and erosion over time diminished the clarity of the inscriptions, affecting readability (Lieberman, 1977). Additionally, the positioning of the calligraphy, placed on a horizontal plane, requires closer inspection for effective readability, which is the ease with which the eye can absorb the message and move along the line. Contrast and lighting conditions, influenced by natural elements, further obscure the carvings, making them less discernible.

6.2 India Gate

- **Typeface:** Identified as Garamond, a serif typeface known for its elegance and readability.
- **Style:** Traditional, serif, and legible. The use of Garamond creates a sense of dignity and timelessness, aligning with the monument's purpose as a war memorial.



a.



b.

Figure 4. a. Typographic engraving over India Gate on sandstone (Author, 2024). b. Cross section of typography at India Gate (Author, 2024).

The choice of Garamond for the inscription at India Gate raises intriguing questions about the context of its construction and its significance in typographic history. Garamond is renowned for its elegance and readability in book typography, its adaptation for a monumental scale is indeed unconventional. This departure from its traditional usage prompts speculation about the deliberate departure from convention and its implications for the visual impact of the inscription. Moreover, the challenges posed by factors such as the background's colour and the text's size highlight nuances in legibility that deserve careful consideration.

6.3 National War Memorial

- **Typeface:** A custom sans-serif typeface explicitly designed for the memorial. It features sharp edges, geometric shapes, and a condensed letterform.
- **Style:** Modern, bold, and impactful. The custom typeface reflects the contemporary nature of the memorial and aims to convey strength, sacrifice, and remembrance.



a.



b.



c.

Figure 5. a. Typographic engraving from War Memorial on Brown Granite (Names of *Shahid Jawans*) (Author, 2024). b. change in the landscape from 2015 to 2019 (as the war memorial was built) (Priya & Kumar, 2021). c. cross-section of the levels of engraving on brown granite (Author, 2024).

Several factors influence the legibility of the custom sans-serif typeface at the National War Memorial. Firstly, the edges and condensed letterforms of the typeface contribute to its aesthetic but pose challenges for readability at a distance. Secondly, the geometric, compact shapes used in the design add complexity to the letterforms, requiring closer inspection for adequate interpretation. Additionally, the style and colour aim to convey strength and remembrance, but the intricacy of the letterforms affects clarity, particularly in adverse lighting conditions. The memorial and its typography are crucial for visitors to appreciate their significance, emphasizing the importance of materials on-site.

- **Script vs. Typeface:** Humayun's Tomb stands out for its unique use of calligraphy, offering a handcrafted and culturally specific touch compared to the standardized typefaces used in the other two monuments.
- **Serif vs. Sans-serif:** India Gate employs a traditional serif typeface that exudes a sense of history and respect. At the same time, the National War Memorial embraces a modern sans-serif design for a more direct and impactful message.
- **Formality:** Humayun's Tomb and India Gate lean towards a more formal style, reflecting their historical significance and grandeur. The National War Memorial adopts a slightly less formal approach, prioritizing clarity and legibility for a wider audience.
- **Color:** While the typeface and style analysis focuses primarily on the inscription itself, it is worth noting that the color choices also contribute to the overall impact. Humayun's Tomb uses natural stone colors, India Gate blends in with its surroundings, and the National War Memorial's gold inscription creates a stark contrast and demands attention.

6. Epilogue

6.1 Discussion

The War Memorial excels in overall readability due to meticulous attention to anthropometric factors, ensuring that the text is positioned at eye level for readers at an optimal distance. Additionally, using a striking gold color against the brown granite backdrop enhances legibility, making the text highly visible and easily discernible. Conversely, the text is scarcely visible at India Gate from a distance, with only the word "India" being readable due to its more extensive scale. To decipher the names of Sahid Jawans, individuals must approach the monument closely, yet visibility remains limited. The absence of color contrast between the text and background, the non-linear layout, and erratic stone joinery all contribute to this lack of readability. Moving on to Humayun's Tomb, Persian challenges contemporary readers. However, despite this linguistic barrier, readability is enhanced through well-defined grooves and a clever play of levels on white marble surfaces.

Furthermore, the typography's calligraphic style adds to the inscriptions' aesthetic appeal. Despite the enduring prominence of these monuments, changes in perception and understanding over time have altered the significance of their typography. With successive generations lacking historical context, there has been a decline in the appreciation of the typographic inscriptions' relevance, relegating them to mere objects of artistic appreciation devoid of contextual understanding. This underscores the importance of preserving and promoting awareness of typographic heritage to ensure its continued appreciation and understanding.

6.2 Conclusion

In conclusion, all three monuments utilize distinct typographic choices that effectively complement their individual design, purpose, and historical context. The technologies, tools used, and artistic and design abilities the artisans possess defined the visual languages of the monuments, thus shaping the visual

landscape of the era. Humayun's Tomb's ornate calligraphy reflects artistic traditions; India Gate's serif typeface conveys dignity and timelessness; and the National War Memorial's custom sans-serif design delivers a bold and contemporary message.

From this study and documentation of the monuments of Delhi, we can relate the use and application of various styles of typefaces in architecture in different temporal periods.

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Rana Shinde, a PhD student at the Indian Institute of Technology, Delhi, has experience in architecture and visual design. During his Masters, he developed an interest in typography, which he pursued by working at the Indian Type Foundry, India's leading type foundry, where he worked on various scripts to create a wide range of typefaces. In this research, he incorporates his interests in architecture and design, focusing on the integration of typography in architectural monuments, ultimately shaping the visual landscape of the city over time.

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P/REFERENCES OF DESIGN

RADICAL INCLUSIVE ATTITUDES: THE CHALLENGE OF DOING, UNDOING, AND REDOING THE WORLD-IN-THE-MAKING.

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KEYWORDS | RADICAL INCLUSIVE ATTITUDES, SYSTEMIC THINKING, RADICAL DESIGN CULTURE, INTERSECTIONALITY, SITUATION-CENTRED DESIGN

ABSTRACT | Social complexities have increased in the aftermath of global phenomena such as the migrant crisis, intensifying socio-economic inequities, racial discrimination, and backlash against the universal rights of minority groups. These are challenging how designers respond to social issues. Human-centred policies and socially inclusive design methods, gravitating towards designer-centred perspectives, fall short of encompassing systemic, intersectional, and transdisciplinary perspectives and limit possibilities for action. Consequently, we are calling for a paradigm shift from the centralisation of power held by design processes to situation-centred approaches (which we define as design-uncentred) that prioritise local communities, strategies, movements, and activism. Responding, we introduce the Radical Inclusive Attitudes (RIA) concept, a cultural design framework to challenge conventional thinking about inclusive design in favour of critical, collaborative, transdisciplinary strategies that can best address complexity. Findings from the Designing for Inclusive Attitudes (DxIA) project illustrate what the Radical Inclusive Attitude (RIA) concept is (or aims to be). RIA was developed from a triangulation analysis of resources such as insights from (i) a co-design workshop run at an international design conference, (ii) a situational analysis of an immigrant hospitality model case study, and (iii) a thematic analysis of data collected via virtual workshops with an international collective of design researchers. We are introducing a novel approach to navigate and explore social complexities while creatively acting in the situation. Conclusions highlight relevant implications of the RIA design framework for the third and voluntary sectors and policymakers and foster the decolonisation of the design process.

1. Introduction

This paper aims to position the idea of Radical Inclusive Attitudes (RIA) which has emerged from the research experiences of the authors. To do so, the paper explores three key aspects through which the RIA concept can be used to explore and support the decolonisation of the design practice. Specifically, literature on radicality and design opens our early reflections. After that part, a discussion on the literature on design for inclusion is presented to demonstrate how the context and the background of inclusive design can support the emerging RIA framework. Essentially, the RIA concept leverages "radicality", "inclusion" and "attitudes" as keywords of a theoretical framework. Finally, in this introduction section, the research context from which the RIA concept was generated is presented about the concept of inclusive attitudes and design. The methodological section of the paper describes the triangulation of data that the authors used to conceptualise the RIA framework. The RIA framework is a theoretical instrument that enables us to consider potential applications in the real world. Indeed, RIA can be described as a way of understanding and acting in a given situation where complex problems about inclusion are manifested. RIA is a way of approaching challenges by focusing on radical evaluations of phenomena that generate inclusive or exclusive practices. In short, RIA promotes a perspective for addressing complex conditions of inclusion needs by focusing on radical promotions of inclusive attitudes. RIA focuses on action-thinking for an inclusive society in those situations where design assumes blurred and hybrid forms.

1.1 Designing Inclusive Radicality

Conventional design research is often initiated from a designer-centred perspective, which limits possibilities for taking meaningful action. Consequently, the line of thought we are advocating for involves us and the "other" within the design process, becoming "we", and collaboratively reflecting on our reasonings, experiences, feelings, and actions concerning any challenges we experience together. Getting 'inside' users' experiences helps researchers better understand their needs, enabling them to participate in shaping what henceforward we refer to as the world-in-the-making, which, building on Dewey's (Dewey, 1928) philosophy, opens a new window into the world we all inhabit. Hence, it's essential to comprehend and interpret the concept of world-in-the-making – a design perspective to understand the world we live in collectively. The proposed paradigm shift should assist those doing social design to disentangle new perceptions of *everydayness* (Lefebvre, 2014) and *otherness* (Husserl, 1960/1933). This will lead to new insights that get closer to the root or core cause of why we need to practise radicality in design, which should be perceived as a way to prevent "the oversimplification and ignorance of power dynamics" (Udoewa, 2022) therefore decolonising it.

Radical inclusion can be seen as an approach based on dialogue among multiple perspectives by also taking into account "unfamiliar and unexpected field situations including potential conflicts" (Sarantou et al., 2018). While the role of design is increasingly less defined in this area, radicality, especially in the context of design literature, is crucial; this literature and work on inclusion in design, despite decades and multiple stages of evolution—excluding literature on participatory practices (e.g., Barcham, 2021; Udoewa, 2022)—has largely been limited to designer-centric perspectives. Many ideas promoted in human-centred design, for example, involve "assuming" the role of the end-user by the designer and successfully "othering" end users (King & Cormack, 2023). Richard Heriott's work articulates that the lack of holistic inclusive practices in design and a tendency to position oneself in a place of authority within design practice is particularly relevant (Herriott, 2013; 2023). In parallel, the "radically inclusive design" perspective is pushing for a decolonial design approach where designers are 'always situated-ness' and contribute to "actively works to bring into being worlds, which are respectful and welcoming of difference and interconnectedness without subsuming one world by another" that, in practice, is entailing a combined design approaches among the involved parts (Barcham, 2021).

In general terms, design must look to more genuinely inclusive approaches from other disciplines to radically reframe how designers approach inclusion. Consequently, we argue in favour of situation-centered design, a concept introduced by Cinnamon L. Janzer, Lauren S. Weinstein and Victor Margolin (see

Janzer & Weinstein, 2014). We aim to champion a collaborative practice that cultivates "a complex, multidimensional understanding of people and their environments" (Janzer & Weinstein, 2014). In this direction, the introduction of the Radical Participatory Design (RPD) approach may help in understanding the meaning of addressing a "design that is participatory to the root" (Udoewa, 2022), in other words, allow people to fully participate in a real inclusive manner. In RPD designers divest of power in favour of the communities and adopt a decolonisation of the participatory design process (cf. Udoewa, 2022).

We learn that to be radically inclusive about attitudes, we should decolonise the meaning of "inclusive attitudes". More specifically, the conception of radical inclusive attitudes centres around two primary concepts – a) Radical Inclusivity as a philosophy and b) the formation of attitudes in society and the professional realm. The first concept is discussed in "The Frustrating Impossibility of Radical Inclusivity" (Nawratek & Nawratek, 2015) as an impossible scenario yet an essential consideration in spatial design. The text looks to religious studies to postulate that while radical inclusion as a permanent state of being may be an impossibility, it may yet be a possibility at certain points in time. Two aspects of this text are crucial: the relevance of temporality in radical inclusion; and the borrowing of ideas and philosophies from a seemingly unrelated discipline (religious studies). This radical inclusivity aims at creating an ideal that is utopian in some ways. On the other hand, design discussions on inclusions/exclusions understand exclusions through lenses of singular identities such as disability, gender or socio-economic backgrounds. Perhaps a middle ground between this position of radical inclusivity and the way design studies approach inclusion/exclusion would be an intersectional approach (Crenshaw, 1991), which offers a more nuanced approach than traditional design thought and is more actionable and implementable than the philosophical radical inclusivity approach. However, even in this thought process, intersectionality is one thread of the larger fabric of radical inclusivity that attempts to get closer to genuinely inclusive design practices.

1.2 Design, Inclusion and RIA

The RIA concept has been influenced by design for social impact and inclusion perspectives. Regarded as a design discipline that purports to "do good" for communities and society at large, social impact design (SID) has been eagerly embraced in the design community and promoted through human-centred design (HCD) and design thinking processes (Janzer & Weinstein, 2014). Affirming designers' collective interest in addressing complex issues, Nigel Whiteley writes in Design for Society, "The strength of the [social design] tradition is that design is firmly grounded in a relationship to society rather than being presented as an area of study which feeds only on itself..." (Whiteley, 1997). At the same time, in our eagerness to participate in solving the world's problems, we have often failed to acknowledge the limitations of what we can or should contribute within such a broad arena of opportunities. Standards of practice vary greatly (Lasky, 2013) and there is little to no accountability or follow-up when projects end.

Still, the field and standards for practice are evolving. And emerging studies on design for inclusion show a gradual change from Inclusive Design (Clarkson & Coleman, 2015), Design for All (DfA) (see European Institute for Design and Disability, 2004; Bendixen & Benktzon, 2015) and Universal Design (UD) (see Story, 2011; Steinfeld & Maisel, 2012) to newer approaches, i.e. Inclusive Service Design (Aceves-González et al., 2016), psychosocially inclusive design (Lim et al., 2021), design for service inclusion (Fisk et al., 2018), the just design perspective (Bianchin & Heylighen, 2018), the Design Justice framework (Costanza-Chock, 2018; Costanza-Chock, 2020; Huffstetler et al., 2022) as well as the Design for Inclusive Attitudes (DxIA) approach (Busciantella-Ricci, 2023b). Collectively, they call for a paradigm shift from design approaches that take into account physical and cognitive barriers towards universal solutions to accommodate as many needs as possible to approaches that take care of the different cultures, diversities, and situated complexities that intercourse in a design process.

Similarly, we are calling for a shift from the centralisation of power held by designers and design processes to situation-centred approaches that prioritise local communities, strategies, movements and activism. This perspective recalls the debate regarding the shift from a "designerly ways of knowing" perspective (Cross, 2001; 2006), which we recognise as predominantly "designer-centred", to a critical view that

questions the uniqueness of “designerly” ways of understanding the world and producing knowledge (cf. Herriott, 2023). We also argue in favour of moderating these tensions to decentralise designers’ sense of omnipotence to address complexities. In response, we are introducing the RIA, a cultural design framework to explore how foregoing conventional thinking about inclusive design in favour of critical, collaborative, transdisciplinary strategies can best address complex social problems.

1.3 Forging Inclusive Attitudes

Traditional perspectives on design for inclusion, and generalised participatory approaches fall short to support the depth or dimensions of the topics we present in this paper. These perspectives do not present convincing models and perspectives to address the complexities that need a ‘radical’ approach (new forms of engagement extending RPD), i.e., it needs to be done in the situation - or while immersed in the 'world-in-the-making'. At the same time, radical positions and approaches in design need support to offer flexibility, encouragement to adapt, and lowering barriers to make it easier for people to speak, act and engage without overly complicating processes.

We argue that RIA can generate a framework to work with and embed the discourse under a common and shared ‘action-thinking’ perspective rather than ‘design thinking’. At the same time, RIA focuses on people's attitudes through a cultural perspective, rather than on a set of tools and methodologies to be applied by designers detached from the 'world-in-the-making'. RIA is also connected to the emerging Design for Inclusive Attitudes approach (DxIA) (Busciantella-Ricci et al., 2022; Busciantella-Ricci, 2023b) and serves as an exponent of the ‘inclusive attitudes’ term that we use to evaluate issues related to diversity, equity, accessibility, and inclusion (Busciantella-Ricci, 2023b; based on the ‘attitude’ meaning in Eagly & Chaiken's 1993; 2007; Maio et al., 2019). This term reflects the main definition of attitudes. Indeed, by assuming a social psychology perspective, attitudes are evaluative judgments about a “stimulus object" (Maio et al., 2019). Using Eagly & Chaiken's (1993; 2007) words, an attitude is “a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor”. In general terms, attitude describes “people’s global and relatively enduring” “evaluations of objects, issues, or persons” (Petty, 2012). In practical terms, we evaluate the stimulus object around us according to the beliefs we associate with that object, the linked emotions, and the past behaviours or experiences regarding those objects, issues, or persons. Respectively, they are the cognitive, affective, and behavioural components that shape this evaluation (Eagly & Chaiken, 1993; Maio et al., 2019). Attitude has also been described as “one’s routine predisposition toward an object or event” (Musgrove, 1998), which underlines a general predisposition toward an object, entity, or issue. Consequently, an inclusive attitude can be described as the tendency expressed by evaluating entities, objects, or issues related to inclusion and diversity with some degree of favour or disfavour. Within the context of design culture, an inclusive attitude is a designerly predisposition toward inclusion and diversity (Busciantella-Ricci et al., 2022; Busciantella-Ricci, 2023b). In our literature review, we had difficulty finding direct support for the RIA concept through frameworks and models that embed the following three key components (i) a radical position toward inclusion; (ii) support of the inclusion concept with instruments that focus on cultural barriers, rather than technical tools that are mostly design-centric; and (iii) a focus on attitudes and people’s actions in a given situation. While these three concepts are partially and/or individually addressed within the related scholarship, the discourse we are facilitating by bringing them together under one framework makes our approach distinct.

2. Methodological Approach

Triangulation of data, which has been used to corroborate evidence and make the findings stronger (see Dezin, 2009; Hanington & Martin, 2012), was a useful process for developing the RIA framework. We first gathered data from a co-design workshop, the analysis of a case study, and the thematic analysis of online workshops made by an international group of design researchers from India, Italy, the Netherlands, the UK, and the USA. These data sets were collected in correlation with a research project that is exploring the DxIA approach. As described in its original version (Busciantella-Ricci et al., 2022) the DxIA is based on the transition design framework (Irwin, 2015; Irwin et al., 2020) through which it is possible to compare (i) the

design for the built world with the perspectives of the design for inclusion approaches; (ii) the design for social innovation with the logic of the design for social inclusion; and (iii) the continuum of the Transition Design with the concept of the DxIA. The DxIA originated as a design research response to create a framework for shifting from a physical barrier-dominated discourse on design for inclusion, towards culturally-driven methods. Consequently, the DxIA corresponds to transition design and focuses on radical change through design for addressing diversity and inclusion issues (Busciantella-Ricci, 2023b).

2.1 Co-Design Workshop, Process and Materials, and Insights

The first author of this paper prepared and delivered a workshop at an international design research conference (Busciantella-Ricci, 2023a) to engage design researchers in exploring the application of the DxIA framework. The workshop (programme in Figure 1) was developed by (i) introducing the main topics related to the DxIA, (ii) discussing and ranking case studies, (iii) discussing the design principles of the DxIA, and (iv) Co-designing a service concept with the DxIA approach. The workshop was attended by six participants (including a facilitator) engaged in three and a half hours of in-person activities (at the conference venues). All four steps were completed except for step four, for which the participants came to do the How Might We question.

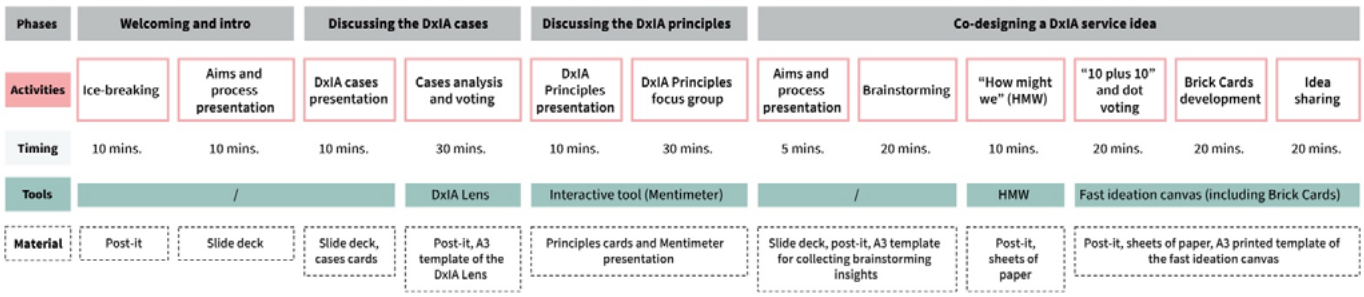


Figure 1. Process and materials of the workshop provided at the International Design Conference (Busciantella-Ricci, 2023a).

Relevant insights for this paper emerged from the workshop. Firstly, a ranking and a qualitative evaluation of the shown case studies have been obtained where the most consistent case for the participant is Riace's model (see paragraph 2.2); it is an immigrant hospitality model (Driel & Verkuyten, 2020; Ranci, 2020) (Fig. 2) and it can completely address the complexity of the idea behind the DxIA approach. Equal merit has been obtained for the Lovegiver project and the Includability service (see Busciantella-Ricci, 2023b for the cases). The first has been evaluated as a potential disruptor for addressing disability stereotypes, and the second is an example that every service should adopt to develop innovations for encouraging organisational changes.

Secondly, participants provided an evaluation for each of the presented DxIA principles (cf. the DxIA principles in Busciantella-Ricci, 2023b). Among the most relevant, they suggested focusing on autopoiesis (Maturana & Varela, 1980) both to provide design responses that can evolve as conditions of the context change and to address the concept of "diversity" in nature with a "more than human" perspective. Also, participants suggested supporting the systemic perspective about inclusion by underlying a needed shift from single-identity approaches to intersectionality theory approaches (Crenshaw, 1991).

Regarding principles, participants suggested supporting transdisciplinarity through models and frameworks to apply the DxIA, rather than focusing on design toolboxes. The latter risks losing the flexibility and adaptability needed in complex conditions determined by action in the situations. In terms of insights gained from the generative session, participants suggested a "how might we" question to be used as a research question in a shared Miro board to involve additional researchers during the conference days. Indeed, additional people were invited to collaborate with the Miro board after the workshop by integrating opinions, comments, and ideas. This was the base to start up an informal community of RIA design researchers. The Miro board continued to be used by the involved researchers after the conference, and it was used as a shared platform for design conversations around the RIA concept.

2.2 Analysis of a Case Study

The second source of methods and data provided insights from a situational analysis of an immigrant hospitality model case study situated in a small village in southern Italy. Specifically, data analysed for the case study emerges from an ongoing project named DesIA (Busciantella-Ricci, 2023b) that explores how to substantiate the DxIA approach with cases, principles, tools, and service concepts. During the research activities of this project, the first author of this paper conducted design ethnography to observe the potential context where relevant information happens for impacting design (Stickdorn et al.,2018; Hanington & Martin, 2019), in this case for the DxIA approach. Two full days were spent in two villages in the south of Italy (Riace and Camini) to understand aspects of two models of immigrant hospitality (see Driel & Verkuyten, 2020; Ranci, 2020). In these contexts, the researcher interacted with the local communities, as well as with the founders and the former policymakers (including the former mayor Domenico "Mimmo" Lucano) who created the case study. Pictures, notes, and a brief diary of the days have been produced by collecting information through direct observations, contextual interviews, and spontaneous focus groups to understand how local communities changed or reshaped, their attitudes towards immigrants. The ethnography activity aimed to observe the context of Riace's model shaped by people not trained in design. The focus was on understanding how designed artefacts (e.g., services), design processes, or practices contributed in this context and how they can impact the DxIA approach.

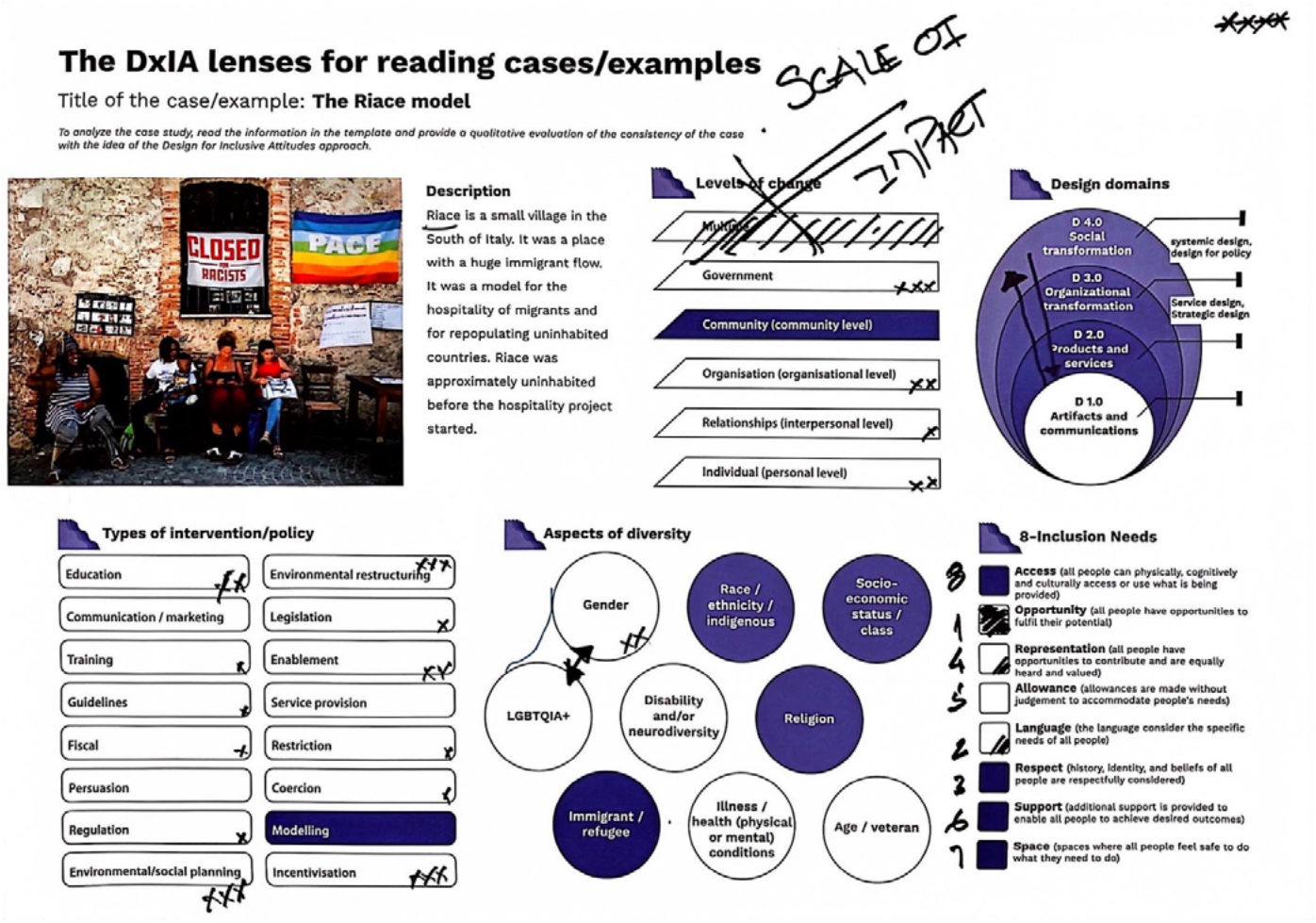


Figure 2. One of the templates participants used during the workshop: an example.

As a result, the design ethnography helped us understand how the Riace model can contribute to DxIA. All the data captured were thematically analysed (Braun & Clarke, 2006) to support the observed context as a case study exploration (Yin, 2018). The obtained insights can be framed through the following themes:

- The Riace hospitality model promoted inclusive attitudes among local communities through collaborative services among locals and immigrants;
- The exchange values of the provided services put everyone on the same level by responding to the needs of long-term residents and immigrants;
- Successful and innovative services were generated because immigrants' and residents' intersectional needs were manifested and used as drivers to find solutions that work for all;
- Third-sector entities played a crucial role in establishing encounters, connections, and organisational and ethical values for the involved stakeholders, both locals and immigrants.

2.3 Analysis of the Virtual Workshops

After the in-person workshop run at the international design conference, and as a result of the encounters at the same conference, an international RIA collective was established and developed virtually, including design researchers from different backgrounds and six different countries. Specifically, insights from a thematic analysis (Braun & Clarke, 2006) of data collected via virtual workshops (with the support of Miro) from October 2023 to January 2024 have been used to set important design conversations (cf. Laszlo & Laszlo, 2008; Glanville, 2007) around the RIA concept. Three main themes have been discussed by the RIA collective in these design conversations, as follows:

- (i) the RIA people; i.e., who are those who impact and are impacted by the idea of the radicality of inclusive attitudes;
- (ii) the RIA applications; i.e., how the RIA concept can be applied in complex, real-world situations;
- (iii) the RIA visions and references; i.e.; where the RIA concept is driving/motivating the people (design researchers) invested in radical inclusive attitudes.

3. The RIA Framework

Data from the co-design workshop, the case study, and the design conversations contributed to the research questions (RQ) related to the framing of the RIA concept (Figure 3). Every set of data provided specific insights that allowed us to structure components of the RIA framework.
Findings support RIA as a novel approach for navigating and exploring social complexities while prototyping solutions for a given challenge or situation. RIA has two core ideologies:

- (i) a commitment to inclusion and justice, which critically examines existing approaches and transcends disciplinary boundaries;
- (ii) inculcating a commitment to inclusion and justice as an ingrained social attitude.

These ideologies have been developed through the insights in Figure 3. Also, the insights we gained from the data triangulation stimulated the formulation of the framework which we present next.

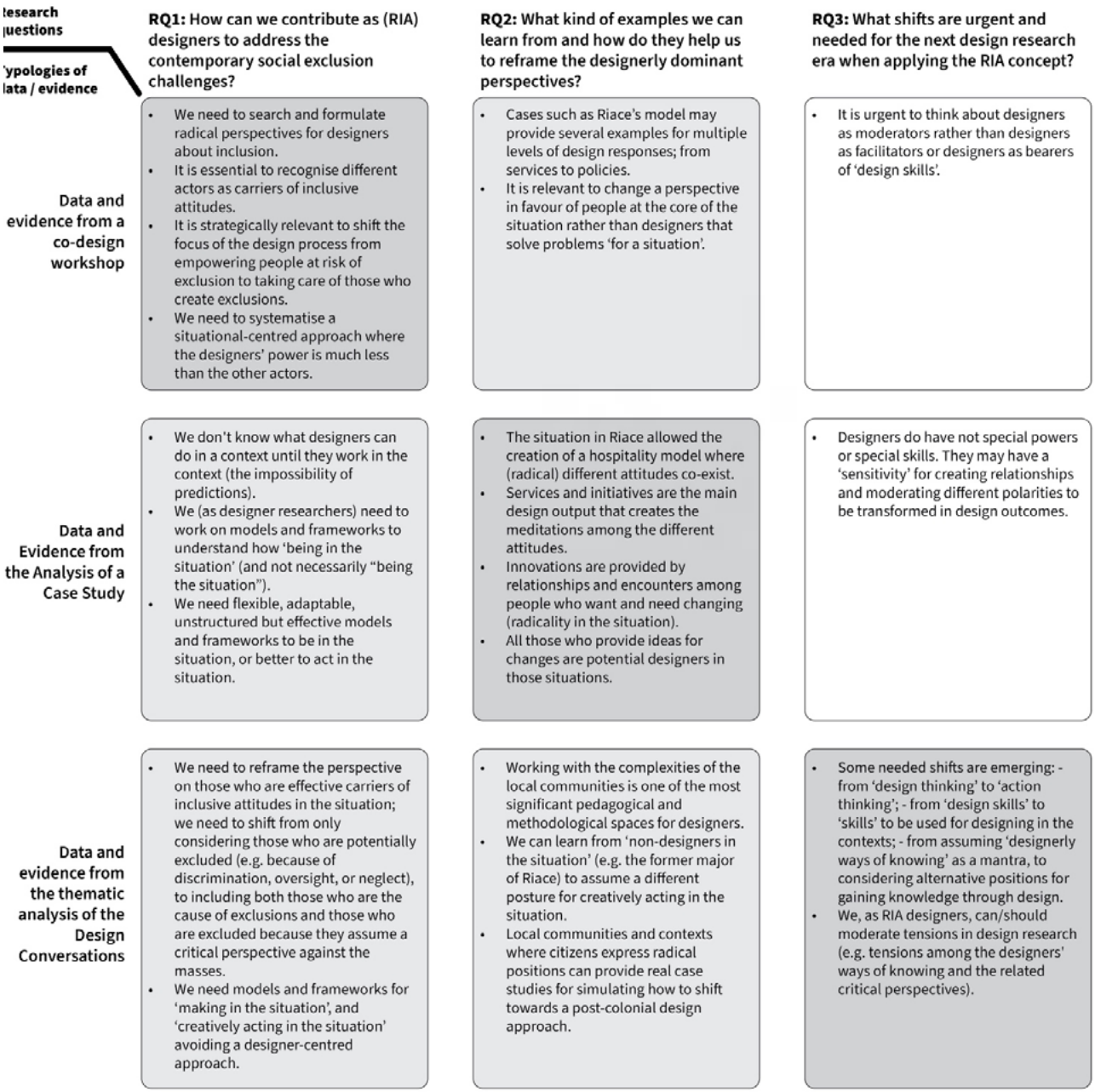


Figure 3. Insights from each data set in correspondence with the research questions (RQ).

3.1 The RIA Framework Components

By following the insights gained from the data triangulation, the RIA framework emerged with four main areas of interest related to:

- i) how can we understand the existence of the RIA concept and perspective (i.e., the RIA design ontology);
- ii) how can we learn by assuming an RIA perspective (i.e., the RIA design epistemology);
- iii) how can we (best) design by adopting the RIA framework (i.e., the RIA design praxiology);
- iv) what kind of outputs and outcomes we can frame through the RIA concept/framework (i.e., the RIA design phenomenology).

The RIA framework manifests itself as a conceptualisation to produce a new kind of design experience that is useful to co-designers (including non-designers, participants, citizens, etc.) (cf. Manzini, 2009) in a given

situation. So, by assuming Cross' (2006) taxonomy in design research and by considering the paradigms for qualitative research (Lincoln et al., 2018), we described the RIA framework through components that are made by dimensions and groups of people such as:

- i) those potentially excluded (e.g., because of discrimination, oversight, or neglect);
- ii) those excluding others (e.g., they create the conditions that exclude underserved, underrepresented, and marginalised groups);
- iii) those 'not involved' but still persuadable (e.g., they may hold controversial views outside of the mainstream but are still open to conversations).

According to the RIA framework, these three different groups of people inhabit three important dimensions of the world-in-the-making, i.e.; the praxeological dimension, the phenomenological dimension, and the ontological dimension, which we describe next:

- i) RIA design praxiology is a component that describes the processes we conceptualised for the application of RIA action thinking. Specifically, we renewed the concept of 'making in the situation'. It is developing a situated process or a situated-centred approach that emerges from case studies such as Riace's model. A situated-centred approach requires empathising with the context by adopting an ethnographic approach as it can be applied in design ethnography. Essentially, a designer in the RIA framework is not an all-knowing designer with a special way of knowing (cf. Herriott, 2023), they are more an active citizen who makes themselves available to the 'situation' and discovers how to be a designer in these relationships. Conceptually, it is a form of active citizenship, a way of acting through design in the situation;
- ii) RIA design phenomenology is a component that includes a set of reasonable and sustainable kinds of design output in the application of the RIA framework in the context. By referring to orders of design (Buchanan, 2001; Mortati, 2022), design contents (Young, 2008), and design domains (Jones, 2014) we expect to work with design disciplines such as product-service system design, service design, systemic design, strategic design, urban design, and design for policies;
- iii) The RIA design ontology is a component that describes what it is and how it is possible to understand its existence. RIA is not an approach, a method, a technique, or a toolkit. RIA is a way of understanding and designing. It is a way of living a given experience. So, we question, what is a radical attitude? It is a radical evaluation of the phenomena that generate inclusion and related values (e.g., equity, dignity, equality, respect, etc.). Essentially, RIA is a radically positive cognitive, affective and behavioural (cf. with the multi-component model of attitudes in Eagly & Chaiken, 1993; 2007 as also adapted by Maio et al., 2019) status in front of a complex condition of inclusion needs.

4. Discussion

4.1 How Does RIA Complement Previous Frameworks

For a better understanding of what RIA is we can provide a discussion by comparing the RIA framework with resources and approaches we introduced at the beginning of this paper. We should premise that RIA is not an approach that purports to substitute or replace existing methods/approaches that are useful for designing for social challenges. Rather, it would provide a broad foundation to support existing approaches while simultaneously promoting positive attitudes towards diversity, inclusion and the unfamiliar and unexpected conditions in situations where social challenges happen (e.g., migration flows and related issues). To use a metaphor, RIA is a new quality of cement to joins known bricks that are needed to build a specific situation. We are not proposing a new kind of bricks, but rather a new kind of cement. In terms of comparing RIA with the approaches and frameworks we mentioned at the beginning of this paper, the following are some similarities, differences and thus novel aspects that can be framed.

Firstly, about the RPD (Udoewa, 2022), as well as radical positions about inclusion - e.g., the radically inclusive design (Barcham, 2021) we can provide the following comparisons:

- similarly, to these approaches, RIA embraces a situatedness action approach and apply a decolonised approach about the concepts of participation and inclusion through design; equally similarly design is a common resource among the parts and design processes the results of the mediation among communities, and the other actors of the actions (including formally recognised designers);
- different to these approaches, the RIA framework focuses on creating the conditions for promoting a diffused culture of inclusion and participation by tackling the attitudes of people as a pre-condition to address real radical acts in the situation.

Second, approaches to design for inclusion:

- similarly, to the emergent approaches, the RIA framework focuses on creating the conditions to design intangible things such as services, strategies, and policies by also focusing on social and psychosocial aspects that affect the way a design artefact is inclusive;
- different to the traditional approaches on design for inclusion, the RIA framework focusses on the inclusive attitudes as a cultural value to be promoted through the design of services, strategies and policies.

Third, let's focus on the design justice framework (Costanza-Chock, 2020) as a relevant approach that adopts the intersectionality theory through a design perspective:

- similarly, RIA, as it is based on the DxIA approach (Busciantella-Ricci, 2023a), is considering a (radical) intersectional perspective to adopt a systemic approach to diversity and inclusion; the aim is to focus on inclusion needs, rather than on very specific issues about diversities (e.g., cf. Wilson, 2023);
- differently, it radically focuses on different targets respect the design justice framework; the main target of an action driven by the RIA framework are not those suffer a condition of exclusion, abuse of power, or marginalisation but on those who generate those conditions; it radically focuses on those cause or contributes to the perpetuations of understanding diversity as a problem; in parallel, it also creates the condition to be emancipated from that abuse of power, i.e. decolonising design process.

Fourth, by taking into account the transition design framework:

- similarly, the RIA framework presses towards diversity as a natural human condition (towards the natural world); RIA looks for a radical change through design in terms of finding radical actions to look at human diversities;
- as a real comparison among the frameworks is not possible, RIA takes the transition design logic to provide a radical interpretation and to be adopted for diversity and inclusion purposes.

Finally, concerning RIA in the DxIA approach: RIA introduces the concept of "radicality" in the DxIA model. We have adopted the political interpretation of the word, which is related to taking an unconventional, revolutionary, extreme, reformist position. RIA promotes inclusive attitudes in an unconventional, revolutionary, reformist way. Radical 'participation', 'inclusion', or 'ideologies' are critical positions towards a subject matter that, if adopted, can influence the way people live and/or how they respond to challenges.

So, the primary objective of RIA is to advocate for altruism as an essential core principle and foster an ideological shift in the way people relate to one another, towards acceptance rather than rejection; prompting individuals to give (back) more than they take (from) (e.g., in our relationship with the natural world we need to understand that resources are not endless); and to practise sharing rather than withholding (e.g., developing altruism and social justice levels). This represents the essence of our concept of "radicality". We aim to develop new ways to reinterpret and understand our beliefs and connect different methods underpinning cultural experiences. Bringing together different cultures can generate true appreciation for the diversity and depth of human life (refer to transcendental phenomenology in Moustakas, 1994). This approach and understanding will, hopefully, help RIA researchers to actively participate in shaping the world we all live in.

4.2 Moderation as Radicality

As initially presented in the introduction of this research, the objective of the RIA methodology seeks to provide situation-centred strategies rooted in design justice principles (Costanza-Chock, 2018; 2020) to push the boundaries until resistance is met. This inherent but favourable tension allows for the emergence of creative energy and new, diverse conceptualisations of the complex, everydayness contexts we are responding to.

RIA challenges power structures by shifting from top-down processes to revolutionary, multidirectional perspectives, similar to the outcomes of the Ripple Framework (Soares et al., 2023). This approach aligns with Husserl's concept of horizontalisation (see van Deurzen et al., 2019), necessitating the construction of novel connections between various actors and situations. This reorientation is supported by a new attitudinal behaviour, i.e., "moderation, as radicality" which allows for new situational understanding in a permanent evolving context, providing a new, and more optimistic horizon, which can be translated to 'hope'.

The dynamic framing of RIA facilitates an increased devolution of power amongst all societal participants, regardless of their background, gender, sexual orientation, age, or socioeconomic status. The objective of this paradigm shift is not only to contest the existing assumption that design by itself can make the world better but to enable new transdisciplinary mechanisms to explore humankind's innate ability to permanently adjust, assimilate and incorporate new things into their existence, i.e., to take action. This would subsequently generate better design processes and enable RIA practitioners to continually adapt to the continual changes and complexity of everydayness in daily experiences: in other words, a world currently under construction as we have been stressing the world-in-the-making.

4.3 RIA Implications and Potential Audience

The findings of this study underscore significant considerations for a few areas of implications concerning design and potential audience such as:

- I) Design research: our findings suggest a need for shifting from a design-centred perspective to a situation-centred perspective; or, better yet, towards a design-uncentred perspective in the situation; we are observing relevant shifts in design research (e.g. from 'design for inclusion' to 'design justice' - Costanza-Chock, 2020; as well as demystifying the 'designerly ways of knowing' - Herriott, 2023) and through this work, our data triangulation confirms the necessity of moving from the application of 'design thinking' to 'action thinking' approaches, as well as from a design-driven perspective to a 'moderation in action' or 'moderation in action through co-design'; those who adopt a research through design approach to address social impacts about diversity and inclusion are the main beneficiaries of these aspects;
- II) Civic innovation/civic design: in the introduction of this paper we discussed the importance of embedding relevant resources for the RIA concept such as radical design positions (e.g. Udoewa, 2022; and Barcham, 2021), and approaches that include interdisciplinary perspectives such as

intersectionality theory (Crenshaw, 1991); consequently, we argue the RIA framework may work as a civic education device for third-sector entities, policy-makers, and design researchers engaged in these realms; they may benefit from the RIA framework due to its capacity to create a common space of reflection in action and by giving a moderation model; the RIA framework can support the encounters between designers engaged in social innovation practices with those communities that know and live the situations;

- III) Design practice: we discussed calling for radical positions in design to look for a new perspective that can address the inclusion issues; effectively, through the data triangulation emerged the need to shift towards radical positions in design for supporting world-in-the-making in the situation; the RIA framework supports mediations through a model for creatively acting in the situation where the fifth order of design (Mortati, 2022) is the main one interested about design, and where the concept of "object" (e.g. the "eclipse of the object" in Findeli & Bousbaci, 2005) is latent and relative; service and strategic designers, as well as those interested in applying design for policy could use the RIA framework as a tool to guide their introduction in the situations;
- IV) Design education: the RIA framework calls attention to the role of the designers that attempt, on the one hand, to dominate the participatory process (cf. Udoewa, 2022), and on the other hand, assume an ambiguous position on the acquisition of knowledge (e.g. as discussed in the Herriott, 2023 discourse); as emphasized by the data triangulation, the RIA framework provides a model for better simulating designers' role in real life where diversity is a systematic variable, and the contexts are full of tangible and intangible complexities that shape the situation; in these contexts, designers need cultural drivers rather than toolboxes; this may inevitably change the way design education (especially in the field of service design, strategic design, systemic design, information design and design for social innovation) is conceived, designed, and distributed.

4.4 Opportunities for Further Work

To understand RIA, it is important to critically reflect on the idea that design can improve the world. Designers who manifest a radical inclusive attitude know that our ontological world requires flexibility, long-term commitment, perseverance, and, more importantly, the need for (new) approaches that simultaneously embrace diversity and create methods/processes that lead to greater understanding. RIA provides a way for us to translate and untangle the twists and turns (or difficulties, challenges) of day-to-day situations, which can often be seen as uncertain and complex. For these reasons, we are positioning the RIA concept as a non-design-centric approach. However, we have used methods which mostly involved people engaged in design research, even though they have very different backgrounds. Despite the case study being fully from a non-design context (with non-designers), and despite most of the experiences of the involved people in the RIA community being design researchers engaged in informal, third-sector, and community-based contexts, the methodology can provide a contradiction concerning the proposal of a non-design-centred perspective. This can be a limit of this work and an opportunity for further research. For instance, further research can focus on replicating the same process in contexts non-led by design(ers) or providing the framework in specific case studies with community-dominant initiation (cf. Udoewa, 2022) processes.

Also, the RIA framework is the result of a joint work of the RIA community that is self-reflecting - in this stage - about the need for design-uncentred approaches that shift from 'design thinking' to 'action thinking' where design is a "mutually constitutive process" (Barcham, 2021). This is quite evident, and where we are learning from, in cases such as the Riace model. For instance, the former mayor of Riace (namely Domenico Lucano - "Mimmo" Lucano) has been recognised as the main creator of Riace's model (see Ranci, 2020). As design researchers, we recognise that Mimmo Lucano is the best example of an RIA person (or RIA designer) who assumed action thinking and contributed to designing services, strategies and policies for applying the ideating, developing and delivering phases of Riace's model. Mimmo Lucano was not formally trained in design. We hypothesise that he applied a radical inclusive attitude and at the same time, he designed artefacts because this kind of attitude can be promoted among the local communities.

Observing and assuming this practice for the RIA framework means recognising the need for a new decentred role of design(ers) and design researchers in those contexts.

5. Conclusion

To conclude, we introduced the concept of RIA as a supporting framework for emerging perspectives in design that follow situation-centred approaches; we refer to this new perspective as design-uncentred. Design-uncentred is not at odds with a design-centric perspective; rather, it extends the design-centric to a new, multi-centric dimension that shapes the situation. This multi-centric perspective requires flexible interactions between designers and the people we design with.

The RIA framework should also be seen as a cultural model for addressing social complexities and global challenges where actions and mediations are rather more relevant than design-driven, design thinking, and design-centred (ego) perspectives.

According to this position, we are calling for shifts from 'design thinking' to 'action thinking'; from promoting design-driven processes to supporting the 'making in the situation'; from design for inclusion and human-centred approaches to cultural models that practise radical positioning towards inclusive attitudes. These shifts can be supported by the RIA framework as we presented in the way of the RIA ontology, praxeology, and phenomenology. It is a framework for supporting the world-in-the-making where conceptually the process of doing, undoing, and redoing is essential for addressing the complexities of certain contexts.

Finally, we highlighted the implication of the RIA design framework for design research, practice, and education, as well as in the civic innovation realms where the third and voluntary sectors and policymakers play crucial roles. We recognise that the RIA representative cases and principles—which are foundational components for understanding how to creatively act upon universal human rights—produce results that might be perceived as intangible, however, we believe the work still provides opportunities for further research.

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P/REFERENCES OF DESIGN

HOW SCENARIO BUILDING AND SERVICE DESIGN CAN CONTRIBUTE TO PLACEMAKING: THE CASE OF THE TOURIST HARBOUR CARLO RIVA IN ITALY.

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KEYWORDS | SCENARIO BUILDING, SERVICE DESIGN, CO-DESIGN, PLACEMAKING

ABSTRACT | This paper presents a case study: the design of future service scenarios for the Tourist Harbour Carlo Riva in Rapallo, the Italy's most important private marina destroyed by a storm in 2018. Historically, design has been viewed as a reflective practice aimed at creating futures to address complex challenges and this is why a group of design researchers and students from the School of Design of Politecnico di Milano were involved in an exploratory workshop to provide original solutions. The traditional urban planning approach has emphasized the consistency of the urban form of the built environment; however, such approach can be complemented by combining a service logic to the spatial planning perspective and this was precisely what was experimented during the workshop. The scenario building methodology and the service design discipline were employed to develop some scenarios to imagine the future of the harbour throughout the workshop, which encompassed three phases: a research stage to get in touch with the context, a concept generation to originate a great variety of ideas and a third phase to build final scenarios and their service solutions.

The scenarios resulted from the workshop served as a basis not only to stimulate the conversation among stakeholders, but above all to enhance the quality of their conversation, providing originality, detail and specifics on space and time. This could be viewed as a part of a wider placemaking strategy aimed at creating an innovative harbour in which (service) designers can provide a valuable contribution to the existing work of urban planners, architects, and policymakers.

1. Background Knowledge: Urban Planning, Service Design, Scenario Building

This paper moves from an unexpected extreme weather event occurred in 2018, a storm that destroyed the Tourist Harbour Carlo Riva in Rapallo, the most important Italian private marina. After this natural disaster, the necessity to redesign the area in light of climate changes and with a more community-centred approach clearly emerged. The real-estate company in charge for the re-opening of the harbour, named Bizzi & Partners, recognized the importance to adopt a different approach to conceive an innovative marina in harmony with the environment and, to achieve this aim, they involved a group of design researchers from the the Polimi DESIS Lab of Politecnico di Milano. Output of this collaboration was the ideation and development of a special educational activity, including students coming from different Masters' Degree of the School of Design who engaged in a dedicated workshop to envision future scenarios for the Tourist Harbour Carlo Riva.

Design has historically been conceptualised as a reflective practice which aims to build futures in response to problematic situations that are uncertain, disordered and indeterminate (Dorst, 2015; Schön, 1983). Here is why Bizzi & Partners identified the design discipline as a valuable set of approaches and methods to tackle the challenge of reimagining the future of the Rapallo marina. Another important element identified by Bizzi & Partners was to consider both the tangible and intangible dimension of the project, i.e. the physical spaces and services to be provided, therefore the expertise of the Polimi DESIS Lab in service design appeared as crucial to build a future scenario in which the spaces are informed and shaped by the activities that take place there.

The traditional urban planning, since the 1950s, was focused on the coherency of the urban form of the built environment and its developmental process with the functional necessities of an area (Beauregard, 2003); however, this approach needs to be expanded by embedding a service logic to the spatial planning perspective (Vargo & Lausch, 2016; Meroni & Selloni, 2022). This is because services are hybrid artefacts that can be viewed as technical and social networks where people, products and places interact for a common purpose (Mont, 2002; Meroni & Sangiorgi, 2011). Hence, assuming a service design perspective in spatial planning means to deal with complexity and to consider a systemic dimension to better organise the people and the infrastructure that may enable interactions in a given place.

The adoption of a service design approach was indeed complementary to the use of the scenario building methodology throughout the experimental workshop to envision the future of the Tourist Harbour Carlo Riva. Such methodology has a long history in business, government, and military sectors: Warfield (1996) suggests that a scenario is a narrative description of a possible state of development over time, it is useful to stimulate imagination and to conceive speculative thoughts about future evolutions. In general, it is possible to argue that scenario-building and foresight methodologies, incorporate diverse techniques, perspectives, and practices from various research and application fields, including Future Studies (Voros, 2001; Dunne & Raby, 2013; Fry, 2020;) and Strategic Planning (Hillgren et al., 2020; Jantsch, 1972). Additionally, strategic foresight has been integrated into the planning processes of the European Commission, with current efforts focused on incorporating it broadly into policy development across all sectors (European Commission, 2020). More specifically, according to Ogilvy (2002) scenarios are stories about the future conceived in a narrative and visual form and this is precisely the way in which design researchers formulate future narratives, i.e. by combing storytelling and visual elements. In the design field, Manzini and Jégou (2004) talk about 'DOS - Design Orienting Scenarios', defining a scenario as a vision for the future that is motivated and illustrated through specific solutions. They are useful to explore a panorama of alternative possibilities and act as 'thinking material' to orient conversations between actors, in other words they are "tools designed to facilitate the design process" (Manzini & Jégou, 2004, p. 193). For the purposes of this paper, it is important to highlight that the idea to characterize a scenario through specific solutions is peculiar to service designers: they use to craft scenarios around a service-logic, by mainly envisioning scenarios of interactions and relationships among people in a way that is anticipatory of the design of the physical space (Selloni et al., 2023). Here is why, during the workshop 'Design of future

scenarios for the Tourist Harbour Carlo Riva' students and researchers firstly envisioned how people could interact and relate within the space of the harbour so that these dynamics can be given priority when planning the related physical layout. Hence, in the next paragraph, an in-depth description of the 'Design Orienting Scenarios' developed during the workshop will be provided, focusing firstly on their service offering and secondly on their application in space and time, while in the final paragraph, a reflection on a wider placemaking strategy for the Rapallo marina will be drafted.

2. Case Study: Design of Future Scenarios for the Tourist Harbour Carlo Riva

Design of future scenarios for the "Tourist Harbour Carlo Riva" is the title of a special educational activity that was carried out at the School of Design of Politecnico di Milano involving a group of 20 international students selected from 3 different master's degrees programme: Product-Service System Design, Interior and Spatial Design, and Naval and Nautical Design. The group of students was created after a selection process and included them in an extensive workshop, conducted from March to May 2022 and designed as a contest for the envisioning of the futures of the marina.

As anticipated, the initiative was part of a larger process of rebuilding, rebranding and managing the tourist harbour 'Carlo Riva' in Rapallo damaged after a sea storm in 2018. Such a process, which is currently in the final phase of the construction site, met the teaching activity at a transition point between the closing of the architectural master plan and the beginning of the design of the intangible elements. This represented a key moment: the main spatial elements were already defined and played the role of creative constraints, and, at the same time, it was still possible to influence the detailed physical layout's choices through the design of scenarios embedding services and activities. Hence, building upon such constraints, we defined a brief that guided the students in the main phases of research, concept generation and development of future scenarios. The following paragraphs will describe these three main phases and the process of setting up and conducting the didactic experience while introducing the 4 emerging scenarios.

2.1 Phase 0: Setting Up and Defining a Brief

The initial phase comprised formulating a brief, followed by a collaborative problem-framing stage with Bizzi & Partners and Tectoo, the architectural firm responsible for developing the master plan. The components contributing to the brief were categorized into two groups: firstly, functional elements necessary for envisioning a novel offering for the harbour, and secondly, potential opportunities aimed at establishing a specific identity for the marina and therefore for the various identified targets.

Regarding the first category, the brief was to create a 'high-end tourist harbour', a marina providing the most complete and updated range of services that could characterize an efficient and pleasant future destination, considering environmental and social sustainability as the basis of the whole project. In fact, although the main customer is the international tourist, the brief indicated as the core element of any proposal the need to imagine this new place as an extension of the historic city of Rapallo. And therefore, to overturn the logic of exclusivity and privacy on which the old marina had been designed, adopting an inclusive, open and above all integrative approach as well as a community dimension.

> "It is an inclusive space devoid of barriers and borders, warmly embracing guests, tourists, and city residents alike. This dynamic environment thrives in every season, seamlessly integrating into the daily life of the city. It serves as a hub where individuals can encounter and enjoy a variety of new services." (from the original brief)

Finally, two must-have requirements have been thoughtfully integrated as key components in each scenario:

- **Sustainability**: this involves embracing advanced approaches to environmental responsibility, optimizing resource utilization, and actively addressing waste and impact through practices such as recycling, repairing, and reusing.
- **Technological Advancement**: this encompasses the seamless incorporation of innovative solutions and the integration of the latest technological products to enhance the port's services and offerings.

As regards the second category, the brief was complemented by a series of contextual project opportunities in different areas, arising from a preliminary analysis of both emerging global trends and the specific vocation and resources of the place. These opportunities have been crafted as potential avenues for further exploration concerning their connection to a local scale, including local services and initiatives. Additionally, they extend to a national scale, delving into characteristics and vocations acknowledged as typical of Italy. Furthermore, they reach an international scale, examining the offerings of marinas in the Mediterranean. This analysis refers to both competitive perspectives and considerations of complementarity within the tourist circuit. The same approach of examining various scales is also applied to the analysis of potential users. This encompasses not only the marina's primary international target but also includes considerations for internal tourism. Most importantly, it involves viewing the residents of the area as potential new users but also potential co-designers and co-producers of services and spaces.

The four identified areas of opportunity are:

- **Sports**: The Tourist Harbour Carlo Riva is a marina highly specialized in water sports. It stands as a centre of excellence in sailing, offering a comprehensive experience for sailing enthusiasts—from learning and practice to competition and the sheer enjoyment of sailing. Additionally, it provides a diverse range of sports, promoting a holistic approach to well-being for its users.
- **Tourism**: The Tourist Harbour Carlo Riva emerges as a new focal point for Mediterranean yacht tourism, providing a comprehensive hospitality experience encompassing accommodation, dining, well-being, and entertainment. In this context, Rapallo is seamlessly integrated into the Golden Triangle of Yachting, alongside the Italian Riviera, French Riviera, and Sardinia.
- **Heritage**: The Tourist Harbour Carlo Riva serves as a hub for the cultural and natural heritage surrounding Rapallo. It is a space where individuals can engage in learning and practical experiences related to biodiversity, environmental sustainability, and landscape protection. It acts as a gateway for exploring and discovering the historical and cultural sites within the area.
- **Design**: The Tourist Harbour Carlo Riva serves as a showcase of Italian design, where the essence of "made in Italy" is manifested in every facet of the environment, services, and activities offered to users. It encapsulates the most authentic and sophisticated Italian experience.

2.2 Phase 1: Research

The initial phase of the programme included both desk research and on-site activities. As students delved deeper into the information provided in the brief regarding future directions and requirements, they seized the opportunity to visit the Rapallo harbour area, which has been inaccessible since 2018 (Figure 1). During this on-site exploration, students engaged with workers and residents of the city, previously identified by Bizzi & Partners. The crucial aspect of this phase was the interviewing of citizens who serve as recipients of the services and beneficiaries of the harbour. This hands-on activity played a pivotal role in gaining insights into the needs and perspectives of the local community, enriching the overall research and educational experience.



Figure 1. Visit to the city of Rapallo and to the building site of the marina (pictures by the authors).

2.3 Phase 2: Concept Generation

The students actively participated in a series of brainstorming sessions aimed at generating a wide array of ideas. The use of the 'DOS - Design Orienting Scenarios' was crucial in exploring possibilities for different futures, moving from the seeds of the present and identifying possible solutions in form of services to be further developed in the following phases. Such methodology makes it possible to explore a range of experiences that people could have in the marina spaces in future, even before these spaces are designed in detail. This set of services and relationships manifested in the scenarios helps build the identity and distinctiveness of each of the scenarios.

Exploring the opportunities outlined in the brief, the students identified a series of influential factors that could shape the design of both scenarios and services. These factors encompassed various polarities of concepts, including Temporary vs Permanent, High Season vs Low Season, Private vs Public, Reserved for Clients vs Open to the City, Personalized vs Standard Offering.

Such dichotomies served as key elements to stimulate the creative phase. They provided a structured framework for considering and conceptualizing different aspects of the potential offering. The outputs of this phase culminated in a series of 'draft scenarios', which would be further refined and selected for the consequent development. This iterative process allowed for a dynamic exploration of possibilities and laid the foundation for more focused and detailed design choices.

2.4 Phase 3: Development of Future Service Scenarios

In the third phase, students built four specific scenarios, for each of them they outlined the following items:

- a general description in the form of a narrative and a visualization highlighting the most important characteristics of each future Tourist Harbour Carlo Riva.
- the main and additional services, therefore exploring the offering and the set of experiences provided to the different targets: from the tourist to the local citizens, including marinas' staff and workers.
- the main user journeys to map out the complete user experiences, touchpoints, and stakeholder maps. These visual representations provided a comprehensive view of how people would interact with the services, illustrating key touchpoints (both tangible and intangible ones) and identifying important actors to be involved in the scenarios, according to different roles and levels of engagement.
- the usage technology and the adoption of technological solutions both by exploring the development of innovative touchpoints as well as by integrating such innovations as part of the offering (see scenario 2 as an example).

This process of scenario generation and development aimed to establish a clear framework for understanding both the distinctive character of each scenario, in terms of actual offering and experiences, but also the stakeholder engagement plan, essential to implement the vision of the future marina. Moreover, it allows to start connecting the level of human interactions with the level of spatial interactions and design, thus contributing to imagine a new 'place' as anticipated in the introduction.

Here below there is a description of the four scenarios, written in the typical storytelling form of the scenario building methodology, which attempts to provide a specific and visionary narration at the same time.

Scenario 1. The Harbour of Amusement: offering 'sportainment' adventures.
Imagine a harbour where visitors embark on an unforgettable "sportainment" adventure, featuring recreational and multi-experience port entertainment facilities unique to the space (Figure 2). The marina has the potential to set a new standard for the region, offering one-of-a-kind experiences for adventure seekers of all ages. From the amusement of wellness to the thrill of intense emotions, individuals can interact with others and have fun.

Picture a scenario where a wholesome family of yacht owners and visitors enters the harbour area in the morning, ready to embark on an unforgettable "sportainment" experience, ranging from recreational multi-experiences to adrenaline-fueled adventures. What if the harbour spaces facilitated playful interactions among visitors and guided them toward community building? Envision the unique sports spaces unveiling new rules and introducing new sports/activities exclusive to Rapallo!

According to the findings, theme parks attract more visitors than any major sports league worldwide, and by a significant margin. Furthermore, sports entertainment is a global industry that has experienced exponential growth in recent decades. Given the diverse activities, locations, and users, there is ample opportunity for a profoundly multi-experiential and community-building experience.

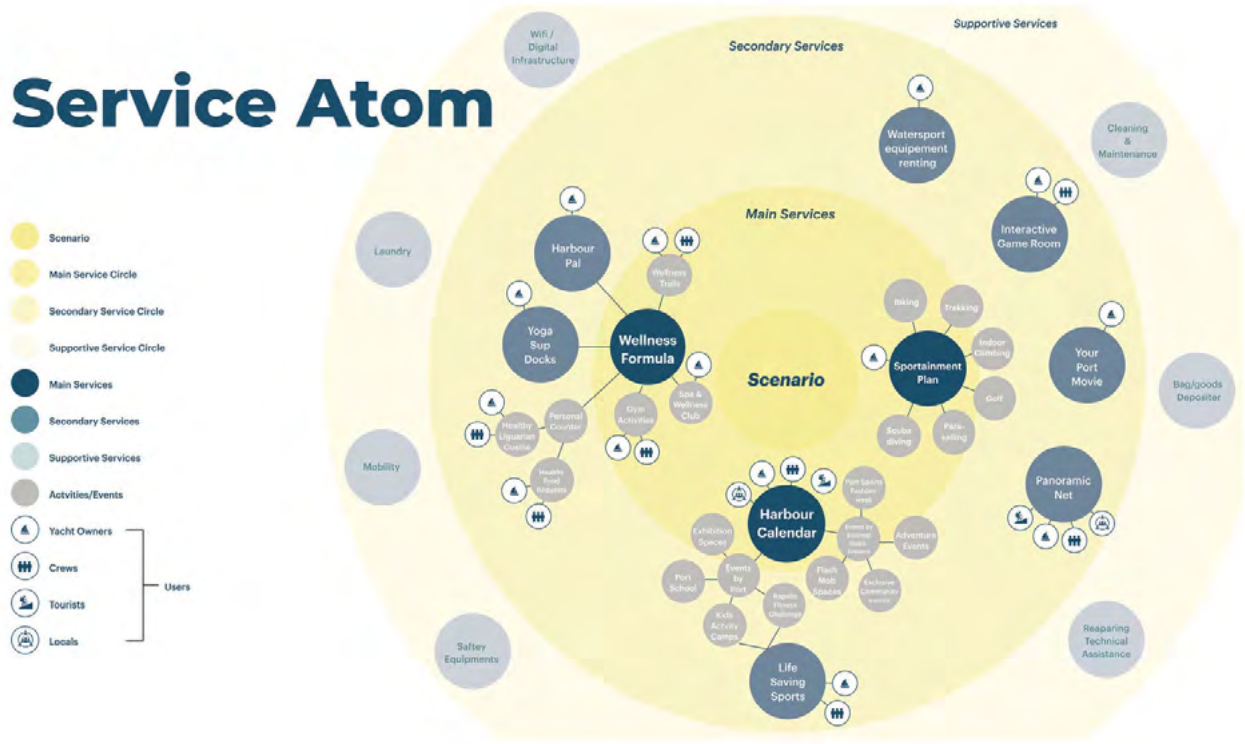


Figure 2. The Harbour of Amusement: offering map (students: A. Bosso, G. Musumeci, A. Panzetti, and D. Perera).

Scenario 2. Europe's leading carbon-negative marina: setting a new standard for sustainable marinas. We live in a new world where the reality of climate emergency is on our doorsteps and can no longer be ignored. Rapallo's Carlo Riva Tourist Harbour knows this reality well and is determined to set necessary ecological boundaries to reduce emissions at the local level and become Europe's leading carbon-negative marina (Figure 3). Rapallo is setting a new standard for the future of marinas by proving it is possible to create a new sustainable ecosystem around how marinas and harbours are run. You just need to be brave enough to leap. The many people who live, work, and holiday in Rapallo are ready to embrace a green economy, live sustainable lifestyles, and contribute to this dynamic, green zero-carbon future. Rapallo is installing the systems and infrastructure needed for this resourceful and innovative green future to become a reality by becoming a car-free private marina. Through their awakened respect for nature, Rapallo is creating pathways for empathy and ingenuity and brings forth a response that breaks free from convention and defies the system.

Those to visit Rapallo will find various products, services, and systems that encourage and enable hassle-free green consumerism. Not only this, but they will also feel refreshed by its spirit and virtue. However, becoming carbon negative admitting marina does not happen overnight, and it takes the coming together of several solutions to create a truly efficient and sustainable ecosystem.



Figure 3. Visualization of scenario 2 “Europe’s leading carbon-negative marina” (students: C. Ravasi, M. Torres, S. Checker and S. Peluzzi).

Scenario 3. Design Bay: aspiring to transform the marina into a hub of nautical design.
In a context marked by a great history of design, the new Tourist Harbour Carlo Riva was born. Starting from its history and from the importance that this place had for the engineer Carlo Riva, Design Bay wants to transform the Marina into a place of reference for nautical design. It becomes a place for everyone, where users can enjoy the best services and live premium experiences, enriching their passion for boat design. This will be possible thanks to the creation of spaces that will be simultaneously related to leisure and culture. In the marina, it will be possible to enjoy the Italian beauty in its simplicity: having a typical aperitif while admiring the hulls rocked by the waves and learning more about the world of boat and product design, thanks to exhibitions, courses, activities, and shops open to everyone (Figure 4).



Figure 4. Visualization of scenario 3 “Design Bay” (students: A. Colombo, G. Frattini, L. Imperio, B. Akyazici, O. Saglam).

Scenario 4. The Floating Resort of Rapallo: combining sea and land tourism to build a destination suitable both for work and vacation.
The harbour of Rapallo presents a unique opportunity to extend a luxurious experience as imagined by Carlo Riva between land and sea. The Floating Resort is a craft of luxury between land and sea, envisioned as an epitome of the ‘Carlo Riva style’. It offers a seamless transition from the shackles of mundanity to the gift of rejuvenation. From the moment of docking, the yachts become the resting abodes to a world of pampering and entertainment, just as cottages are to resorts. Responding to the remote lifestyles of today, it presents a unique destination for celebrating life on vacation and at work alike (Figure 5).

Nowadays tourists are totally connected with all available experiences they could reach. Harbours are changing their approach toward very different solutions, becoming a point of reference in a specific area. Carlo Riva Harbour could become the one where tourists find new engaging entertainment based on the idea that the sea mixes with the land generating a unique surface where the show takes place. Around it, people will meet and share the experience and enjoy the journey as a yacht owner, as a Rapallo resident, as a tourist, and as part of the Tourist Harbour Carlo Riva.

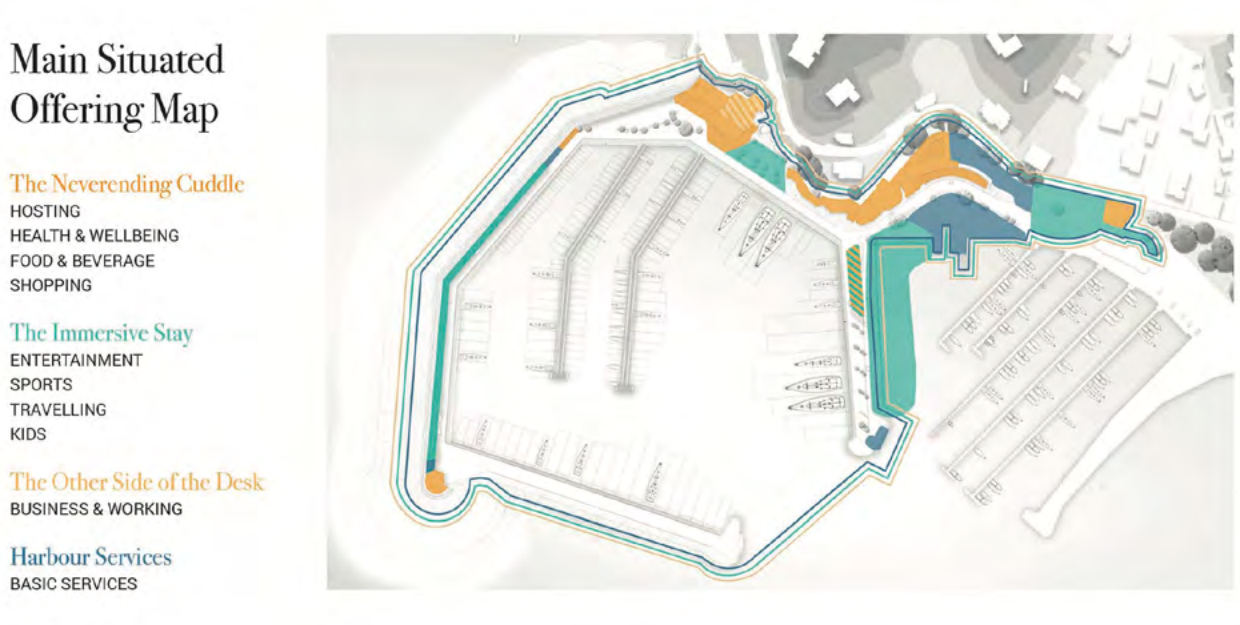


Figure 5. The main situated offering map of scenario 4 “The Floating Resort of Rapallo” (students: M. Diaz Gonzales, G. Lisoni, G. Luciani, G.Martini, R. Mondal).

Finally, a public presentation took place at the Municipality of Rapallo in the presence of the city's mayor, council members, and representatives from Bizzi & Partners. The outcome of this phase contributed to a broader and comprehensive conversation concerning the future of Rapallo, wherein the new marina played an integral role. The scenarios crafted by students offer a valuable framework for envisioning the city's future, thanks to their ability to incorporate and integrate a diverse range of spatial and service elements.

3. Service-Oriented Scenarios as a Placemaking Strategy

The scenarios elaborated during the workshop served as a stimulus for the executive project as each of them made emerge potential elements that, selected and combined in the most appropriate way for Rapallo and its context, can be considered as an integral part of a wider placemaking strategy to create an innovative harbour. More specifically, the identification of several service solutions was useful in imagining an unprecedented use of the spaces, which become then actual ‘places’ thanks to the involvement of physical, cultural, and social identities into the equation. The transformation of a space into a meaningful place (LeGates & Stout, 2020; Gehl, 2013) is precisely the very aim of a placemaking strategy and, in Rapallo, this was possible thanks to the inclusion of intangible elements extending beyond the physical aspect. Granata, in her book about placemaking (2021), states that traditional urban planning and architecture have long lost their role as society’s spur, their capacity to transform places and conceive long-term visions. Here is why the adoption of the scenario building methodology and of a service design approach was useful to shift the focus on people and their interactions, aiming at strengthening social relationships to share meanings about a place (Buser et al., 2013 in Romeiro, 2017). In the same vein, Granata (2021) continues arguing that placemaking centres mainly on behaviours, nature, feelings, and lifestyles, employing an envisioning perspective that originates in the real world but looks further, perceiving possible connections, and integrating apparently unrelated components into new opportunities. Therefore, she highlights that complex urban projects (as that of the Tourist harbour Carlo Riva is) need a great variety of ‘placemakers ‘who are not only architects or policymakers but more widely ‘inventors of places’ who elaborate on people's necessities and desires and generate a common future vision. It is not by chance that the real estate Bizzi & Partners and the architectural firm Tectoo recognized the need to include in their strategic conversation experts in service design and scenario building and to benefit from the fresh perspective of design students. After the natural disaster of 2018, the pressure on the part of the community and the municipality of Rapallo to develop a more meaningful project in a strategy of adaptation or mitigation to climate change was high: however, it was not only a challenge related to

environmental sustainability, but it was also about envisioning a way to build communities around that place, identifying activities and services, ensuring diversity and inclusion, in other words to create a new 'place' as integral part of life's people. The work of the students in conceiving scenarios in which tourists and local communities coexist and interact was a key component in building a wider placemaking strategy in which both time and space are carefully designed and combined. One of the distinguishing features of the service-oriented scenarios built by students was precisely the development of a calendar considering a variety of time ranges, from the seasonal dimension to weekly or daily levels that need different reasoning and approaches and conceive the wide plethora of services in a systemic and progressive way. Another 'time feature' that was attentively designed was the distinction between permanent and temporary activities: this was important to make an estimate of the effort needed for each service and, above all, to better define the hierarchy of the service offering, identifying the main one and what was on the contrary considered secondary. The adoption of a well-known tool as the service offering map (Foglieni et al.2018; Morelli et al.,2021) with the 'time filter' integrating permanent and temporary activities was made in every scenario and was considered a fundamental ingredient in a planning perspective, not only by Bizzi & Partners but also by the Municipality of Rapallo who expressed a clear interest in considering such agenda the starting point for the future. The inclusion of the time dimension into the project is a specific characteristic of service design (Meroni & Sangiorgi, 2011; Sangiorgi & Prendiville, 2017) and its integration in a wider placemaking strategy was particularly meaningful in the case of the Tourist Harbour Carlo Riva, as the objective was to envision the transformation of a place over time. The time issue was central not only in terms of the 'service agenda' for the harbour, but also as a fundamental reference in applying scenario building: this methodology is employed considering a future perspective, in the case study described it was specifically a timespan of about 10-15 years. The medium and longer term are particularly useful in complex situations, full of uncertainty and conflicting issues (Leney et al., 2004) especially because they usually cover a broad spectrum of elements, including demographic shifts, geopolitical and climate changes, and disruptive technologies. They demand a higher level of creativity and the capacity to imagine alternative futures that may seem distant or speculative (as some of the Rapallo scenarios are, as 'Europe's Leading Carbon negative Marina' scenario) but they complement and extend the value of traditional forecasting and above all they are useful to ignite a conversation among stakeholders. The four scenarios designed by students for the Tourist Harbour Carlo Riva contributed not only to encourage but above all to enhance the quality of the overall conversation, providing originality, detail and specifics on space and time. They served as basis for the wider placemaking strategy that Bizzi & Partners together with the Municipality of Rapallo intend to develop and apply in future.

Preparing and cultivating the ground for making this conversation flourish is precisely what Selloni and Meroni (2023) suggest in their attempt to define design for placemaking: "a collaborative process by which we can shape our public realm by acting on soft infrastructural and intangible (cultural, relational, policy, etc.) levels to maximize communal value/common good and sustainability in a community-centricity perspective and configure, re-configure and re-signify the space (from space to place)" (p.2). Hence, the contribution of the service design researchers and students in the case study here presented can be defined as a pioneering activity of design for placemaking valuable for the future: here there is room for further research as the work of designers can provide an effective contribution in complementing and expanding that of urban planners, architects, and policymakers.

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P/REFERENCES OF DESIGN

CULTIRIDER - THE CASE STUDY OF A MOVING COMMUNITY SPACE CREATING INTERCULTURAL CONNECTIONS BETWEEN LOCAL AND MIGRANT YOUTH IN HUNGARY.

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KEYWORDS | CO-CREATION, FLEXIBLE ATTACHMENT, INTERCULTURAL ENCOUNTER, VISUAL COMMUNICATION, COMMON VALUES

ABSTRACT | CultiRider is a moving community space that has been bringing intercultural workshops to several villages in Hungary in the form of a redesigned camper van since 2020. CultiRider is also a case study illustrating a collaboration of urban and rural NGOs, communities, and artists. The paper explores how design might take a role in community building by creating a shared place and shared language. The authors are both doctoral candidates, practising designers, and social activists whose aim is to support creating common values by connecting two very different target groups: youth with refugee and migrant backgrounds living in Budapest as well as their underprivileged Hungarian peers living in the rural area of Hungary.

First, the paper introduces the diverse challenges of the involved groups, highlighting the dimensions of the insecure physical environment and the barriers of language. It also discusses the significant roles of "flexible place attachment" (Dúll, 2009) and visual communication (Kress & Van Leeuwen, 2020; Radtke, 2021) in the context of intercultural encounters (Kapitány 1996). In the case of migration, besides the transformation of cultural identity, separation from home entails a multiple loss. In the new society, the migrant loses the gestures and codes that help the problem-solving ability in social contacts (Horvát-Militity, 2011), and by losing their home, they face the challenges of grieving the old environment and rebuilding a new one (Dúll, 2009). The group of underprivileged Hungarian youth living in rural areas of Hungary face the challenges of rural segregation and lack of intercultural encounters, leading to closed communities and discrimination (Halász, 2020). While the ability of "flexible attachment" can support effective adaptation to changing environments (Dúll, 2009), visual communication, as a global language, can be a tool for intercultural communication, storytelling, and self-expression. The opportunity to work in intercultural teams develops new competencies and creates shared ownership and community. (Murdoch-Kitt, 2020)

In the second part, the paper introduces the case study of CultiRider, a community-created project using collaborative design methods. Following a democratic decision-making process from the very beginning, the project of CultiRider developed through the steps of community brainstorming, redesigning and rebuilding a van through co-creation, conducting intercultural creative workshops focusing on language barriers and sharing different cultural views as well as creating common values such as a commonly owned flexible space and a common visual language. Non-formal evaluation methods and half-structured group interviews were

Conducted to monitor the process of co-creation and understand the learnings of the project. Results show that by joining CultiRider, migrant youth raised their motivation to learn about the local culture and the Hungarian language, enabled them to create new friendships, and offered them a chance to share their culture with others in a respectful environment. Hungarian youth became motivated to learn foreign languages, which helped them to dismantle stereotypes and xenophobia. Both target groups benefited from gaining intercultural and collaboration skills. The moving community space created a flexible but still stable environment in multiple places, raising the feeling of security and belonging in the participants.

1. Introduction

The bottom-up project of CultiRider is initiated by an interdisciplinary group of activists in the frames of a Hungarian NGO, Útilapu Hálózat, emerging as a dynamic and innovative moving community space aimed at fostering intercultural dialogue and cooperation. The NGO itself is home to the Open Doors working group - a diverse and proactive community open for Hungarians, foreigners, refugees, volunteers, and activists, or anyone who is engaged in building an inclusive society by opening spaces (physical or metaphoric) for intercultural dialogue which enables us to learn from each other through a co-operative design process (planning, designing and realising) by workshops, pieces of training, and events since 2013. The inception of CultiRider during the COVID-19 pandemic was the result of an online collaborative design thinking process involving the NGO community members. Since 2020, CultiRider has been delivering intercultural workshops by a redesigned minivan to various rural locations in Hungary, serving as a case study that illustrates intercultural collaboration among urban and rural NGOs, communities, and artists. The project focuses on how design can play a pivotal role in community building, bridging the gap between youth with refugee and migrant backgrounds living in Budapest and their underprivileged Hungarian peers in rural areas. The collaborative efforts involve three rural partner organisations.

The paper examines the role of flexible place attachment and visual communication in fostering intercultural encounters, drawing on theoretical insights from Dúll (2009), Csíkszentmihályi and Halton (2011), Roberts (2018), and Gustafson (2013). It highlights the importance of creating safe spaces for encounters among underprivileged groups and explores the complexities of belonging in disrupted environments. The necessity of acquiring intercultural competencies for effective communication and understanding is emphasised by Hidasi (2004), while visual communication, as advocated by Neurath (1936), serves as a universal language facilitating dialogue across cultural boundaries. The collaborative approach in design, as discussed by Radtke (2021) and Murdoch-Kitt & Emans (2020), fosters innovation and inclusivity, promoting problem-solving skills and a sense of shared ownership and community. Visual tools outlined by Manzini (2015) play a vital role in facilitating intercultural teamwork, serving as conversation starters and storytelling aids, ultimately enhancing intercultural dialogue and promoting inclusivity in diverse cultural contexts.

Based on the theoretical background and the case study, the paper states that collaborative design methods can be effective tools for creating a common space and common language to bridge together underprivileged youth from different cultural backgrounds. By transforming a minibus into a multifunctional space, CultiRider seeks to address the challenge of lost connections exacerbated by the COVID-19 pandemic and provide opportunities for intercultural encounters. Through a series of collaborative workshops, camps, and community-based projects, the project facilitates dialogue, skill-sharing, and the co-creation of meaningful experiences among participants. Commonly owned tangible results such as workshop materials and a renovated van, combined with improved social and language skills, can boost participants' confidence in their creativity.

2. Bringing Together Underprivileged Hungarian and Refugee Youth

CultiRider brings together two very special underprivileged groups who do not have many opportunities to meet in the Hungarian context: (1) young refugees from the Middle East and Africa living in Budapest and (2) disadvantaged Hungarian youth living in the rural areas of Hungary.

The global rise in asylum seekers and refugees, particularly in transit countries like Hungary, presents significant societal challenges. Integration barriers are compounded by xenophobia and stereotypes, leading to conflicts between host society members and newcomers (Gyulai, 2014; Sik, 2016). "In every case, we consider migration as an unexpected, so-called accidental crisis, which is an important task of the individual to process it" (Hautzinger et al. 2014, 69). This crisis alters interpersonal relationships and can lead to learned helplessness, isolation, and depression due to communication difficulties and cultural differences. Migration involves more than just a shift in cultural identity; it encompasses multiple losses,

including the loss of familiar gestures and social codes crucial for problem-solving in new environments (Horvát-Militity, 2011). Additionally, migrants face the challenge of grieving their old surroundings and rebuilding new ones after leaving home (Dúll, 2009). This study focuses on unaccompanied minor refugees and young migrants who arrived in Hungary between 2013-2023. These minors face unique challenges, as their experiences are shaped not only by refugee status but also by their protection under the childcare system. Their arduous journeys and uncertain asylum processes exacerbate post-traumatic stress disorder stemming from the trauma of displacement. Cultural disparities and language barriers further complicate their social integration, necessitating new tools such as cultural knowledge and language proficiency (Hautzinger et al., 2014).

The group of underprivileged Hungarian youth living in rural areas of Hungary face the challenges of rural segregation and lack of intercultural encounters, leading to closed communities and discrimination (Halász, 2020). When speaking about the underprivileged Hungarian target group of this project, similarly to many other underprivileged families in Hungary (Bányai & Kelemen, 2022), each of the participating youngsters has parents who were raised in state care. Families living in extreme poverty experience material deprivation, one-sided diet, intermittent or even regular hunger, shortage of proper clothes, and disconnection of utilities, which can force families in winter to move in together to reduce the number of apartments or houses to be heated (Husz-Marozsán, 2014). Because of their insecure situation, these families might have to face debts and family conflicts, which can lead them to hide or change their place of residence. These families have less chance to develop supportive relationships in the local community, and they often have to face prejudices from the majority of society. Children raised in families facing these problems live in a “culture of poverty” (Lewis, 1968; Solt, 1998; Kozma, 2003, cited by Bányai & Kelemen, 2022, 8).

The challenge of bringing together these two very special groups has different layers but might have one main source: the challenge of cultural differences. Nothing is more proof of the multiple layers of culture than the fact that it covers and influences countless areas of our lives. Without wishing to be exhaustive, we must mention here the most striking aspects of culture, such as the material environment, time management, the dominant worldview, religion, celebrations, and communication. However, culture also affects many more elementary details, such as the way we help others, human relations, the way we experience conflict, appropriate behavior, our main ambitions, the boundaries of the private sphere, the use of space, attachment to the material environment and the concept of power (Kapitány & Kapitány, 1996). It is understandable, then, that our culture influences our most basic habits and can determine our most fundamental values and behavior (Kapitány & Kapitány, 1996). Socialisation and culture go hand in hand (Hidasi, 2004) since "it is only through the medium of culture that man can act meaningfully and relate to others" (Hall, 1987, 251). Connected to this, both Hall (1987) and Schütz (1944) point out that our culture-based knowledge is incoherent and only partially clear. Since we socialise in this knowledge system, it gives the members of a group coherence, clarity, and consistency to understand each other. Still, it creates huge confusion and conflicting points for outsiders (Schütz, 1944).

In conclusion, we can see that the main challenge of the CultiRider project is to facilitate two culturally very different groups towards a commonly accepted set of rules, including a shared place and common language. On one hand, "one's culture determines how one perceives the world" (Hall, 1987, 251), which can lead to deeply rooted conflicts among different groups. On the other hand, culture can also be seen as a major integrating and socialising force of a group since the set of rules and norms are correct and accepted by its members (Haviland, 1987). To use cultural differences as an empowering resource, intercultural competence needs to be developed. According to Radtke (2021), intercultural competence is a trainable skill which refers to the ability to effectively navigate and communicate across different cultures, understanding and appreciating diverse perspectives. (Radtke, 2021)

3. Co-created Place and Language

It is not easy to decide which should come first: creating a common language for a transnational and intercultural dialogue or creating a safe place for the encounter of differently underprivileged people. The

Paper has no intent to prioritise these needs but rather raise awareness about the importance and opportunities offered by flexible place attachment (Dúll, 2009) and visual communication (Kress & Van Leeuwen, 2020; Radtke, 2021) in the context of intercultural encounters (Kapitány & Kapitány, 1996).

3.1 Safe Place

As we have made clear above, both target groups have their sense of belonging and place-based security disrupted: refugees are uprooted from the communal and physical connections of their home that provides security, while young Hungarians living in poverty are anchored in a distorted conception of home that cannot provide security. If the primary territory is (burned down) or psychologically (receives a negative charge) destroyed or damaged, "this causes the same grief as the loss of important companions." (Tuan, 1974, cited by Dúll, 2009, 131). By this damage, the person leaves the familiar, intimate, protective, and autonomy-providing environment, the personal sphere and territorial behavior are violated, and the possibility of control is also lost. In this case, the person faces a double task: "to deal with the grief of the lost place and to create attachments to a new environment at the same time" (Dúll, 2009, 238).

While several studies of environmental psychology state that place attachment has countless advantages, such as the sense of security, belonging, control, and ownership, as well as experiencing social connections (Dúll, 2009). Still, others conclude that mobility is associated with development and personal growth (Gustafson, 2013). What is for sure is that place attachment is the emotional bond between person and place, and it has different dimensions (Dúll, 2009). With Dúll's (2009) summation, it becomes obvious that knowledge of a place and its usage together create place attachment, social actors, ownership, a sense of security, and self-determination play an important role as well. Maybe it is not surprising that the highest manifestation of place attachment is the place called home.

As we discussed earlier above, we can see that cultural differences reach not only material dimensions but also habits, social connections, values, and perceptions, which also leads us to the point that the concept of home as well depends very much on cultural dimensions. If the sense of home has a cultural context, it can also mean that changes in the home environment do not have to be a traumatic event in every case. The Eskimos, the North American forest Indians, the nomads of the Inner Asian steppes, have no permanent homes (Csíkszentmihályi&Halton, 2011). By this, we can conclude that the idea of an irreplaceable home has been created not as a universal human concept but as a culturally influenced definition “created in certain places at certain times and neglected in others” (Csíkszentmihályi&Halton 2011, 181). Even though this change can burden everyone and can be a source of many conflicts, it does not result in a negative effect only, as it also promotes the formation of "flexible attachment" (Dúll, 2009, 239). A growing body of research suggests the advantages of a lifestyle based on mobility and that even highly mobile people may develop strong bonds to place (Gustafson, 2013; Roberts, 2018). Marshall (2018) states, based on his research, that participants who live a modern nomadic lifestyle put down roots instead of passing through locations; the homes of these participants became multi-sited, and still, they needed strong and embedded connections. According to his findings, people on the move can develop belonging through multiple grounded practices, such as gardening, cooking, and finding familiar landscapes. Active homemaking practices create connections between people and their environment, and by this act, “remembering also becomes an active process and constitutes a motion of attachment” (Roberts, 2018, 40). Sense of belonging involves tangible resources, everyday embodied practices, as well as memory and emotion (Roberts, 2018).

Studies also point out that it is not only stable physical environments where we can develop strong place attachments and that emotional bonds can be developed towards different scales of settings (Dúll, 2009;

Gustafson, 2013). Gustafson points out that vehicles and infrastructures for travel may become meaningful places for mobile people: they may develop an attachment to such places of mobility. Studies of mobile workers show that they can even try to make themself at home in settings that theorists stated before as liminal places or places of transition, such as cars, train compartments, airports, and hotel rooms (Gustafson, 2013). Speaking about different scales of attachment, immigrants in Denmark expressed a sense of belonging to their new hometown and residential area but not to the country of Denmark. According to Gustafson, immigrants suggest that their belonging was based upon everyday positive interactions, while their national belonging was limited by negative representations of immigrants in national Media (Gustafson, 2013). These findings mean that research about place attachment “needs to go beyond its common focus of Home places and examine other important places as well, including non-residential settings” (Gustafson, 2013, 45).

Concluding we can understand that mobile people may develop and sustain attachment to several different places, multiple attachments are potentially enriching since "flexible attachment" can support effective adaptation to changing environments, and the "settlement identity" can mean effective adaptation also to the pace of modern life and this flexible bond can develop spontaneously in the case of immigration (Dúll 2009). However, it needs to be highlighted that these advantages mostly come when positive experiences are associated with these journeys and changes, which is not the case in either of the target groups of this study. This leads us to one of the sub-questions of the project of CultiRider: Are temporary setups able to create (and if so, how) a supporting environment where vulnerable people can cooperate and grow?

3.2 Intercultural Competence Through Visual Communication

The issue of social integration and its relationship with culture concerns a much wider audience than refugees and asylum seekers since not only does cross-border migration involve an encounter with a new culture but in case of small geographical movements within national borders or movements between different social groups also entail interaction between different cultures (Hidasi, 2004). Even though we no longer need to cross a national border to encounter another culture, in the era of globalization and during migration processes, there is a growing need for intercultural competencies related to both transnational encounters and encounters among the citizens of the same nation. According to Hidasi, “intercultural communication is nothing other than the interaction of people from different cultural groups” (Hidasi, 2004, 33). Learning culture is as essential to successful interaction as learning a language, and it cannot be avoided in our everyday conversations and work. About intercultural competencies, Hidasi states that.

> "To have an effective and smooth conversation with a foreign partner, or to read a foreign novel, or even to understand an advertisement, or to be successful in marketing, these are all essential skills" (Hidasi, 2004, 25).

Culture is, therefore, not an innate quality but an acquired and learned set of knowledge and norms. This fact makes it possible to learn culture and acquire intercultural competencies.

As Otto Neurath (1936) states, "Words divide, pictures unite." (Neurath, 1936) Visual communication is the language of images and has the potential to bridge language barriers and promote intercultural understanding. Visuality speaks to a much more ancient layer; it skips a stage in the process of the mental image becoming a verbal concept, and it connects to reality more directly than words (Mitchell, 1986). While the perception and recognition of images is indeed a universal ability, reading them and decoding their meaning is far from being so. Meaning in images is often negotiated through cultural and social contexts, requiring an understanding of semiotic codes (Kress & Van Leeuwen, 2020). Understanding the pictorial signs that make up visual language is a social process, one that presupposes a social, historical, and geographical context and one that requires prior experience and knowledge. Just as spoken language conveys a shared understanding of the world within a specific community, images also reflect this collective comprehension among members of the same group. Consequently, the interpretation

individuals derive from an image often hinges on the common knowledge they share with others in their group (Kostelnick, 1993). According to Kostelnick (1993), three levels of social context influence the perception of images: (1) the cultural context includes the shared worldview and values of the group members, (2) the conventional context means that members of the group share a particular discipline or a visual language of a particular discipline or a special topic, while (3) immediate context is the situation in which the participants use the particular image.

Therefore, we can say that images are universal and culture-specific at the same time, they have an important role in both bridging cultural differences and sharing cultural specifics and values. Visual communication as a global language can be a tool for intercultural communication, storytelling, and self-expression, and it is an extremely important tool when the participants of the communication process do not share the same language or culture.

In the context of design, intercultural collaboration fosters innovation and creativity by bringing together diverse perspectives. Problem-solving competence, social competence, professional competence, and self-competence can be seen as the four cornerstones of intercultural competence that enable participants to work in teams, overcome difficulties, share skills, and act self-reflectively and responsibly (Radtke, 2021). By integrating various cultural insights, collaboration becomes a catalyst for developing more robust, inclusive solutions that cater to a broader audience (Murdoch-Kitt & Emans, 2020). The opportunity to work in intercultural teams develops new competencies and creates shared ownership and community. Visual tools can be effectively used in intercultural teamwork, as conversation subjects, conversation prompts, or experience enables the starts of social dialogues. They can be tools for mapping and amplifying, mapping and placemaking, amplifying and dynamizing, creating stories, reconstructing local identities, digital storytelling, hybrid realities as well as building scenarios (Manzini, 2015).

4. Cultirider - a Case Study of Collaboration through Design

CultiRider is the outcome of an ongoing bottom-up movement started four years ago: the developers of CultiRider (also the authors of this paper) did not articulate the goal to bring the project into academic discussion. Instead, they are members and coordinators of a creative community aiming to open (physical and metaphorical) places for intercultural exchange using the tools of participatory design, visual communication, and placemaking. Therefore, the introduced process, methods, and structure used through the project were developed based mainly on their own experiences complemented by the relevant literature on participatory design (Armstrong & Stojmirovic, 2011; Simonsen & Robertson, 2013; Duarte et al., 2018; Bustamante Duarte et al., 2021). These methods ensured that the often-neglected target group had a say on the design of Cultirider (both its physical and program development), and their needs were at the center of the project.
During the ongoing project of CultiRider, collaboration happens on different levels, such as collaborating between (1) different organisations, (2) participants representing different cultural and social backgrounds, (3) professions, as well as (4) urban and rural locations. On the level of organisations, the project so far involved three different NGOs and a child-care center based in different parts of Hungary. Collaboration with locally operating NGOs ensures the link between the different stakeholders and provides the base of knowledge for new ideas. The program involved participants coming from more than ten countries as well as underprivileged Hungarian youth. Cultirider used an interdisciplinary approach involving different stakeholders in the co-design process from the very beginning. Designers and artists coming from different fields (visual communication, media, architecture) worked together with local community leaders, social workers, psychologists, local and international volunteers coming from different professions, and local and international youth. Cultirider, as a moving community space, connects urban and rural communities, giving a chance for dialogue about local issues and finding common interests in global values. Through these connections, a network was born - the involved places are no longer isolated entities but part of a larger network.

4.1 Creating a Common Space

In 2020, just like everywhere in the World, the intercultural community of a Hungarian NGO had to face an unknown challenge: COVID-19 reached Hungary as well, and suddenly, all public indoor places had to close for an unknown period. Like many other collectives, this organisation also tried to hold together its community through online events and meetings, but the members slowly started to fade away due to a lack of motivation and a sense of distance and isolation. The core members of the community accepted the invitation of the two authors of this paper to join a series of sessions on the online design thinking process to analyze together these new challenges and try to find solutions somehow. The main design challenge of this process was: “How might we strengthen and rebuild the lost connections for our community after COVID-19?” This joint online process took six weeks, including problem-mapping workshops, user and expert interviews, brainstorming, and rapid prototyping sessions, followed by voting on different ideas from different perspectives and expectations. We could conclude several insights from the problem-mapping workshops and the interviews. First, our community is not motivated to socialise through online platforms, they rather stay isolated or take the risk of real encounters. Second, food is a key element in motivating people to join activities. Third, our refugee members have high motivation to visit the Hungarian countryside since the rural environment reminds them of home. Fourth, our intercultural community is active only in the capital, while people living in rural areas have much less chance to experience intercultural encounters, which leads to prejudices. After several brainstorming sessions, the final two most supported ideas were (1) developing a series of intercultural cooking events after the lockdown and developing a structured task-sharing system among the community to give roles and responsibilities to the members and (2) transforming a minibus into a moving community space to be able to bring intercultural values to new locations, to give infrastructure for outdoor activities and by that, to serve the community even at times of lockdown.

After the decision to dedicate our energies to creating a moving community space, we have learned by desk research that the idea of reconstructing a minibus reached other creative initiatives as well: there are examples of vans upgraded into a photo machine, a climbing wall for refugee children, or a warming space for street workers. The Inside Out Photobooth project (Insideoutproject, 2023) mobilizes portable printers, allowing participants to instantly receive black and white posters of their portraits, which are then displayed as public art, fostering connection and expression. Wapikoni Mobile's 40-foot studio (Evenementswapikoni, 2023) offers intervention services and dialogue spaces for the Aboriginal community living on the streets, promoting inclusivity and skill development among youth through audiovisual and musical creation. Fantastic Norway (Fantasticnorway, 2013) utilizes a bright red caravan as a mobile platform for architectural discussions and workshops, engaging communities in inclusive design processes that enhance public awareness and participation in urban development. ClimbAID's "Climbing for Peace" project in Lebanon employs "A Rolling Rock" (Katherinechoong, 2020), a mobile climbing wall, to bring joy and promote mental health among over 2,000 disadvantaged youth, showcasing the diverse possibilities of reconstructed minivans in fostering community engagement and well-being.

Designing and creating the minivan of the CultiRider project has also been a joint effort, from ideating its exact functions and creating a crowdfunding campaign through learning about the renovation process and obtaining materials until the last step, the realisation itself. For the first ideation sessions, different visualization tools were used, such as paper mockups, small-scale physical prototypes, and 3D models, which allowed community members to discuss priorities concerning the main functions and appearance of the moving community space. As a next step towards realisation, participating community members collaborated on a short narrated animation. The collaboratively written script and the tangible 3D paper models provided an opportunity to use storytelling to make decisions, set goals, and visualize and communicate ideas to others.



Figure 1. Frame from a crowdfunding video - https://www.youtube.com/watch?v=Yy12bPRFdeA&ab_channel=OpenDoorsHungary November 2021.

The short animation was used as a base of a crowdfunding process, which created the financial opportunity to turn ideas into reality: our association bought an old minivan, and the construction work could begin. Even if some parts of the minivan are still under construction, CultiRider already served its main purposes for two years. The minivan, on the one hand, needs to involve in itself the functions of a huge storage, a kitchen, a meeting room, and a small workshop space, on the other hand, thanks to its several doors and the foldable items of furniture and accessories it carries as a storage, CultiRider can open up to create the outdoor environment of a community space, a workshop space, an open-air kitchen or an outdoor cinema. After the event is over, the outdoor space can be folded again into the minivan and taken to the next location. Not only its inner functions but also its appearance needed to be characterised: by decorating the minivan through co-creational painting sessions, CultiRider became a common landmark for the communities of different locations. The purpose of creating such a moving space was to take community events outdoors, gather people, attract new participants, and facilitate connections with diverse communities. The mobility of the van addresses the challenges of lost connections and diversification by reaching people from different locations, including those who may be hesitant to attend large indoor gatherings.



Figure 2. Decorating the minivan through co-creational painting sessions. September 2022.

4.2 Creating a Common Language

In 2022, the minivan of CultiRider started to fully operate, visiting different communities in the rural area of Hungary. During the two full seasons of the project (2022 and 2023), several team-building meetings and five short (two to five days long) camps were organised in different locations to enable intercultural creative collaboration between underprivileged participants from different backgrounds and creative professionals. The team building events happened outside of the communities' original location to meet all together in a neutral environment where we could create our common safe space from zero. The aim of team building meetings has two levels: one is to support participants to get to know each other, and two, to give space for them to plan their local programs, share ideas through facilitated participatory design workshops, and create a network based on shared experiences. By this approach, youth were involved in all stages of the design process, starting from research through ideation until the realisation itself. Through their involvement, they could design the program according to their interests and needs, which ensured a common understanding of each result and design product. The programs of local short camps were built based on the ideas of the team building meetings, implementing the concepts on site. Besides the participants who were involved in the preparation, the short local camps were joined by new local and international participants as well.

All (two to five days) camps used participatory design methods and followed the same structure:

1. *Preparatory site visits:* The one-day-long site visits allowed participants to meet and get to know each other informally. The international Cultirider team from Budapest visited all the venues (Ágasegyháza, Fót, Tiszadob) during several site visits. The visits involved icebreaker games, playful brainstorming sessions about future programs, and usually, a community cooking event that allowed participants to get to know each other informally. These site visits served as a main foundation for long-term collaboration.

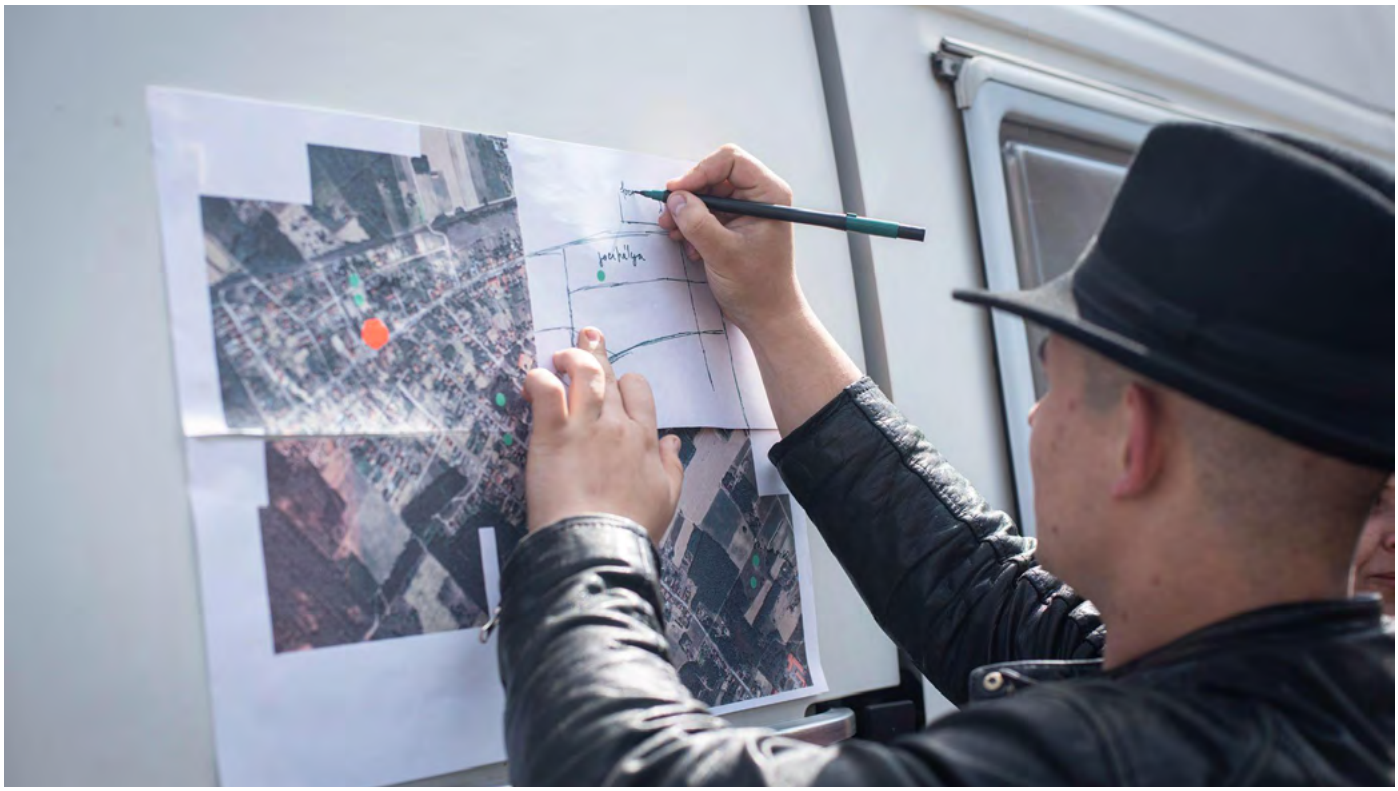


Figure 3. Creation of a common cognitive map about one of the involved rural locations. April 2022.

2. *Getting to know each other & team building:* non-verbal and visual tools such as drawing collaborative portraits or “rapid date” using visual signs ensured that participants could learn each other's names and basics about each other and enabled them to talk to each other even though they do not share a common language. Participants also created a community-based memory game, working in pairs and creating matching cards about their shared interests. They also created a common cognitive map of their village, which gave the structure of an afternoon bike tour.



Figure 4. Drawing collaborative portraits during a summer camp. August 2023.

Short creative workshops in pairs or small groups: The creative workshops aimed to actively involve all participants in mixed groups, facilitated by experienced designers and workshop leaders. Through participatory photo workshops, local participants had the chance to guide their international teammates through their hometowns, map and analyse their environment, point out problems, and look at their known environment with a new perspective. Through a zine workshop, participants were able to share ideas about the topic of "help" from the perspective of a local donation shop. Through screen-printing workshops, participants used and personalised already prepared visual symbols and templates for self-expression and self-representation. Refugee participants - who have been part of the Open Doors community for a longer time - have stepped up as workshop facilitators themselves: Afghan paper kite workshops were organised for the local children using the format of participatory design workshops. This gave a chance for participants for intercultural learning and exchange.



Figure 5. Discussion of a photo workshop. August 2023.

3. *Community-based project work:* In each camp, participants had the chance to form messages together and create common products based on shared values. In Tiszadob, through a community-based design workshop, participants collaborated to design a mural for the facade of the local donation shop, which plays an important part in every local's life. The participants of the process were local and international youth, the workers and managers of the donation shop, and the designers leading the program. As a first step, each participant created their designs, which they shared and combined in pairs, then in groups of four, and later in groups of 12. The final two designs were discussed by the whole group, and the elements were synthesized into one design with the help of the designer. The community actively participated in the realisation process of the mural as well: the design was projected and masked on the wall of the donation shop, and stencils were created from the drawing of the participants, which allowed all participants to participate in the painting process but keep the result clean and visually pleasing. In Ágasegyháza, participants - aged between 6 - 15 - created a community-based stop motion inspired by the topic of "magic." Each participant was asked to use their creativity with the given prompt - make it appear or disappear, grow, transform into something else - using different visual tools and random objects. We created stop motion clips of 8-12 frames by each participant and edited them into one single video, merging everyone's creative trick as a common visual result.



Figure 6-7. Design and co-creational process of the community mural. August 2023.

4. *Evaluation and follow-up* - As a closure of each camp, participants were asked to share their experiences verbally and in a playful form as well. Visual aids were used to help the intercultural understanding of participants, such as picture cards and large-scale diagrams, that provided opportunities for youth to reflect on the learned tools, give feedback, and have ideas about the possible continuation.

5. Results

The bottom-up project of CultiRider aimed to create a common space and common language to be able to connect two very different vulnerable groups and their supporting NGOs, as well as to create a bridge between the urban and rural areas of Hungary. The results and learnings of the project are based on non-formal (participatory-based) evaluation methods and half-structured group interviews with the target groups, NGO members, and professionals. We could recognize that both the tangible and the non-tangible results of the CultiRider project led to positive changes in the target groups as well as the collaborating NGOs.

According to the target groups, results show that by joining CultiRider, migrant youth found the motivation to learn about the local culture and the Hungarian language, which enabled them to create new friendships and offered them a chance to share their culture with others in a respectful environment. At the same time, Hungarian youth became motivated to learn foreign languages, and by joining these activities, they dismantled stereotypes and xenophobia. Based on our observations and the interviews with the NGO leaders, both target groups benefited from gaining intercultural and collaboration skills. The moving community space created a flexible but still stable environment in multiple places, raising the feeling of security and belonging in the participants. One Russian participant, who joined the collaborative process from the very beginning of the online ideating process, expressed her surprise since she “would not have thought back then that such an idea could come to reality.” Both the tangible (such as the results of the workshops, like posters, memory games, zines, photos, murals, as well as the commonly renovated van itself), the non-tangible results (such as the improved social and language skills) and the whole collaborative process led the participants to gain confidence in their creativity. The participatory methods contributed to the sustainability of the project by ensuring the sharing of responsibilities: participating youth are motivated to continue the collaboration and take on different roles in the future.

The ongoing project brought positive changes into the life of the collaborating NGOs as well. On the one hand, some of the members of their involved target group became inspired by the developed intercultural community of CultiRider to take a step towards being a community organizer in their local environment as well as being a bridge person of the ongoing CultiRider project. By encouraging these young participants to take on new roles and more responsibility, NGOs can gain more capacity in the long term. The other main change, on the other hand, for NGOs is connected to the motivation to learn the used collaborative and creative methods in the next stage of the project. By mastering these new methods, both the members and the staff are going to be enriched with a creative toolkit supporting their community with visual and spatial tools. NGOs also gained and strengthened their partnerships with each other, which brings new ideas and project opportunities.

6. Conclusions

The ongoing project of CultiRider illustrates a bottom-up movement aiming to create a bridge between refugee and Hungarian underprivileged youth, involving designers, artists, international volunteers, and NGOs, bringing together the rural and urban areas of Hungary by a moving community space. In the paper, practice is supported by theoretical background to explain how it is possible to create a peaceful common platform for such extreme diversity with the tools of participatory design. In the long-term, by owning shared values through commonly created space and language, youth living in disadvantaged rural areas may find new perspectives through intercultural inspirations, migrant youth may start rooting through their new senses of belonging, and grassroots organisations may reach sustainability through their newly engaged members.

The main limitation of the project comes from the challenges of time and scale. Community-based processes need time to find engaged members, to support each other, build partnership and trust, as well

as to learn the local context of each community and location. In the sense of mobility, traveling is also time- and energy-consuming, especially if we consider that every involved person (designers, facilitators, coordinators, builders, and project writers) is a volunteer. The refurbishment and operation of a minibus seems to be a scale that challenges the capacity of bottom-up initiatives: in the context of voluntary-based engagement, it takes a lot of time and cooperation - more than an average funded project - to learn and rebuild such a complex construction.

The project of CultiRider highlights several takeaways for the future: the importance of tangible results and flexible roles. Tangible results of the participative design process fostered confidence among participants by providing concrete evidence of their contributions and the value of their input. It boosted their confidence in their ability to influence outcomes and encouraged further engagement. We acknowledge the nature of participative design processes, where roles are often flexible, allowing for a dynamic and collaborative approach. The designer facilitates the process, providing a design framework and technical support while ensuring that participants' voices are heard and valued. Participants actively contribute their knowledge, insights, and creativity to the design process. The importance of changing these roles lies in promoting inclusivity, empowering participants, and fostering a sense of ownership.



Figure 8. Group picture of a team building meeting. May 2023.

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Erzsébet Hosszu is an architect, lecturer, and doctoral candidate at MOME. She aims to understand how design can support developing place attachment and processing the trauma caused by loss of place. She is also a co-founder of Open Doors Hungary.

Acknowledgements: We thank all the trust and work placed in CultiRider by the involved participants and communities, as well as all the support of our colleagues for their constructive comments about this project. We gratefully acknowledge that the project was and still is supported by several funds, such as by the European Solidarity Corps, the European Youth Foundation, and the KDP-2021 Program of the Ministry for Innovation and Technology from the source of the National Research, Development, and Innovation Fund.

P/REFERENCES OF DESIGN

SEED PODS OF DEMOCRACY: DESIGN FOR HUMAN RIGHTS.

Moon Jung Jang*[a], Kyungwon Kim[b], Yumi Kang[b]

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b Dongseo University, South Korea
* moonjj@uga.edu

DOI: 10.63442/THVB5833

KEYWORDS | DEMOCRATIC DESIGN, GRAPHIC ACTIVISM, VISUAL SOCIOLOGY, DESIGN FOR HUMAN RIGHTS, POSTER DESIGN

ABSTRACT | The so-called Namyeong-dong Anti-Communist Interrogation Office Building in Seoul, South Korea, was designed as a place for the torture of pro-democracy activists in the 1970s and '80s. Since 1987, as the subsequent effort to address a history of state violence and to put democracy into practice, the Anti-Communist Investigation Office transformed into the Human Rights Center of the National Policy Agency in 2005 and became the Democracy and Human Rights Memorial Hall in 2018. The Korea Democracy Foundation, which oversees the management of the hall, began preparations in 2021 to reopen it in 2024 as the National Museum of Democracy and Human Rights. This new setting aims to serve as a space for memory, reflection, communication, solidarity, and human rights education—something akin to an organism that the public can sense and connect with directly.

In 2022, Seed Pods of Democracy: Design for Human Rights was designed to support these changes in the memorial hall. It consists of three parts: poster designs, a publication, and an exhibition for democracy and human rights. This project aimed to collect and preserve artistic work related to the democratization movement and human rights while sharing issues related to democracy and human rights to enhance broader awareness. Seed Pods of Democracy: Design for Human Rights used posters as a medium and tool to investigate incidents and issues involving resistance to state abuses, anti-democratic activities, and human rights infringements—events that persist in a world of intensifying polarization and domination by corporate interests.

This project explored how visual language maximizes the effectiveness of democracy and human rights discourse and practice by inviting 51 international artists and designers: Guerrilla Girls, Jonathan Barnbrook, Garth Walker, Roshi Rouzbehani, Everyday Practice, etc. Some artists created work in environments and wars where actual state violence occurred, while others told stories relating to multinational and multiple identities. To enable viewers to comprehend the state and problem areas of global democracy today, these artists juxtaposed or connected two newly created posters. These posters explored and expanded on incidents related to systems and critical values of democracy, acts of state violence, and human rights within their historical temporal and spatial contexts.

In the process, artists used dynamic visual languages to interpret such intangible values as dignity, empathy, memory, critique, dialogue, boundaries, resilience, future, sustainability, and solidarity. Those visualized values have raised questions about the present and future of democracy and the creation of new civic spaces. It has resulted in 100 posters shedding light on the suffering experienced by the vulnerable in society and visualizing the power and importance of solidarity. Lastly, as an expansion of this project, a publication and exhibition, Seed Pods of Democracy, are work in progress to guide audiences not toward some stale version of enlightenment but rather a dynamic and organic future; they will take place in the National Museum of Democracy and Human Rights in 2024.

WAYS of LIVING TOGETHER Seed Pods of Democracy: Design for Human Rights CUMULUS BUDAPEST 2024

Seed Pods of Democracy: Design for Human Rights

Moon Jung Jang[a], Kyungwon Kim[b], Yumi Kang

a University of Georgia, USA
b Dongseo University, South Korea

moonjj@uga.edu

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The History of the Namyeong-dong Anti-Communist Investigation Office

A “perfect torture chamber” in 1976



In 1970s and 1980s

The National Museum of Democracy and Human Rights in Seoul, South Korea in 2024

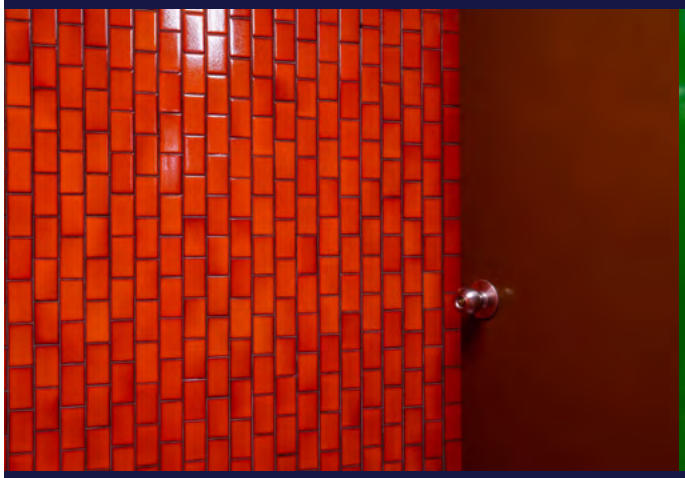


In 2024

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CUMULUS BUDAPEST 2024

Photos by Suh Youngkul



According to the testimony of victims, they shivered because they felt as if the illuminated orange tiles were stained with blood.

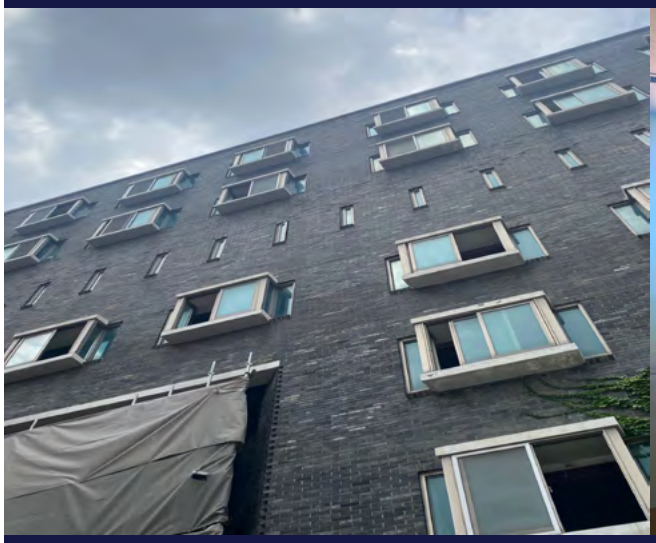


The staggered entrance doors of the investigation rooms on the 5th floor. Even when the door was opened, the victims did not see anything and could only hear screams from the hallway.

WAYS of LIVING TOGETHER Seed Pods of Democracy: Design for Human Rights

CUMULUS BUDAPEST 2024

Photos by Moon Jung Jang



Façade of the Namyeong-dong Anti-Communist Investigation Office. The 5th floor, where the interrogation rooms were located, was designed with thin vertical windows 300 mm wide, too narrow for a human head to fit through, to prevent victims from escaping or harming themselves. Currently, this building is being prepared to be reborn as a new space.



Perforated wooden boards used on the walls of the investigation room for soundproofing. The victims could not be heard from outside, but the high-pitched screams were transmitted through the walls to adjacent rooms, instilling endless fear.

Objectives (Design for Human Rights)

1) To support the inauguration of The Democracy and Human Rights Memorial Hall in South Korea
2) To investigate incidents and issues involving resistance to state abuses, anti-democratic activities, and human rights infringements—events that persist in a world of intensifying polarization and domination by corporate interests
3) To investigate how visual language can maximize democracy and human rights
4) To take action on improving social justice through visual communication design / graphic activism
5) To envision the future design tasks and responsibilities for human rights

WAYS of LIVING TOGETHER Seed Pods of Democracy: Design for Human Rights CUMULUS BUDAPEST 2024

Research

1) Democracy: Persistent questions for Freedom, Peace, Equality, Equity



2) Human Rights: Everyone’s story



Methodology and Creative Works

1) 100 Posters newly created by 51 international artists who were invited to Seed Pods of Democracy:

- Everyday Practice, Jonathan Barnbrook, Karo Akpokiere, Chris Burnett, Cristina Daura, Garth Walker,
- Pracha Suveeranont, Design & People, Viktoria Cichoń, Bernhard Lenger, Mykola Kovalenko, Kateryna Korolevtseva,
- Chris Lee, This Ain't Rock'n'Roll (Charlie Waterhouse and Clive Russell), Mark Gowing, An Mano, High on Type,
- Elliot Stokes, Aaron Nieh, Good Question (Yuni Ooh and Sun-ah Shin), Kyungmin Lee (flagflag), Shin In-ah,
- Minho Kwon, Jiwon Lee (archetypes), Saehan Parc, Guerrilla Girls, Roshi Rouzbehani, Anina Takeff, Melinda Beck,
- Raven, Jaeyoung Lee (6699press), Yeji Yun, Elmer Sosa, Luis Mazón, Frenci (Francesca) Sanna, Luca Soncini,
- Jieun Guk, Yudai Osawa, Mun Sang, Golden Cosmos (duo Doris Freigofas and Daniel Dolz), Saki Ho, Sebastian Curi,
- Fahmi Reza, Diana Ejaita, Elaine Lopez, cement (Hyojung Yang and Park Yonghoon), Elaine L, Studio Half-bottle,
- Kim Albrecht, Studio Rejane Dal Bello, and Moon Jung Jang

2) A publication including research, 100 posters, and articles

3) An exhibition, Seed Pods of Democracy, at the National Museum of

- Democracy and Human Rights, Seoul, South Korea in 2024

WAYS of LIVING TOGETHER Seed Pods of Democracy: Design for Human Rights CUMULUS BUDAPEST 2024

Themes and Visualized values

Themes
1) Democracy: Persistent Questions
2) Human Rights: Everyone's Story
3) Seed Pods: Empathy and Solitude

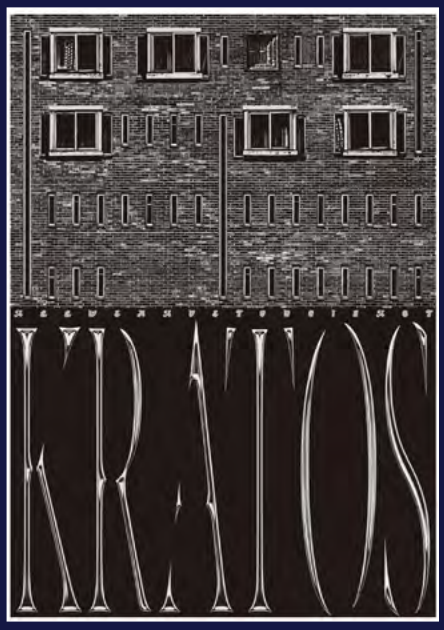
Visualized Values
Dignity, Empathy, Memory, Critique, Dialogue, Boundary, Future, Resilience, Sustainability, Solidarity

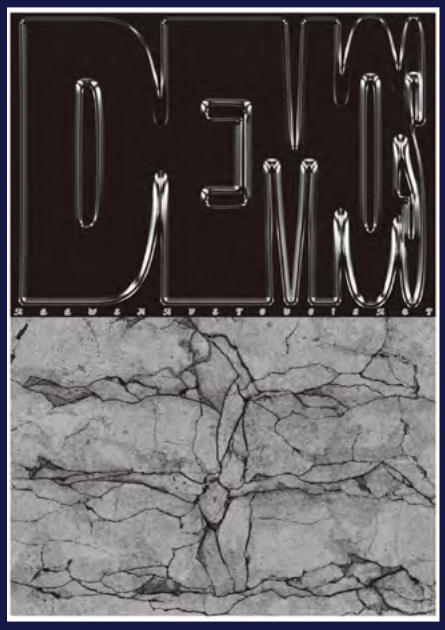


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1

Democracy: Persistent Questions



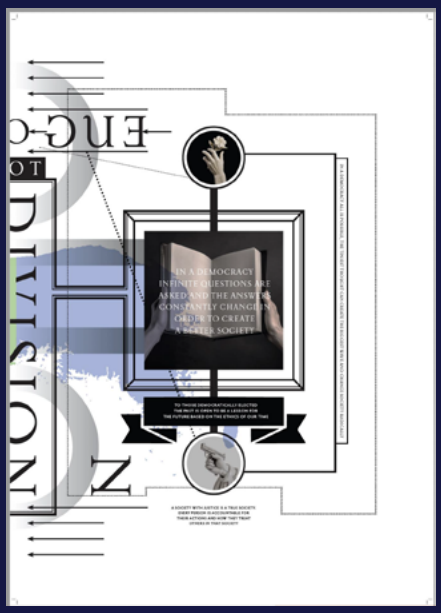


Everyday Practice

民×KRATOS
DEMOS×主
2023

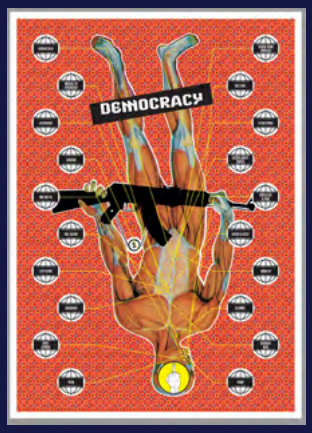
WAYS of LIVING TOGETHER Seed Pods of Democracy: Design for Human Rights CUMULUS BUDAPEST 2024





Jonathan Barnbrook

Dialogue Not Division
2023



Garth Walker

Democracy Upside Down
AMANDLA!
2023



Chris Lee

A Settler's Land Acknowledgement—
Public Space as Colonized Space
2023





Kateryna Korolevtseva

Never?
AGAIN
2023

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2

Human Rights: Everyone's Story





An Mano

Modu
Mosim
2023

WAYS of LIVING TOGETHER Seed Pods of Democracy: Design for Human Rights CUMULUS BUDAPEST 2024

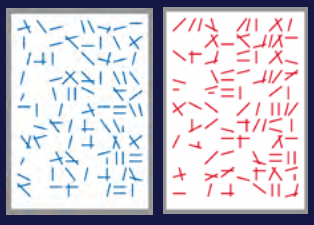




High on Type

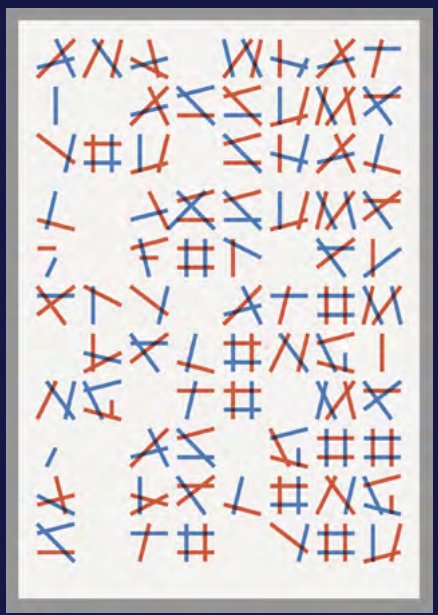
Who's Left?
Who's Right?
2023

WAYS of LIVING TOGETHER Seed Pods of Democracy: Design for Human Rights CUMULUS BUDAPEST 2024



Mark Gowing

Language System of Overlapping Lines
(And what I assume you shall assume)
2023

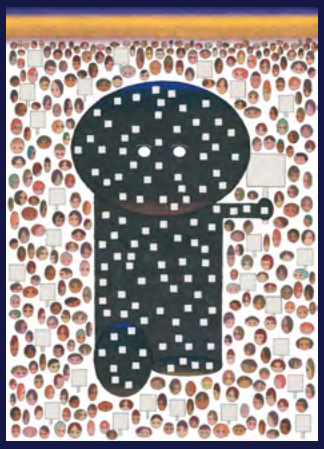




Minho Kwon

Unpicked Shell
2023

WAYS of LIVING TOGETHER Seed Pods of Democracy: Design for Human Rights CUMULUS BUDAPEST 2024



Saehan Parc

Walking Together
2023



Melinda Beck

My Body, My Voice
2023



Guerrilla Girls

It's Not Democracy Without Feminism
2023



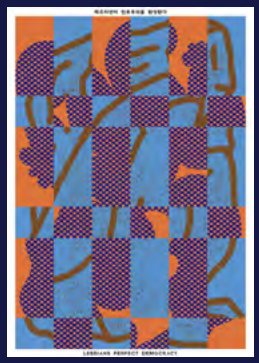
Shin In-ah

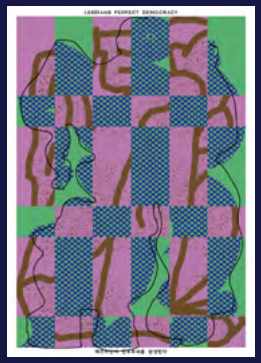
Equality for Life, When?
2023

WAYS of LIVING TOGETHER Seed Pods of Democracy: Design for Human Rights CUMULUS BUDAPEST 2024

Good Question (Yuni Ooh and Sun-ah Shin)

Lesbians Perfect Democracy
2023







Elliot Stokes

See Me, See Us,
2023





Yeji Yun

Over the Bodies of the Immobilized
Over the Bodies of the Workers
2023

3

Seed Pods: Empathy and Solitude





Elaine L

Protesters (1989)
Protesters (2022)
2023

WAYS of LIVING TOGETHER Seed Pods of Democracy: Design for Human Rights CUMULUS BUDAPEST 2024



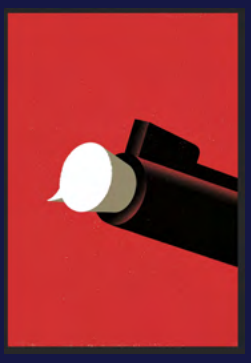
Elmer Sosa

No Border
2023



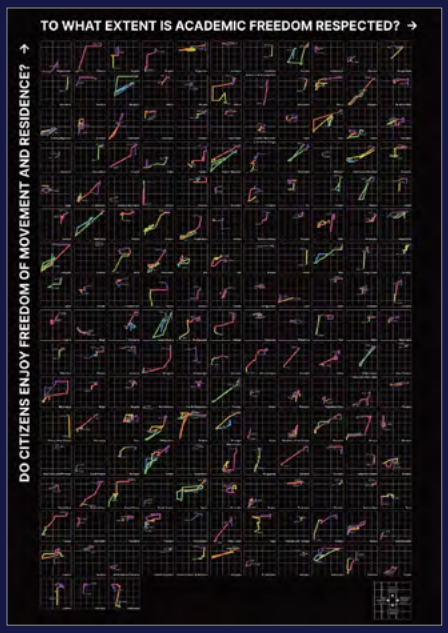
Diana Ejaita

To Move
2023



Golden Cosmos

Freedom of Speech
2023

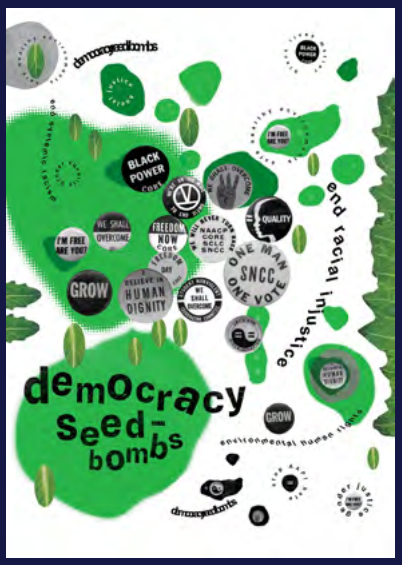


Kim Albrecht

Empowered Women and Political Corruption
2023

Expansion of the Project

Those visualized values have raised questions about the present and future of democracy and the creation of new civic spaces.
It has resulted in 100 posters shedding light on the suffering experienced by the vulnerable in society and visualizing the power and importance of solidarity.
Lastly, as an expansion of this project, a publication and an exhibition, Seed Pods of Democracy, are works in progress to guide audiences not toward some stale version of enlightenment but rather toward a dynamic and organic future; they will take place in the National Museum of Democracy and Human Rights in 2024.



Moon Jung Jang Democracy Seed-Bombs, 2023

P/REFERENCES OF DESIGN

HUMANIZING HIGH SECURITY SPACES: REFORMATORIES FOR MINOR OFFENDERS - THE TEACHING AND PRACTICE OF DESIGN FOR SOCIAL INNOVATION TOWARDS VULNERABLE COMMUNITIES.

Eugenia Pérez de Mezquia*[a], Álvaro Albajez [a], Vanesa Gil [a], Maria Anonia Valverde[a]

a Escuela Superior de Diseño de Aragón, Spain
* eperezdemezquia@esda.es

DOI: 10.63442/CBRZ4297

KEYWORDS | DESIGN FOR SOCIAL INNOVATION, VULNERABLE COMMUNITIES, REFORMATORIES FOR MINOR OFFENDERS, ENVIRONMENTAL PSYCHOLOGY, LIMINAL SPACES

ABSTRACT | Community-engaged design project between the students of design of Escuela Superior de Diseño de Aragón (ESDA) and the minor offenders interned in the Education and Internment Center by Court Order (CEIMJ Juslibol) Zaragoza, Spain. The focus of the project is on teaching our students and practicing design skills with people living in poverty or at risk of exclusion, working with vulnerable communities to accelerate the transition to a fair and ecological society. The practice of design involves intervention in a social group, and therefore, we should incorporate the anthropological dimension in methodological terms. Man being spatial, all experience depends on the place where it happens (Herrera & De Oña, 2016) A collaborative effort between students and vulnerable communities contributes to various aspects of design. A different approach and change of mindset applicable to teaching social design and design for social innovation (Mazini, 2015) A reformatory for minor offenders is neither a prison nor should it look like one (Pol, Esteve, García-Bores & Llueca, 1992)

Educational-formative and welfare institutions, and more explicitly correctional institutions, are organizations that have served, by satisfying the urgent basic needs of the vulnerable population, as an effective method of social control, and architecture plays a very important role in this. The main objectives are:

- The better use of space and its environmental conditions as spatial resources of intervention to facilitate treatment.
- More dynamic environmental conditions facilitate the appropriation of the space by the inmates.

The first project, “My personal space,” developed in 2023 by the students in the 3rd year of Interior Design, focuses on the individual rooms of the inmates, developing 14 proposals for more friendly and personalized rooms through the design of interior details and complying with the necessary safety conditions. Surveys were conducted to measure the mood of the design students before, during, and at the end of the project. The students who were initially against working directly with minor offenders were, in the end, satisfied that they were actively involved. During the ESDA DESIS Social Design Days, experiences and projects of social innovation are shared publicly. Our students explained the project to the educational community.

The second project, “Humanizing high-security spaces,” developed in 2024 by the 3rd year Interior Design students with the collaboration of 3rd and 4th year Graphic Design students, focuses on the reception module, a liminal space where the minor is admitted for the first time and spends his first week of adaptation to the center until he is transferred to the module that corresponds to him with other inmates.

Design students learn and discover in an immersive way the social dimension of design by developing new interpersonal skills.

The proposals were born from the dialogue between the designers and the inmates as a process of deep knowledge of their needs and expectations, bringing together new points of view through participatory design. The result confirms how small gestures in interior design make possible great improvements, creating an environment conducive to positive therapeutic development work.



The focus of the project is on teaching our students and practicing design skills with people living in poverty or at the risk of exclusion

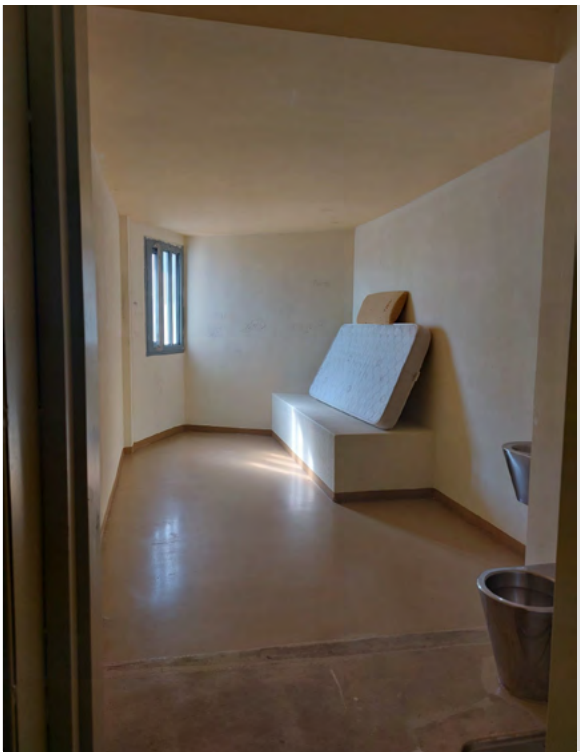
Minor offenders

Education and Internment Center by Court Order
Zaragoza, Spain



A collaborative effort between students and vulnerable communities contributing to various facets of design

A different approach and change of mindset applicable to teaching social design and design for social innovation (Manzini, 2015)



A reformatory for minor offenders is neither a prison, nor should it look like one (Pol, Esteve, García-Bores & Llueca, 1992)

- The better use of space and its environmental conditions as spatial resources of intervention to facilitate therapeutic treatment
- More dynamic environmental conditions that facilitate appropriation by the inmates











The few students were initially against working directly with minor offenders, at the end they were motivated and actively involved.



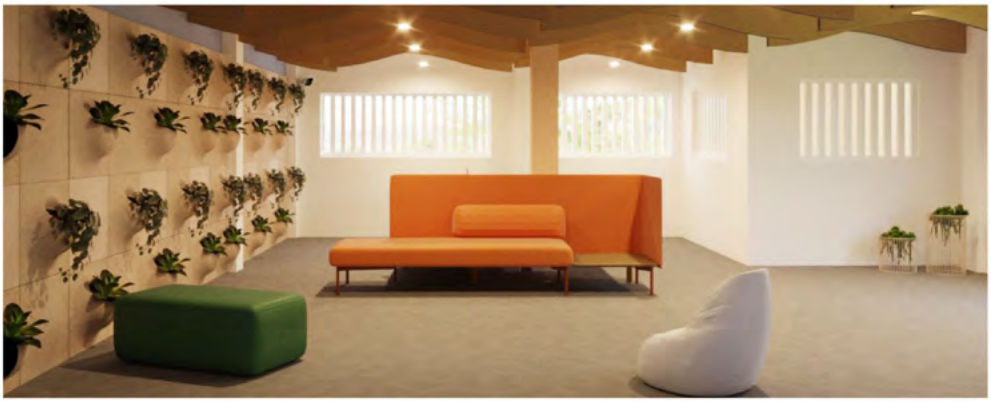
Concert in ESDA
by MURALLA

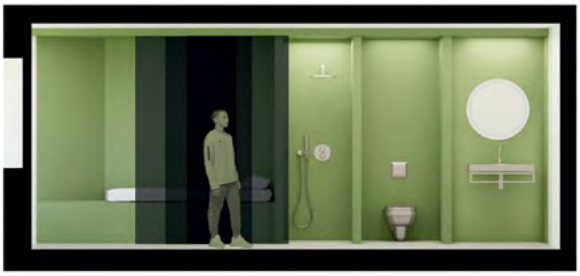
II ESDA DESIS Social Design Days

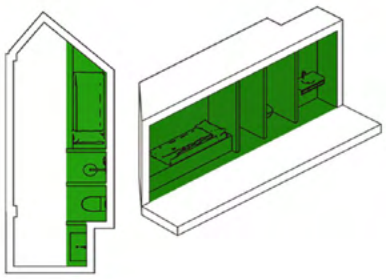


THE RECEPTION MODULE

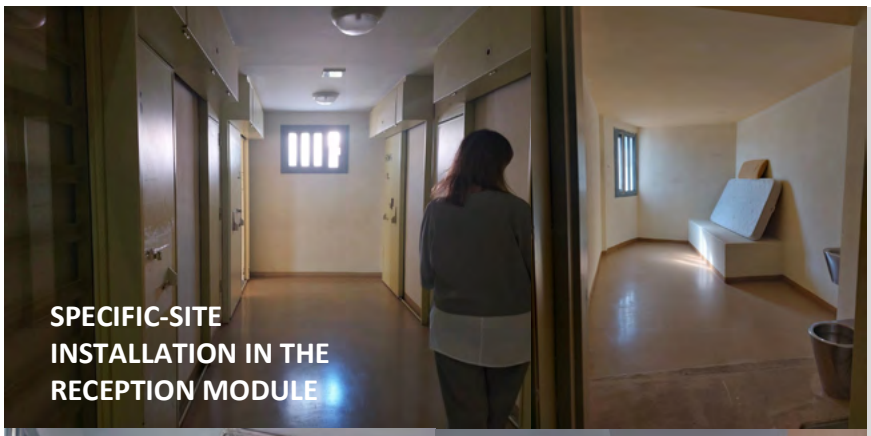
A liminal space where the minor is admitted for the first time and spends his first week of adaptation to the center



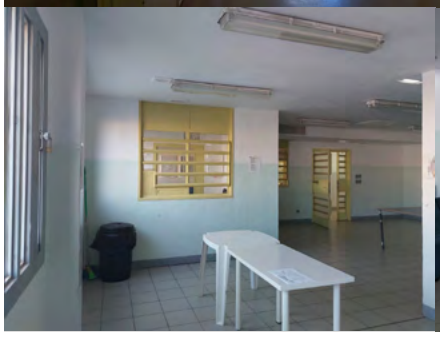


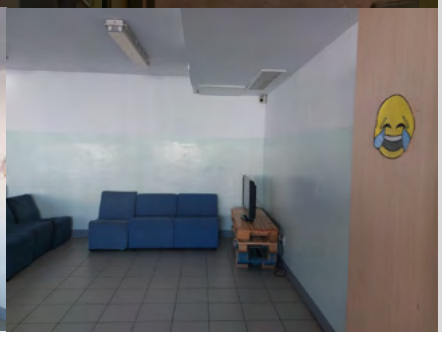


Presentations in digital 3D and feedback with the management team on the utopian theoretical proposals.



SPECIFIC-SITE INSTALLATION IN THE RECEPTION MODULE











The result confirms how small gestures in interior design make possible great improvements, creating an environment conducive to positive therapeutic development work.



Design students learn and discover in an immersive way the social dimension of design.

"There cannot be aesthetic values if there is no ethical value."
Felix Beltrán_BID 2021

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Pol, E., Esteve, J., Garcia-Bores, J., & Llueca, J. (1992). Centros de reforma de menores: La dimensión ambiental. *Intervención Psicosocial, 1*(2).

IMAGES AND FIGURES

Álvaro Albajez, Jorge Cebrián, Nicolás De Pablo, Marcos Fernández, Vanesa Gil, Julia Moliner, Lara Navarro, Eugenia Pérez de Mezquia, África Prados, Marian Red, Pilar Sopena, M. Antonia Valverde



THANK YOU

EUGENIA PÉREZ DE MEZQUIA

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Escuela Superior de Diseño de Aragón
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DESIS NETWORK
Design for Social Innovation and Sustainability

P/REFERENCES OF DESIGN

PAINTED PLAYLAND: DESIGNING ‘WITH’ THE COMMUNITY, ‘FOR’ THE COMMUNITY.

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KEYWORDS | DESIGN FOR SOCIAL INNOVATION, VULNERABLE COMMUNITIES, REFORMATORIES FOR MINOR OFFENDERS, ENVIRONMENTAL PSYCHOLOGY, LIMINAL SPACES

ABSTRACT | This project was part of the ten-week course 'Design for Social Change.' The design inquiry began with questions about access to public spaces in the city. How can public spaces be transformed into equitable and fair spaces? How do different communities perceive the city and its spaces? We investigated how factors of religion and class affect the usage of public spaces in the western city of Ahmedabad, India. Our study focused on how religious communalism has led to the segregation of Ahmedabad's neighbourhoods into ghettos. The area of focused study was the neighborhood of Juhapura, an urban ghetto that has predominantly residents of the Muslim faith (a minority community in India), and developing an understanding of how communalism affects their lived reality (Rajagopal,2011). The insights from our study indicated an overall need for better access to public spaces (Bobbio,2022), and we felt that directing our action toward children was essential since their play spaces are neglected. The demographics include women who have been discouraged from working and are asked to stay home. Still, they show resilience and work out of their homes with jobs like tailoring and catering (Wahid,2019).

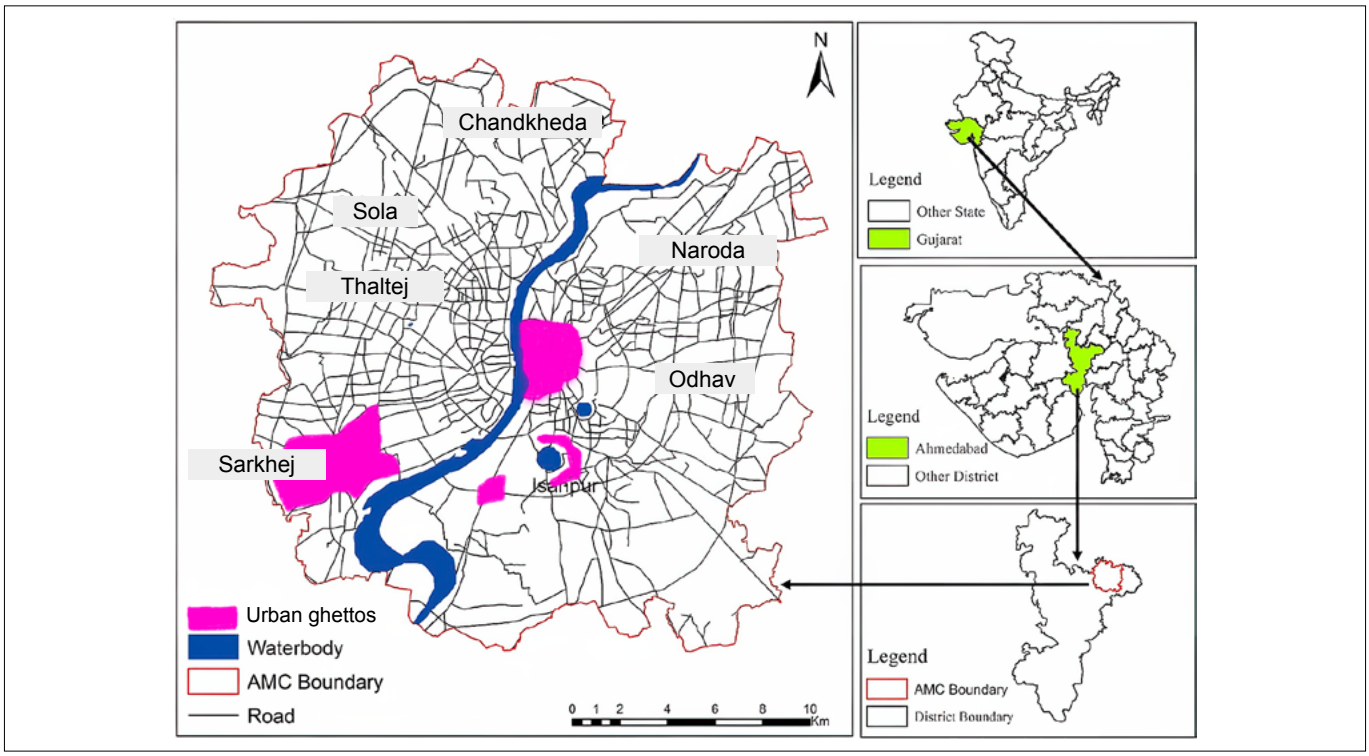
The central question we addressed became: Why is there a lack of access to public spaces for people belonging to a specific community? The project aimed to create space for all stakeholders involved in a neighbourhood by converting an open ground used by multiple stakeholders into a shared, equitable, and inclusive space. Inclusive public spaces are essential for marginalised and underserved neighbourhoods, as they often do not have equal access to other paid services and commodified spaces in the city. This is true for Juhapura, where the community does not have access to public spaces such as parks that function as play areas. (Mahadevia, 2007, pp 27-30)

We studied how Juhapura's residents have shown resilience and how the city can change if it is planned with children in mind as vital users of space (Danenberg, Doumpa, and Karssenberg, 2018). Working with children as our primary focus group, we aimed to create a habit of equitable sharing and inculcate ownership of the space. The children of today will go on to become the voice of the future, and we felt it was pressing to address issues of discrimination from the bottom up. Parwaaz, a women-led organization, facilitated our access in the community. We used participatory action research while working with the community, and their input was crucial to designing the solution. The final design solution developed was a 'Painted Playland,' using the floor as our canvas to demarcate space in the area. Throughout the process, the project was constantly grounded by the question- whom are we designing for and why?

The community came together to clean the space and help in the execution of the painting of the ground. The paintings immediately activated the space and attracted many people. Children from other neighbourhoods came to play, and older adults joined in. The issue of vehicles taking over the space was tackled by painting parking lines. This behaviour change resulted in a shift in the attitude toward space among the women of the community, who then took charge of cleaning areas where construction debris was dumped to convert them into parking spaces. The design intervention became a blueprint for the community to show themselves that they are capable of change and can adopt small measures to make their space more inclusive.

How can *young designers* tackle convoluted, systemic problems?




N
Chandkheda
Sola
Naroda
Thaltej
Odhav
Sarkhej
Isanpur
Urban ghettos
Waterbody
AMC Boundary
Road
0 1 2 4 6 8 10
Km
Legend
Other State
Gujarat
Legend
Ahmedabad
Other District
Legend
AMC Boundary
District Boundary




Ahmedabad
Untitled measurement
Perimeter
61.47 m
Area
316.91 m²
Edit

safety, *play* and *happiness* in urban spaces









How can we divert attention towards kids to create ownership and responsibility of the shared space?



"How can we transform the existing common ground to be *equally accessible* to all the stakeholders with the community?"



How can we design with, within and for the community?

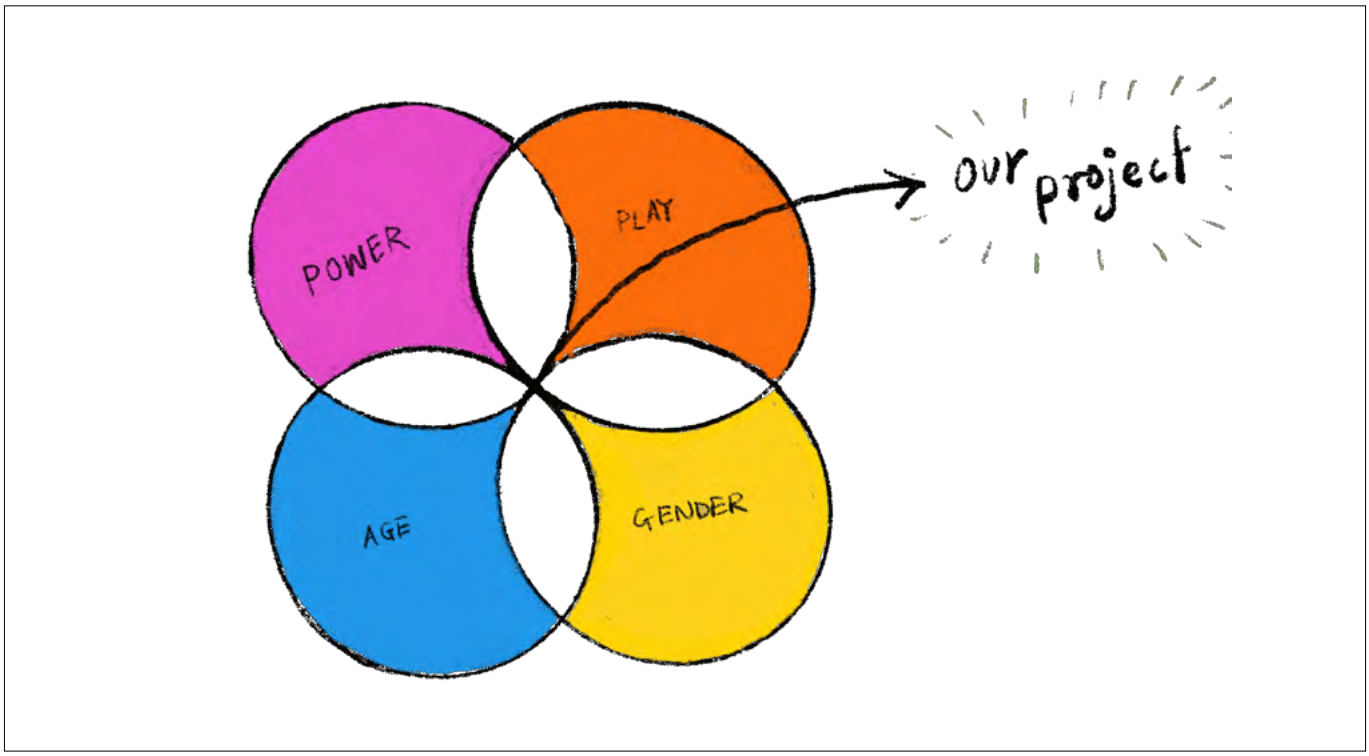


How can we dismantle existing hierarchy that functions on power and age in shared spaces?

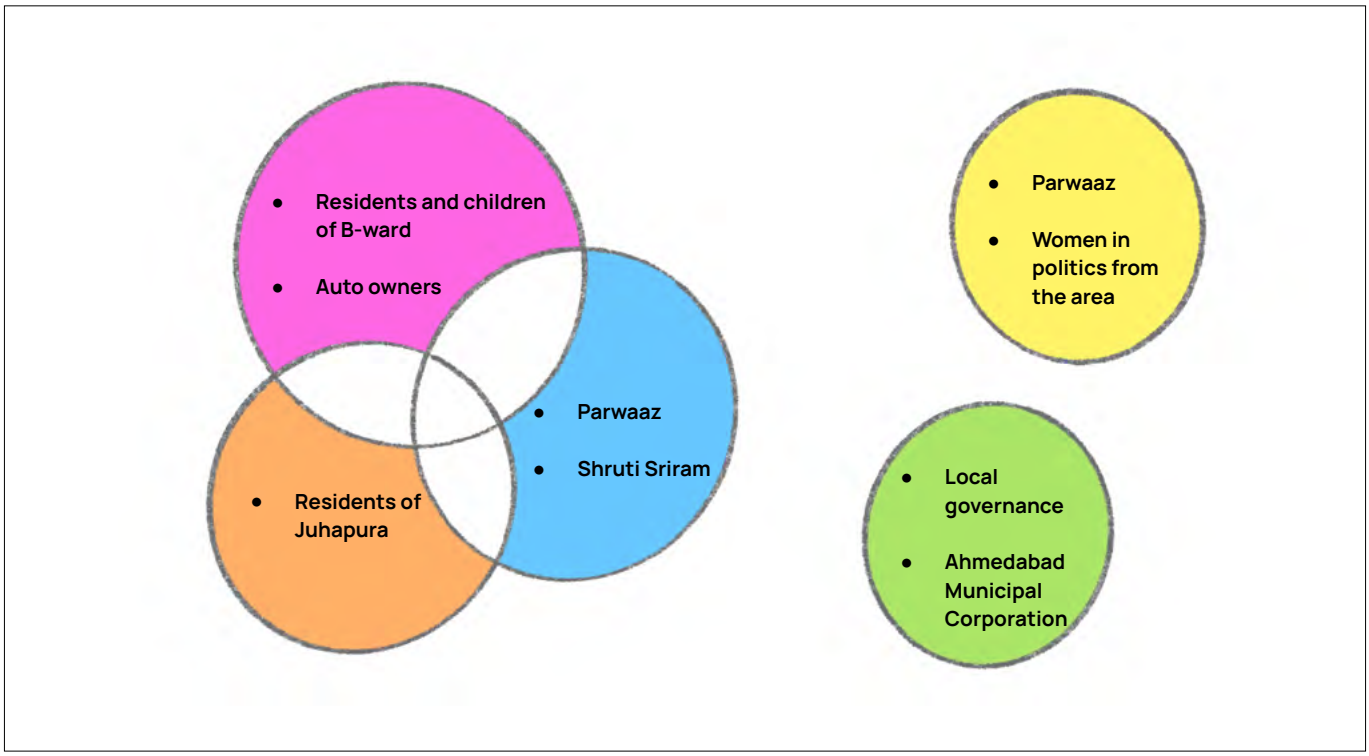


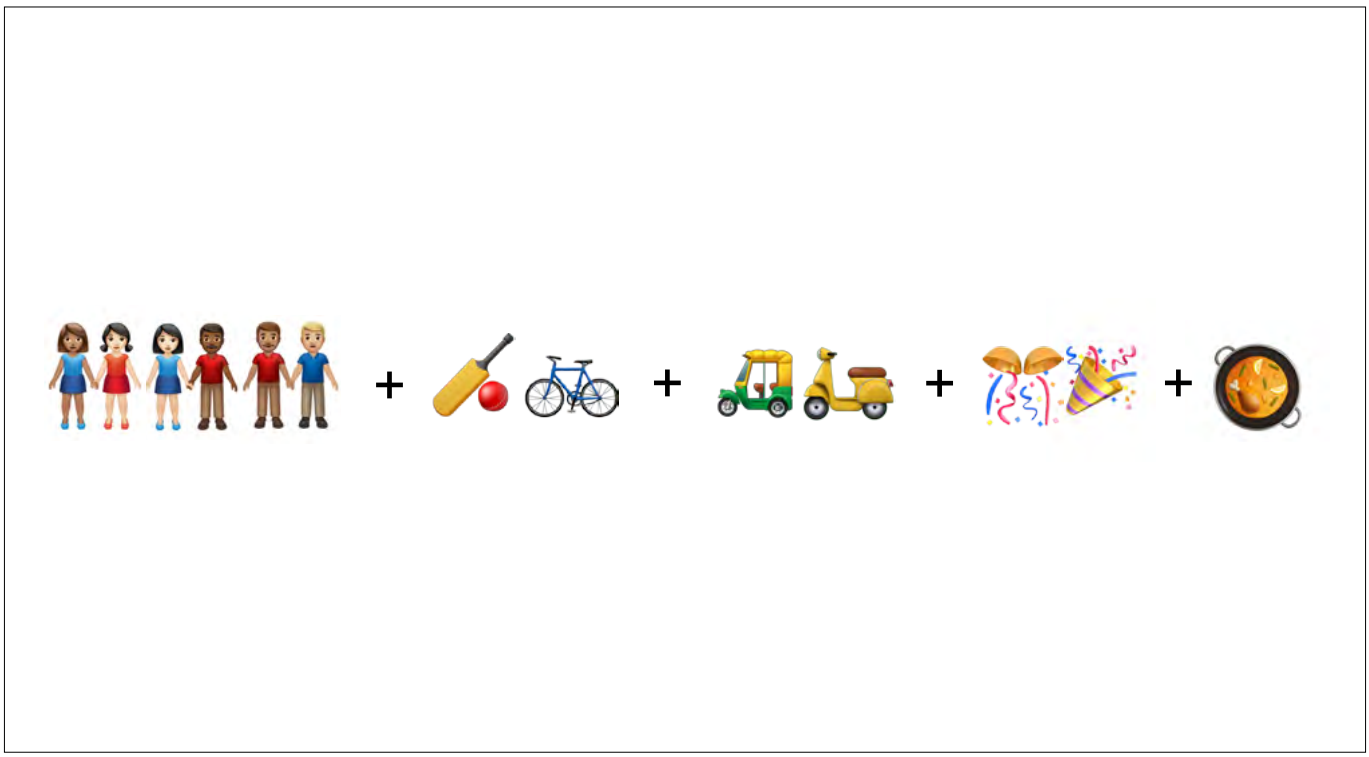
How can we empower communities to take charge of their spaces and make them realise that they can create change with small actions?




POWER
PLAY
AGE
GENDER
our project


Finding answers to these questions


Residents and children of B-ward
Auto owners
Parwaaz
Shruti Sriram
Residents of Juhapura
Parwaaz
Women in politics from the area
Local governance
Ahmedabad Municipal Corporation







How can children take
ownership of space?

What are the ways of *reorganizing* existing power structures through *spatial interventions*?


GUIDANCE BOOK
OUTDOOR
GAME




1 PARKING
2 CYCLING TRACK
3 TIC TAC TOE
4 LUDO
5 DOG AND THE BONE







THE BEFORE



THE AFTER



THE BEFORE



THE AFTER



CREDITS

Organization: **Parwaaz**
Community leader: **Hajra Apa**
Ward councillor: **Ashrarbeg Mirza**
Sanitary Inspector: **Manish Rathod**

Asian Paints
Shruti Sriram
Aaromal
Anustin
Aakash

Vidit, Sara and Pankti for their initial collaboration
Tanishka and Shemal for guiding us
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Parth, Tol

Ayesha, Ashad, Arsh, Alhaj, Maseena, Yushra and all the kids of the community <3

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THE CONVERSATIONS OF DESIGN.

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ABSTRACT | Even in its most elementary manifestation as involving just a single designer and a single client, designing is a process of interaction between different people who command different bodies of knowledge and who approach the design process from different perspectives and expectations, and most design processes involve a much wider range of stakeholders and expertise. The mobilization of this varied cast of characters and the sustaining of a process of working together towards a common goal requires an ongoing web of interactions and exchanges among the participants in the context of conversations.

Additionally, efforts toward achieving more inclusive and informed design processes underscore the importance given by designers to achieving more effective modes of engaging non-designers in the conversation of design (Floyd et al., 1989). Growing attention is being paid to processes of design undertaken by communities of heterogeneous individuals and (not necessarily involving designers) in addressing issues in their own lives (Manzini, 2015). This broadens the meaning of design to include processes involving the efforts and intentions of diverse others in practices that transcend the understanding of design as a special purview of professionals operating in controlled teams.

The impacts and implications of design processes and the designed things that they put out into the world, though, are felt by others even beyond this broadened perspective on the communities of design, to include a wide swathe of members of society, who are thus also drawn into the conversations of design. This workshop aims to explore what a cybernetic perspective can contribute to our understanding of communal processes of design.

The field of Second-order Cybernetics explicitly links processes of conversation and processes of design. Pangaro has argued that conversation and design are analogous processes through which goals and understandings are negotiated through interaction (Pangaro, 2008). By this reckoning, there is no designing that is not co-designing. Gordon Pask's (1975) Conversation Theory, as further elaborated by Glanville (2004), asserts that all learning happens by the communal construction of understanding through conversations. Different types of conversation, each with its role, are central to the processes of design (Dubberly & Pangaro, 2009). Within the field of Design Cybernetics (Glanville; Fischer & Herr, 2019), Conversation Theory has been applied to articulate Design as a set of nested conversations at levels spanning from the design team to society at large (Jachna, 2019).

Workshop participants will undertake a series of awareness-building and diagramming exercises to elucidate the actual and potential conversations involved at different levels in their design practice, building up from the conversations within the design team incrementally to the level of the conversations between one's design practice and design products and the myriad of systems and practices in society and the world at large. This approach will provide a framework and conceptual/practical tools for an intentional and methodical approach to engaging in the conversations of design.

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P/REFERENCES OF DESIGN

GUT FEELINGS: AN EDIBLE EXPLORATION OF PARTICIPATORY DESIGN LANGUAGE.

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KEYWORDS | EATING, RELATIONALITY, PARTICIPATORY DESIGN, EMBODIED KNOWLEDGE, GLOSSARY

ABSTRACT | Grounded in Participatory Design (PD)'s evolving embrace of relational and processual approaches (Huybrechts et al., 2022; Huybrechts & Teli, 2020; Pihkala & Karasti, 2022), this session explores the intersection between bodily experiences, particularly related to eating and digestion, and the language we use in PD. The specificity, situatedness, materiality, relationality, and transformation capacity already embedded in eating make it a rich and provocative field for researchers and designers to engage with. The focus of this session is on how the acts of cooking, eating, and digesting together can inform and shape new terms and concepts—and, by extension, new practices—within the realm of PD. By incorporating the insights from philosopher Boris Groys (2022), anthropologist Annemarie Mol (2008, 2021), and sociologist Elspeth Probyn (2004, 2015), we aim to craft a collection of meanings that reflects the interplay between personal satisfaction, communal experiences, and the materiality of our designerly actions.

Exploring bodily experiences and their intersection with language is critical to "thicken" (Haraway & Goodeve, 2000) our understanding and approach to Participatory Design. Sensitivities are born through the act of naming; "we cannot perceive that which has no name" (Sekiguchi, 2023). Therefore, we aim to develop a sensory-rich glossary, a collection of word meanings that captures the nuances and subtleties of our experiences when we dare think and feel with our guts (Escobar, 2016). The format of the session will be divided into three acts, as follows: :

1. Creating a setting to challenge what a "conference lunch" is. And its hygienic, formal, ready-toeat format. We will devise a space for in-digestion as the moment to gain awareness of the diversity of bodies, positions and biases participating, bending ourselves and PD notions to allow the gut—instead of our brain—to step in.
2. Participants will engage in a shared cooking experience set up as a reflective platform to digest the embodied aspects of PD. It will be a very interactive moment for collectively smashing, massaging, crushing, peeling, cutting and squishing materials and meanings.
3. A communal meal. When eating, participants will be encouraged to reflect on how their senses are expanding their understanding of PD during the session. By actively listening to our gut, we will give shape to our Gut Feelings glossary: a sensory-rich collection of meaning, coining new expressions and redefining existing ones based on the many forms of digestion explored during the session.

For tools and infrastructure, a space with a round table, essential cooking tools, and ingredients for the planned meal. Additionally, participants may bring utensils or ingredients to contribute to the collective experience if we can contact them before the session.

Exploring the connection between the gut and brain in Participatory Design could potentially lead to more embodied and holistic approaches, considering the messy and complex nature of human experiences and interactions (Braidotti et al., 2018; Haraway, 2016). This experimental format promises an engaging, social, and cooperative environment, fostering a deep exploration of our guts and digestion processes as mediums to access embodied knowledge and its integration into the language of Participatory Design.

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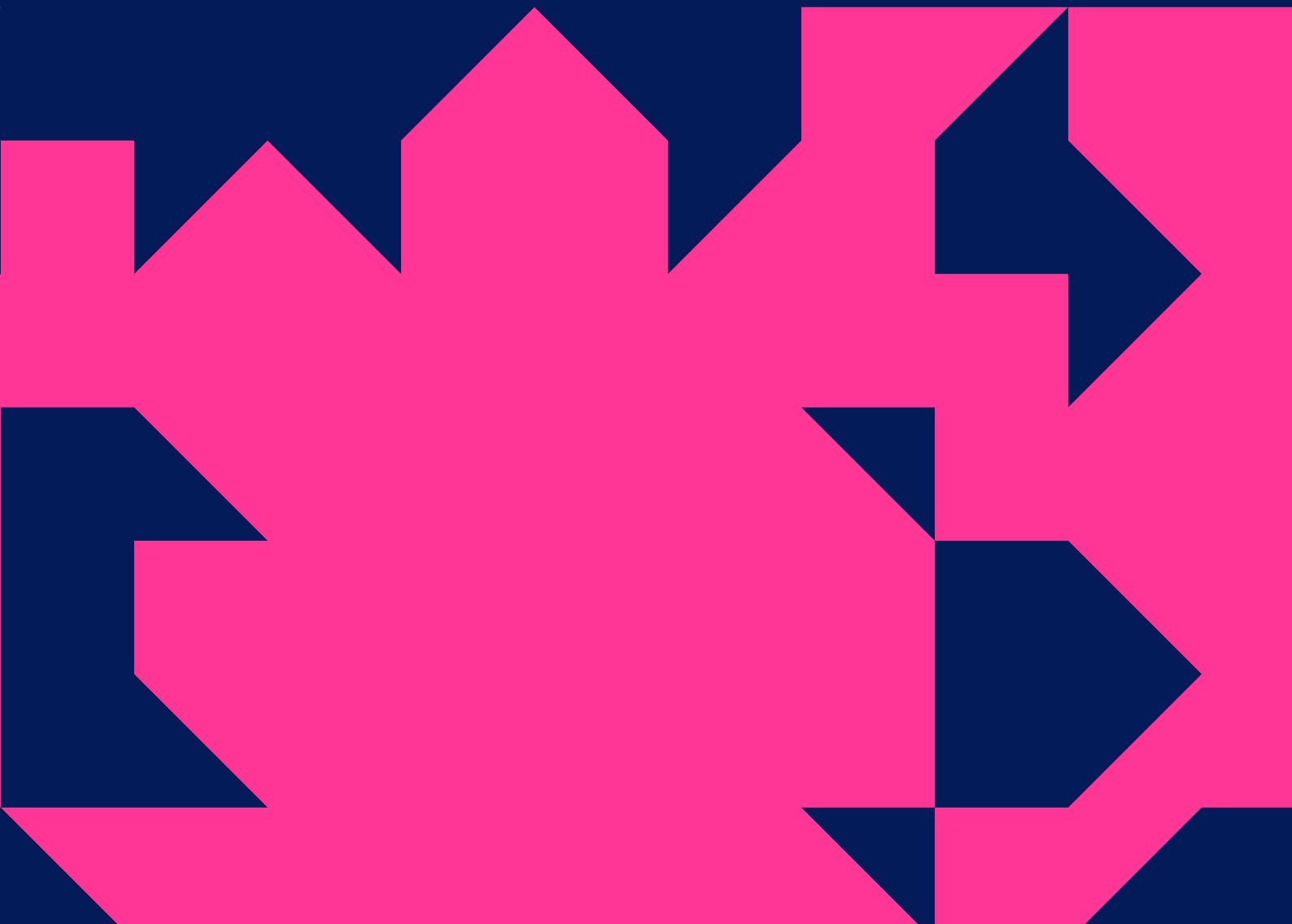
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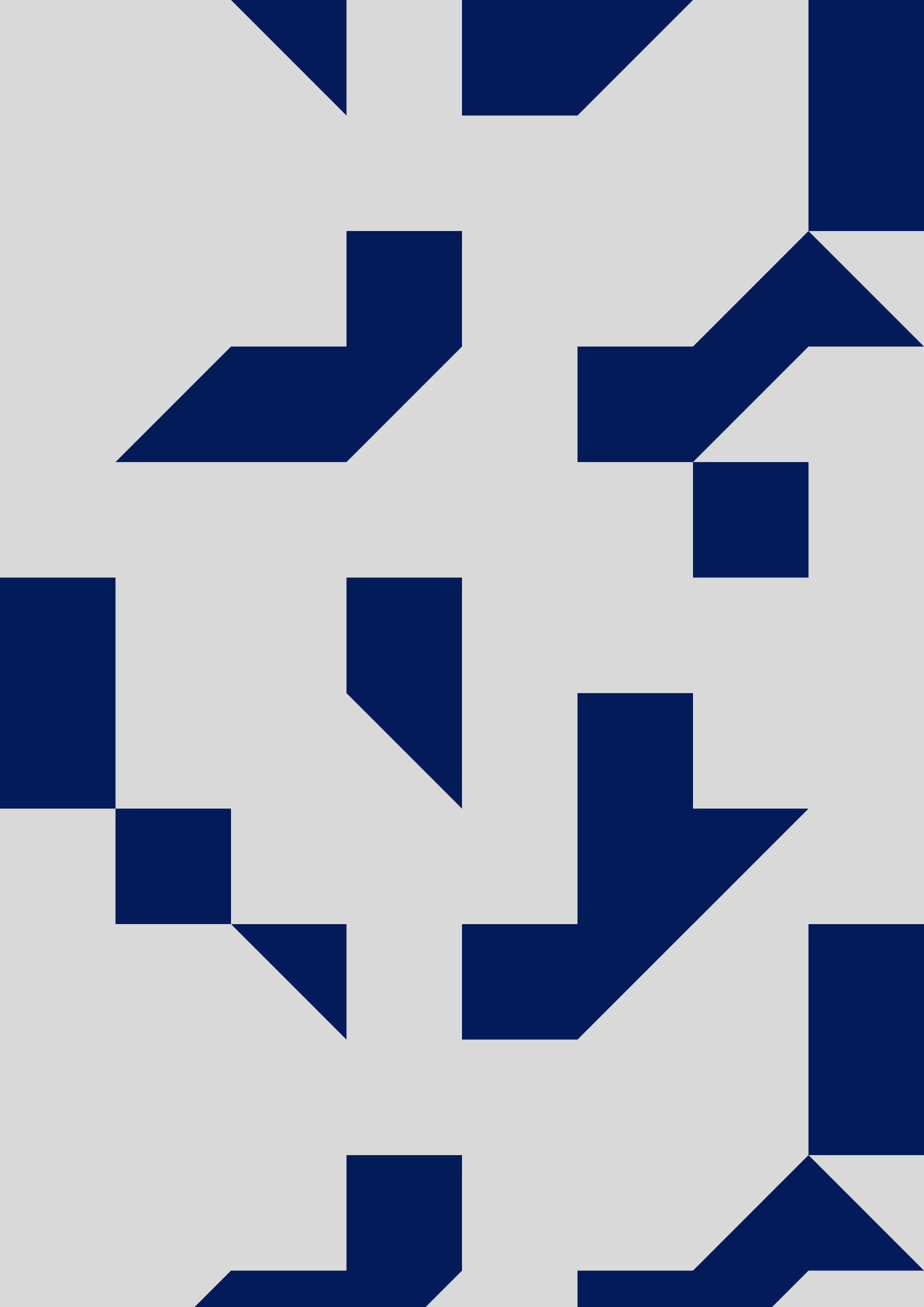
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ARTEFACTS FOR CHANGE: INTEGRATING ECO-SOCIAL JUSTICE INTO DESIGN EDUCATION.

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KEYWORDS | EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD), ANTICIPATORY COMPETENCE, GAME-BASED LEARNING (GBL), BOARD GAME, COGNITIVE DEVELOPMENT

ABSTRACT | The urgent issues of climate action and social justice are intertwined, demanding immediate attention, particularly within higher education. Educators underscore the imperative to incorporate climate change into the curriculum, emphasising the integration of eco-social justice (ESJ) within educational frameworks. Building upon critiques of emphasis on making-oriented aspects in traditional design education, scholars highlight the disproportionate focus on crafting often overshadowing broader ecological and societal contexts.

Stemming from my experience in product design and university teaching, this doctoral research explores the potential of design education and physical interventions in addressing the climate crisis and social justice. The research is currently in its early experimentation phases, and this paper outlines the ongoing progress and achievements.

My research revolves around embedding eco-social justice into curriculum content through "object-based learning (OBL)", advocating for student engagement with artefacts in learning and teaching. The overarching aim is to investigate how OBL artefacts can serve as communicative tools, conveying knowledge of eco-social justice within design education. The research question, "How might we design and embed artefacts in design education to convey eco-social justice in higher education learning and teaching?", leads to sub-questions exploring current practices of OBL, the typologies of artefacts, and the understanding of eco-social justice within higher education curriculum. The methodology conducts a practice-based research framework, incorporating qualitative research, research through design, and document analysis, utilizing a triangulation approach. The case studies are currently collaborating with the BA and MA Design Management programs at a creative arts university in London, UK, spanning over two academic years. Within this research context, the artefacts indicate (re)designing and creating 'drinking vessels' for Design Management curriculums.

The contribution of this research extends beyond enriching our understanding of object-based learning, design practices, and eco-social justice. It aims to explore OBL and its potential to enrich student learning and teaching about eco-social justice by emphasizing the design of artefacts. It contributes to narrowing the divide between general commitments to Education for Sustainable Development and day-to-day learning and teaching activities, thereby contributing to the transformation of design education toward a more sustainable future.

1. Introduction

In an era marked by escalating environmental challenges and the pressing need for social justice, the role of design education stands at the forefront of reshaping eco-societal perspectives. As emphasized by Meyer and Norman (2020, p. 16), addressing global challenges is imperative, including those outlined in the United Nations' Sustainable Development Goals, such as inequality, climate change, justice and so on. Papanek (2019) underscored that design schools focus excessively on design skills and neglect aspects of the ecological, social, economic, and political environment. Coinciding with Meyer and Norman (2020, p. 22), traditional design education tends to lean towards “creating great craft”, and although making-oriented has served a purpose, it falls short of meeting today’s needs. This research responds to the growing need for a shift in design pedagogy by addressing the identified gap and exploring the potential of object-based learning (OBL), as a pedagogical approach to convey eco-social justice principles.

The subject area of this research encompasses design practices and learning and teaching (L&T) within the context of eco-social justice (ESJ) in this research. The following diagram illuminates the relationship between these subject areas and the research aims. The overall aim is to demonstrate how designed artefacts for L&T sessions can communicate the knowledge of ESJ through curriculum delivery in design education. This research contends that the prevailing framework of design education predominantly emphasizes materialistic aspects in design practices when teaching sustainability to higher education students. In contrast, this research seeks to address the gap by exploring object-based learning (OBL), a pedagogical approach, to centralize eco-social justice within the domain of design education in Higher Education Institutions (HEIs).

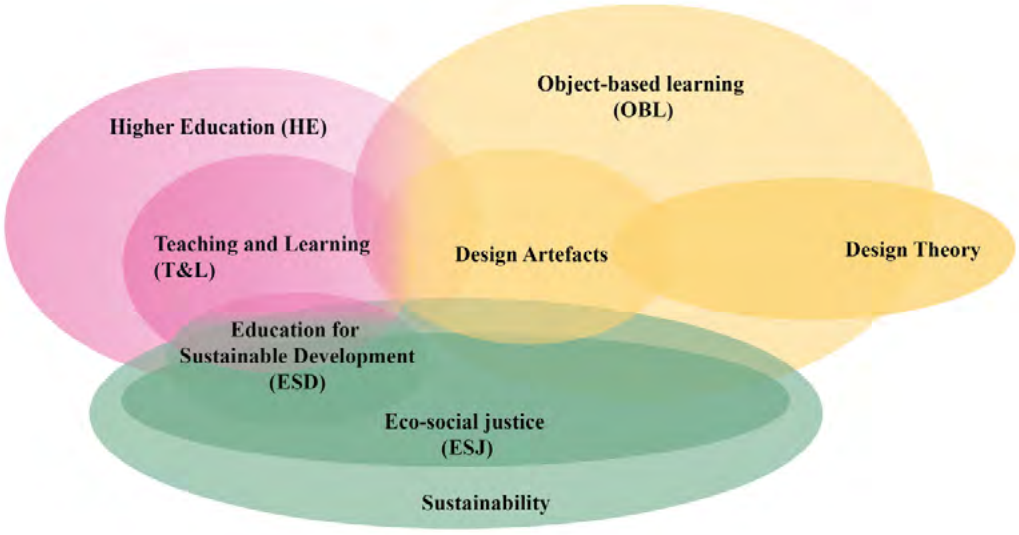


Figure 1. General Subject Area.

The primary aim transforms into the main research question: “How might we design and embed artefacts in design education to convey eco-social justice in higher education learning and teaching?”. This research question unfolds into five sub-questions:

1.1 What is the current practice and scholarship from OBL and related pedagogy, and in what potential ways this can be integrated with (product) design knowledge and practice?

1.2 How might artefacts be used to generate students’ ESJ awareness and understanding in teaching and learning sessions?

1.3 What characteristics or typologies of artefacts are designed for in-classroom learning, and in what theory could be built for designing from design curriculums?

1.4 What are current articulations and understandings of ESJ, particularly in HE curricula, and how can ESJ be understood for purposes of T&L in a particular case context?

1.5 What typologies of artefacts are designed for eco-social justice in higher education teaching and learning?

Each of these sub-research questions has its own set of objectives contributing to the research: Starting with 1.1, the objective is to investigate the current utilization of OBL in integrating with (product) design knowledge and practice required for HE. This investigation will primarily rely on literature reviews to discern existing practices and scholarly perspectives in this intersection. Moving on to 1.2, the objective is to understand how the integrated knowledge gained from OBL can be practically applied in experimental settings, specifically through the utilization of designed artefacts. This incorporates a literature review, 'research through design' and qualitative methods with experimentation and iteration within case studies. In sub-RQ 1.3, the focus lies on evaluating the typologies and characteristics of artefacts within OBL environments, their impact on learning and teaching, and the methods of designing them. This investigation will employ research through design and iterative practice to assess the artefact typologies. Sub-RQ1.4 captures the current understanding of eco-social justice within higher education through document analysis, allowing for comprehending ESJ for teaching and learning. In 1.5, the objective is to comprehend the typologies of artefacts designed for eco-social justice teaching and learning in HE.

The research adopts designer's perspective rather than that of a teacher, focusing on resolving design problems instead of pedagogical issues. In this context, as the designer-researcher, I position myself in the role of a designer instead of assuming the perspective of a teaching staff. This approach ensures the exploration of design artefacts for teaching and learning while delivering ESJ knowledge.

This research aspires to make contributions to three subject areas: object-based learning (OBL), design practice, and eco-social justice (ESJ). The logical relationships among these components are visually represented in Figure 2.

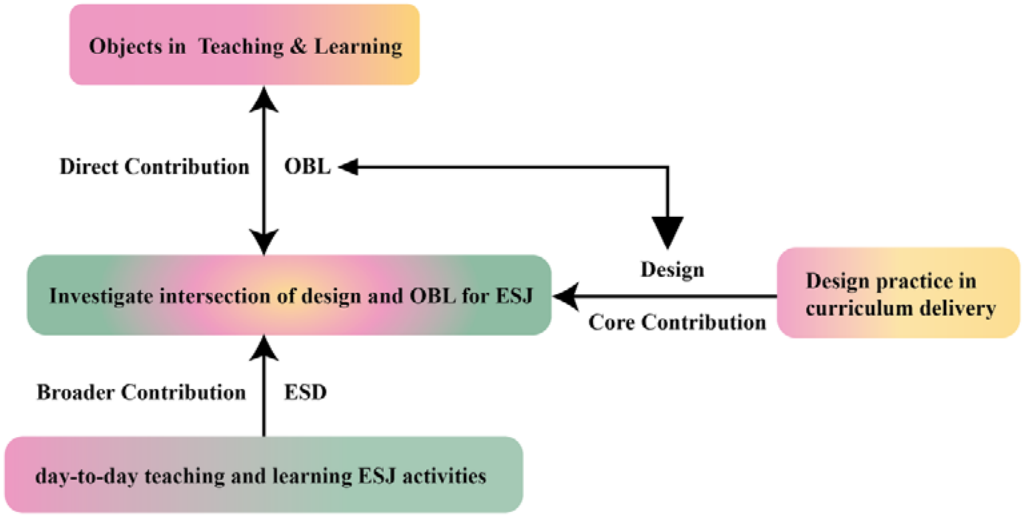


Figure 2. Framework of Contributions to Knowledge.

The direct contribution of this research centres on generating new design insights for object-based learning, particularly in how objects are designed to communicate knowledge in teaching and learning contexts. Emphasizing the incorporation of design practice (artefacts) into curriculum delivery, the research reveals typologies and characteristics that convey information about eco-social justice within

educational settings. The long-term impact extends to the domain of Education for Sustainable Development (ESD). It is crucial to emphasize that the research does not aspire to revolutionize every aspect of ESD. Instead, the ambition is to bridge the gap between general ESD commitments and the day-to-day learning and teaching activities of educators by utilizing design practices.

2. Context

The term "object-based learning (OBL)" refers to a student-centred pedagogy (Cain, 2011), that provides students with opportunities for active engagement with artefacts or objects in immersive and multisensory learning experiences (Chatterjee & Hannan, 2016). Artefacts as a central information source for students engaging in object-based learning, necessitating observation, analysis, and interpretation (Reiley & DeLong, 2023, p. 57). The term "artefact", originating from anthropology/archaeology, refers to a man-made object (Stappers & Giaccardi, 2014). In this research context, "artefacts" are defined as three-dimensional tangible objects, extending beyond traditional specimens (Cobley, 2022), and artwork, to encompass everyday items and designed practices.

Hardie (2015, p. 23) notes that physical objects play a pivotal role in facilitating the exploration of "design, culture, and society" within teaching and learning contexts, also serving as a "host" for interdisciplinary viewpoints. The significance of objects is highlighted in transferring "subject-specific and cross-disciplinary" (Chatterjee & Hannan, 2016) knowledge. Schultz (2018) asserts that students' learning is enhanced through interaction with artefacts, a perspective endorsed by Hardie (2015).

Within the scope of this research, eco-social justice (ESJ) serves as the contextual content for integrating object-based learning into design education within the creative arts university. ESJ, constitutes the foundational precept of sustainable development, emphasizing the interconnection between ecological and social systems (Jaffe & Gertler, 2008). Wang and Altanbulag (2022) underscore that ESJ prioritizes the interdependence between nature and society. Specifically, Attfield (2021) advocates for ESJ, acknowledging the realm of racial justice, colonialism, and capitalism in creating social divides and environmental disasters.

The implementation of OBL is posited as a pedagogical strategy, that not only navigates the complexities of climate action and social justice but also situates learners at the centre of the educational experience, fostering active engagement and a holistic understanding of eco-social justice issues.

3. Research Method and Approach

This doctoral research is grounded in a practice-based research framework, guided by the principle that "creative artefact is the basis of the contribution to knowledge" (Candy, 2006, p. 3). Various methodological approaches have been employed in this research, including literature review, qualitative research, research through design, and document analysis. These methods are utilized in a triangulation approach (Gray & Malins, 2004) to analyze complex issues. A non-chronological diagram (Figure 3) has been introduced to visually elaborate on the intricate relations and structure of these approaches and methods.

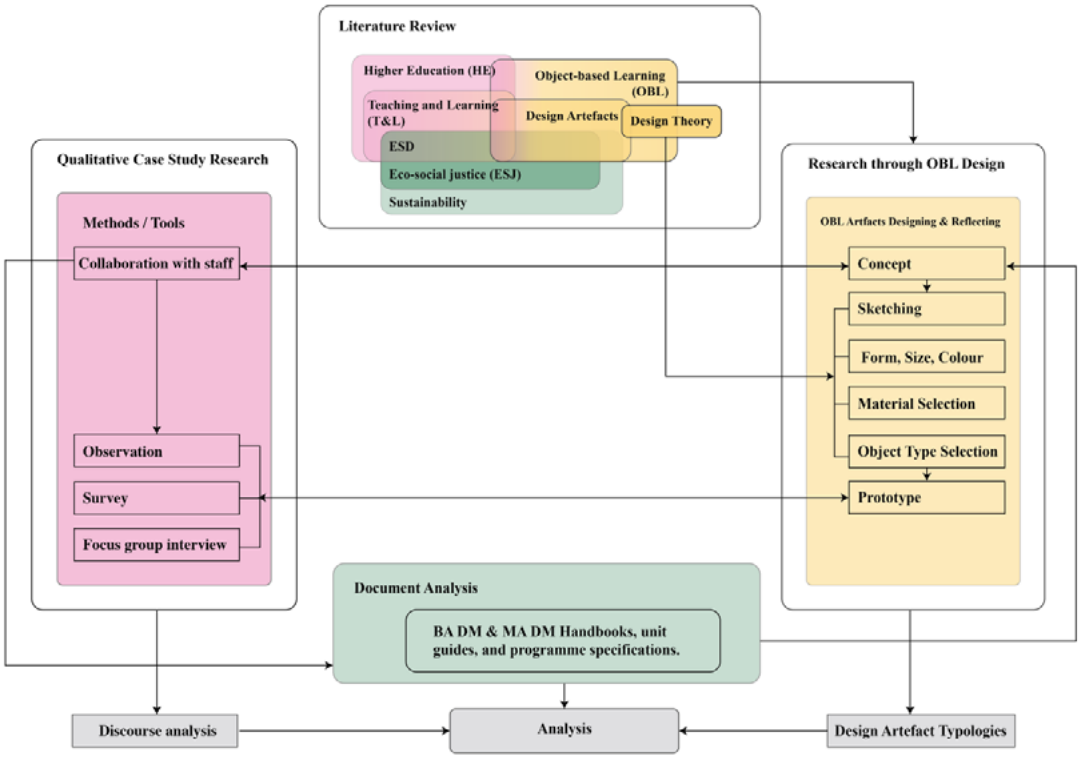


Figure 3. Research Approach and Methods.

3.1 Qualitative Inquiry

This study employs qualitative research, as defined by Leedy and Ormrod (2019, p. 418), encompasses the exploration of information that “cannot be easily reduced to numbers”. In this approach, the researcher assumes a pivotal role as the primary instrument, actively engaging in the collection of data “through examining documents, observing behaviour or interviewing participants” (Creswell, 2018, p. 164). This multi-sourced approach surpasses reliance on a single data stream, providing a richer dataset. The data in this research comes from the researcher's first-hand observations, interviews with students and teaching staff, surveys, and analysis of documents. While there might be instances where data emanates from surveys, the predominant focus will be on questions that do not lend themselves to numerical categorization.

Research through design stands as one of the primary research approaches applied in this research. Research through design not only draws upon established theories but also generates new knowledge through design practice (Gaver, 2012). As articulated by Downton (2003), the process of research through designing involves applying practical knowledge to attain tangible outcomes, thereby revealing the inherent knowledge embedded in their creation. The significance of artefacts in research through design is underscored by Stappers and Giaccardi (2014), who emphasize the important role that objects crafted by designers play in the research through design process. Within the context of this research, the generation of new knowledge occurs through the process of designing artefacts specifically tailored for authentic learning and teaching environments. In essence, the research through design employed in this study contributes to the application of knowledge in the domain of OBL artefacts within educational settings.

3.2 Research Strategy and Research Structure

In the exploration of qualitative designs and research strategies, this study incorporates two research strategies - ‘case study’ and ‘document analysis’. The utilization of both case study and document analysis strategically contributes to the depth and breadth of insights sought in this inquiry.

A case study, also referred to as “idiographic research” (Leedy & Ormrod, 2019), involves in-depth studies of a particular individual, program, or event for a defined period. This research adopts the case study, defined by Yin (2014) and is characterized by its empirical inquiry into real-life contexts (Creswell & Poth, 2016; Yin, 2009). This research collaborates with Bachelor of Arts (BA) and Master of Arts (MA) Design Management (DM) programs at a London-based creative arts university over two academic years, spanning two academic years from 2023 to 2025. The objectives of case studies are to (re)design and evaluate a series of tangible artefacts aligned with the existing curriculum and learning outcomes for DM programs.

DM, as a cross-disciplinary field, adopts a non-traditional design education approach by avoiding centralization of the making process. Meanwhile, the DM programs have graciously supported and provided me access to their classrooms and their teaching materials (such as handbooks, unit guides and reading lists) for this research. It makes those two DM programs an ideal environment for OBL practices, especially testing of OBL artefacts and evaluating the impact these artefacts have on student learning experiences.

Document analysis is one of the strategies in this research, which investigates the inherent meanings present in text, images, and spoken languages (O’Connor, 2019). This analytical method applies various textual analytical techniques to study texts “as sources or objects of study” (Karppinen & Moe, 2012, p. 189). Within the BA and MA Design Management case studies, document analysis is applied to comprehend existing course curricula by analyzing course materials such as course handbooks and unit guides. The focus will be on scrutinizing sections or parts of the course handbook that are pertinent to eco-social justice in DM courses.

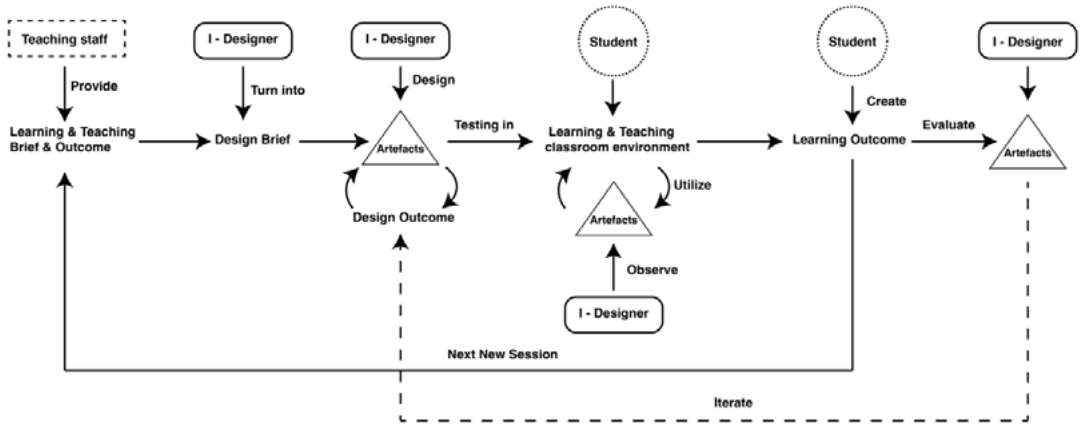


Figure 4. Research Structure.

The ‘research structure’ in my research refers to a systematic chain (see Figure 4) that guides the progression of the research, delineating key phases and activities undertaken. My position in the research as a designer-researcher converting extant Design Management learning and teaching briefs into design briefs. This involves (re)designing a series of OBL artefacts infused with ESJ information, introduced into the classroom for student interaction. Analysis grounded in students’ learning outcomes, gauges the incorporation of ESJ information, and iterative refinement relies on student feedback from questionnaires and focus group interviews. This systematic approach ensures the integration of OBL artefacts into ESJ education within the case studies.

4. Proposed Design Intervention

This research aspires to (re)design a series of ‘drinking vessels’, chosen as the primary type of designed artefact. In this research, the term ‘vessel’ extends beyond its conventional definition as a container

facilitating liquid consumption, encompassing broader conceptualizations as described by Sharpe (2022) in her keynote 'What Could a Vessel Be?'. Emphasis is placed on integrating design practices and OBL with conveying ESJ knowledge within the Design Management curriculum.

The rationale behind selecting drinking vessels is grounded in the following key considerations. The direct reason arises from the universal nature of "drinking vessel" and its immediate recognition as a sustainability concern. The prevalent awareness surrounding issues like disposable, plastic, and reusable cups make them an accessible and pertinent subject for intervention. Simultaneously, this reason intertwines with the historical and cultural connection between humans and vessels. Dating back to the earliest civilizations, using vessels for liquid consumption has been a fundamental practice.

The realistic reason emerges from my observations during over 15 hours of shadowing and sketching in Design Management courses. Analyzing objects present in the classroom (refer to Figure 5), a pattern emerged, with water bottles, cans, plastic bottles, and coffee cups being common items categorized as "drinking vessel". Recognizing these objects as ubiquitous in the DM learning environment, the study acknowledges that conveying knowledge related to ESJ can commence through the familiar entry point of "drinking vessel".

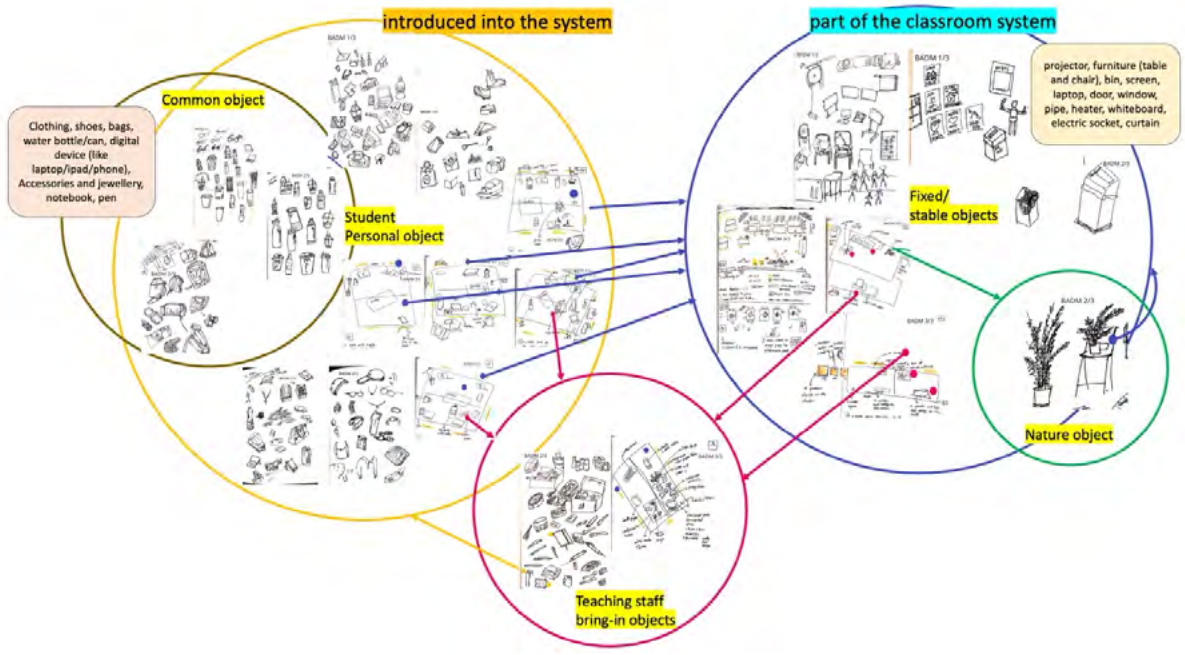


Figure 5. Mapping of object sketches in DM classroom.

5. Conclusion and Future Development

This research, currently in its early phases of experimentation, has sought to address the imperative need for a paradigm shift in design education toward an emphasis on eco-social justice (ESJ), through the integration of object-based learning (OBL) artefacts. Collaborating with Design Management courses has provided valuable insights into the potential of incorporating ESJ within the curriculum.

As this research progresses, ongoing iterations of drinking vessels within the context of eco-social justice in Design Management courses will continue. The emphasis remains on evaluating student learning outcomes, refining the artefacts based on feedback, and ensuring the integration of ESJ knowledge into the curriculum.

Future research could extend to broader subjects, emphasizing the transferability of OBL artefacts and exploring their application in diverse educational settings. This continual journey of research holds the promise of further enriching our understanding of OBL as a pedagogical approach to fostering eco-social justice.

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Lezhi (Crystal) Zhang is a PhD student at the London College of Communication, University of the Arts London, with a background in industrial design. Her doctoral research explores embedding artefacts into curriculum design in design education towards eco-social justice.

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P/REFERENCES OF DESIGN

DESIGNING AUDITORY EXPERIENCES: EXPLORING THE MIGRATION OF BEIJING SWIFTS THROUGH SOUNDSCAPES.

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KEYWORDS | MIGRATION DATA SONIFICATION, BEIJING SWIFT, ECOSYSTEM HEALTH

ABSTRACT | “The Voice of Swifts” is an ongoing sonification installation project that transforms the migration data of Beijing Swifts into an immersive soundscape. Utilizing beamforming speakers and spatial audio techniques, the project recreates the swifts’ 30,000-km journey from Beijing to South Africa. It blends swift flocks’ sounds with environmental elements, reflecting geographical stopovers. The installation’s design symbolizes the swifts’ flight, using a “one month per minute” scale for sonification and aligning speaker placement with migratory waypoints. This approach bridges science and public engagement, deepening the understanding of swifts’ ecological significance and the impact of environmental changes. The project exemplifies how art can communicate scientific concepts, enhancing environmental awareness and education.

1. Introduction

The Beijing Swift (Apus apus pekinensis), renowned for its remarkable speed, serves as a key model for one of biology's most intriguing puzzles: the mechanism of long-distance migration. Highlighted by “Science” magazine as one of the 125 most challenging scientific questions, it remains at the forefront of ecological research. The migratory journey of Beijing Swifts, spanning nearly 30,000 kilometers between Beijing and South Africa, offers a unique perspective on this complex biological phenomenon. However, this species faces severe threats in its native habitat of Beijing. Urban redevelopment and pesticide use have reduced their numbers from a peak of 50,000 in the early 20th century to just 3,700 in 2021 (National Forestry and Grassland Administration, 2021). This drastic decline not only signals an ecological crisis but also underscores the urgency of understanding and protecting these swifts. Their transcontinental migration is more than a biological phenomenon; it serves as a window into complex ecological interdependencies and the consequences of human activities. Studying their migratory patterns provides insights into ecosystem health, species adaptability, and the broader impacts of human-induced environmental changes.

Sonification is the process of translating data into sound, forming a core component of auditory display systems. By systematically transforming sound parameters, it represents changes and structures in data, leveraging human auditory abilities to enhance data understanding and exploration(Hermann, T., Hunt, A., Neuhoff, J. G. ,2011). A study by Supper(2014) emphasizes how sonification in ecological research can turn abstract data into an experiential format, revealing patterns and dynamics that might otherwise remain obscured. In the context of Beijing Swift migration, sonification extends beyond mere data representation. It evolves into a storytelling medium, effectively bridging the gap between scientific understanding and public awareness. By transforming abstract ecological data into auditory forms, sonification provides experiencers with a new sensory dimension, thereby enhancing their intuitive and immersive understanding of these data, and deepening their appreciation of complex natural phenomena(Foteinou, Kokla, Tomai, & Kavouras, 2022)

In an endeavor to accentuate active listening and foster a heightened sense of embodiment among participants, beamforming loudspeakers are utilized. These speakers are notable for their pronounced directivity, creating an immersive soundscape that is perceptible only within a specific listening radius. This characteristic compels participants to physically follow the path of the swifts to fully engage with and appreciate the auditory representation of their migration. The use of beamforming technology aligns with contemporary auditory display research, which emphasizes the importance of listener engagement and interaction in spatial sound experiences. Brownell (2017) thoroughly explores the importance of active listening in his comprehensive work, defining it as “a deliberate and conscious endeavor directed toward achieving understanding.” Active listening is not a passive occurrence; rather, it requires awareness and conscious effort, demanding high levels of concentration and engagement. Moreover, the goal of active listening is to achieve understanding, not merely to hear sounds superficially. This necessitates proactive decoding, analysis, and internalization of the information heard.

2. Installation Design

“The Voice of Swifts” is a multi-channel immersive audio installation that skillfully employs beamforming speakers suspended from the ceiling for a unique auditory transmutation of data on the migration of Beijing swifts. This design draws inspiration from the swift as an emblem of Beijing and its characteristic of nearly uninterrupted flight, symbolizing the continuity and omnipresence of sound reverberating through the air. This piece integrates sound materials from Beijing swift flocks and, based on the geological features of the stopover locations, skillfully incorporates marine and wind sounds to reflect the topographical characteristics of the migration stopovers. In alignment with key waypoints on the swifts’ migratory route, eight speakers are meticulously arranged. I used Python to create a simple map of spring and winter migration paths based on the description of Swifts migration in (Zhao, Zhao, Wu, et al., 2022), as shown in Figure 1. A projector is utilized to cast a mapping of the area onto the floor, providing a visual reference for spatial orientation. Subsequently, specific coordinate points are meticulously marked on the surface, delineating precise locations based on the projected map. Following this, loudspeakers are strategically positioned in

accordance with these demarcated coordinates. This methodical approach ensures accurate spatial distribution of sound, adhering to the predefined mapping for optimal auditory experience.

The distance between each speaker mirrors the kilometers spanned between nations traversed by the swifts. For example, the distance from Beijing to Mongolia, approximately 1273 kilometers, is represented by a spatial interval of 636.5 millimeters between two speakers. Additionally, each speaker serves as an independent auditory channel, facilitating sound movement within the space. By representing geographical distances through proportional spatial intervals between speakers, the installation transforms the abstract concept of migration into a tangible auditory experience. This innovative approach brings the audience closer to the swifts' epic journey, spanning thousands of kilometers, by translating these vast distances into an intimate, immersive soundscape. The choice of beamforming technology further enhances this experience. These speakers, known for their ability to direct sound with precision, create a focused and intimate auditory environment. As a listener moves through the space, they encounter different segments of the swifts' migratory path, almost as if they are traveling alongside the birds. This dynamic interaction between sound and space invites the audience to actively engage with the installation, fostering a deeper connection to the story being told.

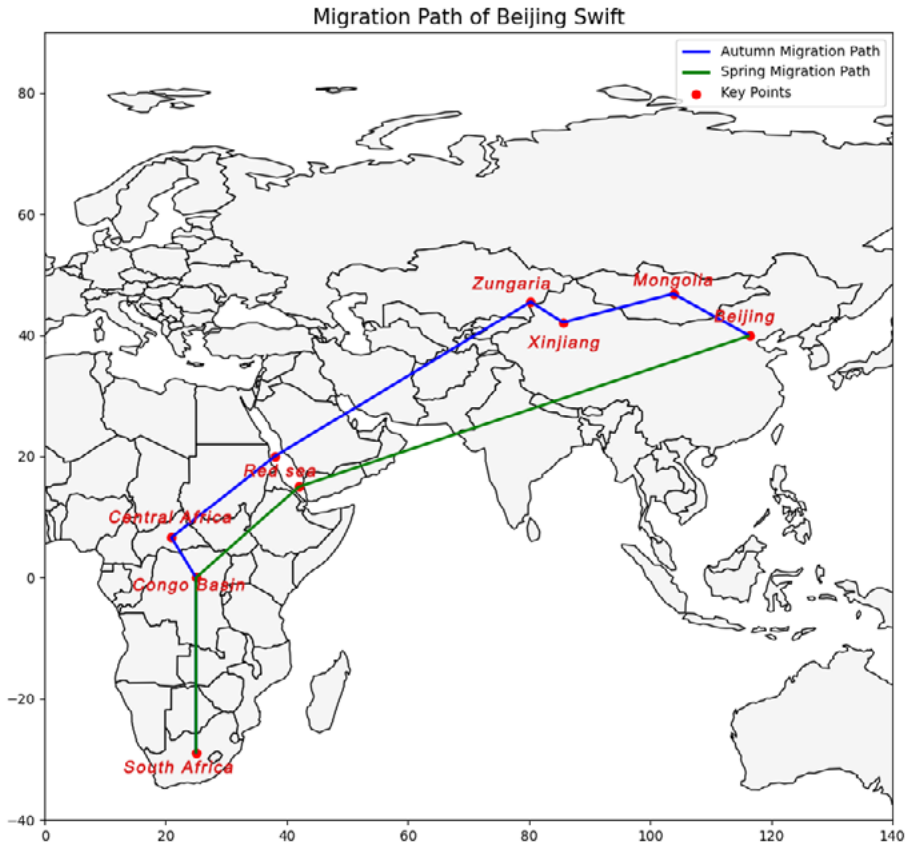


Figure 1. Migration Path of Beijing Swift made by Python.

3. Sonification Method

The 12-minute composition simulates swifts' migratory process through dynamic auditory changes. Aligned with the actual migration timeline, each minute represents one month, starting from mid-July in Beijing. Due to the limitations in the number of speakers, a perfectly smooth transition of sound is not feasible. Currently, this is managed by adjusting the volume between two speakers. For example, if the sound moves from one coordinate to another in one minute, a one-minute fade out is executed on speaker A, while a simultaneous one-minute fade in is implemented on speaker B.

Furthermore, the flying speed of swifts is mapped onto the volume of the sound. The velocity is deduced from the distance between coordinates, which in turn informs the volume adjustments: higher speeds result in louder volumes and slower speeds in quieter volumes. In this study(Zhao, Zhao, Wu, et al., 2022), a total of 66 geographical locators were used, but only 25 provided effective data. This data was then mapped to the complexity of the swifts' sound. Initially, the sound material of swifts was processed to create 66 separate audio tracks, which were reduced to 25 by the end of the journey. This method allows for the creation of a dynamic soundscape in the performance, reflecting the characteristics of the swifts' migration.

From the sound design aspect, the integration of environmental factors affecting the swifts' migration into the auditory experience. As the swifts encounter different environmental conditions – from the urban sounds of Beijing to the natural sounds of the Red Sea and Congo – these changes are reflected in the sound design. This not only adds a layer of realism to the experience but also educates the audience about the diverse challenges faced by the swifts during their journey. Additionally, the use of real-time data processing techniques can be explored to further enhance the dynamic nature of the installation. By incorporating live data feeds, such as current weather conditions along the migratory path or real-time tracking of swifts, the sound composition can evolve continuously, making each performance unique. This approach not only reflects the real-time aspect of migration but also emphasizes the ever-changing nature of ecological systems.

Also, the representation of the swifts' migratory journey through musical elements, infused with the geographical features and cultural contexts of their various locations, is an innovative blend of music, geography, and ecology. This concept, where the swifts' presence in Beijing is signified by the ancient sounds of Bianzhong, aligns with the idea that geography profoundly influences musical styles and instruments, as well as the emotional resonance of melodies(‘Musical Landscapes - How Geography Influences Music’,2023.). This traditional music, known for its melodious and resonant tones, linking the swifts' journey to the historical and cultural context of Beijing. Upon reaching Africa, the installation embraces the vibrant and rhythmic music of the continent. African music, known for its complex drumming patterns and lively melodies, reflects the diverse ecosystems and rich wildlife of the continent. As depicted in Figure 2, a basic conceptual illustration includes sound design examples of locations where Beijing swifts dwell.

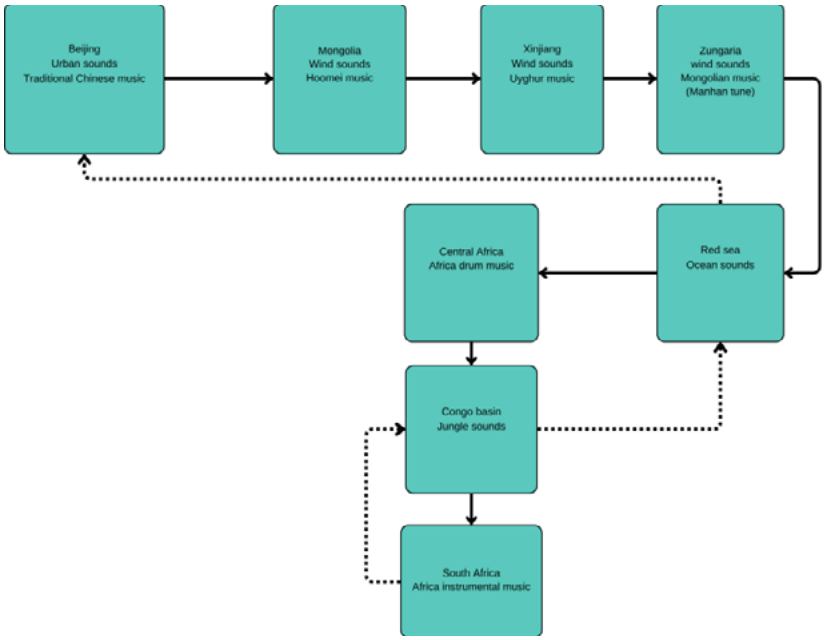


Figure 2. A Basic Conceptual Illustration of Sound Design.

This shift to a more energetic and dynamic musical style symbolizes the swifts’ arrival in a land teeming with life and diversity. By incorporating these regional musical elements, “The Voice of Swifts” not only charts the geographical journey of the swifts but also celebrates the cultural diversity of the regions they traverse. This approach enriches the narrative, allowing the audience to experience the migratory path of the swifts not just

as a biological phenomenon but as a journey through diverse cultural landscapes. This method deepens the audience's engagement, making the swifts' migration a journey through sound, culture, and history.

4. Conclusion

“The Voice of Swifts” serves as a pioneering exploration in sonifying ecological data, transforming the intricate migratory patterns of Beijing Swifts into an immersive auditory narrative. This innovative blend of art and science not only deepens our understanding of these birds' journeys and their ecological significance but also highlights the impact of urbanization and climate change on biodiversity. By employing spatial audio techniques and thoughtful speaker placement, the installation invites active listen and fosters a deeper appreciation for nature's complexities. Ultimately, this project stands as a testament to the potential of sonification in bridging the gap between scientific research and public engagement, offering a compelling model for future interdisciplinary endeavors in environmental awareness and education.

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Prof. Zhigang Wang, his research innovates in merging technology with performing arts, creatively transforming traditional Chinese culture through new media art, and exploring spatial narrative methodologies in this field.

P/REFERENCES OF DESIGN

CONTEXTUAL REVIEW OF THE PEDAGOGIC DESIGN STUDIO.

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KEYWORDS | TERTIARY PEDAGOGIC DESIGN STUDIO, SIGNATURE PEDAGOGY, CONTEMPORARY DESIGN EDUCATION, CONTEXTUAL STUDY OF PEDAGOGIC DESIGN STUDIO

ABSTRACT | In Higher Education the design studio has evolved as an intimate space of learning that facilitates experimentation, discovery and personal growth as an enduring typology within creative education. When design departments are incorporated within larger institutions where most subjects are taught through lectures and seminars a difficulty can arise trying to create a studio culture within a classroom setting. The classroom has developed through a different educational philosophy that conflicts with the design studio model and compromises the design student experience. This study explores the distinctive character of the design studio and design pedagogy to develop recommendations for institutions and educators as to how to provide and manage studio spaces that will strengthen their students' creative skills, aspirations and access to global design professions.

Applying Henri Lefebvre's position that space is never neutral but is constructed through multiple inter-related social and political dynamics. This study examines five key spheres of influence on the studio as a signature space of learning: the geographic location, the socio-economic status of the area; the pedagogic philosophy; the spatial configuration; and the digital strategy developed for the learning environment. The investigation seeks to explore how these spheres combine with cultural perceptions of the studio space to influence the student experience and their aspirations.

To create a theoretical framework that can consider the relationships between the multiple variables that shape the student experience, the thesis references the work of sociologist Pierre Bourdieu and his work on habitus, field, and capitals. The framework is developed by applying Doreen Massey's theories that geography shapes social relations and power dynamics, Donna Haraway's work on situated knowledges and the work of bell hooks and Paulo Freire in relation to educational equality.

The methodology undertakes case studies of different institutions that offer design starting with the institutions where the researcher teaches. Adopting a user-centred, mixed methods approach, the research draws on the experience of the multiple stakeholders who shape the values of the studio: tutors, students, management and architects. It analyses their opinions and experiences with reference to theorists in pedagogy, sociology and architecture and draws on the knowledge and best practice of a case study analysis. As this is a practice-based investigation, the insights will be used to develop new spatial and pedagogic models which will be tested and evaluated at the host institution with design and creative media students.

It is anticipated that the outcomes of the analysis and the new recommendations will consist of guidelines that enable institutions to create studio spaces which can be configured to their specific socio-geographic contexts and to digital transformations in pedagogy.

1. Introduction

> "In the first half of the twentieth century, there were 180 Art Schools in the UK, and there were 28 universities. By 2011 there were 11 Art Schools and 119 universities (Beck and Cornford 2014)." (Orr and Shreeve 2018, p.11)

The 'academic turn' and trend to absorb design education into university campuses, which emerged in the early 1970s in the UK and Ireland, has created challenges in many institutions (Orr and Shreeve 2018, Houghton 2016). The enduring studio pedagogy of design education is not easily adopted in more traditional lecture and classroom spaces of learning. This research aims to investigate the role of the design studio and its associated pedagogy, to discover how these can be strengthened. Although proposed before the coronavirus outbreak, this study has become more urgent in the wake of the pandemic. The physical space of design learning was lost in the pivot to online learning, however, new educational practices were developed with fresh approaches to student-centered education. This seismic shift has caused questioning and re-evaluation of the studio as a signature pedagogic space (Shulman 2005) and the assumptions on where teaching is based. These conditions have led to the central research question: can the enduring typology of the pedagogic design studio accommodate emerging curricula to support the aspirations and creativity of the students?

This paper condenses the initial contextual review of the history of the pedagogic design studio and introduces the five key spheres of influence identified in the PhD study.

2. Historical Outline of the Pedagogic Design Studio and Design Pedagogy

Acknowledging the importance of context, this section offers a brief historical outline of the development of the design studio to identify the multiple strands that contribute to its present-day pedagogic and spatial characteristics and contribute to its enduring character. The outline encompasses the design studio as a physical place as well as the site of many cognitive and social practices and values. As such, the term studio represents the space, the activities within it, and the teaching approach.

The artist's studio and architectural studio have received most academic attention (Beck and Cornford 2014, Cole 1983, Cret 1941, Culotta 2020, Green and Bonollo 2003, Houghton 2016, Pevsner 1940, Souleles 2013) and inform this research but it is Nicholas Houghton 2016 paper that the study adopts and adapts. Houghton defined six periods or 'historical curricula': Apprentice, Academic, Formalist, Expressive, Conceptual and Professional. Figures 1-3 illustrate the changes in practice, principles and relationships within the design studio and the legacy of each of these historical curricula on the contemporary pedagogic design studio.

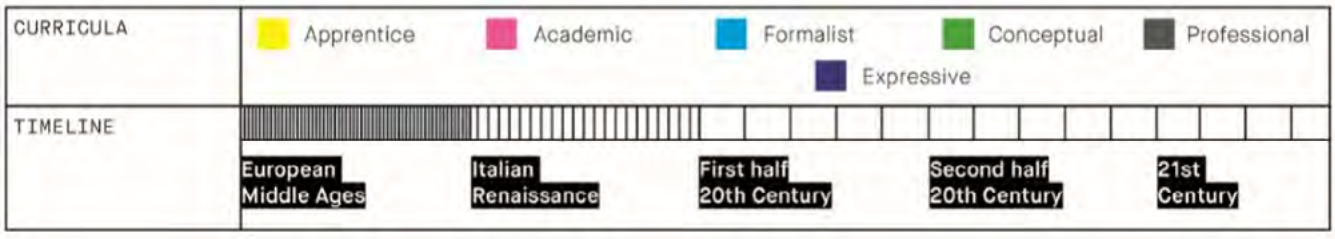


Figure 1. Timeline adapted from Houghton's (2016) Six Historical Curricula.

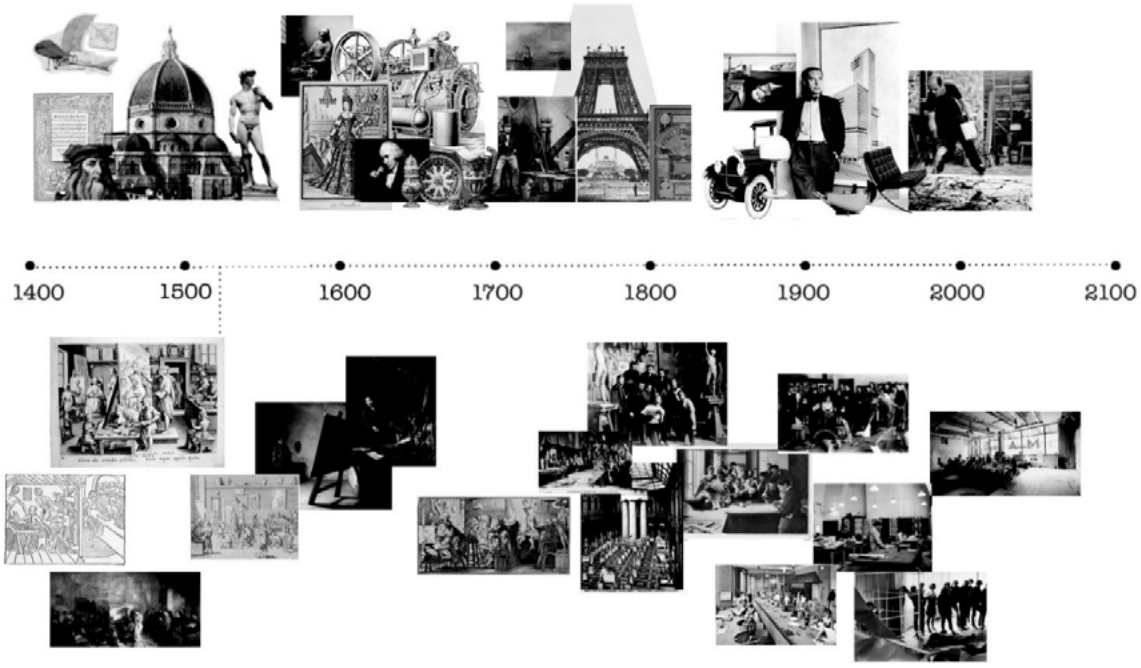


Figure 2. An illustrated timeline of key thinkers, innovations, artistic practices and studios from the 16th to 20th century based on Houghton's curricula.

For this abbreviated paper the different priorities of each curriculum are summarised in figure 3. This is a simplified analysis of Houghton's findings, with an emphasis on what was most valued rather than the only attributes honed.

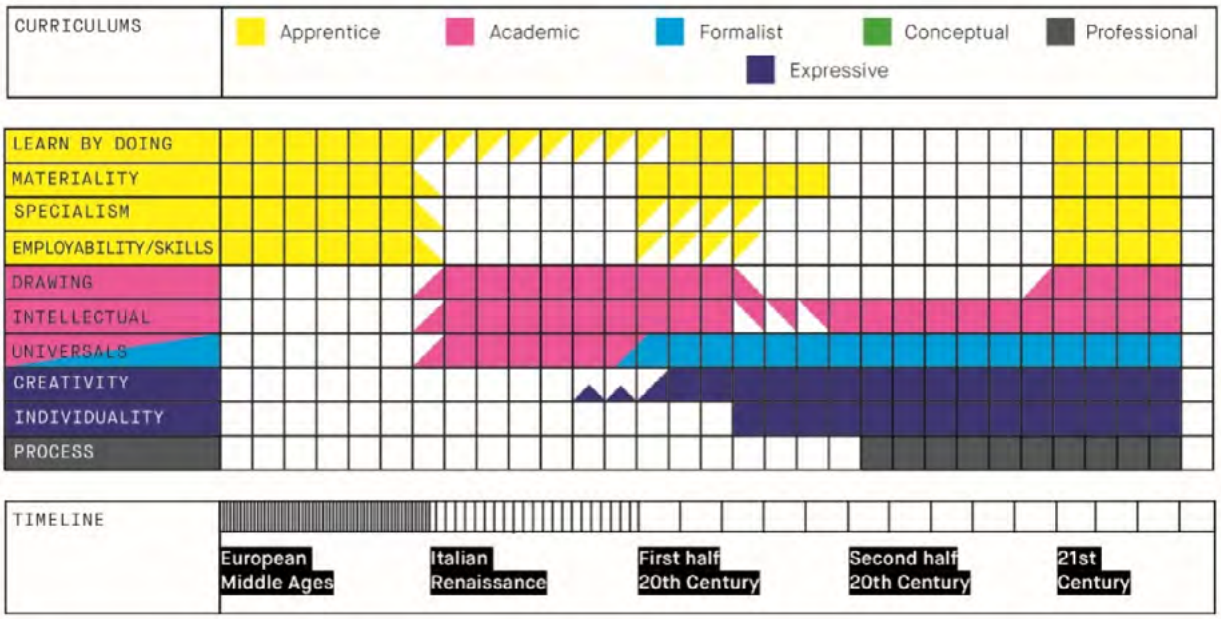


Figure 3. Identifies key attributes that emerged from Houghton's (2016) six curricula, some fall out of favour to reemerge in later periods. Others are unique for their combination of previous curricula.

Applying Houghton's six periods to the design studio reveals the complexity and often contradictory affordances necessary in the space: head-down quiet work, group work, making, prototyping and presentations, these have been further explored by design researchers: Thoring et al (2018)1; Williams (2009)2; Groves and Marlow (2016)3; Doorley and Witthoft (2012)4; Velhhoen (2005)5.

These strands have been organised into a studio hierarchy of needs-based Abraham Maslow's 1943 study on motivations for human behaviour, the Hierarchy of Needs Pyramid. Although criticised by some for the 'hierarchical' nature of his stages and the singular basis for the categorisation (Méndez and Rojas 2023) (Wahba and Bridwell 1976), the holistic approach Maslow takes to the physiological and psychological well-being of a person resonates with the student-centred, embodied ethos of this study and the scaffolding nature of design education (Orr and Shreeve 2018).



Figure 4. Learner's Hierarchy of Needs of the Studio, created by the researcher.

This diagram encompasses a student-centred, practically based, industry-led, experiential, socially driven approach to education which creates unique relationships between tutor and learner and demands a tailored teaching environment. It also recognises the external factors that envelope the studio which will be explored next.

3. Spheres of Influence

The contexts refer to the multiple intersecting strands that shape the experience of the pedagogic studio. These dimensions were identified as the spatial, the space of the studio, the architecture of the building and the campus; the geographic, the location of the institution, regional employment and enterprise; the pedagogic, the embodied practices of teaching and learning design; the socio-economic demography of the area and the student profile; and the digital, its particular infrastructure and practices in the institution. At the core of all these lenses is the students' educational experience and the impact of these variables on their learning and motivation.

3.1 Spatial Dimension

There is an argument and evidence that education can occur anywhere, and indeed design pedagogy happens in many spaces, but a key focus of this study is to explore the perception and therefore impact of the enduring typology of the pedagogic studio. Architect Peter Carl's reflections on the difference between type and typical assist in this exploration.

> "For example, the type "bedroom" tends to solicit a medium-sized room with a bed, side-table, window, closet, and access to a WC; whereas the typical situations of sleep, dreams, sex, illness, death, etc., open much more profound and rich possibilities of interpretation (evident, for example, in the sleeping-terrace beneath the canopy of Le Corbusier's Villa Shodan, 1952)." (Carl 2011, p.3)

Considering the 'space of' opens greater possibilities and more authentic ways of viewing space. The spatial is the practical elements but as Lefebvre (1991) argued, space is not a neutral backdrop but is itself a product of social relations and plays a crucial role in shaping them. More than just an area to work in, the studio is a learning culture and 'space of' learning, experimentation, expression, safety etc., affordances a regular classroom cannot nurture as effectively (Boys 2011, Spruce 2007). This was born out at creative educators' workshop, March 2023.



Figure 5. Responses from creative educators, March 2023 via Mentimeter on what they felt the pedagogic studio was a 'space of'.

Carl recognises the "tension between the conceptual field for types and the concrete topographies which we inhabit." (Carl, 2011, p 3). This is taken to mean how a person teaches, how the students respond, their expectations are influenced by the physical configuration and the cultural values of the space and the appropriateness of the space for the activity being undertaken.

Critical theorist Homi Bhabha urges that we examine the way we theorise and historicise architectural production with a contemporary lens of cultural interrelatedness (Hernandez 2010). He reminds us that 'in a world of increasing transnational traffic, the signature of specificity and locality – the productive signs of difference – often inhere in the telling detail that provides a narrative of the dialogue between tradition and social change' (Bhabha 2007).

3.2 Geographic and Socio-Economic Dimension

To create a theoretical framework that can consider the relationships between the spatial and the other variables that shape the student experience, the study turns first to sociologist Pierre Bourdieu. Bourdieu (1984) observed that a person's standing in society does not simply depend on their material worth, their economic capital but also on symbolic capital (social and cultural capital). Bourdieu suggests capital equals power and this thesis argues the studio may be seen as a symbolic form of capital that may have the potential to empower students. In Richardson (1986) Bourdieu notes that unlike economic capital, embodied cultural capital cannot be accumulated from someone else. "The worth of acquisition is work on oneself (self-improvement) an effort that presupposes a personal cost" (p 244). It can be described as their habitus.

> "Habitus is the learned set of preferences or dispositions by which a person orients to the social world. It is a system of durable, transposable, cognitive 'schemata or structures of perception, conception and action'." (Bourdieu 2002, p.27)

This is of particular significance for this study as it points to an opportunity to contribute to students' embodied cultural capital through the tacit knowledge exchange and an opportunity to introduce students to objectified cultural capital through the studio.

Donna Haraway (1991) also explored the power and legacy that visuals have on how we perceive something and notes that these are often not formed locally or organically but are tied "to militarism, capitalism, colonialism and male supremacy" (p 188). She argues that this produces specific visions of difference and hierarchy (Rose 2012, p 9). This links to the perception of the studio and the inherited cultural capital it represents. Further to this Haraway's work on situated knowledge (1988) suggests that knowledge is situated in specific social contexts, and that our understanding of the world is shaped by our positionality within those contexts. She advocates that knowledge is not a universal, objective truth, but rather is situated within specific social and historical contexts. In the context of higher education, this means that students' experiences and outcomes are shaped by the spatial and cultural context in which they are learning.

Social geographer Doreen Massey echoes Haraway's position asserting that, knowledge is always located and partial; it is always the product of a particular set of social relations and practices and reflects the interests and concerns of particular social groups (Massey 1994). Bourdieu argues that individuals from higher socio-economic backgrounds have access to cultural resources such as knowledge, skills, and networks (capitals) that can help them succeed in educational institutions. This leads to the "geography of opportunity" theory (Briggs 2005, Reece 2019, Brain and Prieto 2021). An investigation in the 'potent impact of 'place''. This theory also suggests that the location of a student's university can provide them with unique opportunities that may not be available in other regions e.g. universities in metropolitan areas may offer students greater access to internships, research opportunities, and networking events.

Educationalist and feminist writer bell hooks argues that the current neoliberal model of education is deeply flawed, as it reinforces rather than disrupts societal inequalities (1994). She envisages education as a tool for social change, "a practice of freedom" that enables students to "transgress" societal boundaries and challenge the status quo (hooks 1994, p. 12). For hooks, the role of education is not just to provide students with technical skills or information, but also to create critical thinkers who can challenge the dominant narratives that perpetuate the inequalities she observed. Educational reformist Paulo Freire had an impact on hooks' philosophical position. Freire argues that higher education is often seen as a means for upward mobility perpetuating existing socio-economic inequalities rather than a tool for social transformation.

3.3 Pedagogic and Digital Dimension

The pedagogic design studio can enact Freire's approach of "the problem-posing concept of education as an instrument for liberation" (Freire 2005 p 71). Orr and Shreeve (2018), Tovey (2015) and Boys (2011) note the ownership and individuality of open-ended briefs, traditionally used in studio pedagogy, afford the learner this agency and are very motivating for the student.

Although computers have been ubiquitous in universities since 1990's the shift to online delivery necessitated by the pandemic further cemented the digital into the fabric of the university (Lamb et al. 2022). This study will examine some of the legacies of the imposed transition online. The positive aspects include greater access to educational resources (online libraries, digital books, industry-standard applications), the ability to visit cultural and educational institutions online and explore their digitised collections, the development of more extensive and geographically spread social and industry connections (equating to greater diversity of voices and experiences), and as a result better understanding of potential future opportunities. These initiatives go some way to lessening the differential between rural universities and their urban counterparts. The internet allows students to accumulate Bourdieu's symbolic capital (1987) by gaining access to cultural and educational resources that were once out of reach (Ignatow and Robinson 2016) of quality internet and digital hardware are not accessible to all and as with physical spaces joining digital spaces can also seem alienating.

The hands-on learning-by-doing approach is more difficult to mediate and feedback on in a digital environment. Research continues (Marshalsey and Sclater 2018, 2020) on how to incorporate ways of online delivery that can facilitate or encourage tacit knowledge exchange, peer learning and even serendipitous moments (Jones et al 2020, Baynes et al 2013; Lotz et al 2015, Makri et al 2014).
Post phenomenology theorists Idhe (2009) and Veerbeck (2006) view the digital in similar terms to many of the spatial theorist mentioned previously, particularly with regards affordances and embodiment. Ihde illustrates this relationship as:

(human – technology) —> world

The technology facilitates the interactions, but it also alters them. Just as space is not neutral, neither are digital interfaces and spaces.

4. Conclusion

This paper sought to outline the central components and contexts that have led to the Western pedagogic design studio typology. It encourages an approach that looks at learning environments not simply as places of learning but to recognise the rich and multiple activities it can encourage and the need to reflect these in the properties and affordances of the space. These may need to alter in response to the five spheres of influence noted in this paper: the physical space, geographic location, socio-economic demographic, and the digital and pedagogic strategies of the institution. It is intended to conduct further research into these spheres to develop guidance and recommendations that enable institutions to create studio spaces that can be configured to their specific socio-geographic contexts and to digital transformations in pedagogy.

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P/REFERENCES OF DESIGN

UNRAVELING IDENTITY'S INFLUENCE ON DESIGN: A HOLISTIC EXAMINATION OF CHINESE INDEPENDENT PRODUCT DESIGNERS' NARRATIVE IN DESIGN PRACTICE, MANUFACTURING, AND EXHIBITION.

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KEYWORDS | GLOBALISATION, CULTURAL REPRESENTATION, IDENTITY CONSTRUCTION, DESIGN CULTURE, CHINESENESS

ABSTRACT | This study explores the intricate interplay between Chinese identity and the design industry, focusing on independent product designers. As China undergoes significant transformations in its economic, political, and cultural spheres due to globalization, this research explores the impact of these changes on the design practices of Chinese independent designers. By examining the narratives of designers such as Mario Tsai, Frank Chou, and others, the study aims to unravel how Chinese identity intertwines with design across practice, manufacturing, and exhibition. Methodologically, the research employs ethnography, involving qualitative analysis through interviews, observations, and thematic analysis. Interviews with prominent Chinese independent product designers, coupled with fieldwork at Mario Tsai design studios and international design exhibitions such as Milan Design Week, provide firsthand insights into their experiences and perspectives. The findings of this research reveal the multifaceted negotiation of Chinese identity within the realm of design practice, manufacturing processes, and exhibition strategies. Notably, Chinese designers are observed to gravitate towards a design language characterized by simplicity and universality, challenging conventional expectations that often associate Chinese design with stereotypical symbols. Moreover, the study discusses the impact of the Shanzhai phenomenon, which refers to the production of fake goods, on the development of design in China. This exploration reveals ideological conflicts and societal tensions inherent within the design field as designers navigate the complex landscape shaped by cultural, economic, and political factors. In conclusion, this study contributes significantly to a nuanced understanding of Chinese identity within the context of design. By illuminating the ideological conflicts, cultural tensions, and strategic maneuvers prevalent within the global design landscape, this research advocates for a liberation of contemporary Chinese design from traditional cultural constraints. Furthermore, it calls for a more nuanced representation of Chinese identity in design practice, detached from conventional stereotypes and government propaganda. Ultimately, this study anticipates a more sophisticated outlook in the realm of international design promotion, fostering a broader appreciation for the diverse and evolving landscape of Chinese design identity.

1. Introduction

During Milan Design Week 2023, when the author was assisting Chinese independent product designer Mario Tsai in promoting his works, multiple visitors inquired, "Are you Japanese?" This question's underpinning logic rests on the stereotype that Chinese identity remains marginalized within the design community. Why is there such a huge discrepancy between the volume of China's economy and its sense of existence in the independent design community? To answer this question and explore the intricate interplay between Chinese identity and the design industry, this study endeavours to dissect how Chinese identity intertwines with the design industry, as seen through the eyes of Chinese independent product designers.

The process of globalisation significantly impacts Chinese identity. After 1978, in a quarter of a century, China has 'moved from communism to capitalism' (Guthrie, 2012, p6). The world's largest communist society is also the world's most dynamic capitalist economy, which is one of the greatest ironies of our time (Wang and He, 2014). The juxtaposition of China's economic progress with its political identity engenders a significant contradiction. Meanwhile, globalisation has also inevitably brought about the Americanisation of global culture, weakening the integrity of local and national cultures, and Chinese culture has been deeply affected by it (Knight,2006). Few countries in history have gone through such a process of transformation involving the economic, political, and cultural spheres, and such a profound transformation is bound to bring about extremely sharp pains in the face of identity (Liu& Turner,2018). The fluidity and pluralism of identity and culture, the homogenisation of lifestyles, and the ambiguities within traditional Chinese culture have all contributed to difficulties in the perception of Chinese identity, which is the Other in the West's context (Said, 2003). However, the impact of globalisation on various fields varies significantly, for example, traditional fine arts, such as Chinese calligraphy, is a cultural phenomenon that remains intricately connected to traditional culture and exhibits minimal association with economic practices of capitalism. So Chinese calligraphy stands as a rare example of a cultural heritage that has endured relatively unchanged for over a millennium and has experienced limited influence from Western factors. In stark contrast, design, particularly product design, maintains a close and intricate relationship with the industrialisation process and cultural and aesthetic contexts, thereby prominently exemplifying the paradoxical implications of globalisation on cultural practices and identity construction. This demonstrates the special attributes of design, especially product design: it can serve as a social medium for loading, extending, and exchanging information, and this research exploits this quality by using product design as a lens to gain insight into the entanglements generated by China's cultural- political-economic identities.

2. Aims of the study

This research focuses on Chinese independent product designers who design lamps and furniture for both national and international consumption. Chen (2006) previously highlighted the lack of globally influential design studios and designers in China, which impacted Chinese designers' identity to some extent. However, after 17 years, China has witnessed the emergence of a group of Chinese independent product designers, such as Frank Chou and Mario Tsai, who now attain stability in profits from their studios, collaborate with European brands like Louis Vuitton, and frequently feature in international exhibitions and media platforms such as Wallpaper. This research takes this small group of independent designers as a starting point to explore how they differently perceive their Chinese identity and how they understand the impact of modern Chinese identity in design practice, manufacturing, and marketing. The objective of this research is to enhance academic comprehension of the professional experiences of Chinese independent product designers and their perspectives on Chinese identity by gathering and analysing their narratives. Pavitt and Crowley's (2008) exhibition and book "Cold War Modern" unraveled the multifarious ways in which Cold War politics and attendant anxieties imprinted themselves upon the canvas of modernist art, design, and architecture post- 1945. In congruence with this lineage, this study aims to offer inspiration to other scholars interested in exploring 'Chineseness' or investigating the influence of diverse national cultural contexts on design. From a practical perspective, through the in-depth analysis of the independent design field's development in China and the consolidation of experiences from established practitioners,

this research seeks to make valuable contributions and serve as a reference for aspiring young designers pursuing careers in this domain. For national design agencies and cultural departments, this study hopes to help them broaden their systematic understanding of Chinese culture by sorting out the Chinese independent design industry and Chinese independent product designers' narratives.

To achieve these objectives, this research is structured around five primary research questions, serving as the foundation for the study's investigation:

1. How have important periods in China's product design trajectory influenced the contemporary Chinese independent product design industry?
2. How did cultural Chinese characteristics impact the construction of modern Chinese design?
3. How do Chinese independent product designers perceive their Chinese identity?
4. How do Chinese independent product designers organize their design and production, whether situated within China or abroad?
5. How do Chinese independent product designers promote their identity at domestic and international exhibitions?

3. Methodology

This research methodology centered on ethnography, involving qualitative analysis through specific methods, including interviews, observations, and thematic analysis. This study primarily focused on interviewing a cadre of famous Chinese independent product designers, including Mario Tsai, Xu Gang (Bento Studio), Frank Chou, Sing Chan, Gao Guqi (Fnji), Weng Yuxin (YUUE), Mona He (Studio Monana) and Jiang Qian (Studio DEJAWU).

These interviews gathered first-hand information about their experiences in the field. Subsequent to two months of fieldwork, the author was involved in extensive engagement at Mario Tsai's studio and Milan Design Week 2023. The immersion in Mario Tsai's studio environment facilitated comprehensive insights into all facets of design, manufacturing, and promotional activities. At Milan Design Week 2023, the author conducted observations focusing on Chinese designers' presentations and the articulation of their identities. This comparative study extended to designers from other countries, notably Norway and Denmark. The aim was to investigate how their national governments and cultural organizations incentivized and facilitated their participation while fostering cultural exchange. After the transcription of all collected material, the thematic analysis served as the analytical framework to decipher patterns, recurrent themes, and underlying meanings embedded within the extensive data acquired through interviews, observations, and fieldwork.

4. Findings

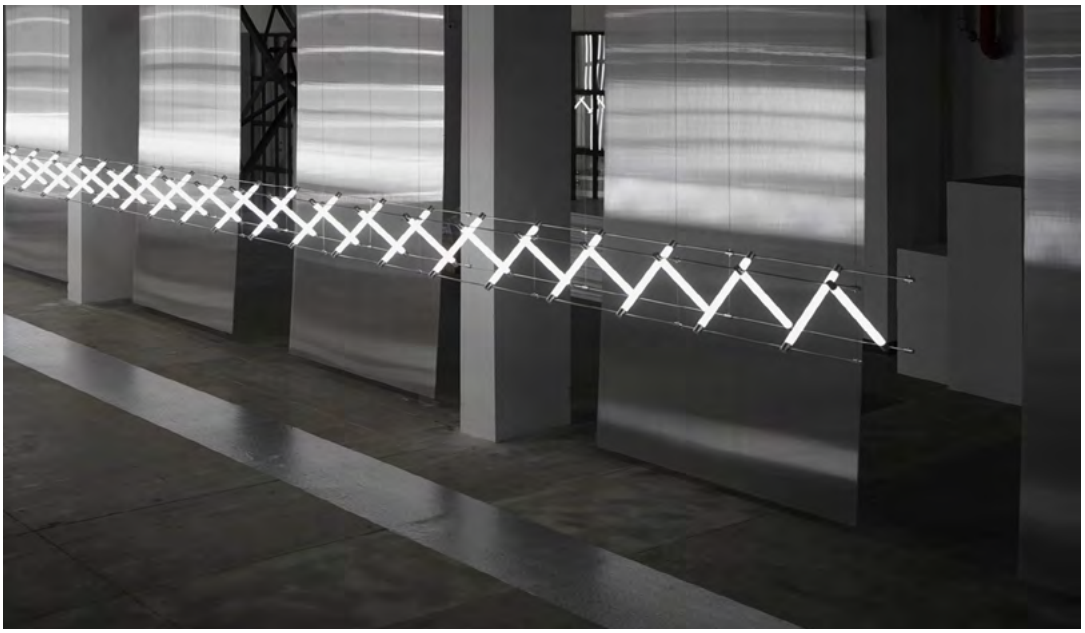


Figure 1. Mario Tsai' Mazha system. The conductive transmission of low voltage across the structure of the lighting allows the lamp to be free from wires and to build diverse and endlessly changing systems with free units. Based on these theoretical and technical foundations, the first generation of modular lighting systems in the Mario Tsai studio was inspired by the traditional Chinese sitter Mazha Lighting System.

I look at the works of these designers (see Figure 1&2), it is almost impossible to find typical Chinese symbols. Instead, they have gravitated towards a design language characterised by its simplicity and universality. Xu and Xie (2019) suggest that Chinese designers predominantly follow Western design systems and aesthetics while overlooking elements of Oriental culture, which affects the construction of their Chinese identity. This research questions this argument, particularly in today's transcultural and globalised world: is the incorporation of classic Chinese cultural symbols indeed the quintessential conduit for the manifestation of Chinese identity in design? However, from another perspective, does the adoption of a so-called universal design language by Chinese independent product designers contribute to expediting the disappearance of China as the 'Other' in the field of design? This research prompts contemplation regarding the extent to which the modern Chinese design might merely function as a rhetorical device, homogenising and consolidating diverse individuals within a specific context. The ostensible emphasis on distinct markers of identity often obfuscates the underlying Western cultural lineage and identities, thereby rendering the 'Other' designation vacuous, making the term 'modern' transmuted into a tool for assimilation. This research explores the reasons behind this conflict, drawing from the historical development of Chinese design from ancient times to the present, the high degree of homogenisation of designed products in the context of East-West fluid relationships, and Western design colonialism.



Figure 2. Sing Chan’s Fragment. Sing Chan's work uses stainless steel folded into long, tense vertebrae with textured glass, exposed lamp bases, screws, and wires to create a structured product.

Jean Baudrillard (1976) claimed that the manufacture of industrial products is not only a process of material production but also a construction of consciousness and discourse. And China is in this secondary discourse. Due to historical negative evaluations of faulty quality toys and toxic pet food, the “Made in China” label is still evaluated negatively (Ling, 2022). Apart from being the world's factory for low-end manufacturing, the Shanzhai factory is also a highly negative label. In Chinese, Shanzhai means “mountain stronghold,” but it is more often used to refer to fake goods (Han, 2017, p56)(See Figure 3), representing a subversive play on the original. Paradoxically, the Shanzhai phenomenon serves as an essential innovation model for China's technological advancement and embodies the spirit of open source (Lindtner and Greenspan, 2015; Wu et al., 2020). Nonetheless, the open-source socialist ideology underlying Shanzhai has inflicted a severe blow upon the independent design sector and the safeguarding of Chinese independent designers’ intellectual property rights, and even worse, they have also suffered from the negative perceptions of their image brought about by Shanzhai, which means they became double victims of Shanzhai. Using manufacturing as an entry point, the study provides insights into the ideological conflict between the careers of Chinese independent designers and the Shanzhai phenomenon, tacitly condoned (or even covertly encouraged) by the government (Hennessey, 2011). Shanzhai embodies a deconstruction of conventional notions of ownership, serving as a pivotal catalyst for expansive production on a broader scale, facilitating enhanced livelihoods for a more significant number of individuals, thereby engendering the realisation, to a certain degree, of what can be referred to as a "commonwealth society." In other words, fundamentally, this contradiction is an inherent conflict between capitalist Chinese characteristics and political Chinese characteristics, this dual victimisation illustrates the inherent contradiction between capitalist and political characteristics in China and unveils a deeper exploration into the role of national political formations in design development.



Figure 3. Shanzhai Gucci shoes, with the label "made in P.R.C.." Photo taken on 16/12/2023 by author.

The fact that China is a manufacturing but design-undeveloped economy, rather than a design-developed one like Japan, profoundly but subtly shapes the overseas promotion of Chinese independent product designers. A decade ago, some Chinese manufacturers attended Milan Design Week to take photographs to copy since many Italian manufacturers were reluctant to receive Chinese guests (Liu, 2016). As a result, some Chinese “designers” printed Japanese business cards, and they had a clear division of work, with someone in charge of the tabletop and someone copying the legs (Ibid). This negative impression of plagiarism and past absence at international exhibitions is an inherent disadvantage for Chinese independent product designers nowadays. This research uses Milan Design Week as another focal point to explore how these designers strategically market their identities and challenge implicit stereotypes caused by “Made in China” and Shanzhai.

Furthermore, a comparative analysis of Design Shanghai and Milan Design Week illuminates the varied formats and participation dynamics, revealing how exhibitions can serve as vehicles for identity promotion and industry representation.

5. Conclusion

In essence, the complex nuances within Chinese identity in design underscore the intricate interplay between global influences, cultural legacies, and economic realities. This study serves as a stepping stone in unraveling the multifaceted narratives of Chinese independent product designers, shedding light on the ideological conflicts, cultural tensions, and strategic manoeuvres within the global design landscape. The exploration of identity construction within the design realm unveils an ongoing discourse where

'Chineseness' negotiates its place amidst globalised paradigms, redefining notions of modernity, identity, and cultural representation in design practice. From a cultural perspective, this study calls for a detachment and liberation of contemporary Chinese design from past traditional culture and the Chinese government's propaganda. It anticipates cultural representation in design to manifest in a more nuanced and profound manner rather than merely through symbols. From the standpoint of manufacturing, independent design undertaken by designers represents a sophisticated top-down influence within society. However, during the research process, it was found that the Shanzhai phenomenon is evolving into a more diverse and democratic force, encompassing societal powers at the grassroots level. The intertwining of these two forces has created a complex landscape within China's social design sphere. In the realm of promoting within the international design community, while the identity label of Chinese designers serves as a rapid and efficient means of promoting and establishing inherent impressions, designers are hesitant to play the identity card any longer. This is because such Orientalist expectations often act as constraints when endeavouring to create designs that reflect a more modern outlook.

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P/REFERENCES OF DESIGN

DESIGN TOOLS FOR A SUSTAINABLE HEALTHCARE: EMPOWERING MEDICAL PROFESSIONALS WITH MULTIFUNCTIONAL CONSUMABLES APP.

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KEYWORDS | CONSUMABLES, HEALTHCARE, CIRCULAR ECONOMY, RESOURCES MANAGEMENT, SYSTEMIC SUSTAINABILITY

ABSTRACT | Climate change, linked to greenhouse gas emissions, has been identified as the primary challenge to public health in the 21st century. The medical device supply chain contributes to over 70% of the healthcare sector's emissions, encompassing the production, transportation, and disposal of items such as drugs, hospital equipment, instruments, and medical devices. The doctoral research focuses on consumables management within the Department of Neonatology of Umberto I Polyclinic of Rome, aiming to support medical personnel and administrative staff in optimizing the procurement, utilization, and disposal of medical consumables. Through a collaborative design process involving key stakeholders, the objective is to create an innovative mobile application that improves the efficiency of managing disposable medical consumables associated with electromedical equipment and medical procedures. This app is anticipated to deliver several benefits, including enhanced operational efficiency, real-time tracking of consumables, and comprehensive data collection for investigating circular design strategies from both qualitative and quantitative perspectives. Relieving users' cognitive efforts, the application promotes sustainable practices throughout the lifecycle of disposable medical consumables, spanning procurement, usage, and disposal. This, in turn, contributes significantly to broader sustainability initiatives. In the long run, implementing strategies focusing on sustainable product use holds the potential to revolutionize how we approach medical consumables. By emphasizing redesign, reuse, recovery, and recycling, these strategies can improve resource availability, minimize waste, and foster systemic sustainability within the healthcare sector.

1. Introduction

Climate change, linked to greenhouse gas emissions, has been identified as the primary challenge to public health in the 21st century. The increasing aging population, rising rates of non-communicable diseases, and rapid advancements in medical technology combine to escalate the demand for healthcare. Without sufficient mitigation measures, this will increase the carbon footprint of healthcare systems (Smith, 2022). These converging factors pose significant challenges for healthcare systems (Karliner et al., 2019; Victoria Gov., 2021). The healthcare sector, in its ongoing dedication to improving societal well-being and health, provides curative care, generating significant economic and environmental impacts due to the extensive use of energy and resources, thereby becoming one of the most polluting sectors globally (Echkelman, 2020; Watts, 2019). To ensure a high level of care, these facilities require a wide range of medical supplies and equipment. Health Care Without Harm has highlighted that the medical supply chain contributes to over 70% of the healthcare sector's emissions, encompassing the production, transportation, and disposal of items such as drugs, hospital equipment, instruments, and medical devices (Karliner et al., 2019). Since the 1980s, SUDs have followed a linear product economy model, causing significant waste and emissions, leading to environmental and public health damage (Benedettini, 2022; Moultrie, 2015). This inherently unsustainable production and consumption model contributes to global ecological destruction, depletion of natural resources, excessive generation of solid waste, global greenhouse gases, and other harmful environmental emissions (Mac Neill, 2020; Rizan, 2023).
To reduce the high volume of waste produced daily by SUDs, the introduction of a circular supply chain can be implemented by adopting innovative human-computer technologies to improve efficiency and transparency in consumable management (SUDs and reusable medical devices), staff training (Walker, 2008; Wani, 2013), and the promotion of sustainable clinical practices (Mang, 2023; WHO, 2017). Similarly, to achieve an ecological transition in the healthcare sector, it is necessary to drive changes in healthcare practitioners' behaviors by engaging various stakeholders in sustainable systemic design phases related to SUDs throughout their entire lifecycle (Hinrichs et al., 2022). To understand and improve healthcare personnel behaviors in the use of consumables, this study focused on Neonatology and the Neonatal Intensive Care Unit at Umberto I Polyclinic of Rome. This department exhibits one of the highest uses of SUDs and significant impacts on costs and the environment (Newman, 2011; Nichols, 2014). The issue originates from a pilot study conducted by Verma et al. (2019), which highlighted that neonatal care, given its acute nature and the high frequency of admissions related to neonatal sepsis and infections, involves the disposal or sterilization of all unused items near neonates that test positive or are suspected of having an infection. Therefore, the doctoral research explored the lifecycle of medical consumables for Neonatology departments in hospital settings, where new sustainable solutions can be observed, designed, and tested for the entire product lifecycle, including proper separation and disposal within the hospital area. In particular, the research questions guiding the study were as follows:

- What behaviors do stakeholders exhibit during the lifecycle of single-use medical devices in Neonatology and the Neonatal Intensive Care Unit at [hidden for peer review]?
- How can interdisciplinary collaboration involving healthcare service users, stakeholders, and hospital staff enhance the delivery and use of healthcare services, particularly in the sustainable management of single-use medical devices?
- What sustainable solutions can be designed and tested to optimize the entire lifecycle of medical consumables, including acquisition, management, use, separation, and disposal?

The research aim is to improve and make transparent the acquisition and management practices of medical consumables for healthcare professionals through the implementation of a mobile application for real-time access to critical information, such as consumables inventory, usage, disposal methods, and their linkage to electromedical equipment and daily clinical treatments in the hospital. After implementing the mobile application in the departments, the results will be analyzed, and staff satisfaction will be assessed. These data will guide future research, providing insights into the procurement, use, and consumption of consumable products within the department. The goal is to identify consumables suitable for circular design strategies without compromising the efficiency and quality of the supply chain.

2. Literature review

2.1 Single-Use Medical Devices and Environmental Impact

Medical devices constitute a significant portion of emissions from healthcare supply chains (Eckelman, 2020; Sousa, 2021). Numerous studies compared the use of SUD with reusable alternatives, highlighting that SUDs typically involve significantly higher petrochemical consumption and global greenhouse gas emissions over their lifecycle (McGain et al., 2010; Sanchez et al., 2020; Sherman et al., 2018). Research, such as that conducted by KPMG (2023), has examined the end-of-life of single-use medical devices and their contribution to environmental pollution. Indeed, the study emphasizes that:

> "Currently, many single-use medical devices and equipment are disposed of through incineration, which generates a dangerous emission of greenhouse gases and has poor ecological credentials. However, every other potentially 'greener' disposal option should be carefully considered, as its benefits are not always easily attainable, with complications such as collection, sorting, and transportation that could add to harmful emissions as much as incineration, especially if size and volume are not managed correctly." (KPMG, 2023)

2.2 Single-Use Medical Devices and Environmental Impact

Effective management of medical consumables has become an area of growing importance in the healthcare sector, identified as a key lever for cost containment in industrialized countries (Volland et al., 2017). An urgent issue pertains to costs and waste associated with the management of medical consumables, which represent about 30% of hospital operating budgets (Zepeda, 2016). There is a growing emphasis on optimization techniques to address the rising healthcare expenditure (Volland, 2017), suggesting the implementation of new management methods to improve operational performance (Aptel et Pourjalali, 2001). For example, an audit in an Australian intensive care unit revealed that 60% of total waste was potentially recyclable with proper processes (McGain et al., 2009). Effective consumable management is closely linked to the optimization of the supply chain, and leveraging inventory management and control can enhance hospital supply chain performance (Dasaklis, 2012). Integrating information systems through technologies like RFID could improve logistics and supply chain management in healthcare (Çakıc et al., 2011; Chong et al., 2015; Reyes et al., 2012). Research suggests that the integration of digital technology into healthcare systems serves as an innovative solution to address the complexities of supply chain management for quality healthcare management (Kim et al., 2016).

3. Methodology

To address challenges and gaps in hospital consumable management, this study adopted a research-based design methodology (Leinonen, 2008) aimed at building on shared evidence to generate design solutions [Figure 1]. This methodology includes the following phases: 1. contextual inquiry, 2. participatory design, 3. product design, 4. prototyping as hypothesis.

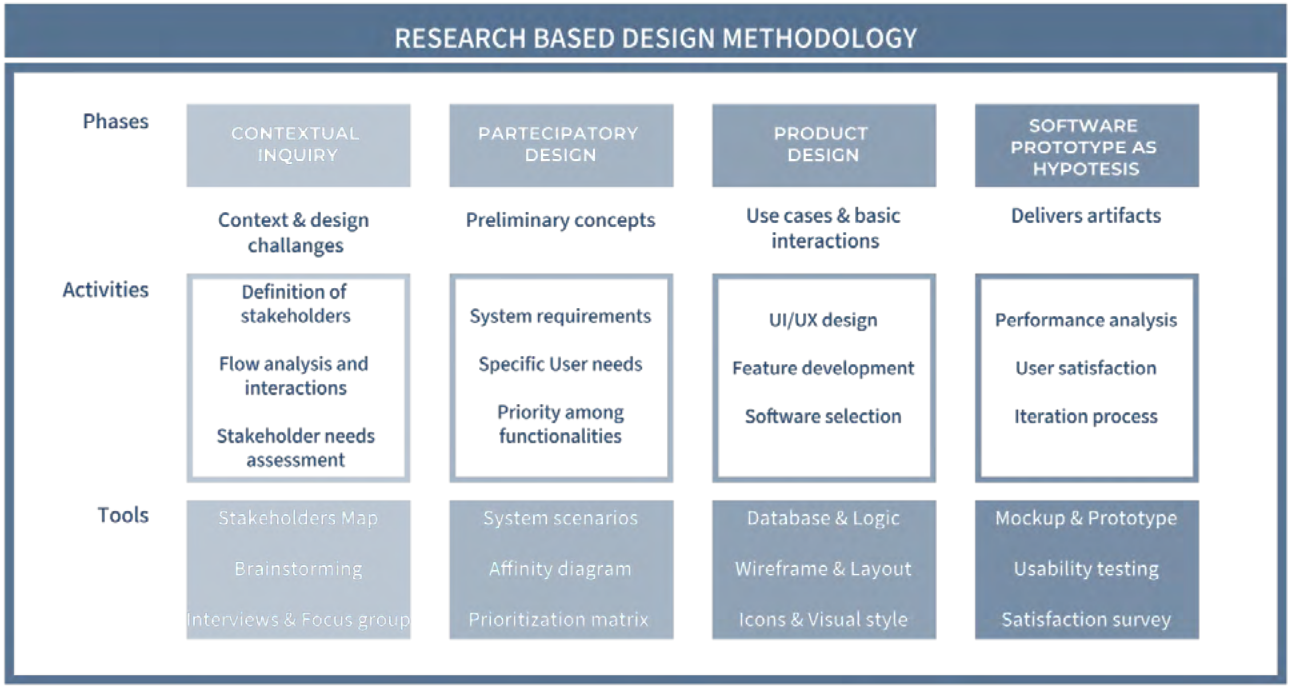


Figure 1. Research-based Design Methodology – adopted from Leinonen, 2008.

1. Contextual Inquiry:
   - Identification of stakeholders involved in consumable management.
   - Analysis of flows and interactions of single-use medical devices (SUDs).
   - Needs assessment through interviews and qualitative research.

2. Participatory Design:
   - Involvement of hospital staff in the development of the mobile app.
   - Collection of key app requirements, including features and technical specifications.
   - Identification of specific needs of hospital staff and stakeholders.

3. Product Design:
   - Selection of tracking management software.
   - User interface design through prototypes and mockups.
   - Development of identified crucial features, considering graphic preferences and design standards.

4. Prototyping as Software Hypothesis:
   - Creation of functional prototypes to evaluate proposed solutions.
   - Evaluation of app performance through usability tests.
   - Collection of feedback on performance, usability, and user satisfaction.

4. Results

The phases of action research have led to several significant outcomes in different stages of the process:

1. Contextual Inquiry:
   - During the stakeholder identification process through comprehensive mapping, it emerged that medical and nursing staff play crucial roles in hospital consumable management. This highlighted the need to create a consumable management support tool capable of guiding nursing staff in adoption decisions.

   - In the analysis of flows and interactions, stakeholders emphasized the importance of compatibility between consumables and department equipment, indicating that some previous consumables were not suitable for the new equipment and vice versa [Table 1]. This was identified as a critical point where consumables were not effectively used. Consequently, solutions were proposed for user training and management in the selection of consumables related to equipment and specific medical procedures and treatments.

Table 1. Stakeholder's needs, challenges, and proposed solutions.

Stakeholder	Needs and Challenges	Proposed Solutions.
Manufacturers	Timely delivery and product quality, regulatory compliance	Supply chain monitoring, quality audits
Medical Device Suppliers	Efficient delivery processes, technical support, long-term supply relationships	Delivery automation, technical support, long-term supply contracts
Hospital Pharmacy	Efficient inventory management, timely procurement	Inventory management systems, real-time inventory monitoring
Administrative Staff	Consumables shortage prevention, optimal costs, supplier management	Improving procurement processes, negotiating contracts with suppliers, reviewing policies.
Medical Staff	Compatibility between consumables and equipment, stock availability, patient safety	Compatibility assessment, entry and exit tracking systems
Nursing Staff	Efficient reordering, quick access to consumables, error reduction	Stock-based reordering, bar codes to identify consumables, staff training
Social and Health Care Workers	Easy consumable acquisition and transport, proper waste separation	Transportation procedures knowledge, waste management training
Waste Collection and Disposal Companies	Safe collection and disposal of medical waste. Reduced environmental impact waste	Waste treatment training, collection and disposal operations monitoring, environmental regulations compliance
Local and National Health Authorities	Regulatory compliance, transparency in hospital practices, quality of care	Policy review, promotion of audits, compliance support.

   - Through interviews with departmental staff, various challenges related to the supply and management of consumables emerged. During these interviews and multidisciplinary brainstorming sessions with doctors and nurses, qualitative observations were made, highlighting the need to create an IT system capable of monitoring consumable depletion rates and issuing alerts for inventory management.

2. Participatory Design:
    - To address the needs, a quantitative analysis was conducted, categorizing clinical procedures, equipment, and department consumables. This led to the creation of Excel databases to store this information. The goal was to automate reordering based on stock levels, implement a consumable tracking system, develop an app for staff training, and integrate everything with the hospital's supply system. Currently, the research focuses on finalizing the app structure and guidelines for consumable disposal in collaboration with a Computer Science Department student at Sapienza University of Rome.

3. Product Design:

The product design phase for the identified solutions was divided into two stages: user interface design, feature development, and software selection.

- User Interface Design: completing these activities allowed the design of the app's user interface in the considered context together with healthcare professionals [Figure 2]. The goal was to make navigation seamless for users, with elements arranged logically and easily accessible. Regarding colors, a palette inspiring trust and seriousness was chosen, using dark blue tones for the main sections and light blue for buttons highlighting positive actions. This color scheme aimed to create a professional and minimalist atmosphere. Additionally, the contrast between text and background was considered to ensure good readability. As for fonts, a clear and easily readable font type was selected, with a size suitable for both mobile devices and desktop or tablet stations.

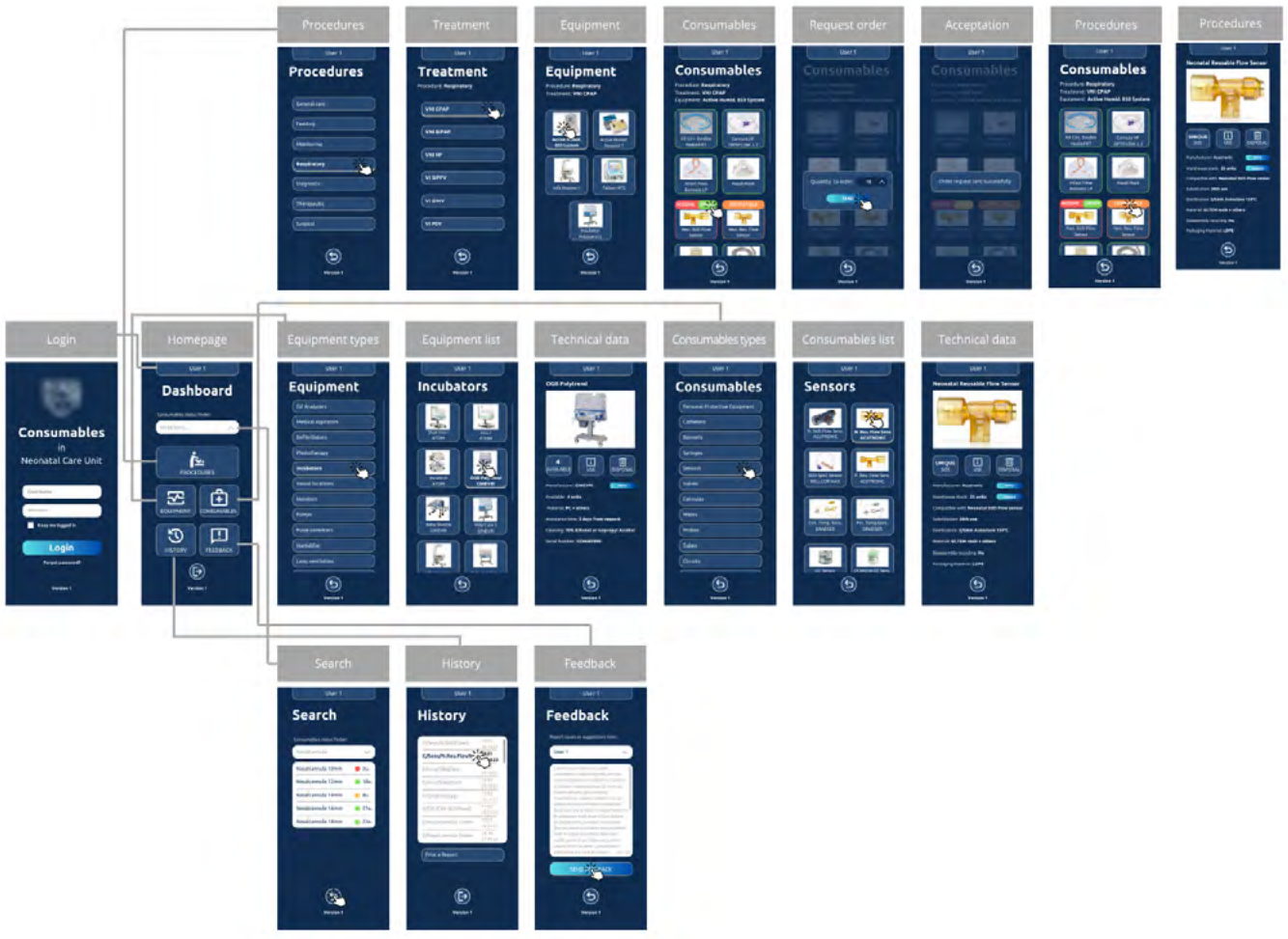


Figure 2. User flow App prototype.

- Feature Development: during the feature development phase, the app was enhanced with a welcoming home page, user access and profile management, a functional dashboard, and a smart consumable search feature. Relationships between procedures, equipment, and consumables were established, and comprehensive management systems for equipment and consumables were implemented. A feedback system was integrated for continuous improvement, and a history and reports function was added for monitoring and compliance purposes.

4. Software Prototype as a Hypothesis:
   - Evaluation of the app through performance analysis: a clearly defined protocol involving healthcare professionals was employed to assess the app's performance. The evaluation included various activities such as app access, consumable search, report generation, barcode scanning, and real-time inventory viewing. The results provide valuable insights into app performance and inform targeted improvements to enhance the user experience in healthcare material management. Key parameters evaluated include:
     - Completion Time: The average time users took to complete assigned tasks, measuring speed and efficiency.
     - Success Rate: The percentage of users who completed tasks without issues, reflecting app usability and user competence.
     - Issues Encountered: Documentation of problems or challenges encountered by users during app usage, such as interface errors, technical difficulties, or navigation confusion.

5. Conclusions and Future Developments

The integration of a mobile app for hospital consumable management is a significant step toward optimizing healthcare operations and achieving sustainable environmental goals. Achieved through a co-design process with key stakeholders, this approach addresses specific needs and challenges in Neonatology and Neonatal Intensive Care. Analysis of fluctuations and interactions highlights the importance of medical device compatibility and inefficiencies in consumable management. The app addresses these issues, offering efficient inventory management, detailed reporting, waste reduction, and improved healthcare operations. Ongoing user involvement and feedback ensure adaptability. The current phase focuses on the tracking system and the user interface, with plans for further system refinements. This project underscores the value of interdisciplinary collaboration and user involvement, promoting behavioral change at various levels. Investing in innovative technologies enhances healthcare efficiency and quality, paving the way for future research in hospital consumable management.

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P/REFERENCES OF DESIGN

CUSTOMER, USER, OR CITIZEN? A COMPARATIVE ANALYSIS OF HUMAN-CENTERED DESIGN PARADIGMS.

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ABSTRACT | A person is always a human being but not always a user, a citizen, or a customer. These terms bring normative and value models that shape how we think, act, and design. And yet, central to design thinking theory and practice, they are used interchangeably. This short paper explores the point of convergence and contrast between different people-centered paradigms. Through systematic literature review, two distinct clusters are identified: the first connects customer and user centricity and is concerned with situated and solution-driven instances; the second associates citizen and human centricity and refers to undefined and discovery-driven instances. This comparative analysis suggests that more research is needed to frame design thinking better when introduced to the public sector, as different values and tensions might be at play. It is the purpose of our Ph.D. proposal to address the knowledge gap at the boundary cracks between design thinking and complex policy change, where design is confronted with politics, power, and democratic dialectic.

1. Introduction

In recent years, growing discontentment with democratic politics has increased worldwide (Foa et al., 2020). In addition to internal pressure, governments are confronted with external burdens of ambiguous, volatile, “wicked” problems (Brown, 2010; Buchanan, 1992). As governments seek solutions, innovation in the public sector appears to be a promising path to foster citizens' engagement on one side while reducing costs and improving efficiency on the other (Lewis et al., 2017). However, more innovative forms of government do not necessarily reflect more open, accessible, and democratic governance (Johnson & Kolko, 2009). Amongst innovation paradigms, design thinking (DT) has captured the attention of governments worldwide (Kimbell, 2016). DT derives from the processes and methods of industrial designers, expanding on the concept of “human-centered design”, often referred to as “user-centered” (Norman, 1998, 1992), which aims at including human factors in the design of information and technology systems. Although the public sector is not new to design thinking (Howlett, 2014), it is the application to the business endeavors that propelled its diffusion, creating methodologies that reflect a business and commercial mindset (Cross, 2019; Shah et al., 2000; Sheth et al., 2000). However, it appears that simply translating DT within the context of public services and policies does not come effortlessly (Brinkman et al., 2023; Tromp & Hekkert, 2019).

Despite the different endeavors, the terms human-centered and user-centered design have been used interchangeably (ISO 9241-210:2010), as well as “citizen” and “customers” (Osborne and Gaebler, 1992), whether or not they have similar meanings or implications. The different paradigms are based on the concepts of “humans,” “users,” “citizens,” and “customers,” which are not synonymous, and they refer to specific, situated, and contextualized instances. A person is always a human being, but not always a user, a citizen, or a customer. These terms bring normative and value models that shape how we think, act, and design (Denhardt and Denhardt, 2000). Lewis et al. (2019) argue that when design thinking meets the power structure of politics, it risks disestablishment. Simply applying the commercial paradigm of design thinking to the politics of policymaking might not be the answer. There is a new and exciting space of research, a locus where lies a broader opportunity for design to make an impact. Our PhD research aims to address the knowledge gap between design thinking and high-level, strategic, and complex policy change.

In this paper, we first investigate similarities and differences in relationship, audience, scope, and values of customer, user, human, and citizen-centric paradigms. Secondly, two clusters are proposed, each with distinct qualities. Finally, we present further research implications for design thinking in the public sector.

2. Four Human-Centered Design Paradigms

In this section, we discuss four human-centered paradigms that sit at the core of design thinking theory and practice. We first introduce customer centricity; then we discuss user-centricity; third, we present human centricity, and we conclude with the citizen-centricity paradigm. Each of these paradigms is scrutinized in terms of relationship, audience, scope, and values.

2.1 Customer-Centricity as a Competitive Advantage

The attention toward customer wants is not new to the industry context, Levitt (1960) argued that companies should not focus on selling products but rather on addressing customer needs. The move from product to market-driven firms already began with the new marketing science (Keith, 1960), whereas customer centricity emerged as a powerful way to establish mutually satisfactory customer relationships (Day, 2003). According to Boulding et al. (2005), there is a double value exchange between customers, who manifest their needs, and firms, which activate their internal resources to meet customers’ requirements while, in the process, creating value for the firm. Ultimately, customer centricity provides the most profitable, and not easily countered by competitors, way to develop close customer relationships (Shah et al., 2000). In this paradigm, customer feedback is integrated into participatory decision-making processes;

the supply chain makes available the resources for highly customized offerings (Lamberti, 2013), and customer needs permeate the whole organization, continuously adapting to customers' preferences, including their emotional, and ethical, social selves (Sun, Li, & Zhou, 2006). In short, the main characteristics of the customer-centricity paradigm imply:

- Establishing a bidirectional relationship with the customer, which is exclusive and targeted.
- Increasing the profitability of the firm while creating value for the customer.
- Transforming the whole organization to fulfill customers' needs.
- Implementing solutions and offerings to contingent and defined customer requirements

2.2 User-Centricity Improves the Usability of Technology Systems

Donald Norman coined the term "user-centered system design" to refer to the practice of engaging the users of designed artifacts, bringing their needs and perspectives into the design process (Marti & Bannon, 2009; Norman, 1988). User centricity is rooted in the mix of ergonomics and psychological studies that seek to recognize the many factors that describe users as humans, reclaiming their role in the interaction with technological systems (Gould et al. 1998; Nielsen 1993). According to Richter and Fluckiger (2014), the user-centered approach involves understanding the user and the context, designing a suitable solution to the problems identified, moving from solution to prototyping and development, supporting the implementation, and finally evaluating the results through user-testing (Gulliksen et al., 2010). Comparably with customer-centricity, user-centered design impacts the whole organization throughout the development lifecycle (Kapor 1990). User centricity increases user productivity and operational efficiency, lowers costs related to training and development as a result of products being more understandable, and improves affordability, accessibility, and overall usability (Chammas et al., 2015).

In conclusion, user-centricity is characterized by:

- A clear action cycle that rotates around the object of usage, which needs to provide feedback on its use to the user him/herself.
- Full iterative integration of users in the design process.
- Improving overall efficiency and efficacy of a system interacting with humans.
- Addressing well-defined and known technical issues.

2.3 Human-Centricity Reflects Human Dignity

Originating from the European human-centered movement of the 1970s, human-centered design acknowledges cultures, practices, and costumes that make humans human (Gill, 1996). According to Boy (2017), human-centered design emerged in contrast to the engineering sciences, which believe that engineers lead the design, and only then can users give feedback on what is produced. Initially lingering towards human rights and human dignity (Buchanan, 2001), the concept of human-centered design was encapsulated by the user-centered approach (ISO 9241- 210:2019). However, the original human-centric paradigm seems to consider a stronger focus on the specificity of cultural diversity when interacting with a design artifact, be it a policy, a service, or an interface. It works with concepts such as human purpose, participation, representation, and tradition (Buchanan, 2001;). On the contrary, the user-centered paradigm is concerned mainly with user practice and user modeling, focusing on the relationship between users and technology without questioning how and why technology might be of service in supporting human activity (Gasson, 2003).

To summarize, the human-centered design paradigm's characteristics are as follows:

- Humans are at the core, as defined by their multiple diverse cultures, practices, and ethnicities.
- It is an essential instrument for implementing and embodying the principles of human rights and human dignity in everyday life.

- Serves human beings and their context in their various activities.
- Establish new forms of participation and representation.

2.4 Citizen-Centricity is Complex and Multifaceted

Despite the growing popularity of the term “citizen-centered” applied to services, policies, and even governance models (Bergvall-Kåreborn & Ståhlbrös, 2009; van Velsen et al., 2009), it seems that governments struggle to be more citizen-centric. Følstad et al. (2004) argue that the lack of user involvement might be one of the reasons for governments to fall short of this promise. However, both Kotamraju et al. (2012) and van Velsen et al. (2009) agree that much of the criticalities are to be found in the differences between governmental services and their commercial counterparts.

Public services address heterogeneous user groups and therefore cater to different cultures (Sandberg & Pan, 2007), capabilities (Wang et al., 2005), political convictions (Oostveen & Van de Besselaar, 2004), and disabilities (Legge 9 gennaio 2004). Citizens access complicated content, which is often linked to policies, and its ownership is shared across public institutions, requiring not only interoperable systems but also interoperable capabilities (Interoperable Europe Act, 2022). In addition, in public services, the provider-user relationship is complex and often characterized by friction and tensions (Brinkman et al., 2023; Tromp & Hekkert, 2019). Notably, even the least repressive and most democratic governments are coercive institutions: they seek to provide for citizens' needs, even if this means going against their wishes - e.g., paying taxes (Kotamraju et al., 2012). Lastly, governments are held accountable for the present and for the future, extending the scope to include intergenerational justice (Glotzbach and Baumgärtner, 2012; Gall et al., 2021).

We can identify some distinct properties of citizen centricity, namely:

- The relationship is ambiguous and, at times, conflicting.
- Civil, political, and social rights are intrinsically embedded.
- It is held accountable for accessibility, usability, and dignity of all.
- Address the plurality of human voices, providing international and intergenerational justice.

3. Comparative Analysis

Through a systematic literature review, four human-centered design paradigms were scrutinized. From the analysis, we identified three main characteristics that sit at the intersections of the four paradigms. We list them as follows:

- The involvement of not-experts in domains first led by experts only (Norman, 1988; Shah et al., 2000);
- The enhancement and improvement of processes and services (Marti & Bannon, 2009; van Velsen et al., 2009);
- The transformation of organizations from within, aligning it to people’s needs and requirements (Boy, 2017; Sheth et al., 2000).

Secondly, we interrogate each paradigm on the relationship it establishes, the audience it refers to, its scope, and the value it embeds. Two distinct clusters emerged with defined qualities. As illustrated in Table 1, the first cluster relates to context-dependent instances, whereas the second cluster concerns fundamental rights-dependent instances. The first customer-user cluster refers to situatedness and works with known socio-technical problems. Both customer and user centricity establish an exclusive, bidirectional relationship between customer/user- firm/product, are transaction-oriented and solution-driven (Marti & Bannon, 2009), and technology is key to establishing long-lasting customer-firm relationships (e.g., Apple products or Amazon services). On the other hand, the second cluster of human

and citizen centricity encompasses humans as well as non-human actors (e.g., the environment) because it considers fundamental human rights (e.g., access to clean water and sanitation, etc.). It is multimodal and problem-discovery driven and establishes a multi-directional, inclusive, and diversified relationship across actors' systems (Brinkman et al., 2023; Gasson, 2003). Ultimately, its humanism emerges from the centrality of positive social impacts, such as in the Cool neighborhood (New York, 2017) and Climate shelter projects (Barcelona, 2021).

Table 1. A Comparative Analysis of Human-Centered Design Paradigms.

Clusters	**Cluster 1: Context-dependent**	**Cluster 2: Rights-dependent**
Human-centered design paradigms	User and customer centricity	Human and citizen centricity
Relationship	Bidirectional - exclusive and contextualized.	Multi-directional - inclusive and diversified.
Audience	Focuses on the user or customer which is specified and determined.	It encompasses "humans" as well as "non-humans" actors as it acknowledges human rights.
Scope	Discrete, works with socio- technical known problems.	Complex, deals with wicked and unknown problems.
Values	Transaction-oriented and solution-driven.	Multi-modal oriented and problem-driven.

Each set of clusters contributes to shaping different normative and value models. Consequently, the methodology might not be transferred easily across or even result in negative impacts on the new context (Denhardt and Denhardt, 2000). In public sector endeavors, simply applying a user-centered approach to solve complex challenges without reconsidering the whole set of processes, tools, and methods might be counterproductive. Citizen and human centricity address specific sets of issues, which are positioned at the extreme of the value spectrum of the user and customer-centricity paradigms. Whereas the former might be more appropriate for complex policy reforms, the latter might be more useful for discrete service redesign instances. Rather than considering the terms human, user, customer, and citizen interchangeably, it is crucial to investigate their synergies and divergences as they embody different normative and value models.

4. Conclusions

Considering the growing interest in applying design thinking to policy and services, we scrutinized four human-centered paradigms to clarify differences and synergies. Two clusters were proposed according to similarities and differences in relationship, audience, scope, and values. The first customer-user cluster is context-dependent, whereas the second human-citizen cluster is rights-dependent. Further research into the methods, practices, and processes of each might be required to improve the robustness of our comparative analysis. From this analysis, additional research questions arise: Which position do these clusters play in the public sector, particularly when introduced to the policy-to-service process? Which capabilities are necessary for design professionals to deal with the politics of the policy process and the normative culture of public institutions? Starting from this comparative analysis, we will conduct PhD research to address the knowledge gap at the boundary cracks between leadership, design thinking, and strategic public policy reforms.

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P/REFERENCES OF DESIGN

EATING TOGETHER: TOWARDS A GUT-CENTRED APPROACH IN PARTICIPATORY DESIGN.

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KEYWORDS | EATING, RELATIONAL, EMBODIED, SOCIO-MATERIAL, PARTICIPATORY DESIGN

ABSTRACT | Designing for the complexity of the socio-environmental challenges we are part of requires a shift from individual-centered methods to more respectful and caring practices. As a response, Participatory Design (PD) is expanding its repertoire to embrace relational and processual approaches motivated by the curiosity to articulate a more caring, response-able attitude toward others, humans, and beyond. This research project aims to contribute to this shift by examining the potential of thinking and doing (with) eating as an embodied experience in PD spatial transformation projects. My research approach intentionally translocates the knowledge-making process from the brain to the gut, taking cues from our everyday metabolic engagement and the material relations they create. Through eating, this approach aims to emphasize body experiences as a primary source of knowledge. Preliminary findings highlight a profound link between gut-driven engagement and researchers, designers, and participants' capacity to address complex societal and environmental issues, advocating a shift towards gut-centered PD.

1. Introduction

In the realm of Participatory Design, this paper delves into the nuanced intersection of bodily desires, collective action, and design processes to reimagine how communities can live together. Drawing inspiration from the conference theme "Ways of Living Together," my research addresses the challenges of engaging communities in decision-making, confronts the inherent difficulty in mobilizing active participation, and proposes an approach rooted in exploring bodily desires, explicitly focusing on eating.

Participatory Design (PD) is a collaborative approach that involves stakeholders in the design process, aiming to create more inclusive and sustainable outcomes. It has gained traction in various fields, including urban planning, community development, and healthcare, as a means to address complex societal challenges together with communities (Huybrechts et al., 2022; Huybrechts & Teli, 2020). Rooted in the principles of Participatory Design, our research reflects on bodily desires (Groys, 2022), mainly eating (Mol, 2008), as a means to activate self and collective reflection and action. The research explores how incorporating bodily experiences, centred on processes around digestion, can facilitate deeper connections and more intimate relations between human inhabitants and more-than-human participants (Akama et al., 2020; Akama & Yee, 2016; Baek et al., 2018; Kasulis, 2002; Light & Akama, 2012, 2014), positioning food as a dynamic catalyst for caring and response-able PD.

2. Thinking and Doing with *Eating* as an Embodied Experience in PD

Designing for the complexities of socio-environmental challenges requires a shift from individual-centered approaches to more respectful and caring practices (Pihkala & Karasti, 2022). Participatory Design (PD) is undergoing an expansion of its repertoire to embrace more relational and processual approaches, driven by a curiosity to articulate a more caring and response-able attitude toward others, humans, and beyond (Huybrechts et al., 2022; Huybrechts & Teli, 2020). This research project aims to contribute to this shift by examining the potential of *thinking and doing with eating* as an embodied experience in PD spatial transformation projects (D. Haraway, 1988; D. J. Haraway, 2016). To connect beyond participation, *reaching out by reaching in.* Envisioning ways of doing PD based on explorations to bring ourselves and the people we work with closer to our bodies, closer to our guts, as a way to avoid distant perspectives, forefront socio-ecological relations, stimulate acting, and enable inhabiting among compromised worlds (Braidotti et al., 2018) (Figure 1).

My research approach intentionally *translocates* the knowledge-making process from the brain to the gut through *eating*, taking cues from our everyday metabolic engagement (Mol, 2021) and the socio-material relations they create (Barad, 2003). The reasons for choosing to eat are multifaceted – personal fulfillment, practical considerations, approach exploration, philosophical inquiries, ontological reflections, and pleasurable experiences all play a part. Eating enables us to deeply immerse ourselves as designers in cultivating meaningful connections within our social, cultural, and natural worlds. Eating is an activity we perform every day. Eating is essential for our sustenance and nourishment, but it is also a fundamental bodily desire. As Boris Groys (2022) suggests, bodily desires are mechanisms by which we are brought back to ourselves. Bodily desires connect our thinking with our body, connecting us with the fleshy side of being human. This is also the case with eating. It allows us to engage with the materiality of our existence (Van Daele, 2022). It reminds us of our interconnectedness with the world around us (Mol, 2021).
My experience as a woman growing up in a food-loving family and my role as an architect in transforming community kitchens in Caracas, Venezuela, are feeding the way I approach Participatory Design. Following a *gut feeling* – could also be named the ethnographic hunch (Pink, 2021) – about the very material possibility of carrying out a more caring (De La Bellacasa, 2012) and engaging PD by centering its processes around eating. Annamarie Mol's ethnographic approach theoretically supports this gut feeling. In her book, "Eating in Theory," she explores how bodily sustenance processes like eating and digesting foster an alternative way of "being, knowing, doing and relating" that facilitates a deeper understanding of our interconnectedness and socio-material relations with other living beings, promotes collective

responsibility and fosters sustainable practices (Barad, 2003). She also delves into the situatedness of eating, the positionality of the eater, and the mutual transformation coming from this engagement:

> "Knowing may also come about when, in a specific situation, a specific person attends to selected bits of the world that, as she ingested them, affect her in this or that not-quite-predictable way" (Mol, 2021, p. 61).

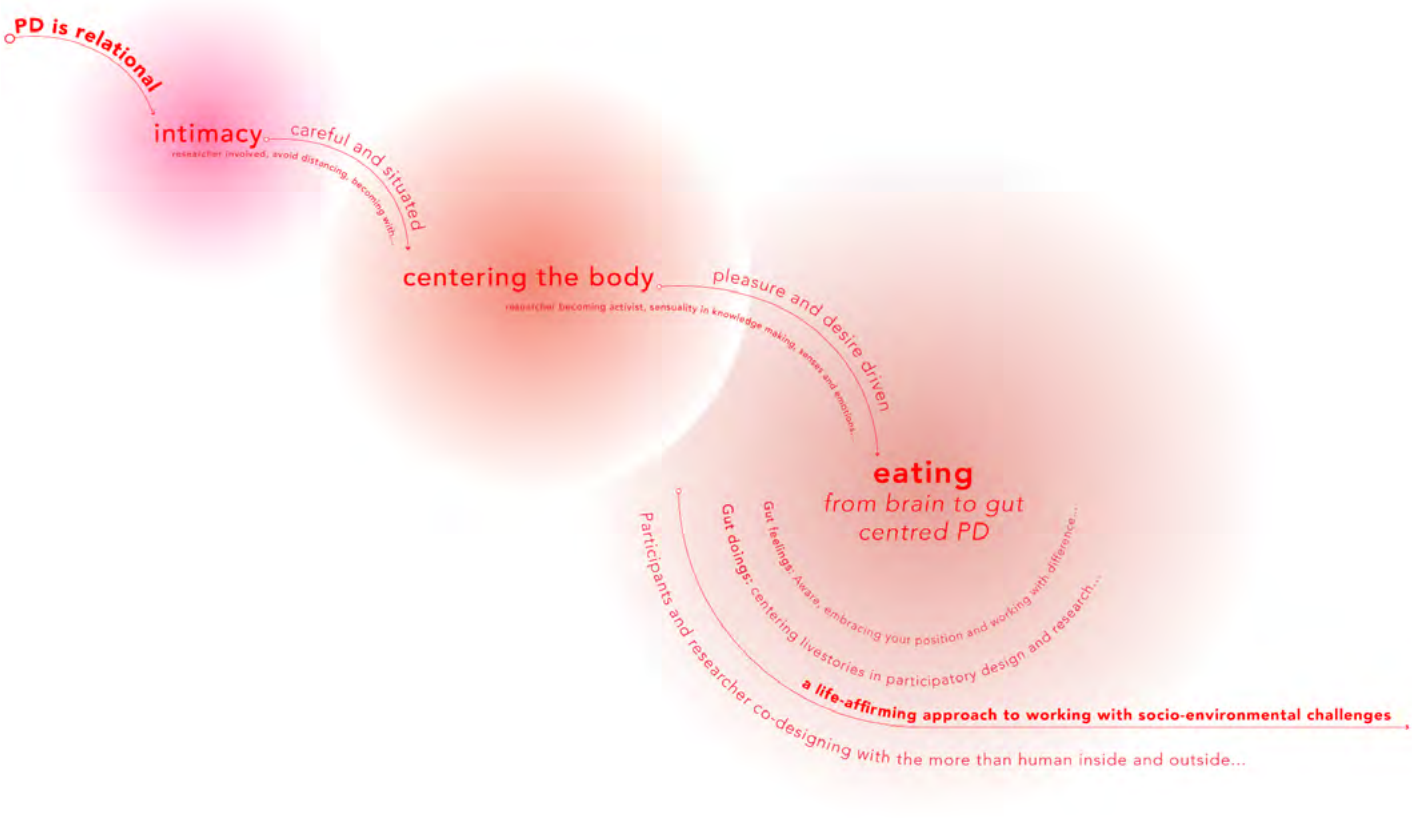


Figure 1. From brain to gut-centered Participatory Design (PD). Eating as a pleasure and desire-driven approach for a careful and situated PD. Eating is a mechanism for PD researchers to centre the body, engage with the sensuality of knowledge-making, avoid distancing, and become involved in the process. Eating as a life-affirming approach to working with socio-environmental challenges.

3. Digestion Analogies for Other Ways of Knowledge-Making in PD

In my research, I hope to disrupt dominant and anthropocentric ways of knowing and embrace what it means to take relationality and emergence seriously (Pihkala & Karasti, 2022). I aim to disrupt dominant and anthropocentric ways of knowing by embracing the embodied knowledge that emerges from our everyday metabolic engagements, mainly through eating. This approach challenges traditional notions of knowledge production and highlights the interconnectedness of human and non-human actors in the design process. This research explores thinking with (De La Bellacasa 2012) our gut with the "explicit purpose to make things 'thicker.'" The specificity, situatedness, materiality, relationality, and transformation capacity already embedded in eating make it a rich and provocative field for PD researchers and designers to engage with. In my work, this translates into three analogies between participatory design stages and the process of digestion, allowing ways of thinking and doing with our guts rather than our minds (Figure 2):

3.1 Auto-Ethnographic Phase: In-Digestion

The first phase, *in digestion*, allows the researcher to recognize her position as an outsider and gain awareness of herself as the body slowly senses and makes sense of the socio-material conditions she is working with. Embracing bodily discomfort becomes a means to process something not yet metabolised. This phase sets the stage for response-able and situated research and a deeper engagement with the site and its actors through digestion.

3.2 Engagement Phase: Digestion

During the *digestion* phase, time allows my body not to "bounce back" but to transform with the site. The researcher engages with the site and its actors through a process of breaking down to aid assimilation. This involves collectively crushing, squishing, cutting, and chewing parts of the site, dissolving boundaries between in and out, land and self, human and beyond. As the process unfolds, connections are created, and as we eat, the gut becomes the locus of thinking and knowing, facilitating shared understanding and action. A process aiming to reveal experiences, imaginations, *past, present* (D. Haraway, 2010) , and future ways forward.

3.3 Outcome Phase: Excretions

The final phase, *excretions*, involves the results of making and coming to be with expanded and deepened relationalities with other beings. This phase encompasses socio-material practices, meanings, projects, and products that emerge from an "enlarged sense of interconnection between self and others," shared concerns, and collective commitments.

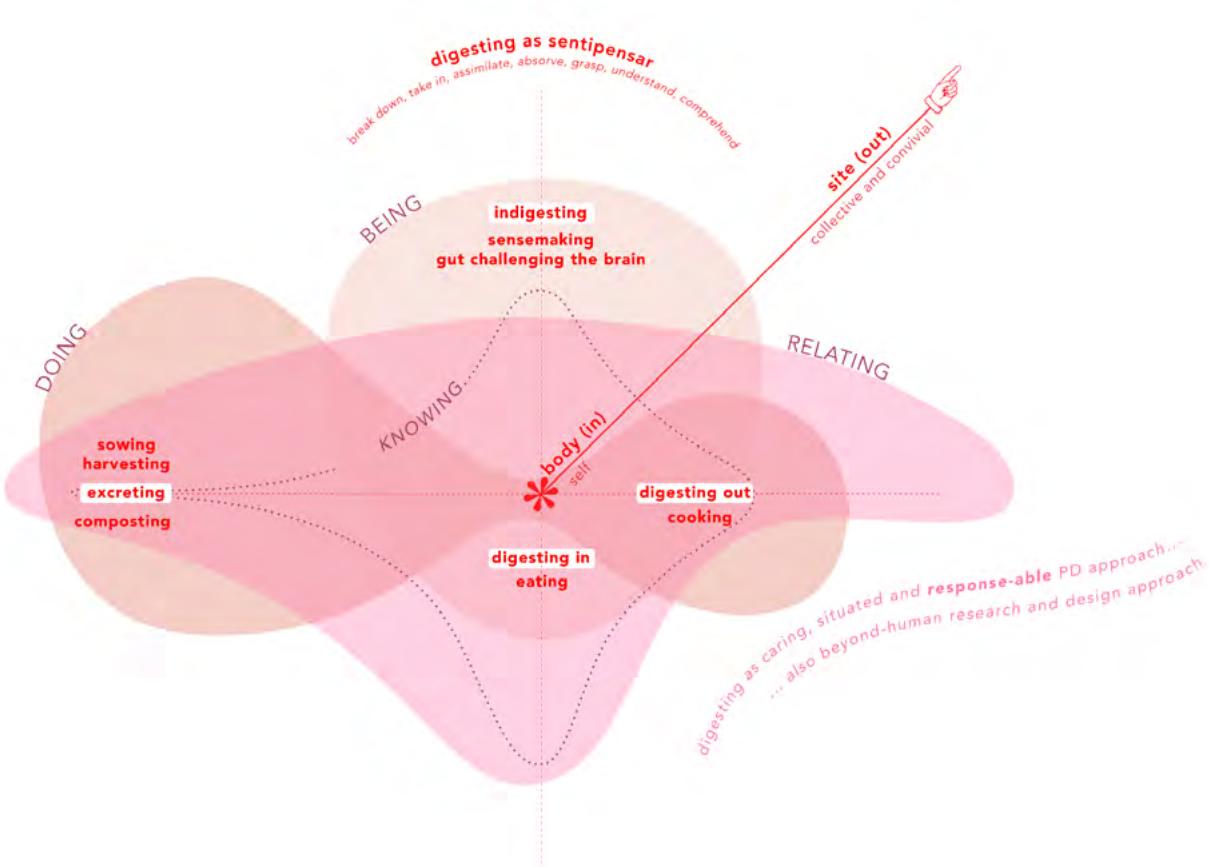


Figure 2. Analogies between participatory design stages and the process of digestion. Three stages of digestion – indigesting, digestion in and out, and excreting – and its relation with a transformational capacity going from the self (inside of our bodies) to the collective (outside: land and others). It is inspired by Annemarie Mol's *Eating in Theory*, in which being, doing, knowing, and relating traverse with different intensities between in and out in the digestion stages.

4. Progress to Date and Plans for Further Research

In my practice-based research, I have worked in different contexts ranging from social housing neighbourhoods and former extraction landscapes in Limburg, Belgium, to community kitchens in the self-built settlements of Caracas, Venezuela. Thus far, I have engaged in three different trajectories through indigestion and digestion from a (self)ethnography perspective centred on eating. Concrete actions include spending time on site, cooking, eating, *sobremesas*, picnics, potlucks, interviews, relations maps, photography, participants photography, gut-guided walks, site sense-making with our guts, composting and planting (Figure 3). As I approach half of my PhD trajectory, I plan to work further in the third stage of digestion, excretions. I will explicitly engage with the materiality and processes of space transformation coming from gut-centred knowledge in the form of, for example, collective infrastructures for cooking, composting, and gardening. I would also like to open a new trajectory to explore the potential of engaging more deeply with more than human actors through a gut-centred PD approach, increasing their agency over imminent spatial transformation projects, specifically urban renewal, so far centred around human concerns.

In working with different communities and landscapes, the research becomes a container (Le Guin & Haraway, 2019), a collection of situations in which our guts have a knowledge-making role—collecting experiences and devising spaces of possibility to materialize the world we want to live in. Thus, going through this collection offers other PD researchers and designers the possibility of translocating knowledge coming to exist from moments filled with specificity to other moments or situations, taking digestion as a body-centred, engaged PD approach, and producing other - also very site-specific outcomes - excretions. However, challenges arise in translocating knowledge respectfully without appropriating or imposing and in navigating the implications of this approach for how we relate to others and transform our ways of living and the spaces we inhabit. I would like to take part, with fellow designers and researchers, in answering these questions. The CUMULUS community and the PhD network have proved to be an engaging scenario to discuss the opportunities and challenges of thinking and doing with our bodies - rather than our minds - and to devise ways of increasing the agency of more than human actors in our processes.

My preliminary findings suggest at least three reasons for PD researchers and designers why need “pay attention to how matter and discourse combine in the visceral body.” First, it provides an embodied way of overcoming dualistic thinking: body and mind, self and others, emotion, and cognition, as it “alerts us to the viscerality of being embodied and entangled in human and non-human nets of materiality and meaning” (Probyn, 2015). Second, it helps us adopt an experimental and transformative rather than a descriptive orientation, as it enhances our willingness to ‘take in’ (quite literally) the world in the act of knowledge-making (Gibson-Graham, 2011, p. 22). Third, it highlights a profound connection between gut-driven engagement and the researchers’, designers’, and participants’ capacity to address complex societal and environmental issues. Therefore, the colloquium could be an opportunity to think together about how centering the body and our guts could aid in developing capabilities to become more caring and response-able researchers (De La Bellacasa, 2012).



Figure 3. Going through the three stages of *digestion* during my fieldwork in the 'El Sinaí' community kitchen in Caracas, Venezuela. This case will be appropriately expanded upon during the presentation at the CUMULUS conference.

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PARTICIPATORY ART IN CONTEMPORARY NEW PUPPETRY.

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KEYWORDS | NEW PUPPETRY, CONTEMPORARY, PARTICIPATORY ART, INTERPRETATION

ABSTRACT | Essentially a folk art, puppetry existed long before Modernism and was used to communicate ideas and express human emotions. Puppetry has carried on the essential characteristic of the country that produces it, reflecting the national temperament and psychology of its society. In many traditions, puppets are articulated objects engineered to receive and express motion. Through this research, the researcher focused on the role of puppetry from a contemporary perspective, especially in its relationship with Participatory Art. In the study case of "Presence in Absentia," the concept of Contemporary New Puppetry is more usefully thought of through the eclectic notion of performing objects rather than the more reified idea of puppets. It offers assemblages on the stage of objects, human performers, and projection. Although the original proposal of this project was based on Conceptual Art and a collaborative mindset with the Performing Art practitioners at the site-specific work, along the way, the conception was shifted into another direction, Participatory Art. Moholy-Nagy, one of the Participatory Art pioneers, believed that everybody has talent, that is, trusting in the creative powers of ordinary people. Participatory Art challenges not only the artists/practitioners and audience intellect and intuition in the strategic choices to be made but also in the physical involvement needed to fulfill the Participatory Artwork, which, in this case, would refer to the contribution of audience in conducting and directing the sound elements of the performance. Through this project the involvement of the audience physically during the performance made this project fully come into being. Contemporary New Puppetry in this project could be a sample that the predominant use and vision of the puppet today is no longer represent an object newly imposed from the outside set to overtake us, but rather something with which we are deeply connected and through which we strive to express, understand, and negotiate our interrelationship with each other in with the non-human world, or in this case is the world of puppetry.

1. Introduction

“Art crystallizes the emotions of an age; art is a mirror and voice,” wrote Laszlo Moholy-Nagy (Almenberg, 2010). As the concept of art has been changing through the centuries, its purpose has been to represent reality, communicate emotions or ideas, create a sense of beauty, or explore the nature of perception (Martinique, 2016). Essentially a folk art, puppetry existed long before Modernism and was used to communicate ideas and express human emotions.

Puppetry has carried on the essential characteristic of the country that produces it, reflecting the national temperament and psychology of its society (Currell, 1974). In many traditions, puppets are articulated objects engineered to receive and express motion. It also acts as an existential mirror, a reflection of the precariousness of our condition as living subjects (Guy, 2013). Asia is the source of many of the ideas and techniques of the puppetry of the West since it was highly sophisticated at a very early date (Currell, 1974). Afterward, puppetry was well established by the thirteenth century in many parts of Europe, and free exchange between the countries there produced similar trends and styles (Wijaya, 2023).

Through this research, I focused on the role of puppetry from a contemporary perspective, especially in its relationship with Participatory Art. The contemporary views of puppetry, or what Orenstein called the “New Puppetry,” predominantly express interrelationships rather than binaries and oppositions, they reflect our contemporary struggle to understand our now deep involvement with technology embedded. As we are in it, the new technologies that have also made us more globally interconnected (Orenstein, 2017). Since the role of art has been changing over time, acquiring more of an aesthetic component and A socio-educational function (Martinique, 2016) will be possible through the “process” of producing art. And relying more on the freedom of interpretation of the audience/participant that runs towards Participatory Art.

2. Study Case on Participatory Art

2.1 Contemporary New Puppetry

Fundamentally, humans directly perceive through senses, physical objects together with their properties. If perceptual experience is representational, it only appears that the audience directly perceives the represented physical objects (Suojanen, 2020). In doing so, we are becoming very at home with the idea of projecting character through objects that we see and use as extensions of ourselves (Orenstein, 2017). In terms of puppetry, there are today more and more international artistic collaborations and cultural borrowings and exchanges taking place in every direction (Orenstein, 2017). Participatory Art can reflect this purpose better than any other kind of art since it wants to highlight this creative capacity within each (Almenberg, 2010), i.e., participant or audience. It is important to transform the cultural sector of puppetry and presenting performance based on the participants’ core competencies and skills without neglecting the sensory perception and experience of the audience.

As a researcher, similar to Almenberg, I also believe that we live in an extremely fragmented world and that the future belongs to those who can combine and recombine, assemble, and reassemble something at least individually meaningful out of all those fragments, which is what creativity is all about (Almenberg, 2010). Historically, traditional puppetry has become a powerful teacher of morals, values, and cultural expressions; Contemporary New Puppetry is more usefully thought of through the eclectic notion of performing objects rather than the more reified idea of puppets. It offers assemblages on the stage of objects, human performers, and projection (Orenstein, 2017), which later can be discussed through the collaborative project of “Presence in Absentia.”

2.2 Performing Art Project

As part of the interdisciplinary perspective of the New Puppetry research, I collaboratively worked on a specific project with an installation artist and performing art practitioner from Southeast Asia. The main objective of this project was to present puppetry in a contemporary perspective, an experimental project of New Puppetry in the form of Performing Art. Even when cultural conservatives mourn vanishing traditions, a generation of Southeast Asian practitioners are seizing the codes of performance culture, inhabiting received forms and re-making them to speak to both local particularities and global issues (Cohen, 2017). The notion was suitable for the Performing Art project since the artists were all focusing on a new form of puppetry. The artists would like to evoke creativity in themselves and the audience through the interpretation of light, shadow, and reflection in the site-specific work.

The concept of "Presence in Absentia" was to maximize the potential of New Puppetry without presenting the main objects, the 'puppets,' but instead representing them with the 'performers' who acted physically as the puppets with the mind of the puppeteers themselves (puppetry without puppet). This project relied on the artistic innovation and interpretation of the artists and performers on how we could represent the subject explicitly by utilizing gesture, movement, and sound in the installation space. Through the collection of elements on stage, collaborative practices, and themes that often deal with connecting the past to the present, Western and non-Western, New Puppetry strives to find and understand integration and interconnection (Orenstein, 2017) that could be shown in the project.



Figure 1. Exploring the puppets' movements and transferring the knowledge to the practitioners' bodily movements.

As the main researcher for the "Presence in Absentia" project, the first phase of this research was to share the knowledge of traditional puppetry within different countries, Western and non-Western, to find the connection and build new interpretations from the participants who were also the practitioners. From Indonesian Wayang Golek puppetry to Austrian Marionette puppetry, the performers experimented seriously with the various gestures and movements in their next phases, Figure 1. They could discover or

invent their techniques and choreography so that they could represent new hybrid puppets' movements and present them through their performance.

2.3 Participatory Art Matter

The original proposal of this project was based on Conceptual Art and a collaborative mindset with the Performing Art practitioners at the site-specific work "Undivided Vision." However, along the way, the conception was shifted into another direction, the Participatory Art. Conceptual Art seems to have been more focused on the participation of the spectator in the execution of a work thought by the artist. However, the next phase of the "Presence in Absentia" project expressed the constantly changing relations in Participatory Art. This project later invited the audience/spectator to contribute and experience their creativity. Participatory Art challenges not only the artists/ practitioners and audience's intellect and intuition in the strategic choices to be made but also in the physical involvement needed to fulfill the Participatory Artwork (Almenberg, 2010), which in this case would refer to the contribution of the audience in conducting and directing the sound elements of the performance, Figure 2.



Figure 2. Performers' interpretation of puppet-based bodily movements and how they worked together with the audience through sounds in the site-specific work.

The basic choreography was based on the interpretation of the puppet's movement from each performing art practitioner. Since their background were diverse (dancers, actors, performers), they interpreted the idea of New Puppetry from the researcher in different ways; some focused on the movement of Indonesian Wayang Golek puppets, and some chose to focus on the movement of Austrian Marionette puppets. The original sound of the site-specific work by the installation artist was the sound of dripping water in a quiet and meditative ambiance. Eventually, the performers played along with the light and shadow by utilizing the space and adding the external sound from the Indonesian musical instrument Angklung that was prepared by the researcher beforehand. This traditional instrument was made of Bamboo, and each item could only give one specific note. The researcher only prepared three instruments, which means only three notes were available since the main purpose was not to play music but only to produce sound.

The participatory element of this project was that these instruments would be moved or played by the audience, not the artists or performers. Thus, the audience would have the choice to be involved physically in this performance. Following the belief of Moholy-Nagy from the Participatory Art perspective, I believe that everybody has talent, that is, trusting in the creative powers of ordinary people (Almenberg, 2010). Through the "Presence in Absentia" project, the involvement of the audience during the performance made this project fully come into being.

3. Conclusion

Through the "Presence in Absentia" project, the site-specific work of the installation artist was transformed into an imaginative space, a space where the performers could become something else, which, in this case, become puppets. It was almost like what Leonora Carrington described in her book, The Milk of Dreams, about a magical world where life is constantly re-envisioned through the prism of imagination, a world set free, brimming with possibilities (La Biennale di Venezia, 2022). Also, in this world, the audience could transform themselves as the puppeteers who controlled the movements and ambiance of the stage. This contribution has shown that artistic strategy is at play. It was the main aspect of Participatory Art, where the pieces designed and/or made or found by the artists and practitioners were rearranged by the audience into a pattern of his/her choice (Almenberg, 2010). Moreover, Contemporary New Puppetry in this project could be a sample that the predominant use and vision of the puppet today is no longer represent an object newly imposed from the outside set to overtake us, but rather something with which we are deeply connected, and through which we strive to express, understand, and negotiate our interrelationship with each other in with the non-human world (Orenstein, 2017), or in this case is the world of puppetry.

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P/REFERENCES OF DESIGN

DESIGN AND PROJECT LEARNING: A SYSTEMATIC LITERATURE REVIEW AND DISCUSSION ABOUT THE FUTURE OF THE FIELD.

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KEYWORDS | DESIGN, EDUCATION, EXPERIENCE, UNDERGRADUATE

ABSTRACT | This article stems from the inception of a doctoral study, wherein the research aims to analyze students' experiences in learning design within undergraduate Design courses. Motivated by global and design-related shifts and considering the challenge of teaching design in the current context of social and technological changes, the authors have conducted a systematic literature review to investigate the current state of knowledge in the field of design education. To this end, the research began by defining the research question, followed by the development of search strategies and, subsequently, the delineation of parameters for data collection across three different databases. Furthermore, the article presents the processes of information gathering, the outcomes derived from the applied filters, and the selected documents that best align with the research theme. Through the analyses conducted, it is understood that for the student's learning experience in design to be memorable and for design schools to produce professionals equipped for the challenges of contemporary society, it is imperative to contemplate new teaching models, skills to be acquired, and to explore future perspectives in design culture.

1. Introduction and Contextualization

One of the most crucial steps in academic research planning, according to Gil (2019), is constituted by literature review, which can be defined as a report on what has been published concerning the topic being researched to inform the reader about theoretical contributions and results of other studies conducted in the addressed area.

Lakatos and Marconi (2003) and Gil (2002) also address the importance of literature review as a fundamental step in building scientific knowledge, emphasizing the need for a systematic and rigorous approach in the analysis and interpretation of bibliographic sources.

Within the context of the Systematic Literature Review to be presented in this study, its execution period spans from November 2023 to January 2024, intending to investigate relevant themes for the research from various sources.

For this development, the research began by defining the research question, followed by the elaboration of search strategies, including a preliminary study to validate the search terms, as well as parameters to define sources and initiate data collection from databases gathering documents in the scientific field (Elsevier, 2024).

2. Development of Systematic Literature Review

The proposed research topic relates to Design, Emotion, and User Experience in educational and learning contexts. Sequentially, the PICO approach was utilized, which, according to Higgins and Green (2011), is a structured method responsible for organizing research questions into four main components:

- Population: Undergraduate students in Design courses;
- Intervention: Techniques, experience models, learning methods that prioritize experiences;
- Comparison: Traditional design teaching methods, models that do not emphasize experiences, teaching experience versus learning experiences;
- Outcome: Relationship of teaching models or experience reports discussing students' experience in learning design or creative activities in undergraduate design courses.

2.1 Search Strategies

For this Review, a preliminary search was initiated in English on the Google Scholar website (2024) to define and validate search terms and their combinations, which were those represented in Figure 1.

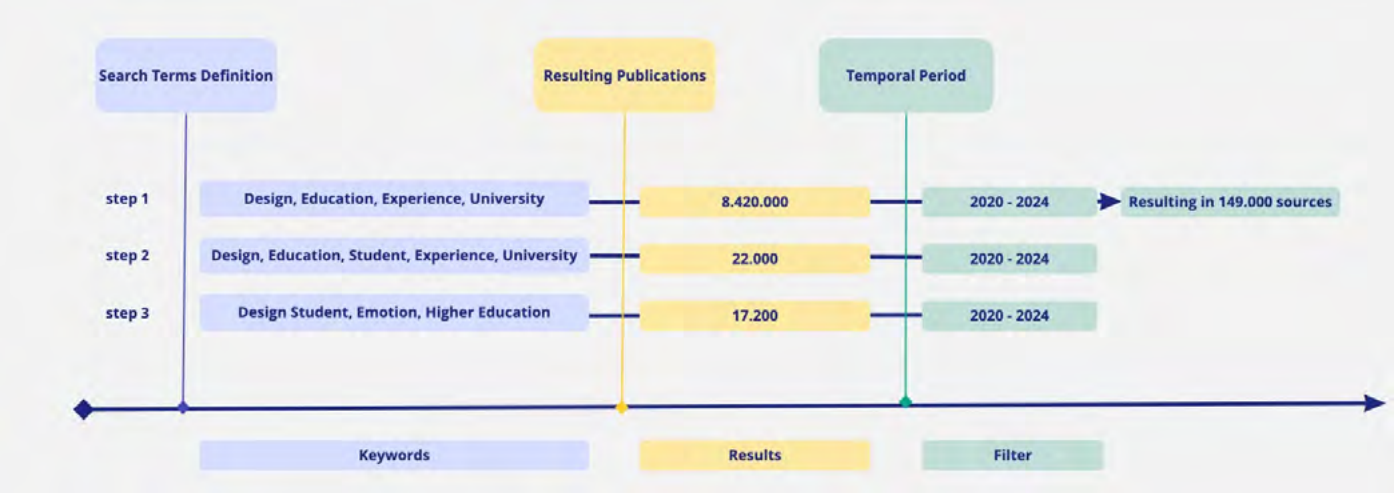


Figure 1. Representation of the three stages that made up the preliminary research.

Many of the results relate to the role of the teacher in these processes, discussing more teaching rather than learning, necessitating the use of a search term like "learning." Hence, a new search was defined with the descriptors listed below.

- "higher education," "learning," "design," "experience" - resulting in 49,200 sources. Generalization was observed due to the broad meaning of the term design, which yields results from various fields, including healthcare. In this regard, efforts were made to validate a new combination of terms.
- "higher education" and "experience learning design" - yielding a result of 34 articles, with topics more closely related to the area of interest of this research.

2.2 Search Terms

The construction of the search string was, therefore, based on the mentioned contextualization and validation, defining the following terms and their synonyms (Table 1).

Table 1. Defining search strings.

Descriptors	Synonyms
“higher education”	Education
	Educação
	High Education
	Universidade
	University
“experience learning design”	Aprendizagem de Projeto
	Experiência
	Experiência do estudante
	Learning design

Although the search terms were defined in English, to ensure a broader search considering the number of academic productions in this language, whether original or translated, synonyms in both English and Portuguese were also chosen.

These terms were used in Parsifal, a website that organizes information from Systematic Literature Reviews. According to its website, it assists in the identification, selection, and evaluation of systematic reviews, extracting, structuring, and providing information, as well as its methodological characteristics objectively (PARSIFAL, 2024).

For this systematic literature review, three databases were used, namely Portal de Periódicos Capes[1], Scopus[2], and Science Direct[3].

2.3 Inclusion and Exclusion Criteria

It was also necessary to define criteria for the inclusion and exclusion of publications to ensure that searches were in line with the research needs and that the collected sources met the expected quality for subsequent analysis. In this sense, the requirements are characterized as follows:

- Articles, book chapters, and case studies published from 2020 to the present moment (2024);
- Articles, book chapters, and case studies in Portuguese or English and related to the areas encompassed by this research: Design, Experience, Education.

On the other hand, publications will be excluded from further analysis if they:

- Are duplicates;
- Articles lacking abstract and/or keywords;
- Articles with unavailability of the work in its entirety;
- Articles showing no signs of relevance to the focus of this research identifiable from the title and keywords.

2.4 Identification, Selection, Eligibility, and Inclusion

The PRISMA protocol (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) is used as a reference, defined by Moher et al. (2009) as a set of guidelines aimed at improving transparency and quality in the development and presentation of systematic reviews, providing a detailed roadmap for reporting the essential elements of a systematic review, helping authors ensure the integrity and clarity of the research process.

Thus, following PRISMA recommendations, the results obtained from scientific databases are subjected to a flow of procedures segmented into four classifications, as described in the table below (Table 2), which relates stages and procedures:

[1] www.periodicos.capes.gov.br

[2] www.scopus.com

[3] www.sciencedirect.com

Table 2. Indexed electronic databases.

Phases	Procedures
Identification	Gathering results from each database
Selection	Exclusion of duplicate articles, outside the period of interest and that do not meet the inclusion and exclusion requirements based on the analysis of keywords, title and abstract
Assessment	Reading the introduction and conclusion of the selected articles, also considering the exclusion criteria
Synthesis and inclusion	Reading, in full, the articles selected based on the proposed quality criteria

Based on the defined search strategy and specified criteria, the results from the three listed databases provided a total of 3728 records for initial selection, comprising 11 records from the Portal de Periódicos Capes, 189 from Science Direct, and 3528 from Scopus. The Parsifal software was utilized for managing these records.

Through this review, 166 studies were accepted, necessitating a further review of their titles and abstracts, subsequently resulting in 60 records meeting the criteria established for the evaluation stage.

At this stage, these 60 documents underwent a review of their titles and abstracts, resulting in a total of 16 records for the fourth and final stage, Synthesis and Inclusion.

2.5 Synthesis and Inclusion of Results

From the 16 selected studies meeting the requirements presented for this Systematic Literature Review, they are classified into three different categories: studies closely related to the research area, studies related to the area but with a more generalist or less in-depth perspective on the research themes, and some texts that stimulate further investigation into what has been presented (especially concerning Participatory Design and Design Thinking). Additionally, articles classified as having a stronger connection with the criteria of the Systematic Literature Review provide more contributions to discussing the future of design education, not so much through students' experiences but towards rethinking some teaching criteria in the field.

3. Design Education: Discussion About Results and Future of the Field

The synthesis of the mentioned studies establishes significant connections, particularly in the category emphasizing core aspects of this research, enhancing understanding of undergraduate design learning experiences. Notably, Wakelam et al. (2020) highlight predictive analysis in small classes as foundational for effective teaching strategies.

Furthermore, Trimmer (2020) advocates for innovative curriculum development integrating design thinking and student-centered research, and Kaviani (2020) emphasizes curriculum design's meaningfulness and motivation through a phenomenological approach. Bigos & Michalik (2020) stress emotional competencies in entrepreneurial intentions, which are vital for socio-emotional

skill development in design students. Jivet et al.'s (2020) study promotes autonomy for effective learning, while Crowther & Briant's (2021) longitudinal research delves into factors affecting long-term student performance. These studies highlight the importance of multidisciplinary approaches in designing educational programs.

Wasson & Kirschner (2020) introduce European learning design approaches, while Blumenstein (2020) explores the synergy between learning analysis and design. Heggart & Dickson-Deane (2022) examine essential skills for learning designers, and Henriksen et al. (2021) explore creativity and risk-taking in design education, collectively deepening understanding of undergraduate design learning experiences. Bishop et al.'s (2021) comprehensive resource addresses instructional design topics beneficial for educators and researchers aiming to enhance educational practice.

Engelbertink et al. (2020) highlight the necessity of active collaboration between students and educators in design education, stressing the importance of involving students in the design process. Similarly, Tsai et al. (2023) investigate the impact of combining design thinking with constructivist learning on motivation and problem-solving abilities. These studies underscore the significance of student-centered approaches for stimulating learning environments. Integrating methodologies like design thinking and constructivism empowers educators to create dynamic learning environments that nurture practical skills and creativity among design students.

In the context of understanding the current state of design education, the authors discussed here delve into its concept, propose curricular changes, and envision the future of the field. Buchanan (2020), as interviewed by Frascara (2020), argues that education transcends mere skill training. It entails intellectual preparation for lifelong learning, fostering mental capacities to tackle new situations with ingenuity, imagination, and creativity.

Buchanan apud Frascara (2020) identifies the four dimensions of creativity as essential elements in design education: inventiveness, receptiveness to discovering new facts, innovativeness, and openness to intuition in perceiving principles and values that provide organization, coherence, and interdependencies in surrounding systems. Another seminal study in this discourse is Findeli's (2001), which reconceptualizes design education through theoretical, methodological, and ethical discussions, proposing an archetypal curriculum model comprising art, science, and technology components.

It is preliminarily concluded that doctoral research in this area necessitates examining various university models to understand their structures concerning student learning needs and contextual demands. These aspects also warrant further exploration to establish principles, guidelines, tools, and methods for their study, fostering the evolution of universities and undergraduates in a rapidly changing field. Furthermore, this discourse on the student experience in learning design enriches the understanding of design education's pivotal role in nurturing creative and innovative professionals. Reflecting on design practice and applying design principles in contemporary and future contexts are integral components of the educational process, equipping students to address the multifaceted challenges of the current market and society.

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P/REFERENCES OF DESIGN

FOOD WASTE NINJAS AND SLEEPING SHEEP: UNDERSTANDING THE ROLE OF VERNACULAR DATA VISUALISATION DESIGN IN CIVIC ENGAGEMENT AND INFLUENCING FOOD-WASTING HABITUAL BEHAVIOURS.

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KEYWORDS | DATA VISUALISATION, CIVIC ENGAGEMENT, VERNACULAR DESIGN, ECO-FEEDBACK, BEHAVIOUR CHANGE

ABSTRACT | Studies have shown that data visualisations designed into eco-feedback technology have the persuasive capacity to change consumer habits that lead to significant financial and environmental consequences. There is, however, growing concern over their ethical, equitable, and psychological implications. This study looks at vernacular data visualisations — analogue representations of self-tracking data collectively designed by non-experts — and how they can be used as a bottom-up strategy for civic engagement and forming new habitual behaviours. Using consumer food waste as a case, this research was deployed as a nine-week, longitudinal, mixed-method study amongst working parents and their children in Australia (104 participants with a control group). Using theories in consumer behaviour psychology as a framework together with the literature in data physicalisation, play, and vernacular design, the participants were provided with a design probe that contained: 1) visual nudges and information demonstrating how to build food-saving habits and 2) a paper-based self-tracker to encode and share how they used the items in Part 1 using their own material and visual fluency. By triangulating the results through thematic, content, and paired samples frequency analysis, the results revealed that the group with access to the trackers was able to sustain newly formed habits for longer. Using visual metaphors like ninjas and sheep facilitated a deeper understanding of their unique household dynamics and instilled a sense of autonomy and accountability. This paper presents vernacular visualisations as democratic behaviour change interventions that have a place amidst their digital counterparts.

1. Introduction

The use of eco-feedback technology has become ubiquitous in Western households, with institutions providing consumers with digital self-tracking tools aimed at examining behaviours that can have both financial consequences and harmful impacts on the environment. For example, these apps and online tools[1] can track expiring food in the fridge and explain how much money, water, and energy is wasted resulting from disposing edible grocery items. These digital self-trackers use data visualisations — charts, graphs, and icons that transform abstract concepts into easily interpretable representations — as a primary means of persuasion (Dragicevic et al., 2020; Bohman, 2015). Several studies support the potential of these design-based interventions in expanding the capacity for self-knowledge, increasing awareness of social issues, and motivating individuals to adopt specific behaviours (Chalal et al., 2022; Lim et al., 2021; Tai et al., 2020; Kouroupetroglou et al., 2015; Normark & Tholander, 2015; Froehlich et al., 2010).

However, growing concern about the ethical implications of these quantitative trackers as a top-down initiative reveal that they can facilitate high levels of surveillance and extend regulatory control of authorities over the general public, resulting in a lack of agency in decision-making about one's own behaviours (Sanders, 2017). Furthermore, digital self-trackers can perpetuate existing social and economic disparities (Lifkova 2019). Requiring access to expensive technology and advanced levels of visual literacy, digital self-trackers can often exclude individuals from low-income households and children. Children, in particular, have the potential to benefit from understanding the mechanics of self-tracking as they have been found to be effective agents of collective behaviour change (Burrows, 2017; Robinson et al., 2011). Finally, digital self-tracking data visualisations can be an unreliable measure of lived experience. Referred to by Porter (2020, p.87) as 'technologies of trust,' over-reliance on data visualisations can arise from their impersonal, objective, authoritative appearance. Normative visualisation design practices that use geometric shapes can promote unhealthy self-scrutiny and fail to capture the complexities of everyday reality essential to understanding human behaviour (Snyder et al., 2019).

To address these issues, this study looks at an analogue, participatory approach to designing self-tracking data visualisations. Used in tandem with digital tools, this method aims to mitigate reductionist assessments of the self and unproductive behaviour changes like removing the pleasures of eating (van Dijk et al., 2015). Designed as a probe, this approach looks at the intersection between data physicalisation, play, and vernacular design and grounds the research on theories in consumer behaviour. Data physicalisation, a practice that encodes data through bespoke, meaningful objects, can engage designers and audiences in novel ways by encouraging reflection on behaviour (Khot et al., 2020; Lupton, 2017; Botros et al. 2016; Nissen & Bowers, 2015). These often-idiosyncratic forms leverage on the *eudaimonic* function of play, which suggests that even if play is not tangibly productive, it can elicit high levels of creative, independent behaviour (Sharp & Thomas, 2019). Theories in play are also closely linked to vernacular approaches to design, where non-experts rely on their intuitive visual fluency and access to materials instead of standards set by existing systems of power to address specific pain points (Hearst & Rosner, 2008).

Food waste coming from working parents and their children was used as a case in this research. Also known as Over Providers, this group was identified as being the largest contributor to the $36.6 billion dollar per year food waste problem in Australia (Karunasena & Pearson, 2022). Aiming to answer the question, "How can designing vernacular data visualisations in self-trackers influence consumer food-wasting habitual behaviours?" this paper critically examines theories in consumer behaviour psychology to provide a theoretical framework for designing the probe and evaluating the results. It then triangulates results to provide a new framework for designers to use in creating democratic interventions that develop environmentally- and mentally-beneficial habitual behaviours.

[1] IGA online food calculator: https://www.iga.com.au/food-smart/calculator/, Bhojan food waste app: https://www.abc.net.au/news/2023-12-23/ai-food-waste-app-kingston-council-melbourne-school-student/103089438

2. Theoretical Framework

Grounding the research in behaviour change theory was critical for designing effective, long-lasting habitual behaviour change interventions. Using principles from Willmott & Rundle-Thiele's (2022) TITE process to guide theory selection (T), iterative schematisation (I), testing (T), and explicit reporting (E), three consumer behaviour models were critiqued and selected. The Theory of Planned Behaviour or TBP (Ajzen, 1991) was valuable in explaining how perceived behavioural control (an internal assessment of one's own ability to perform a skill) and subjective norms (the extent to which social pressure from people of importance can influence behaviour) could lead to behavioural intention. However, the TBP did not account for affective factors nor contextual cues that trigger habitual responses. The Habit Alteration Model, or HAM (Pinder et al., 2018), was also considered useful in defining habits and understanding the stages of context-response links. While the model was able to sufficiently pinpoint where self-tracking feedback could be beneficial, it focuses largely on actions at a given point in time rather than wider contexts. Lastly, the Motivation, Opportunity, and Ability or MOA framework (Binney et al., 2006) was also considered for its strength in identifying situational factors (Opportunity) and articulating the difference between external and internal motivation. While it provided a pragmatic overview of behaviour formation, the MOA does not consider whether behaviour needs to be performed multiple times or be part of a broader set to provide benefit (Parkinson et al., 2016). It was, therefore, essential to use a combination of the three theories in understanding how design can influence habitual behaviour (Figure 1).

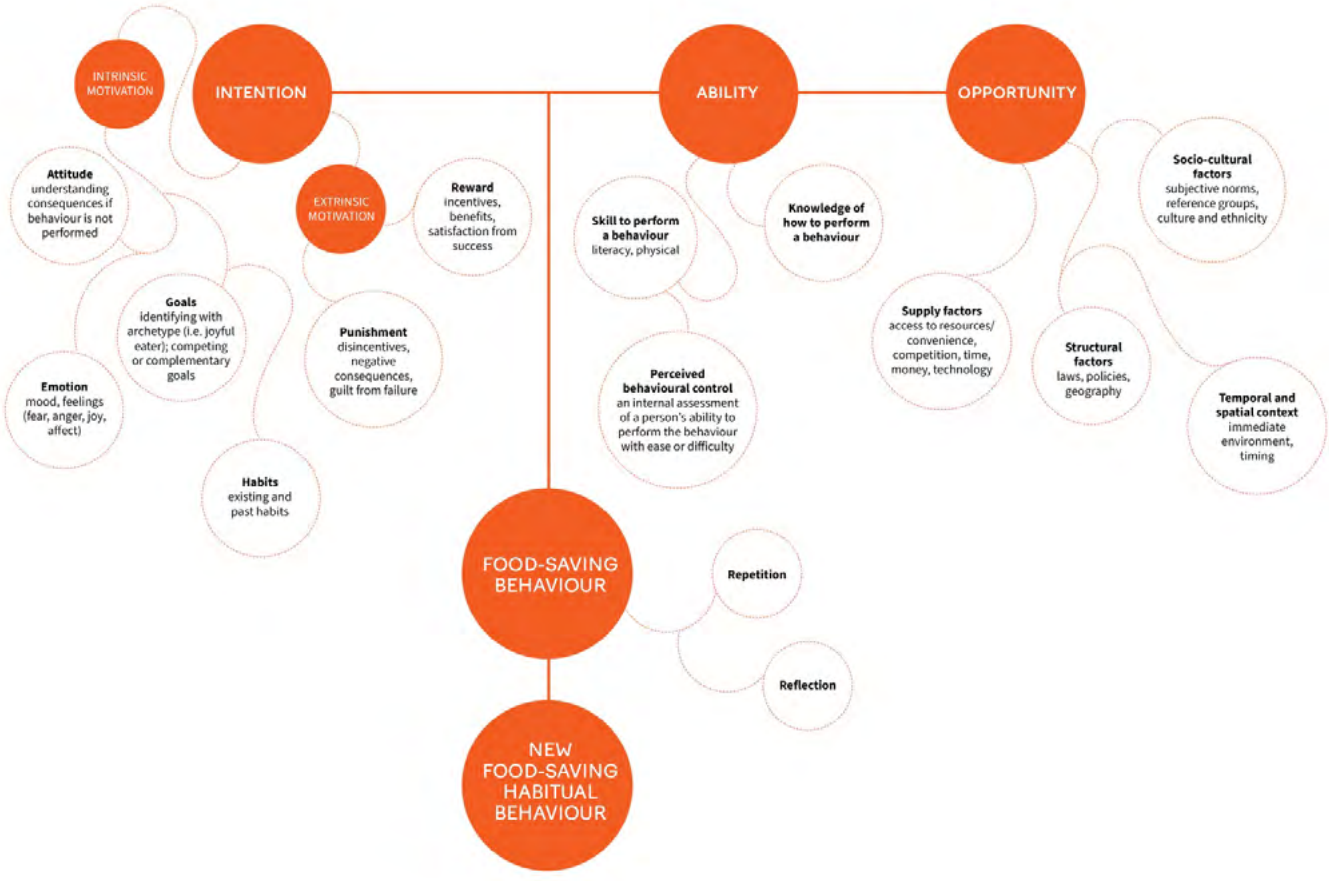


Figure 1. Framework amalgamated from the Theory of Planned Behaviour (Ajzen, 1991), the Habit Alteration Model (Pinder et al., 2018), and Motivation, Ability, and Opportunity Framework (Binney et al., 2006).

3. Methods

In order to effectively understand and measure habitual behaviour around household food waste, this study used a longitudinal, mixed-method approach that involved triangulating three research instruments:

1. A two-part design probe (Figure 2): Part 1 consisted of playful prompts2 to increase abilities, shape attitudes, and provide opportunities to enact the top three food-saving behaviours endorsed by the End Food Waste Cooperative Research Centre: eat leftovers, store food properly and prepare the right quantities of food (Ananda et al., 2021). Part 2 consisted of paper-based habit trackers deployed in participants' homes. A nine-week deployment period was chosen based on empirical evidence demonstrating that habitual behaviours take 66 days to form (Tull, 2022; Lally et al., 2010). Allowing participants to design, reflect on, and share bespoke data representations of how they used items in Part 1, the self-trackers aimed to enable social influence, reflection, and repetition of behaviours. The results were analysed through ethnographic content analysis.

2. Surveys: Distributed at three points of measurement using 5-point Likert scales, these assessed participants' frequency of performing food-saving behaviours before the probe, immediately after the probe, and one month after the probe through a paired samples frequency test.

3. Semi-structured interviews: These two online household interviews gathered qualitative data on participants' initial motivation levels, clarified survey and probe results, and explored the reasons behind the design of their chosen encoding system. Transcripts were analysed through thematic analysis.

[2] This included a roll of Use it Up tape to mark a section of their fridge or pantry where food needed to be used up, googly eye stickers to mark individual items of food in the fridge, freezer, or pantry that needed to be used up, making them more visible, the Use it All book where participants could find suggestions on ingredient combinations and maximising their use, and a meal planner and shopping list that participants could share within the household. The planner also included tips on getting children involved in meal planning and preparation, information on food waste, and advice from recruited role models.



Figure 2. Items in the design probe.

All 104 participants were recruited using snowball sampling and divided into three groups:

- Group A: Over Providers[3] with self-trackers (N=12 households, 46 participants)
- Group B: Over providers without trackers (N=12 households, 46 participants)
- Group C: Considerate Planners[4] (N=6 households, 12 participants)

The participants in groups A and C posted the trackers back to the researcher via a post office box every three weeks. The trackers were then scanned, de-identified, and uploaded to a shared Miro board for each household to view. The experiment group (Group A) was given parts 1 and 2, while the control group (Group B) was given only part 1. Group C was also given parts 1 and 2 to serve as social influencers to the experiment group.

4. Results and Discussion

4.1 The Self-Tracker Led to the Formation of New Food-Saving Habitual Behaviour

The quantitative analysis of the paired samples frequency test showed that both Groups A and B increased the number of times in which they performed food-saving behaviours. However, Group A showed that they were able to sustain or increase the frequency of the behaviours a month after. Only the results for "Almost all the time (over 90%)" from the survey were considered as this points to behaviours performed regularly, which is consistent with the definition of habitual behaviour as repeated, default responses in a given context (Wood & Runger, 2016). Figure 3 shows the frequency graph of "Behaviour 1: Plan meals to be cooked for a set number of days", illustrating that less households in Group B were able to maintain this behaviour a month after the probe was deployed.

[3] Over Providers, typically represented by working parents and their children, have the highest weekly food waste (6.33kg). While they plan their food shopping, they tend to purchase and cook more than is needed and often negotiate the unpredictable tastes and appetites of their children (Karunasena & Pearson, 2022, p.7).

[4] Considerate Planners, best represented by older couple-based households, many with children that no longer live at home. This segment engages in waste reduction behaviours across planning, shopping and cooking practices and show pride in being organised (Karunasena & Pearson, 2022, p.7).

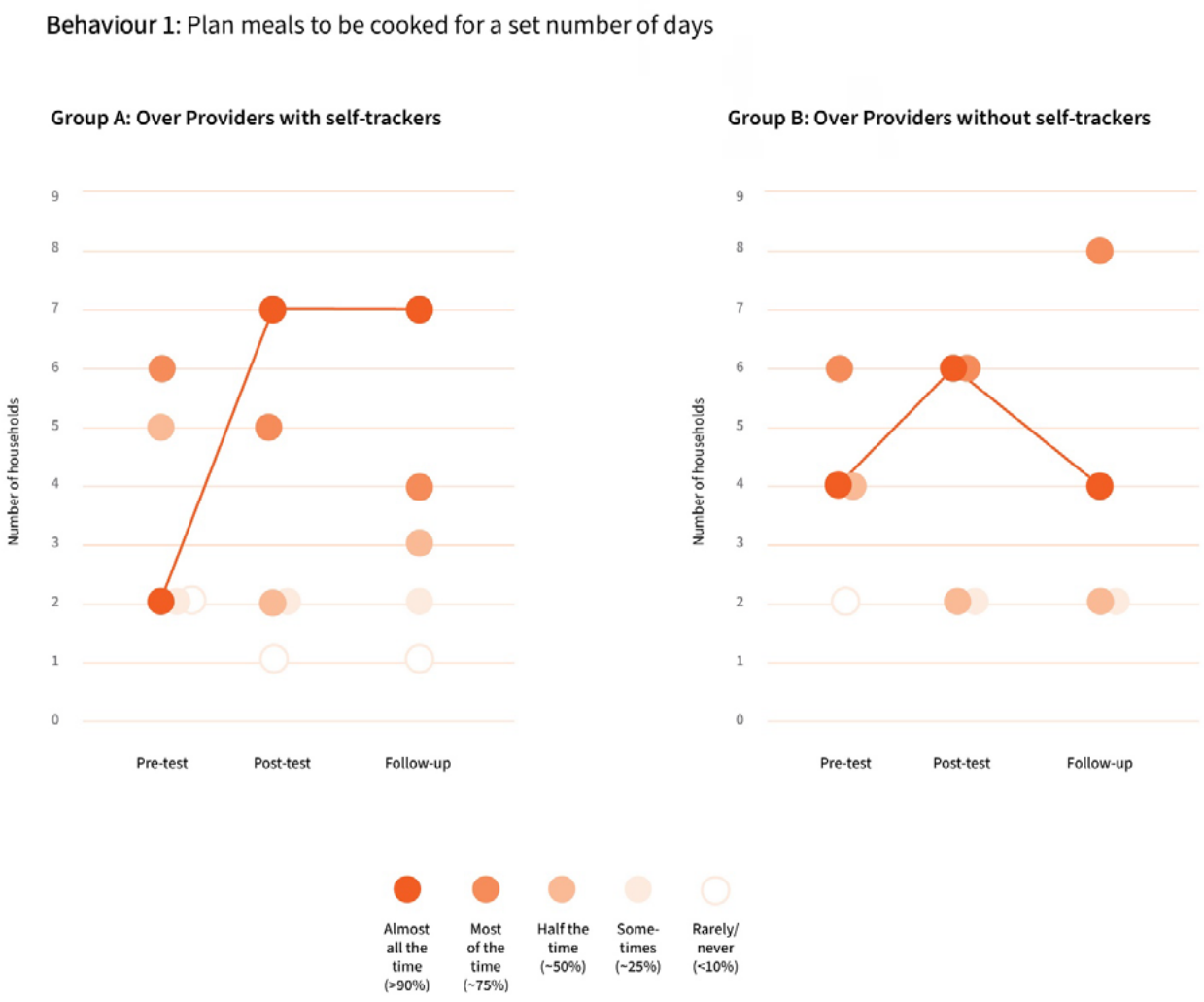


Figure 3. Paired samples frequency comparison of meal planning behaviour between Groups A and B.

4.2 The Self-Tracker Instilled a Sense of Autonomy and Accountability

The analysis of the probe responses showed how a vernacular approach led to having a sense of autonomy, with two-thirds of the households choosing to stray from conventional graphs and charts (Figure 4). This sense of autonomy can be attributed to the playful tracker design and the eudaimonic function of play to support agency, allowing people to choose, act, and express themselves in ways that were meaningful to them (Altarriba-Bertran et al., 2020).

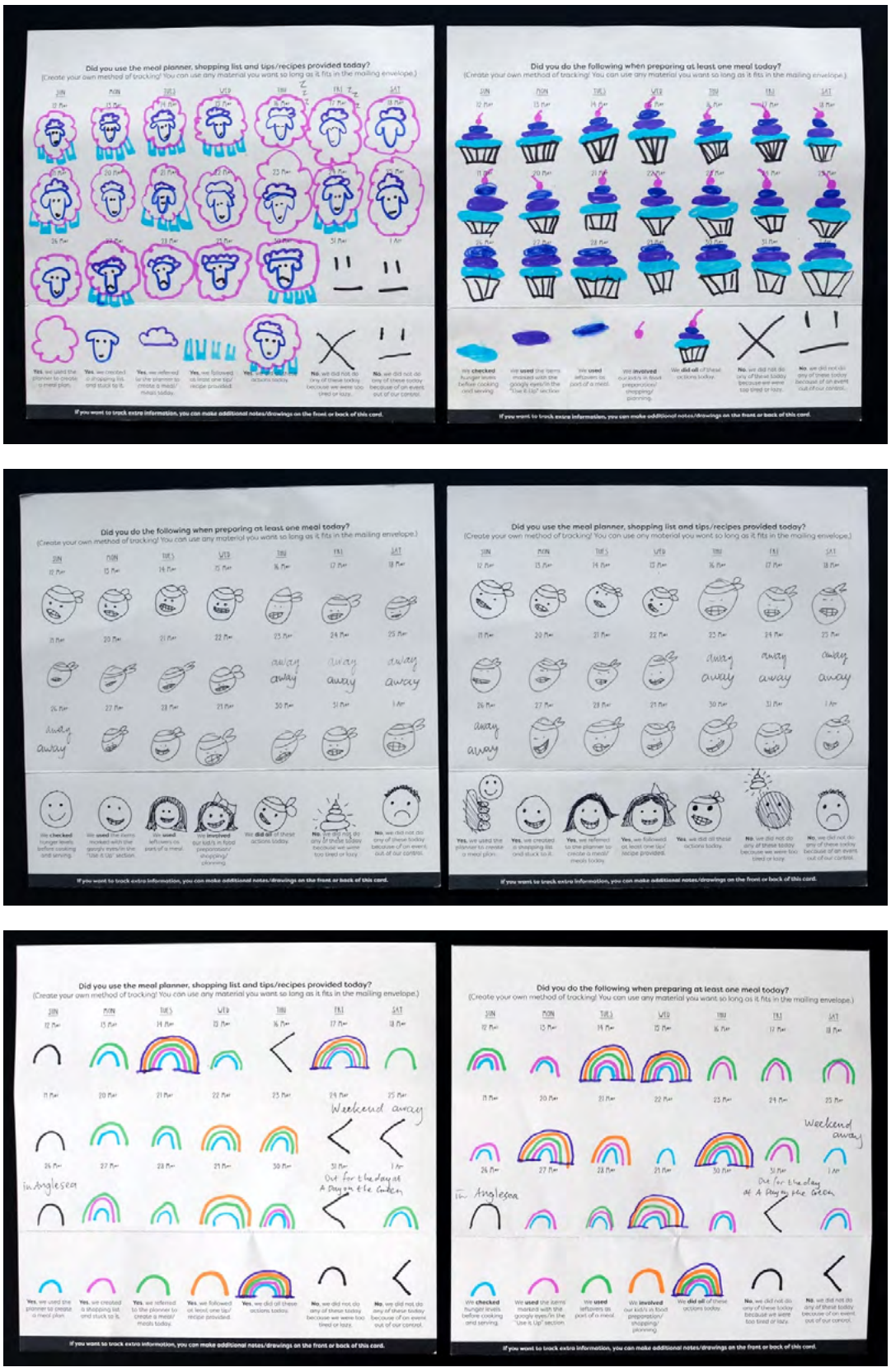


Figure 4. A sample of participants' visual representations of food-saving tracking behaviours.

The thematic analysis of the semi-structured interviews revealed that using personalised visual metaphors also led to a deeper understanding the effort required by individual family members in collectively reducing food waste. Through familiar figures like cupcakes, ninjas, sheep, and rainbows, participants were able to map their own behaviours to properties of these items. For example, a ninja was chosen by one of the children in an Over Provider household because of a ninja's need to make deliberate, precise actions to

achieve a mission — an apt representation of how many seemingly small, everyday actions lead to household food waste reduction (van Geffen et al., 2020). Using one's own visual abilities is not just a performative act of reproduction but involves the construction and transformation of meaning, resulting in emotional, physical, and cognitive investment (Sanders & Stappers 2014). These bespoke representations allowed participants to see themselves as creators of their own stories and created deeper connections with the data.

Participants also felt responsible for their own actions instead of being dictated to by an institution:

> "I felt more responsible and was called out more because they were our own trackers and creations." (Over Provider 12)

Conversely, families belonging to Group B expressed that they would have liked to have more visual reminders to hold them accountable for their actions. This finding is consistent with the concept of self-determination (Binney et al., 2006), an innate human proclivity to be the agents of their own behaviour.

It is also worth noting that participants reported that emotions such as enjoyment, enthusiasm, guilt, and worry from recording their behaviours through a vernacular approach were factors that engaged them in the nine-week study. Additionally, the predominant use of anthropomorphism (i.e., smiley faces), as opposed to food-related items, implies that behaviours are largely driven by emotion and feelings rather than what the behaviour is about. This confirms Wang et al.'s (2019) argument that emotional or affective engagement is key in determining the value of physical data visualisation: affect can enable data-driven objects to rate higher in terms of user experience (more pleasurable and meaningful) and can directly influence motivations, actions, and learning.

4.3 The Self-Tracker Played a Role in External Motivation

Scrutinising the results against the theoretical framework revealed that socio-cultural factors and spatiotemporal environments acted as external motivators rather than macro-level social factors. Socio-cultural factors had a closer relationship to emotions associated with rewards and punishment (e.g., participants reported feelings of pride and satisfaction from using the entire vegetable because it was 'doing the right thing' according to cultural norms). The immediate environment (e.g., seeing the tracker on the fridge in the kitchen while cooking) and the tracker's physical format allowed for behaviour to happen in personal contexts, instigating conversations about the causes and consequences of food waste between parents and children and enabling children to participate without the use of digital devices.

Based on the results, the theoretical framework was modified, and a new design framework for habitual behaviour formation was presented (Figure 5).

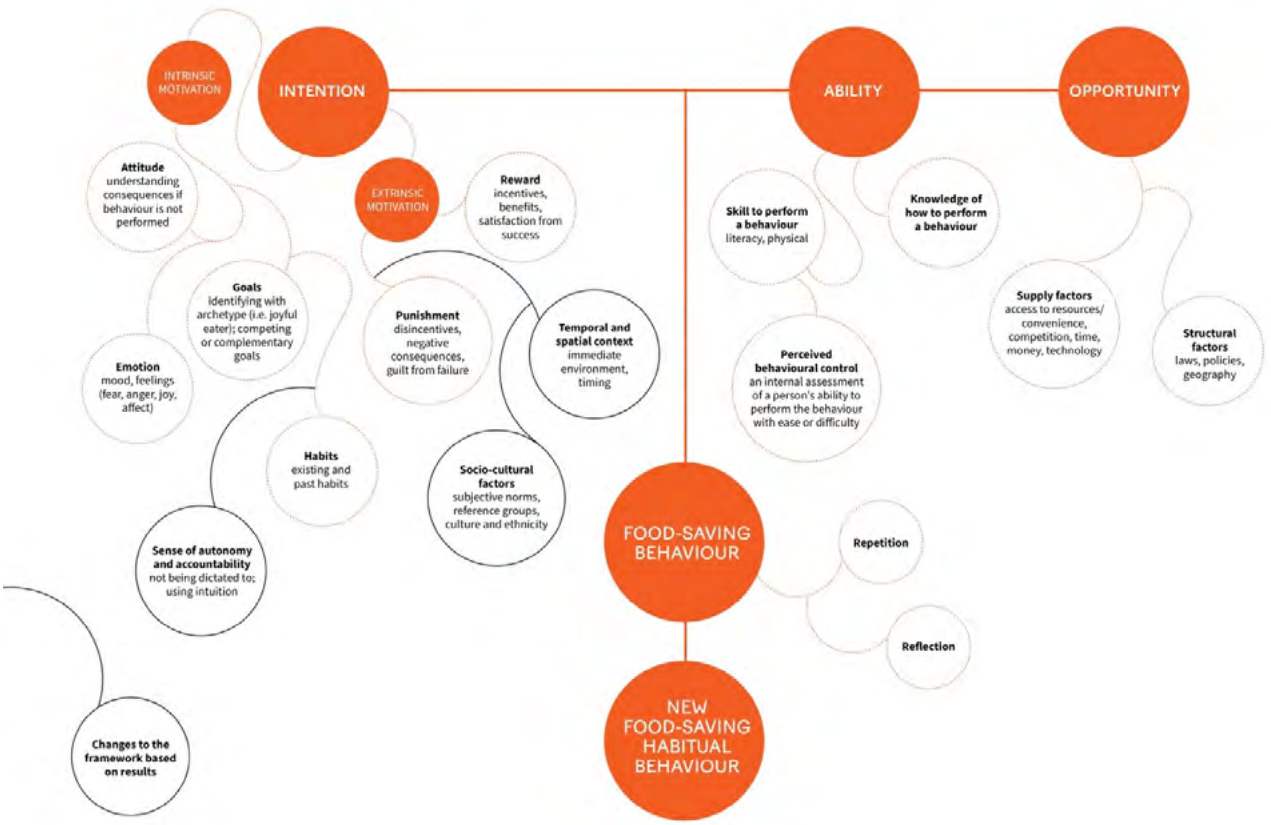


Figure 5. A new design framework for habitual behaviour formation.

5. Conclusion

Designing data visualisations in self-trackers using a vernacular approach had a significant capacity to influence habitual food-wasting behaviours in households. While the study could be implemented across a broader population for more robust statistical results, it strongly suggests that behaviour change theory is fundamental for designers to construct interventions, unpack active ingredients and identify common factors contributing to observed outcomes (Willmott & Rundle-Thiele, 2022). This research concludes that vernacular visualisations can augment existing frameworks and enhance the potential of data visualisation design to increase motivation, allow access to broader audiences, instigate conversation, and enable agency.

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P/REFERENCES OF DESIGN

UNLOCKING THE POTENTIAL OF POST-CONSUMER TEXTILE WASTE: EXPERIMENTING WITH NEW RECYCLING PRACTICES.

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KEYWORDS | TEXTILE WASTE, NEOMATERIAL, TEXTILE RECYCLING, MATERIALS DESIGN, PROCESS INNOVATION

ABSTRACT | The textile sector represents one of the most important industrial supply chains in Italian manufacturing and, at the same time, is characterized by a significant ecological footprint.

In particular, end-of-life management of products is a significant challenge, both because of the textile composition composed of mixtures of synthetic and natural fibers - which hinders recycling operations - and because of the increasing volumes of material given the dynamics of fast fashion and changing production patterns. Currently, only 1 percent of textiles produced globally are reused, and the percentage of waste is expected to grow.

The increasing visibility of the problem has brought about a change in the perception of the fate of waste. The concept of waste today has taken on a positive connotation, being viewed no longer just as an inert object to be discarded but as a resource. Given the paradigm shift that sees waste as a new resource, it is crucial to outline a design framework that paves the way for a significant change of productive, economic, environmental, and cultural scope in the use of material resources. This approach becomes crucial to turn waste abundance into a design opportunity. The purpose of the research is to explore the potential applications of post-consumer textile waste, focusing mainly on textiles with mixed fiber composition and those whose material is difficult to identify due to the lack of labels, thus preventing the recycling process.

The objective is to study, test, and define a new process of producing neomaterials from post-consumer textile waste in mixed fibers and, from their qualitative and quantitative properties, define the most suitable application.

The research is supported by the main case study, Insieme Cooperativa Sociale of Vicenza. This entity (ex. L.381/91) is a non-profit organization (Onlus) that involves more than one hundred workers in a single project, giving a second chance to people and things that do not have one.

The research is structured into a desk research part and an applied research part. The former focuses on the analysis of the textile sector in the age of circularity, post-consumer waste management, and analysis of the relevant regulatory and economic framework. Important is the mapping of national and international case studies, which include all those entities operating in the textile waste and scrap recycling sector. The second phase focuses on the definition and application of the experimental methodology and is structured into the following phases: waste selection and sampling, material preparation and fraying, testing of material specimens, validation of the process, and analysis of qualitative and quantitative properties of the samples obtained.

The added value of the research will be precisely the promotion of new recovery actions that are struggling to emerge today, demonstrating the potentials of textile waste metamorphoses, intrinsic peculiarities, and otherwise little exploited properties. The research results can be used to devise targeted strategies to promote the application and dissemination of the developed process along with the related results obtained. This effort can help promote and increase the adoption of circular design and ecological transition principles within the area's manufacturing companies.

1. The Textile Industry in the Era of Circularity: from Production to Waste Management

The textile sector represents one of the most important industrial supply chains in Italian manufacturing and, at the same time, has a significant ecological footprint. The European Commission's Circular Economy Action Plan states that the textile sector is the fourth largest user of raw materials and water (after food, construction, and transport) and the fifth largest emitter of greenhouse gases, estimated to account for 10 percent of total global emissions (European Environment Agency [EEA], 2019). In addition, textile production has nearly doubled in the years between 2000 and 2015 (European Commission, 2020), and apparel consumption is estimated to grow 63 percent by 2030, from the current 62 million to 102 million tons (EEA, 2022). Many of these products, unsold in stores or worn only a few times, end up being thrown into illegal landfills, incinerated, or put into other routes (de Castro, 2021).
The problem extends to end-of-life management of products: the combination of increasing production and shortening the life cycle of garments has generated an exponential increase in textile waste. Currently, only 1 percent of globally produced textile materials are reused (Ellen MacArthur Foundation [EMF], 2017). The waste rate is set to grow: gross waste volumes are projected to increase to 8.5-9 million tons by 2030 due to increased consumption and population growth (Cobbing et al., 2022). In addition, due to some technological gaps, recycling operations are further complex for products composed of a mix of fibers.

2. From Vicious to Virtuous Circles: Waste as a Resource

These wastes constitute a fundamental and complex part of the life cycle of textile products and, at the same time, continue to be a pervasive element. The increasing visibility of the problem has brought about a change in the perception of their fate. The concept of waste has acquired a positive connotation, being considered no longer just as an inert object to get rid of but as a resource. This vision change allows the transition from a vicious circle to a virtuous one: waste and refuse from one production or consumption cycle become inputs for another process, different or similar to the previous one (Viale, 1994, p. 108). The outcome of this transformation is a rethinking of the cardinal positions of resources and waste as the starting and ending points of economic and production processes.
Consequently, it is essential to outline a design framework that paves the way for a significant change of productive, economic, environmental, and cultural significance in the use of material resources. This approach becomes crucial to turn waste abundance into a design opportunity to prevent a situation in which the waste issue can assume apocalyptic dimensions (Armiero, 2021).

3. Research Objectives and Methodology

Textiles today are the subject of great interest in recycling processes, motivated by significant environmental, social, and legislative pressures. In line with contemporary needs, the research aims to explore the potential applications of post-consumer textile waste, focusing mainly on textiles with mixed fiber composition and those whose material is challenging to identify due to the lack of labels, thus impeding the recycling process. The objective is to study, test, and define a new process of producing neomaterials from post-consumer textile waste in mixed fibers and, from their qualitative and quantitative attributes, determine the most suitable application.
The research is supported by the main case study, Insieme Cooperativa Sociale of Vicenza, a company that co-funded the doctoral fellowship. This entity (ex. L.381/91) is a Non-Profit Organization of Social Utility (Onlus) that involves more than one hundred workers in a single plan: to give a second chance to people and things that do not have one. Insieme Cooperativa Sociale collects, in the territory of Vicenza, 300 tons of textile inputs each year, specifically 100 tons per year of used garments collected in 18 municipalities and 200 tons of garments donated by citizens. Of this material, 65 percent manages to be recovered through reuse, recycling, or downcycling operations, while 35 percent becomes final waste. For Insieme

Cooperativa Sociale, it is essential to intervene in end-of-life waste management in such a way as to optimize all resources by implementing strategies aimed at maximizing the value of the material at each stage of its life cycle.
The research consists of two distinct parts: a desk research phase and another dedicated to applied research. The desk research focuses mainly on the investigation of the textile sector in the age of circularity, - assessing its environmental and socio-economic impacts - on post-consumer waste management, and the analysis of the relevant regulatory and economic framework. Of particular importance in this phase is the mapping of case studies at the national and international level, which include all those entities operating in the textile waste and scrap recycling sector.

The second phase, applied research, focuses on establishing the experimental methodology. The latter is framed in the following steps:

- **selection and sampling of waste**, starting with a big bag and sorted by (a) the presence or absence of the label and then (b) by prevailing material type;
- **preparation of the material and fraying**, the waste is stripped of non-textile components that could damage the machinery (buttons, zippers, various inserts) and subjected to a fraying reduction operation using the machine named "fraying machine";
- **experimentation of material specimens**, favoring treatments of a mechanical nature, to be replicated for each distinct group of frayed material and different reference batches;
- **validation of the process**, in the case of performing specimens, the process will have to be repeated to be validated;
- **analysis of qualitative and quantitative properties** of the material to define the most suitable application scenario.

4. Existing and Emerging Entities Engaging in Textile Waste Recycling

The reuse of textile scraps and waste has ancient roots: evidence of these practices dates back to the period between 1500 B.C. and 1500 A.D., where widespread recycling and reuse practices are traced not only for clothing but also for other purposes such as pots and pans, bricks, jewelry, insulation, etc. (Grömer, 2017). On the Italian territory, one of the most relevant examples is that of the textile district of Prato, which has been recycling wool from used clothes for more than 150 years - when these were called "rags" and recycling had no positive - meaning boasts numerous realities involved in studying, recycling or reusing textile material.
Today, these traditions are adapting to evolving textile composition, which is becoming more diverse, leading to innovations in recycling processes. This diversification has made it possible to identify three distinct approaches in recycling practices, influenced by the type of fiber input and output produced.
The analysis of the entities, divided into the three approaches, is intended to provide an overview of the promising emerging, productively diversified reality of companies or research groups that have reached different stages of development but are still relevant to the study.

4.1 Single Input Fibers that Remain Single

"Fiber-to-fiber" recycling processes are frequently marked by using mechanical practices. In conformity with ISO 5157:2023, such recycling processes are usually based on physical forces that can be used in isolation to recycle fabrics or fibers or as pre-processing for other recycling processes.
Manteco, a leading company in the Prato district, has launched MWool, a line of regenerated wool fabrics that meets the same stringent quality standards as virgin wool. Similarly, Beste, also in the Prato scene, is dedicated to regenerating natural fibers to reintegrate them into the fashion and related sectors. In Spain, Recover Fiber, based in Alicante, excels in processing cotton fibers from post-industrial and pre/post-consumer sources. The Recover™ recycling processes convert textile waste into high-quality recycled cotton fibers and blends, providing an end-to-end closed-loop solution.

4.2 Mixed Input Fibers that Return a Single

The case studies presented share an approach to chemical recycling, defined by ISO 5157:2023 as a process that uses chemical dissolution or chemical reactions to recycle polymers or monomers. A prime example is Renewcell, based in Sweden, which has introduced Circulose. Through the manipulation of clothing, Renewcell extracts cellulose dries it, and presses it into sheets, which are then processed into new textile fibers by third-party companies. Similarly, Infinite Fiber, based in Finland, has patented Infinna, a 100 percent material from post-consumer textiles, with at least 88 percent cotton, fully recycled and recyclable. The process of obtaining Infinna uses cellulose from fabrics, eliminating other matter, generating a virgin fiber that is similar to cotton and completely biodegradable.

4.3 Mixed Input Fibers that Remain Mixed

The case studies presented here address the complex challenge of recycling mixed fibers composed of post-consumer natural and synthetic materials. In these situations, the output does not belong in the textile sector because of the inferior material quality but finds innovative applications in other sectors. A significant example is Paris-based FabBrick, which uses patented technology to transform textile waste into semi-finished or finished products using a natural resin. In Campi Bisenzio, near Firenze, Manifattura Maiano converts textile scraps and industrial waste into thermoacoustic panels, which are then sanitized without water, chemicals, or adhesives. If the product is free of contamination, it can be fully recovered for recycling or reuse. In Ebeltoft, Denmark, Kvadrat stands out for processing post-consumer wool and cotton into panels and felt used as vertical wall coverings or as tabletops (Textile Tabletop). The felts, composed mainly of industrial wool waste and thermoplastic binder, are produced without the use of any artificial dyes or chemicals, exhibiting variations in color and fiber arrangement from batch to batch.

Table 1. Classification of case studies by type of fiber input, type of waste, output, and recycling.

Case study	Classification	Type of waste	Type of recycling	Website
Manteco (Italy)	Single input fiber that return single	Post-industrial, post-consumer	Mechanical	manteco.com
Beste (Italy)	Single input fiber that return single	Post-industrial, pre-consumer	Mechanical	beste.it
Recover Fiber (Spain)	Single input fiber that return single	Post-industrial, pre-consumer, post-consumer	Mechanical	recoverfiber.com
Renewcell (Sweden)	Mixed input fiber that return single	Post-industrial, post-consumer	Chemical	circulo.se/en/
Infinited Fiber (Finland)	Mixed input fiber that return single	Post-consumer	Mechanical, chemical	infinitedfiber.com
FabBrick (France)	Mixed input fiber that remain mixed	Pre-consumer, post-consumer	Experimental	fab-brick.com
Manifattura Maiano (Italy)	Mixed input fibers that remained mixed	Post-industrial, post-consumer	Mechanical	maiano.it
Kvadrat (Denmark)	Mixed input fibers that remained fibers	Post-industrial, post-consumer	Experimental	kvadrat.dk

5. Initial Results, Next Step, and Conclusion

Although virtuous examples emerge of realities operating in the sector, recycling - which starts from an upstream rethinking since separate collections - especially for post-consumer, remains a segment of the textile value chain to be built almost from scratch (Berardi et al., 2023). From the analysis of the case studies, three different approaches in textile recycling practices were intercepted, which change according to the type of fiber inputs and outputs obtained, namely:

- Output composed of **single fiber inputs that remain single**, e.g., a material consisting of a single fiber, which is processed, often mechanically, to become mono-fiber yarn again;
- Output made up of **mixed input fibers that return single**, e.g., a material composed of polyester/cotton, which is processed, often chemically, to achieve monomer or polymer dissolution;
- Output composed of **mixed input fibers that remain mixed**, e.g., materials consisting of a fiber mix, often of unknown origin, that is processed mechanically to obtain semi-finished products composed of the same original fiber mix.

The initial analysis shows that recycling materials composed of a mixture of fibers is still an unresolved challenge. However, this is attributable to the lack of advanced technologies on the market and the tendency to process only specific types of fibers, even when present in blends. In an attempt to provide an answer to the problem, the applied research part has started.
Specifically, the first phase included the sorting and sampling of waste from an initial starting lot. These wastes were divided, at first, between labeled and unlabeled garments, and these wastes, at a later stage, were divided by prevailing fiber type, i.e., into (i) mixed fiber textile material with wool percentage >60%; (ii) mixed fiber textile material with synthetic fiber percentage >60%; (iii) mixed fiber textile material with cotton percentage >60%. The unlabeled textile material was not included in one of the described categories because the type of fibers could not be understood, but it will also be processed in the next stages of experimentation. The second stage involved the removal of non-textile components from the garments, such as buttons, zippers, and various applications (which would damage the machinery). Next, the waste was frayed by groups, as per the subdivision described, using the fraying machine on Cooperativa's premises. Once all the necessary frayed material has been obtained, the next step will be the production of neomaterial samples, using technologies and processes either specific to the textile sector or from other sectors. The goal is to draw inspiration also from entirely different contexts to address the problem at issue in an innovative way. The added value of the research will be precisely the promotion of new recovery actions that are struggling to emerge today, demonstrating the potentials of textile waste metamorphoses, intrinsic peculiarities, and otherwise little exploited properties. The research results can be used to develop targeted strategies to promote the application and dissemination of the developed process along with the related results obtained. This effort can help promote and increase the adoption of circular design and ecological transition principles within the area's manufacturing companies.

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Carmen Digiorgio Giannitto, a PhD student in Design per il Made in Italy, between the Università della Campania Luigi Vanvitelli and the Università Iuav di Venezia, focuses on the valorization of textile waste for new applications, promoting circular processes in the production, and territorial ecosystem.

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P/REFERENCES OF DESIGN

CRAFT-DRIVEN INNOVATION – THE "KNOW-HOW" AT THE BASE OF INDUSTRIAL INNOVATION.

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KEYWORDS | CRAFT-DRIVEN INNOVATION, KNOW-HOW, MADE IN ITALY, KNOWLEDGE SHARING, OPEN INNOVATION

ABSTRACT | This industrial PhD. research, co-funded by industry, aims to highlight the potential arising from the integration between innovative technological processes and traditional manual techniques, transmitting know-how within the new product development of the upholstered furniture sector high-end, with a focus on small and medium-sized enterprises (SMEs) of the “Made in Italy.”

Simultaneously, the value of Open Innovation is underlined, hence the collaboration between the research world and the enterprise and the role of design as a mediator between this bidirectional flow of knowledge. Today, Italian manufacturing SMEs face complex and interconnected challenges exacerbated by environmental, economic, and social crises. In this context, synergies such as those described above are strategic tools for achieving sustainable innovation and enhancing the “Made in Italy” value.

The scientific literature supporting the contribution includes various research areas, such as the role of design in innovation, the craft-driven innovation approach, and the concept of innovation through tradition. Moreover, different ways of adopting technological innovations are explored, both in production phases and in dissemination within new product development.

In this phase, the research is based on User Research, exploring the co-financing company and its surrounding context to define specific business needs. Subsequent adoption of additional methodologies is planned to define the proposed research trajectories and achieve a pilot project to be tested in the host company. This study contributes to the scientific landscape by enriching the surrounding industrial field, validating the hypothesis that collaboration between digital and artisanal skills and between the research and business worlds represents a significant potential for the future of the sector.

1. Introduction

Today, industrial realities face global challenges where issues are increasingly complex and interconnected. Design, as a discipline, has always sought new ways to tackle these complexities and is now more involved in these major transformations than ever before. (Dorst, 2019; Fondazione Symbola, 2023)
These challenges, resulting from market developments, mass production, and environmental, economic, and social crises, severely test manufacturing companies, specifically the small and medium-sized enterprises (SMEs) of the "Made in Italy." (Assolombarda, 2021)
For instance, one of the models that many countries around the world are leaning towards today is driven by a market economy and a mass consumption society. (Brocchi, 2022)
In the above context, to maintain competitiveness and add value, the "Made in Italy," although associated with prestige, quality, artisanal innovation, and "know-how," must also be synonymous with circularity and sustainability. (Barbaritano, Bravi & Savelli, 2019)
Regarding these strategies, and specifically a reconsideration of production paradigms, SMEs, being aware that they cannot solely rely on their internal Research and Development expertise, are expanding their vision to allow external actors such as Universities to permeate their boundaries, adopting the Open Innovation (OI) approach. (Chesbrough, 2003; de las Heras-Rosas & Herrera, 2021)
These exchanges of bidirectional knowledge flows require an intermediary, namely the figure of the designer, who, as a mediator of complexity, allows for the construction of a simplified model of reality, observing and utilizing other disciplines as project inputs. (Germak, 2008)
This highlights a fundamental approach for the current research based on interdisciplinarity and cooperation, where design is defined as a tool to connect different actors in innovation (Magistretti et al., 2020)
The general objective of the research is to identify points of contact between the development of advanced technologies and the world of artisanal experience, exploring how this traditional and ancient knowledge contributes to new product development (NPD) to bring innovation within manufacturing enterprises.
The project was funded by EDRA S.p.A, an Italian family-owned company based in the province of Pisa, specializing in the creation of high-end upholstered furniture. EDRA employs both industrial machinery and manual techniques. This adoption constitutes specific know-how that is both passed down internally and developed together with external collaborators. The company's supply chain is mainly confined to the Tuscan territory and consists of long-standing relationships. Thanks to these relationships, EDRA develops innovative technologies and methodologies often subject to patents and thus represents a potential case study of innovation in the "Made in Italy" and the context of Italian family businesses. Being a family business, it is even more interesting, based on the existing literature, to investigate how know-how is strategic in innovation. (De Massis, et al., 2016).
Therefore, such innovation must not be an end in itself but must be meaningful with social and environmental repercussions. The present research thus focuses on re-evaluating the importance of the hand industry, with its risk workmanship (Pye, 1968) and the concept of "Craft Driven Innovation" (CDI) (Veliz Reyes et al., 2019), which combines craft skills and learning through learning by making, implementing the most up-to-date technological components. These approaches are reflected today in the figure of a contemporary craftsman who adopts technology to support traditional practices. (Micelli, 2011)
According to De Massis et al. (2016), the main area of "Innovation Through Tradition," based on the "Know-How" and historical-cultural tradition, is considered a useful strategy to bring quality and innovation.

2. Literature Review

The literature on the distinctive role of the design discipline in stimulating innovation is extensive, and different ways of innovating through design are addressed based on the drive adopted, such as Design Thinking or Design Driven Innovation. A further perspective on the role of design in knowledge acquisition emerges from an analysis of the literature on Open Innovation. (Lambert, & Flood, 2017)
Indeed, it has been emphasized how the involvement of design and researchers within companies can help

imagine future scenarios to meet current challenges. (Magistretti, et al., 2020) In this context, for example, the European Commission (policy no. 3, 2021, Industry 5.0 A Transformative Vision For Europe) suggests shifting from a scenario based on overproduction (Industry 4.0) to an environmentally and socially sustainable one defined as Industry 5.0. (European Commission, 2021) Furthermore, the 2030 Agenda promotes technological development, research, and innovation, recognizing culture and creativity as drivers of sustainable development. (European Commission, 2022) To foster the relationship between enterprises and research entities, there are actions guided by research projects with objectives like those outlined in the National Recovery and Resilience Plan (PNRR), particularly within Mission 4: Education and Research "M4C2" - from research to enterprises - "Strengthening research and the dissemination of innovative models for basic applied research conducted in synergy between universities and companies." (Italian Government, 2021)

Beyond the main contributions concerning design, it is relevant to explore the literature on traditional knowledge and its relationship to innovation. Regarding this phenomenon, numerous studies have revealed the role of the so-called innovation strategy through tradition, through the "Innovation Through Tradition" approach (De Massis et al., 2016), where the influence of knowledge maturity on the value of innovation is analyzed, (Petruzzelli, Ardito & Savino, 2018) and tradition is considered as an accumulation of know-how, contributing to the identity formation of individuals, organisations, and territories. (Magistretti, et al., 2020)
The "Computing Craft" study (3D printing for architectural, structural elements in clay, robotically supported) is a project that explores the CDI approach and shows how craftsmanship allows the identification of innovative approaches to robotic manufacturing in architecture, thanks to its ability to understand and experiment with materials. (Veliz Reyes et al., 2019)
Similarly, the DefeXtiles research project (3D printing quasi-woven textiles via underextrusion) exemplifies the proposed CDI approach, where underextrusion, a technological gap, can be exploited to quickly print thin and flexible textiles. This approach reflects how, within NPD, a craftsperson's attitude and mindset towards technology can lead to significant and radical innovation. (Forman, et al., 2020)
Considering manual techniques as an element of inspiration is not the only aspect addressed in this research. Indeed, biology-inspired design uses analogies with biological systems to achieve solutions for sustainable development. (Helms, Vattam & Goel, 2009)
The literature on design sciences from a project perspective indeed presents numerous bio-inspired design case studies, such as the "Biomimicry Chair" project - 3D Printed Soft Seat, Lilian van Daal, 2014. In response to traditional upholstered furniture, impactful in production and disposal, this mono-material product in nylon, inspired by the structure of plant cells, utilizes additive manufacturing as the sole production technique, where varying local structures achieve different properties to meet the requirements of different elements, such as legs or seating. (Sauerwein, et al., 2019)
This approach is reflected in Hybrid Design, which allows the creation of hybrid artifacts halfway between nature and artifice, where the design is inspired not only by nature but by its conception of logic, and thus interdisciplinarity is fundamental. (Langella, 2021)
As diverse skills are required, communication challenges arise, highlighting once again the importance of the designer's role as a mediator of knowledge. (Germak, 2008)
Craftsmanship is primarily about tools as well as materials, and digital tools are transforming the way things are made, where they are made, and how they are communicated.
Adopting such tools must, therefore, result in an enhancement of certain knowledge on a multitude of levels, both for the design and production process by acting on the generation change and also for the dissemination of know-how by enhancing certain intangible values.
In this section, the research emphasizes how technologies such as eXtended Reality (XR) are increasingly applied as they benefit from the phenomenon of Immersive Experience Design. (Elmezeny, Edenhofer, & Wimmer, 2018)
In the context of XR, the DISTANCE project (Digital Immersive Technologies and Craft Engagement) allows artisans to apply their tactile skills and material knowledge in a digital immersive space, with the opportunity to collaborate and share experiences. In this case, it is emphasized how crucial it is for creative professionals to acquire digital skills, both for creative production and collaboration. (Panneels, et al., 2023)

3. Methodology

This research is based on the general objective of evaluating the potential of integrating innovative technological processes with traditional manual techniques, preserving and transmitting intangible knowledge and values within the entire NPD process in the upholstered furniture sector.
Being a Ph.D. co-financed by a company, eighteen months at the company, EDRA S.p.A. is planned, where alternative investigative strategies aimed at qualitative research, such as ethnographic research (Creswell, 2017) and the collection of case studies (YIN, 2009), will delve deeper into the company's needs to act more efficiently and targeted. The first investigative tool applied is ethnographic research, in which the company is studied as a whole, actors, and context for an extended period, collecting observational and interview data (Creswell, 2017). To these participatory observations, which involve a high level of involvement, other documentary sources such as books and publications are integrated.
This exploratory and qualitative approach will be added to the activity of collecting and analyzing information on how people experience User Research (UR). (Rohrer, 2014)
Tools such as interviews and surveys will first be submitted to the top management of the main corporate areas, followed by more targeted surveys of the employees of each area and then to the end customers.
This first phase will make it possible to bring to light specific problems connected to the company, both those directly expressed and, above all, those unexpressed, and thus identify which of the potential research trajectories listed below to undertake to realize a pilot project aimed at the development of the expected outputs, which can be adopted within the company and thus 'tested' within the company (Fig.1).

3.1 Research Trajectories:

- Innovative production based on the interpretation of existing technologies through a vision inspired by manual techniques, developing new design and production methods identified in the terminology of "Craft Driven Design";
- Development of an innovative approach to design that combines craftsmen and artists with the designers of the future through a methodology identified in the terminology "Craft Inspired Design";
- Definition of new ways of conceiving upholstery through the adoption of interdisciplinarity and an experimental approach, with a focus on sustainable materials/structures, bio-inspired and/or technologically advanced;
- Transferring and enhancing the company's know-how on various levels, design, production, and communication, to raise awareness among future designers and end-users towards the firm's identity.

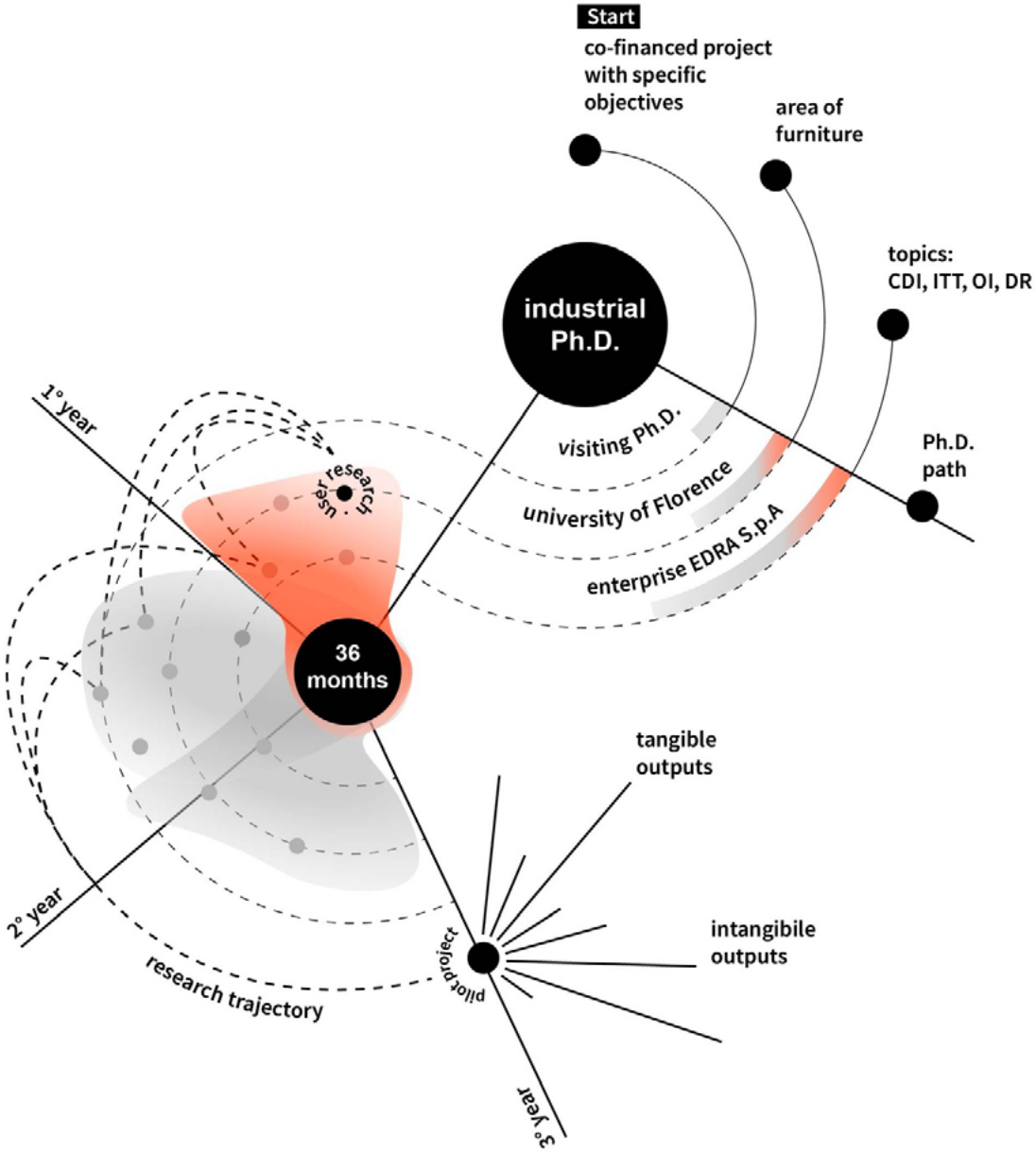


Figure 1. The graph shows the path of the industrial Ph.D. Starting from a co-funded project with pre-established objectives and an established context of intervention, to which topics are added (CDI: Craft Driven Innovation; ITT: Innovation Through Tradition; OI: Open Innovation; DR: Design Research) The development of the course extends over 36 months of which: 6 Visiting Ph.D., 12 University of Florence and 18 within Edra S.p.A. The highlighted area describes the current state, while a pilot project is envisaged that will extend through tangible and intangible outputs.

4. Expected Results

Based on the pre-set objectives in this research project, the valorization of know-how through the CDI methodology is anticipated. As analyzed in Section 2, this methodology, which combines craft skills and learning through practice with the latest technological tools, will be applicable in the corporate context and will branch into the research trajectories mentioned above.
Furthermore, an increased awareness among future designers and end-users towards the company's identity and the issues emerging from the research problem is expected. Indeed, within these scenarios, sustainability will be achieved in multiple areas, including social, environmental, and cultural, for example, through respect for materials, resources, and intangible values.
Through qualitative and quantitative analysis using User Research (Rohrer, 2014), a vision of the company's issues will be obtained both macroscopically and microscopically, directly confined to the reference

company and also extended to broader contexts. This will then allow for the implementation of such context by identifying the most critical practices to act upon.
Subsequently, additional methodologies will be adopted capable of directing the research trajectories toward a pilot project "tested" within the enterprise, aiming to confirm the research question by introducing new practices or solutions for improvement or innovation.

5. Conclusions

The research is currently in an initial testing phase with the project 'Craft Driven Innovation. The 'Know-How' at the basis of industrial innovation,' in the context of the doctoral fellowship 'Innovative Methods of Industrialization with Manual Techniques,' aims to meet the research question based on the innovation of production techniques by emphasizing the role of manual skills through scientific interpretation.
From the initial investigative approaches described in Section 3, within the company and the surrounding reference context, the need to demonstrate how the capabilities of the design discipline can bring innovation, intertwining the know-how belonging to the "Made in Italy" and technological advancement, is evident.
The project will be the starting point for other company activities aimed at practical experimentation by adopting advanced technologies. This will lead to an expansion of academic awareness of the industrial context with the possibility of materializing the added value of the research. Thus, the contribution enriches the scientific and industrial landscape, validating that the collaboration between digital and craft skills and between the research world and the business world represents a significant potential for the future of the sector.

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DESIGN AND RESEARCH FOR A FASHIONABLE PROTOTYPE FOR PATIENTS WITH FECAL INCONTINENCE.

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KEYWORDS | FASHION DESIGN, TRANSDISCIPLINARY DESIGN, FECAL INCONTINENCE, ADOLESCENCE

ABSTRACT | The negative impact of Fecal Incontinence (FI) on the quality of life of adolescents and their families and healthcare systems is well established. Moreover, it has been observed that FI leads to a decline in the psychological well-being of affected adolescents. Fashion Design can positively impact society by integrating creative design and social innovation. However, particularly in the intimate fashion field, the adolescent segment is an unexplored area of scientific research.

This paper addresses the theme's importance, focusing on the research design for developing an innovative and fashionable prototype for FI as part of an ongoing Ph.D. work. The current research proposes a mixed methodology through a case study, using Portuguese adolescents diagnosed with FI aged 8 to 14 as a sample.

This paper aims to contribute to the literature review of incontinence-related design products research and describe a sample of existing products on the European market. Finally, it states the importance of a transdisciplinary dialogue in creating products to enhance the quality of life for those diagnosed with FI.

1. Introduction

Fashion designs assume a purpose by creating aesthetically pleasing products capable of triggering emotions and sensations (Lerpiniere, 2013).

The importance of studying the evolution of intimate fashion design, especially in the children's segment, cannot be overstated. It can unlock new knowledge in fashion design and open new research areas on the emotional experience that aesthetics can bring to fashion products at younger ages. The research on the aesthetic preferences of children and adolescents for their intimate apparel needs to be deepened. According to a recent study by Rocha et al. (2020), age is an essential factor influencing our aesthetic preferences and development. Despite other variables that can also affect our aesthetic preferences, it was found that different stages of aesthetic development are achieved at different ages. Thompson (1991) highlights the fundamental role that childhood and adolescence have in individual construction, where emotional and conscious beings are developed. For those reasons, a deeper theoretical reflection on the symbolism the experience assumes in the relationship with intimate apparel at young ages, mainly adolescence, is essential to further research. Additionally, a study that contributes to developing a prototype capable of addressing the problems arising from incontinence, particularly fecal, can have far-reaching benefits for the user, the caregiver, and the healthcare system. By conducting such research, we can create products that will improve the quality of life for those who use them and positively impact society.

Incontinence can be categorized as urinary or fecal. This paper presents the design of an ongoing Ph.D. research that proposes a higher incidence of fecal incontinence, as it is a growing problem. Child fecal incontinence can be challenging for children and adolescents between the ages of 4 and 17 (Ferreira-Maia et al., 2016; Robin et al., 2018; Rajindrajith et al., 2021). The involuntary loss of stool can cause embarrassment and discomfort. The initial treatment usually involves drug therapy, which may include laxatives, along with a fiber-rich diet. Additionally, establishing a daily routine to re-educate the anal sphincter muscles can help manage the condition (Rajindrajith et al., 2021).

FI belongs to the group of gastrointestinal disorders. According to a recent study by Rajindrajith et al. (2021), fecal incontinence can be classified into two categories: fecal incontinence (FI) and Organic Incontinence (OI). The first category has a higher prevalence, especially among males. The study also suggests that constipation is one of the primary reasons for fecal incontinence. Another study conducted by Scarpato et al. (2018) in school settings (sample of 13,750 children and adolescents) in European Mediterranean countries showed a prevalence of gastrointestinal disorders of 20.7% in children between 4 and 10 years old and 26.6% in adolescents between 11 and 18 years old, among these cases 11.7% and 13.1% respectively were related to constipation. Levy et al. (2017) conducted a systematic literature review and found that the prevalence of constipation varies across different regions worldwide. In North and South America, the prevalence of constipation in children and adolescents ranges between 10% and 23%. In Europe, the prevalence is lower, between 0.7% and 12%, only in the group of children. In Asia, the prevalence ranges between 0.05% and 29.6%.

Fecal incontinence is a common problem among children and is one of the main reasons for referral to gastrointestinal consultations (Ferreira-Maia et al., 2016). Inan et al. (2007) state that fecal incontinence is common in childhood and should be considered a common problem. According to Levy et al. (2017), constipation (most often resulting in FI) has an estimated average prevalence of about 15% of the child population. There is a consensus that this pathology affects the quality of life of children and families, impacts healthcare systems, and contributes to a decrease in the psychological well-being of these children (Joinson et al., 2006; Rajindrajith et al., 2013; Rajindrajith et al., 2021).

The ongoing research presented in this paper sets out the main objective of developing and testing a fashionable prototype that can enhance the quality of life of adolescents diagnosed with FI.

2. A Review of Incontinence Products

Despite the significant evolution of products for incontinence, from a design point of view over the last decades, there are no aesthetically attractive solutions, especially in the children's segment. Although an undergarment does not solve the incontinence problem, particularly fecal, a tailored fashion design product can solve or mitigate several initial problems, mainly using smart and functional textiles.

Three significant issues related to fecal incontinence are identified in an initial analysis: storage, odor, and tactility. Involuntary stool loss results from the loss of anal sphincter movement, and children and adolescents are often unaware that they are defecating, which makes stool storage problematic (Levy et al., 2017).

It is essential to understand how to reduce the time the child's skin is in contact with feces while following the daily hygiene routine suggested in therapy.

Moreover, the unpleasant odor of feces leads to stigmatization and exclusion (Joinson et al., 2006; Rajindrajith et al., 2013). Many of these children lose their sensitivity to fecal odors and cannot identify them after some time. When designing a new solution, neutralizing the odor released and accumulated in intimate fashion clothing should be considered. McNichol et al. (2018) state that frequent skin exposure to feces can cause 'incontinence-associated dermatitis.'

An initial literature review on research into textiles applied to developing products for incontinence reveals different lines of research. Still, most of them are aimed at monitoring and alarming urinary incontinence. Liu et al. (2012) have presented a novel solution for incontinence monitoring, incorporating conductive yarns on a seamless textile structure with an alarm system. The authors also state that smart and functional wearable textile product research requires collaboration across multiple disciplines, including aesthetic design, biomedical engineering, science, and technology, reinforcing the need for transdisciplinary dialogue in developing this type of product. Also, in a study published in 2020, Gaubert et al. focused on improving enuresis alarm systems. They aimed to make the systems more comfortable for children and increase their acceptance. They achieved this by replacing the rigid alarm with a flexible one. The new system includes a humidity sensor and wire that are fully integrated into a textile structure.

2.1 Existing Products

An analysis was conducted on the existing products that primarily address incontinence, which can be urinary, fecal, or both. The main objective was to understand the current product offerings better.

Table 1 showcases a sample of existing products available on the European Market. The products are compared by gender (female, male, or unisex), age group (child or adult), type (pants, boxers, diapers with flaps, diapers-pants, pads), response to physical and sensory problems arising from incontinence such as storage and odor, and product life cycle (disposable or reusable). The survey also includes washable and reusable products for urinary incontinence that can inspire designing a product that addresses fecal incontinence.

Table 1. Sample of existing products on the European Market.

Product	Gender	Segment	Typology	Answer	Life Cycle
Happyjam, Dodot	Male and Female options	8y to 12y (27-55kg)	Overnight Diaper	Odor Control, Nocturnal Enuresis, Ultra Absorbency (12h), Comfortable textiles that allow the skin to breathe, Elastic waistband for better fitting, and that maintains protective barriers for possible leakage.	Disposable
Underjams, Pampers	Male and Female options	Size S/M (17-29kg) Size L/XL (26-39kg)	Overnight Diaper	Odor Control, Nocturnal Enuresis, Ultra Absorbency (12h), Comfortable textiles that allow the skin to breathe, Elastic waistband for better fitting, and that maintains protective barriers for possible leakage.	Disposable
DryNites, Pampers	Male and Female options	4y to 7y (17-30kg) 8y to 15y (27-57kg)	Overnight Diaper	Odor Control, Nocturnal Enuresis, Ultra Absorbency (12h), Comfortable textiles that allow the skin to breathe, Elastic waistband for better fitting, and that maintains protective barriers for possible leakage.	Disposable
McKesson	Unisex	Adult + Senior	Daily Diaper	Odor Control, Nocturnal Enuresis, Ultra Absorbency (12h), Comfortable textiles that allow the skin to breathe, Elastic waistband for better fitting, and that maintains protective barriers for possible leakage.	Disposable
Protective Underwear, Tena Men	Male	Adult	Diaper-Pant	Odor control, enuresis, humidity control, and an elastic waistband are needed for better fitting.	
Active Fit, Tena Men	Male	Adult	Pad	Odor Control, Enuresis, Thin (4mm), Ergonomic, Humidity Control.	
Training Pants, Bambino Mio	Unisex	12m to 24m (11-13kg) 2y to 3y (13-15kg) +3y (+15kg)	Pantie	Enuresis, Water-resistant and inner par, Comfortable and stretchy waistband for active toddlers	
Confitex for Men	Male	Adult	Boxer Short	Ultra Absorbency, Discreet design, close to regular boxer short form, Comfortable and breathable textiles.	
Organics for Men, LeakWear	Male	Adult	Boxer Short	Ultra Absorbency, Discreet design, close to regular boxer short form, Comfortable and breathable textiles.	
Incontinence Boxer Short, Impetus	Male	Adult	Boxer Short	Ultra absorbency, discreet design, close to regular boxer short form, comfortable and breathable textiles, and odor control.	

Since feces in fecal incontinence can have a range of densities, from pasty to liquid, menstrual underwear was also considered a product that could contribute to innovation and design in this area. Small clots often accompany liquid menstruation on the surface of regular menstrual pads. Therefore, technology transfer from non-disposable products to menstruation into fecal incontinence products could partially solve the storage problem.

Menstrual pants are one of the most advanced products in intimate apparel, and they have an absorbent function. Impetus Group, for example, has developed the Period EcoPanty, which is absorbent, hypoallergenic, thin-layered, anti-odor, and reusable.

3. Methodology of the Ongoing Research

The ongoing research is exploratory and adopts a methodological approach that recognizes the various terminologies used in the fashion industry. The term "intimate fashion clothing" refers to underwear, undergarments, and intimate clothing.

The research employs a mixed-method approach to collect and analyze quantitative and qualitative data in different phases, as described below:

1. The first phase will be a case study using a qualitative methodology that will allow a more profound knowledge of FI medical disorder:
    - Semi-open interviews with a focus group of specialists, mainly from pediatrics, a pediatric gastroenterologist, a child psychiatrist, and parents/caregivers. To validate our data collection, a pediatrician will lead this expert group;
    - In-depth semi-open interviews will be conducted using an exploratory and phenomenological approach to understanding the main problems arising from fecal incontinence. These interviews will be conducted with a non-probabilistic sample by convenience, consisting of patients diagnosed with fecal incontinence aged between 8 and 14 whom two health institutions are following in Oporto. The Interpretative Phenomenological Analysis (IPA) will be adopted to interpret the interviews.
2. (Once the problems arising from FI are acknowledged, a study will be conducted on Portuguese adolescents aged between 8 and 14. The study assesses their aesthetic preferences and perception of aesthetics, comfort, and well-being. The surveys will be applied to a probabilistic sample of adolescents without the disorder. The sample will be selected from a randomized selection of schools in the metropolitan area of Oporto. This sampling method integrates the two stages of Piaget's child development (1964): concrete (8 to 11 years) and formal operative (12 to 14 years). The prototype can be developed more accurately by cross-referencing the perceptions and needs of adolescents with and without the disorder.
3. Prototype development;
4. To validate the prototype, it will be tested in a focus group with adolescents between 8 and 14 years old and a control group with children without the disorder.

This study involves minors who must voluntarily agree to participate. To ensure the study is conducted ethically, it will be reviewed and approved by the Ethics Committee of the University of Beira Interior and the Ethics Committees of partner hospitals. It is important to note that all minors who participate in the study must obtain prior consent from their parents or legal guardians. Additionally, all data collected will be protected by the Data Protection Act, which aims to preserve the anonymity and privacy of the participants.

4. Conclusions

Understanding the emotional relation with intimate fashion clothing in adolescence will allow this knowledge to design more visually pleasing fashion items that align with modern ergonomics theories and promote the user's comfort and well-being. Particularly in the case of FI disorder, the application of new knowledge from this research can be helpful to the creation of innovative intimate fashion products that improve intimate hygiene in adolescents. This research aims to develop a lower environmental and economic impact product. Additionally, it is expected that the research will generate interest in the field of children's intimate fashion clothing and pave the way for further studies in related areas such as the history of children's intimate fashion clothing, ergonomics, and children's anthropometrics, and the role of design in children's fashion products. Finally, as the research is conducted, it will be pertinent to realize the importance of transdisciplinary dialogue in product development, such as the one proposed.

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P/REFERENCES OF DESIGN

IMPLEMENTING EDUCATION FOR SUSTAINABLE DEVELOPMENT AS A GUIDING PRINCIPLE IN FASHION DESIGN HIGHER EDUCATION.

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KEYWORDS | ESD, SUSTAINABLE FASHION, HIGHER EDUCATION, IRAN, GERMANY

ABSTRACT | This doctoral research explores ESD implementation in higher education of fashion and apparel design in Germany and Iran using a design-based research (DBR) model. It encompasses multiple phases, with this paper covering the first two: a systematic literature review and qualitative document analysis of B.A. and M.A. fashion and apparel design curricula. The following phases will involve DBR iterative processes. Initial findings reveal limited research in Germany and Iran on this topic. Nine German universities have integrated sustainability-oriented aspects into their curricula, while five have not. In contrast, Iranian universities allocate only three modules to sustainability-oriented content, indicating varying levels of integration between the two countries.

1. Introduction

Programs embracing Education for Sustainable Development (ESD) not only enhance students' sustainability knowledge but also cultivate skills essential for their future careers (García-González et al., 2020; Brandt et al., 2021). Additionally, UNESCO's 2030 map mandates higher education curricula to embrace the ESD approach (UNESCO, 2020). Fashion education is no exception due to its significant global impact (McKinsey and Company, 2023). Given the various approaches to sustainable fashion transformation, product design education is paramount, especially with initiatives like the Digital Product Passport and the EU's provisional agreement on sustainable and circular products (European Commission, 2023). These developments underscore the need for education to align with ESD principles, equipping future designers and educators with essential knowledge for a more sustainable industry.

Considering Germany's leading role in European fashion markets (Oxford Economics, 2023) and the growth of Iranian fashion retailers and brands despite economic sanctions (Nabati, 2022), it is important to explore the implementation of ESD in fashion and apparel design B.A. and M.A. programs in both countries. Furthermore, the status of ESD implementation in several universities of fashion and apparel design programs in Germany and Iran has remained unexplored despite the need to shift to a holistic approach. This doctoral research aims to answer the following research question by researching fashion and apparel design programs in Germany and Iran: How to contribute to a sustainable clothing design by implementing ESD as a guiding principle in fashion design higher education? The research map consists of several phases, which will be described in the next section.

2. Methodology

This doctoral research utilizes a design-based research (DBR) model, integrating research and practice (Grunau & Gössling, 2020) through iterative interventions. It follows a six-phase process (Figure 1) derived from the DBR model (Oppl et al., 2022) to analyze the problem, identify, develop, and evaluate ESD implementation practices in fashion and apparel design programs in Germany and Iran.

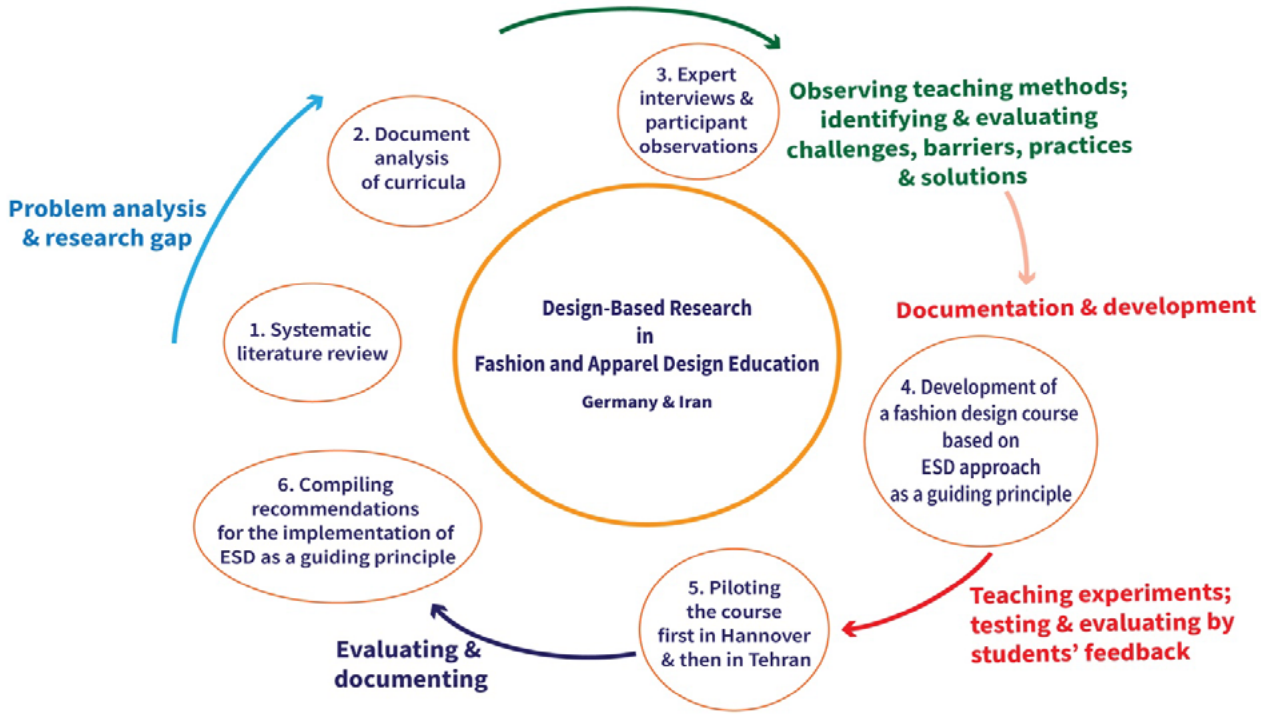


Figure 1. Concept map of DBR approach. Source: authors.

Mayring's deductive-inductive content analysis is a widely used method in various research phases, and MAXQDA software is commonly employed for data analysis. Phases one and two of the research have been conducted, and their results have been analyzed. After delving into the first two phases, an overview of other phases are described in this section.

2.1 Systematic Literature Review

Following Paul and Criado's systematic literature review guidelines (2020), ESD in higher education of fashion and apparel design in Germany and Iran was assessed through material collection, descriptive analysis, category selection, and material evaluation (Mayring, 2022). Publications in German, Persian, and English language were reviewed from January to September 2023, using specified inclusion and exclusion criteria (Figure 2).

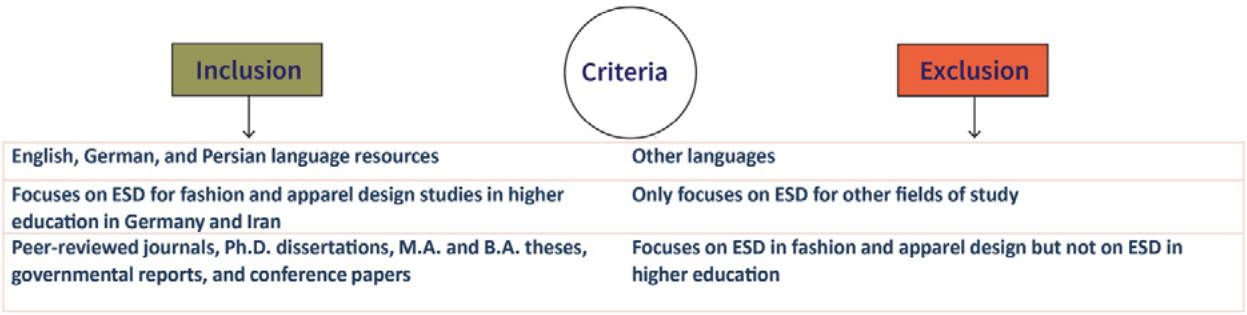


Figure 2. Inclusion and exclusion criteria. Source: authors.

The publications underwent a three-phase screening process, resulting in 13 publications for Germany and two publications for Iran on the implementation of ESD in higher education of fashion and apparel design programs. The results of this phase identify the research gap and analyze the problem (See Section 3.1).

2.2 Document Analysis of Curricula

Curricula from 14 German universities and the Iranian Ministry of Science, Research, and Technology were collected online. German universities offer distinct fashion design curricula, while all Iranian universities follow one curriculum. The gathered German (n = 23 documents) and Persian (n = 2 documents) curricula were translated and analyzed in English using MAXQDA software. Mayring's (2022) content analysis method was employed, initially selecting categories based on theoretical frameworks such as a didactic model (Ermer, 2018), triple bottom line (Gimenez et al., 2012), and ESD competencies (Rieckmann, 2022). The subsequent deductive-inductive analysis resulted in the elimination of categories like "participatory learning" and "transdisciplinary learning," while new categories like "sustainable product development," "sustainable textile chain," and "sustainable design strategies" emerged (Figure 3).

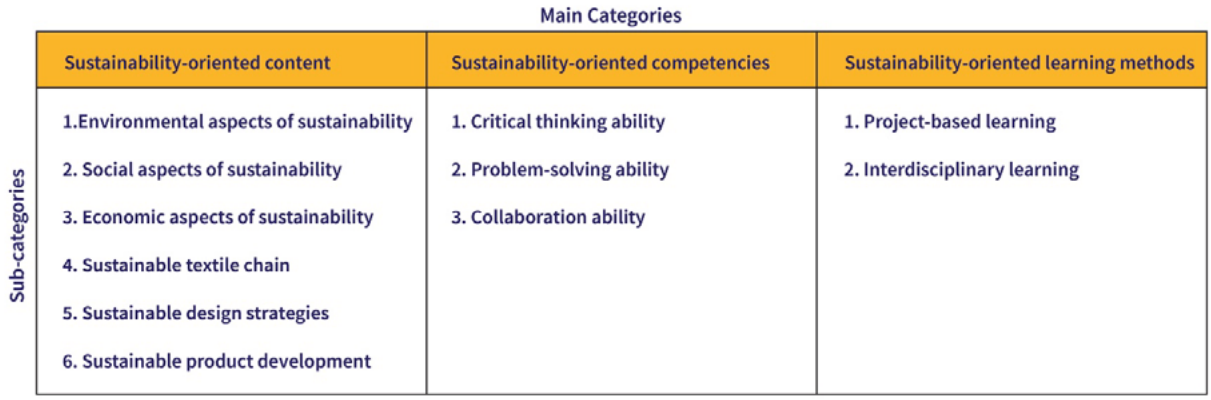


Figure 3. Categories formed during deductive-inductive content analysis. Source: authors.

Throughout the study period, the documents (e.g., the curricula of Iranian universities were replaced by the revised versions), and the coding process was reviewed and updated by the authors in monthly meetings from May to December 2023. In the results of this phase, the status of ESD integration in the curricula of fashion and apparel design programs is identified (See Section 3.2).

2.3 Expert Interviews and Participant Observations

The third phase of the DBR model involves conducting problem-centered expert interviews (Döringer, 2020) with fashion design lecturers and professors in Germany and Iran and fashion design students and graduates at Hochschule Hannover University of Applied Sciences and Arts (HSH), along with participant observations for fashion design courses at HSH in Hannover, Germany. To understand the adoption of ESD in higher education studies of fashion and apparel design, twenty professors and lecturers in Germany and eleven professors in Iran were contacted, resulting in interviews with nine in Germany and six in Iran so far. Interviews with HSH students and graduates aim to evaluate sustainability integration and gather feedback on teaching methods. Additionally, participant observations (Kawulich, 2005) were conducted for two winter semesters in 2022 and 2023, recording classroom interactions and course content. These activities aim to identify and evaluate practices for implementing ESD in fashion design courses. Moreover, the doctoral student gained teaching experience at HSH, developing and testing sustainability-oriented course concepts and teaching methods for fashion design education in Germany.

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Phases four and five focus on developing and evaluating a fashion design course, using the ESD approach along with additional teaching experiments. The doctoral student will define the course content and structure based on analyzed data. Supervisors, experts in education and design, will review and provide feedback on the course framework before piloting at HSH and gathering student feedback. The course will then be revised for implementation in a fashion design program at a university in Tehran, supported by student portfolio assessment and course evaluation. These phases encompass development, piloting, evaluation, and analysis, with recommendations compiled from all phases on implementing ESD in fashion and apparel design higher education.

3. Results

3.1 Results of Systematic Literature Review

Ermer (2018) proposed a holistic framework for learning sustainability in fashion design. Ermer and Schwarzkopf (2021) analyzed curricula from five German universities offering a B.A. in fashion design, finding only one directly addressing sustainability. The EU-funded project Fashion DIET aims to implement ESD as a guiding principle in fashion and textile study programs. Researchers from four universities in Germany, Romania, and Bulgaria developed an ESD module with 42 courses for higher education, provided as an Open Educational Resource on the Glocal Campus platform (Grundmeier & Höfer, 2023).

In comparison, only two publications in Iran's fashion and apparel design context discuss sustainability. Davari et al. (2016) surveyed female students in textile, apparel, and industrial design programs, revealing a lack of awareness and anti-sustainability attitudes among peers. Rezvani Ahangar Kolaee et al. (2021) focused on female undergraduate students at Shariati Technical and Vocational University, designing courses to enhance sustainable clothing design skills. However, they did not address ESD implementation in the curriculum. Iran's fashion industry is heavily influenced by socio-political factors (Shirazi, 2019), impacting sustainability efforts. Navigating these complexities requires a nuanced understanding of cultural and political realities and the educational system.

3.2 Results of Document Analysis of Curricula

In the analysis of German university curricula, sub-categories are grouped into sustainability-oriented content, competencies, and learning methods. Social and environmental aspects of sustainability are more prevalent than economic aspects (Uni01-BA, 2019; Uni02-BA, 2022; Uni04-BA, 2017; Uni05-BA, 2021; Uni08-MA, 2021; Uni11-BA, 2014; Uni13-BA, 2022; Uni14-MA, 2023). Sustainable textile chain and product development have low frequencies after critical thinking ability (Uni01-BA, 2019; Uni04-BA, 2017; Uni13-BA, 2022), with sustainable design strategies being more common (Uni03-MA, 2021; Uni04-BA, 2017; Uni05-BA, 2021; Uni13-BA, 2022; Uni01-BA, 2019). Collaboration ability is the second most frequent sub-category under sustainability-oriented competencies, emphasizing teamwork (Uni02-BA, 2022; Uni03-BA, 2023; Uni05-BA, 2021; Uni13-BA, 2022; Uni14-BA, 2023). Problem-solving appears with varying frequencies, while critical thinking is less frequent (Uni02-BA, 2022; Uni05-BA, 2021; Uni13-BA, 2022; Uni14-MA, 2023). Additionally, sustainability-oriented learning methods, such as project-oriented and interdisciplinary learning, are prevalent (Uni01-BA, 2019; Uni02-BA, 2022; Uni03-BA, 2023; Uni05-BA, 2021; Uni13-BA, 2022). Some modules are titled “sustainability”, and six teach with a holistic approach (Uni01-BA, 2019; Uni03-BA, 2023; Uni13-BA, 2022; Uni02-BA, 2022).

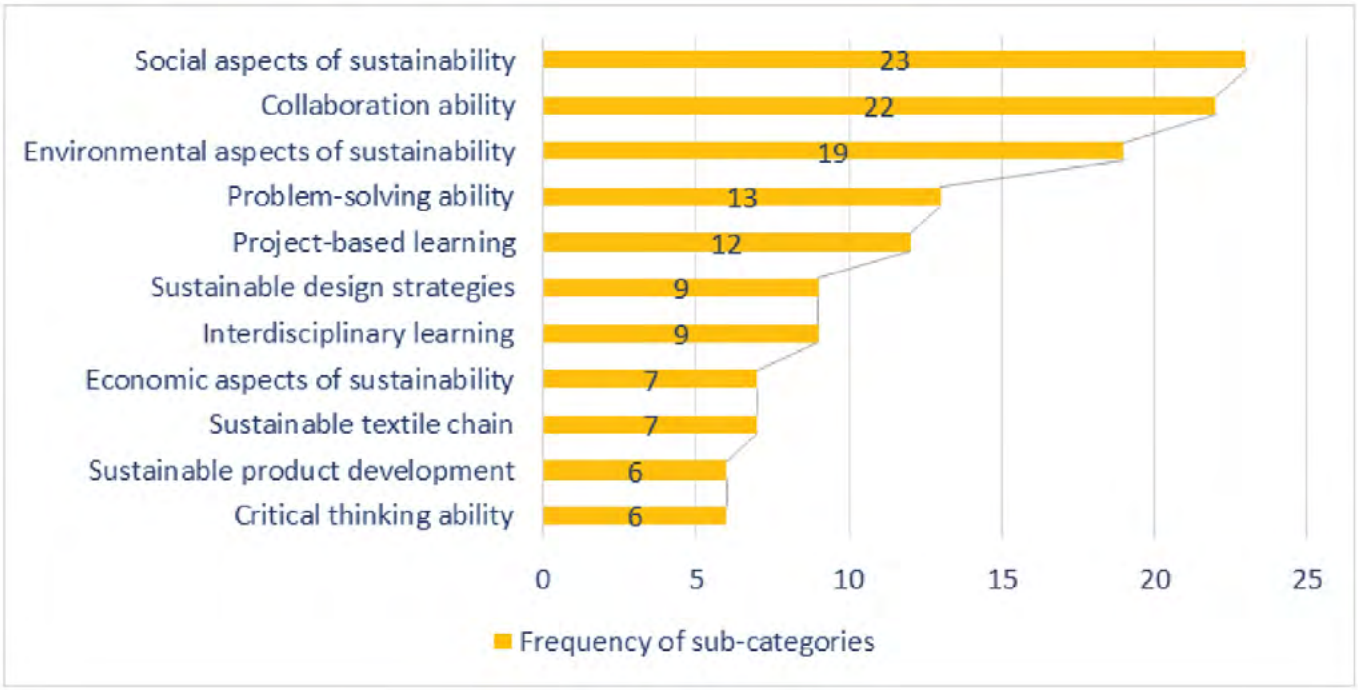


Figure 4. Frequency of sub-categories in the German universities’ curricula. Source: authors.

In Iranian curricula documents, only three modules were found teaching sustainable concepts, including green or sustainable textiles, environmental sustainability of the apparel and textile industry, sustainable design, and recyclable fibers (IrUni-MA, 2023; IrUni-BA, 2023). Conversely, 11 sub-categories were identified in the 11 German curricula out of the 23 analyzed documents (Figure 4), covering all three main categories. The remaining 12 documents from five German universities did not include relevant sustainability keywords.

3.3 Initial Results of Expert Interviews

So far, three out of nine expert interviews with lecturers and professors in Germany and four out of six expert interviews with professors in Iran have been analyzed. Regarding these interviews, it can be stated that universities in Germany adopt sustainability in fashion design courses, with each university employing distinct approaches, starting from the implementation of consumer education and circular fashion

practices to curriculum changes, which encourage collaboration with other departments and industry partners. At Iranian universities, efforts to integrate sustainability into fashion design courses are evident despite the absence of dedicated courses in the curriculum. Practical projects and workshops focus on, e.g., reducing fabric waste and historically sustainable methods.

4. Discussion

The initial phases of this doctoral research comprised a systematic literature review and a curriculum document analysis. The literature review revealed limited research on ESD in higher education of fashion and apparel design in Germany and Iran. In Germany, two projects addressed ESD implementation: the Fashion DIET project, offering an online ESD further education module applicable to higher education curricula, and Ermer's publications focusing on fashion design education. However, no papers on ESD integration in higher education of apparel design curricula in Iran were found.

Secondly, the comparative document analysis of curricula highlights the integration of sustainability aspects in fashion and apparel design programs in Germany and Iran. Significant progress has been noted in German universities, with nine institutions integrating sustainability-oriented aspects into eleven B.A. and M.A. curricula by 2023, compared to previous research indicating limited sustainability focus (Ermer and Schwarzkopf, 2021). While three universities in Germany offer modules directly related to sustainability and six adopt a sustainable and holistic approach, five have yet to integrate sustainability aspects. In contrast, Iranian universities have only three instances of sustainability-oriented content in their curricula, significantly fewer than in Germany. The disparity may be attributed to differences in the educational systems of both countries. Although recent revisions to Iranian curricula show progress in sustainability integration, there remains a notable lack of focus on sustainability. Addressing these disparities and gaps in ESD integration requires further research.

Thirdly, according to the analyzed expert interviews, universities in Germany incorporate sustainability into fashion design courses with different approaches. In Iran, efforts are made to integrate sustainability into fashion design courses. However, challenges remain, including the need for updated facilities and resources to achieve comprehensive integration. As some interviews have not yet been analyzed, one of the next steps will be to elaborate and compare further expert opinions.

5. Conclusion

This doctoral research assesses the status of integrating Education for Sustainable Development (ESD) in B.A. and M.A. programs for fashion and apparel design in Germany and Iran. While limited research exists on ESD integration in German fashion design curricula, none addresses Iranian universities. Notably, sustainability aspects are integrated into nine German university curricula, whereas Iranian universities devote only a small portion to sustainability-oriented content. However, five German universities have yet to include any sustainability aspects. This stage does not conclude the research; further phases will explore ESD implementation as a guiding principle in fashion and apparel design programs.

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P/REFERENCES OF DESIGN

MAPPING THE NEW NORDIC REGION'S START-UP ENTERPRISES FROM THE PERSPECTIVE OF LEADERSHIP CHARACTERISTICS, MINDSET, AND SKILLS: THE RELEVANCE OF SOFT SKILLS IN SHAPING ENTREPRENEURIAL ECOSYSTEMS.

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KEYWORDS | START-UP LEADERSHIP, INNOVATION COMPETENCE, SOFT SKILLS, ORGANIZATIONAL VIABILITY, ENTREPRENEURSHIP, DEVELOPMENT TOOL, ENTREPRENEURIAL ECOSYSTEM

ABSTRACT | This short paper expands the discussion on what cultivates a successful entrepreneurial ecosystem, outlining the importance of personal competencies such as soft skills and leadership dynamics. The increased appearance of high-value start-ups in the Nordic region demonstrates the impact of these ecosystems. The author argues that cultivating personal skills and leadership qualities is as pivotal to their success as the economic frameworks within which start-ups operate. Adding these competencies to well-grounded ecosystems may determine startups' sustainable, future-oriented success stories.

The paper aims to provide an overview of a research study on the role of leadership in high-growth start-up success, with a specific focus on 'unicorn' companies in the 'New Nordic' region (Denmark, Finland, Iceland, Norway, Sweden, and Estonia). Leadership in start-ups is identified as a crucial factor for performance. Yet, there is a lack of focused research on leadership within rapidly scaling ventures, such as unicorns – privately held start-ups valued at over one billion dollars. The paper will bridge this gap by examining entrepreneurial leadership, which merges leadership and entrepreneurship research. The study will explore the unique leadership attributes, psychological flexibility, identity, and resilience that predict entrepreneurial satisfaction and contribute to the success of unicorn start-ups.

The research emphasizes that existing studies on entrepreneurial ecosystems do not fully capture the transition from start-up to unicorn status, especially outside of Silicon Valley. This analysis calls for a more detailed understanding of the Nordic ecosystem's components and how they contribute to unicorn success compared to other regions, highlighting the impressive per capita rate of New Nordic unicorns.

1. Introduction: Start-up Leadership and Unicorn Start-ups

Start-ups are a vital component of the global economy, representing an ecosystem value that exceeds $7.6 trillion, overshadowing the individual GDP of many G7 countries (GSER, 2023). Despite the high number of start-up inceptions, their success rate remains modest. Leadership significantly affects start-ups' performance (Swiercz & Lydon, 2002); however, despite the amount of research on leadership in the start-up environment, there is little focus on the rapidly scaled-up ventures and their underlying leadership phenomena. The proposed study offers a new perspective on this. Understanding the factors of success and conceptualizing learnings is essential for developing the future of scale-up businesses.

Entrepreneurial leadership is a newly developed theory in leadership research because it provides insights into the intricate processes of leadership associated with establishing and expanding new ventures. The theory has emerged from two different academic fields: leadership and entrepreneurship research. Despite abundant research, scholars cannot agree upon a common definition of entrepreneurial leadership (Leitch & Volery, 2017). Given these gaps, exploring the founders' and founding teams' perceptions and interpretations of their leadership while involved in entrepreneurship ventures appears to be an important research topic. Psychological flexibility, entrepreneurial self-identity, and resilience are linked to entrepreneurs' satisfaction and performance (Van Hugten et al., 2021).

This short paper will delve into the geographical, social, and cultural dimensions underpinning high-growth entrepreneurship from the perspective of entrepreneurial ecosystems to enhance our understanding. Additionally, the researcher will propose incorporating certain soft skills and mental frameworks that may play a pivotal role in the success of business growth. These include *entrepreneurial leadership attributes, psychological flexibility, identity, and resilience.*

2. Definition of the Unicorn

The unicorn status of start-ups is a topic of much discussion in the startup community. This figurative term is applied to businesses valued at a billion dollars in less than ten years. The phrase was coined in 2013 by venture capitalist Aileen Lee to describe these kinds of ventures' exceptional success and rarity. Since then, it has been a widely used term on the start-up scene, and academic discussions about unicorns have increased; however, unicorn start-up leadership has not been the main topic of these discussions (Audretsch et al., 2021; Bertoni et al., 2019; Dellermann et al., 2017; Kwon & Sorenson, 2021; Van Burg et al., 2020; Welter et al., 2017; Wurth et al., 2021). The only studies conducted regarding unicorn companies focus on cases in Silicon Valley. This highlights another gap in the current literature that the proposed research aims to fill: to bring a Nordic perspective to the unicorn start-up equation.

2.1 Unicorn Start-ups in the New Nordic Region

The Nordic countries, commonly referred to as the Nordics, are a group of countries in Northern Europe and the North Atlantic Ocean connected both geographically and culturally. It comprises the autonomous territories of Greenland, the Åland Islands, and the five countries of Denmark, Finland, Iceland, Norway, and Sweden. In 2015, Estonia's prime minister, Taavi Rivas, referred to the nation as a 'new Nordic country,' and the Nordic Council of Ministers (2022) frequently discussed Estonia's future as a Nordic nation. For these reasons, this paper will refer to the aforementioned Nordic nations and Estonia as the 'New Nordics.'

With less than 30 million inhabitants, the New Nordic region is home to many unicorn start-ups and accounts for the largest number per capita. The Nordic region saw record private equity and venture capital investment levels last year. BOLT, Skype, Rovio, Pipedrive, Wolt, Unity, Just Eat, Klarna, King, Trustpilot, Supercell, Aiven, iZettle, Transferwise, Tradeshift, and Bambora are some of the New Nordic region's unicorn companies. A 2021 Joint Research Centre of the European Commission Science for Policy report states that the number of scale-up businesses in the EU, particularly unicorns, lags behind the US and

China (Quas et al., 2021). Comparing the number of unicorn start-ups per capita is an effective way to evaluate a region's success in terms of scaled-up start-ups. According to this assessment, the New Nordic region has the highest number of unicorn start-ups per person. In the US, for instance, there are 963 unicorn companies and 332.4 million people (CB Insights, 2022) – that is, 2.89 unicorns for every million people. Compare this to Estonia's unicorns per capita. With a population of 1.32 million, Estonia has ten unicorn companies (Tallinn. ee, 2022). This means there are 7.57 unicorns per million people, more than twice the unicorn density of the US.

3. 'Entrepreneurial Topography' – An Ecosystem Review

Examining entrepreneurial success metrics, it becomes evident that high-valuation startups (unicorns) share many characteristics with their more commonplace entrepreneurship counterparts. Davidsson (2015) has emphasized the integral role of the broader startup landscape in driving economic growth and employment across various nations. The rapid emergence of unicorns in the New Nordic territories, including Finland and Estonia, underscores a dynamic entrepreneurial surge that current literature struggles to document in real-time, reflecting a rapidly evolving landscape where even the most up-to-date data lags behind the pace of development.

Entrepreneurial ecosystems are increasingly used to understand the supporting elements of fast-growing startups in certain areas. These ecosystems blend local culture, social connections, funding, educational institutions, and supportive economic policies to help innovation-driven businesses succeed. Academics, policymakers, and business experts agree that these ecosystems are vital to building strong economies fueled by entrepreneurial innovation. However, the research on how these ecosystems work is still in its early stages and lacks a solid, unified theory. Essentially, the term 'entrepreneurial ecosystem' covers various ideas about how entrepreneurship flourishes in different places without explaining how these tech entrepreneur groups sustain themselves over time.

The current body of literature on ecosystem research offers limited insights into the relationship between ecosystems and highly successful startups or unicorns. The existing metrics for assessing ecosystem research have yielded a significant understanding of the factors that contribute to a startup's initial survival. Nevertheless, they do not explain how a company goes from nothing to becoming a unicorn, especially when it comes to geographic areas other than the well-known Silicon Valley ecosystem (Civera et al., 2019; Dilli et al., 2018; Neumeyer & Santos, 2018; Neumeyer et al., 2019). For example, Autio et al.'s (2018) study thoroughly analyses the frameworks that support early-stage startups and differentiates between various stages of ecosystem growth. However, it does not delve into the specific frameworks or factors that elevate startups to unicorn status or address the New Nordic region.

Spigel (2017) proposes that entrepreneurial ecosystems can take on diverse configurations. These ecosystems consist of interlocking elements and institutions that support entrepreneurship and provide the necessary resources businesses need as they evolve. The characteristics of these ecosystems are sustained and multiplied through their interactions with one another. In environments where these elements are closely connected, there is a significant exchange among a supportive entrepreneurial culture, networks of entrepreneurs, employees, and investors, and robust public programs and organisations.

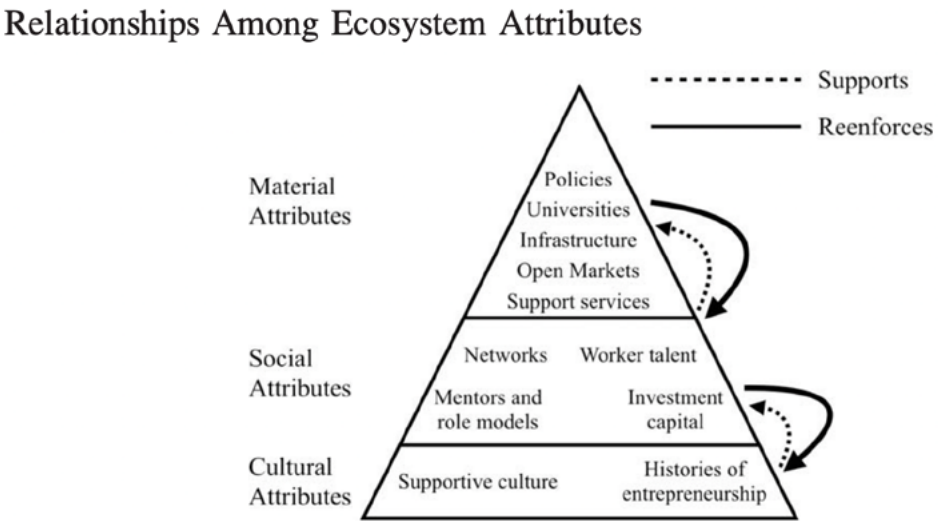


Figure 1. A Relational Approach to the Entrepreneurial Ecosystem Using Spigel's (2017) Model.

In Spigel's model, besides cultural, social, and material attributes, there might be relevance to introducing personal competencies or skills as additional attributes that contribute to entrepreneurial ecosystems. This paper seeks to expand on the existing notion of entrepreneurial ecosystems – comprising cultural perspectives, social networks, investment funds, academic institutions, and proactive economic policies that nurture innovation-driven enterprises. It intends to contribute to the dialogue by exploring how bringing certain mindsets and soft skills to the equation can further enhance these ecosystems. The following offers a review of soft skills such as entrepreneurial leadership competence, psychological flexibility, entrepreneurial self-identity, and resilience.

4. Entrepreneurial Leadership

Literature assessing entrepreneurial leadership in start-up environments found a connection to innovation behaviour and creativity. Entrepreneurial leaders are identified as the driving forces of creativity and innovation (Denti & Hemlin, 2012). Furthermore, this leadership approach influences organisational exploratory and exploitative innovation activities (Huang et al., 2014). Quantitative analysis outlined positive factors affecting entrepreneurial leadership in terms of efficiency and creativity at individual and team levels (Cai et al., 2018). As start-ups have changing life cycles, exploring leadership through different stages is essential. According to Swiercz and Lydon (2002), two sets of leadership competencies are crucial at various stages of the venture's growth: self-competencies and functional competencies.

Overall, Wise (2015) identified three significant leadership challenges associated with the start-up growth process. These are creating a vision, reaching optimal perseverance, and moving forward in the face of chaos. The suggested skills that aid in overcoming the difficulties include self-evaluation, coaching, and strategic thinking.

4.1 Psychological Flexibility

A person's ability to move toward what matters to them and cognitively control emotions that could otherwise hold them back is known as 'psychological flexibility.' Psychological flexibility is a key component of acceptance and commitment therapy, as outlined by Hayes et al. (2011). The following six skills are related to psychological flexibility from the perspective of acceptance and commitment therapy: 1) Acknowledging negative emotions and allowing them to pass through rather than running away from or fighting them; 2) Taking decisive action rather than procrastinating; 3) Defusion, the process of

disentangling ideas from feelings so that one can consider feelings objectively; 4) Mindfulness concerning maintaining attention on the here and now in the face of distracting, pessimistic thoughts; 5) Self-as-context refers to viewing things in a broader context, acknowledging that everyone makes mistakes and that you do not control everything; and 6) Values, which refers to having a strong sense of your values rather than being unsure of what you want (Rolffs et al., 2018).

In the business setting, the term 'emotional agility' has been used frequently (David, 2016) and studied in the workplace domain (Brassey et al., 2019). My aim in using the term psychological flexibility is to follow the most recent work in business research and explore the multi-fold process behind the notion that it is by nature both emotional and cognitive. Van Hugten et al. (2021) identified psychological flexibility as a significant new predictor of entrepreneurs' satisfaction. It is critical to comprehend entrepreneurs' satisfaction as it can influence the caliber and success of their business endeavours (Bradley & Roberts, 2004; De Cock et al., 2020; Dijkhuizen et al., 2018; Kibler et al., 2019). Compared to their 'unhappy' counterparts, 'happy' entrepreneurs are likelier to persevere and outperform them (Stephan, 2018).

4.2 Entrepreneurial Self-Identity and Resilience

Entrepreneurial self-identity, or in other words, identity centrality, is found to be one of the more essential entrepreneurship concepts (Foo et al., 2014). As entrepreneurs identify very closely with their venture, anything limiting their roles and activities would take a toll and negatively affect their self-worth. Entrepreneurial passion (EP) is conceptualised by positive feelings from identity-meaning activities and executions performed by entrepreneurs (Cardon et al., 2009). As self-identity leads to self-verification, EP is typically highly correlated (Vignoles et al., 2006). Engaging in activities where entrepreneurs strongly believe in their ability to succeed can increase passion (Baum & Locke, 2004). Entrepreneurial resilience can be a measure of entrepreneurs' performance in the early stages of their ventures. These early stages are often linked with a lack of resources (not only financial), and their reachable resources impact their viability (Blatt, 2009); hence, there is an increasing number of start-up accelerator programs and a growing number of start-ups attending them.

5. Conclusion

This paper aims to broaden the scholarly discussion about what makes a thriving entrepreneurial ecosystem – those supportive spaces comprising local culture, networks, funding, schools, and helpful government policies. It plans to show how important personal qualities and skills are for enhancing these ecosystems. These skills include leadership, psychological flexibility, and resilience. The many high-value startups in the New Nordic area highlight how powerful these ecosystems can be. The researcher suggests that nurturing the right personal skills is as crucial as setting up the economic environment for startups to flourish. Looking ahead, combining these individual strengths and strong ecosystems will help new businesses grow and reach their full potential, possibly becoming the next sustainable success stories in the start-up world.

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P/REFERENCES OF DESIGN

PARTICIPATORY DESIGN PRACTICES FOR INCLUSIVE LEARNING ENVIRONMENTS. A CROSS-FERTILIZATION EXPERIENCE FOR A PILOT PROJECT ON ACCESSIBLE SIGNAGE AT THE INSTITUTO SUPERIOR TÉCNICO – LISBON.

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KEYWORDS | INCLUSIVE SIGNAGE, PARTICIPATORY DESIGN PRACTICES, HIGHER EDUCATION, ACCESSIBILITY, DESIGN FOR DEMOCRACY

ABSTRACT | The research delves into the realm of accessibility within Higher Education, advocating for a paradigm shift towards inclusivity. It underscores the significance of participatory design methodologies rooted in Universal Design principles. Central to this exploration is a collaborative pilot initiative concerning inclusive signage at IST Lisbon, developed in cross-fertilization with Politecnico di Torino. Employing a robust methodology, the study conducts a thorough examination encompassing literature reviews, exploratory inquiries, and focus group engagements. Through this comprehensive approach, the research aims to elucidate both global best practices and localized challenges about accessibility. Particularly noteworthy is the emphasis on participatory focus group sessions, designed to delineate the role of signage and determine effective communication strategies within the project framework. By leveraging insights garnered from these deliberations, the study seeks to inform the development of comprehensive guidelines, thus steering the trajectory of the pilot initiative towards greater efficacy and impact. Ultimately, the overarching goal of this research endeavor is to advance accessibility and inclusivity within the realm of Higher Education. By fostering collaborative partnerships and embracing holistic design approaches, it strives to cultivate learning environments that cater to the special needs of all students, thereby fostering a culture of diversity and equitable access to educational resources and opportunities.

1. Introduction

The debate about the aspects that make the built and educational environment accessible in the Higher Education context started spreading on the threshold of the new millennium: in 1993, the United Nations formulated the Standard Rules on the Equalization of Opportunity for People with Disabilities, outlining an ambitious program for governments aimed at ensuring equality for individuals with disabilities. Subsequently, in December 2006, the Convention on the Rights of Persons with Disabilities (United Nations, 2006) was adopted, along with its Optional Protocol: "with its 50 articles, the Convention represents the most comprehensive document ever produced on the rights of persons with disabilities" (Barnes & Vehmas, 2020), aiming to ensure their independent living, active citizenship, equal opportunities, and social inclusion. Thus, a new awareness begins to emerge, a shared sensitivity about the role that Universities must play in defining a paradigm of best practices that actively and participatively promote the integration of students with special needs. On the one hand, academic interest is growing on the part of many Italian universities, which are independently developing complex and diversified training tools, carrying out in-depth studies and research around the issues of inclusion and accessibility of spaces and services provided to students. On the other hand, Sustainable Development Goals 4 and 10 contained in the UN Agenda2030, linked respectively to Quality Education and the Reduction of Inequalities, require immediate and circumstantial action.

However, even today, university campuses

> “are often ill-suited to accommodate users with special needs, and efforts to enhance their accessibility to services are typically limited to regulatory compliance. This results in the creation of dedicated spaces that, while designed for specific needs, are poorly integrated, thus erecting barriers within the university community" (Lacirignola et al., 2022)

Taking into account the diverse student population and the educational offerings within university spaces and reconciling these complexities with the framework of human rights principles of equal opportunity, accessibility, and social inclusion constitutes a pathway that can and must transcend mere integration. Creating a genuinely inclusive learning environment necessitates a transversal, multidisciplinary, and complex design approach wherein the principles of design for all give rise to integrated, effective, resilient, and tailored solutions for each member of the university community.

The ethical and practical imperative recognized by international institutions and organizations to initiate a design for all capable of ensuring equal access to all members of the academic community, bypassing the need for redesigning offerings specifically for special needs individuals (Trieglaff, 2022), appears to necessitate a shift in perspective: adopting a design approach that goes beyond mere resolution of immediate needs, focusing instead on the general well-being of the involved communities and the long-term impact of proposed solutions. The adoption of a humanity-centered design, rather than a human-centered one, allows for broadening the scope of intervention: while on the one hand, there is consideration of the needs, desires, and aspirations of individuals, with a humanity-centered approach, the focus shifts to larger groups, more complex systems of relationships,

> “including society at large, all living things, and the ecological system, as well as the design of work in general and services. This encompasses digital products and services as well, due to their significant but often invisible impact on power and energy usage and, of course, on the physical infrastructure required for their delivery to customers. While human-centered design remains appropriate for mass markets, humanity-centered design becomes crucial for addressing larger issues, such as aiding a community in self-improvement" (Norman, 2023).

2. Outlining the Context

Building upon a collaborative and cross-fertilized experience between Politecnico di Torino and Instituto Superior Técnico (IST), integrated within 'Técnico Sustentável – Ambiente Sociedade Economia' (TS), an initiative of IST-Ambiente, a transversal and interdepartmental structure in Environmental Science and Engineering and related areas, this contribution presents a pilot project of inclusive signage for a green area of the IST Campus Alameda, the largest Portuguese School of Engineering, Architecture, Science, and Technology.

The pilot project, guided by a humanity-centered approach (Norman, 2023), focuses on the necessity to reinvigorate the debate surrounding the Special Needs dimension within the university context, aiming for the advancement and implementation of truly accessible spaces, services, and teachings. This perspective adopts a participatory approach based on the Principles of Universal Design.

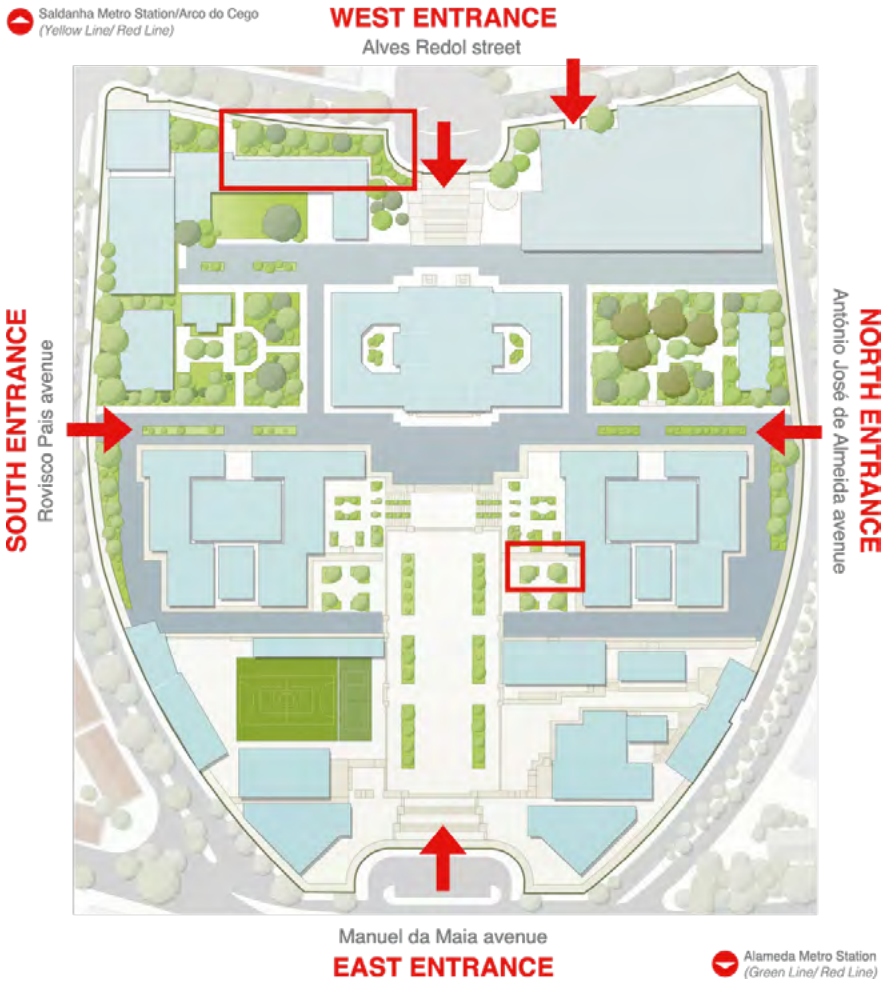


Figure 1. Map of the Main Campus Alameda.

The pilot project of inclusive signage integrates with the design of a meeting and debate space on IST's sustainability initiatives, developed by a group of students for a green area of the Alameda Campus (Figure 1). The project area, located on the western border of the campus, serves as a privileged space connecting the campus, the city, and the surrounding area, ideal for promoting the sustainability initiatives undertaken by IST. The design process for this space is led by students from the architecture field, civil engineering, management engineering, and communication design, coordinated by faculty members and researchers in architecture, within the framework of the European Horizon project 'A European Competence Framework for a low carbon economy and sustainability through education' (ECF4Clim).

3. Methods of Inquiry

The research method includes:

1. **An in-depth research phase.**
   The research phase starts with a thorough analysis of existing literature concerning accessibility within the university context, focusing on recent developments and international best practices. Concurrently, there is an acknowledgment of the need to conduct a case study research involving the analysis of similar projects carried out by other academic institutions globally, with a focus on the strategies employed and the outcomes achieved, to derive a comprehensive mapping of best practices to be adopted in the design phase.

2. **An exploratory investigation of the Institution.**
   The investigation directly focuses on the Institute through interviews with academic and administrative staff, field observations, and analysis of institutional documentation, with a perspective of close collaboration and support from the Responsible for supporting the SEN students. The aim is to understand IST's existing policies, resources, and practices for supporting students with disabilities and to identify areas for improvement through a top-down approach.

3. **A collection and analysis of data from the student community with disabilities.**
   The collection of data is essential to fully understand the landscape of needs among students with disabilities at the Alameda Campus and to effectively guide the design intervention. These data provide an empirical basis for identifying key needs and trends in supporting students with special requirements, enabling the adoption of targeted strategies and appropriate resources.

4. **Focus Group design.**
   To ensure a participatory and inclusive approach, it is envisioned that the formation of a focus group involving diverse members of the university community will be necessary. The aim will be to cultivate a conducive environment for investigating the specific needs of users of spaces and services provided by IST to gather direct insights on the pilot project of inclusive signage from a bottom-up perspective.

5. **Identification of the requirements framework.**
   In essence, identifying the needs and specific challenges faced by students with special requirements within the context of IST Lisbon is both feasible and imperative through interviews, field observations, and analysis of collected data. This process will aid in delineating a clear framework of priorities and intervention gaps to contribute towards creating a more inclusive and accessible university environment.

6. **Guidelines development.**
   Critical to ensuring a methodological and practical approach to the project is the development of guidelines for inclusive signage at IST Lisbon. Addressing user needs and adhering to best practices in university accessibility, these guidelines will translate research findings and consultations into practical solutions, ensuring coherence, stakeholder participation, and compliance with international standards.

4. First Results and Conclusion

From the initial research phase, a detailed overview of international best practices in university accessibility emerged, as well as the specific challenges faced by Instituto Superior Técnico (IST) Lisbon in promoting an inclusive environment for students with disabilities. Through the analysis of academic sources, institutional documents, and research reports, a comprehensive understanding of feasible scenarios was obtained by interpolating documented experiences from other institutions and insights gathered from the survey conducted at Técnico. It became evident that designing inclusive signage at Técnico requires a balanced approach that integrates parallel, bottom-up, and top-down processes.

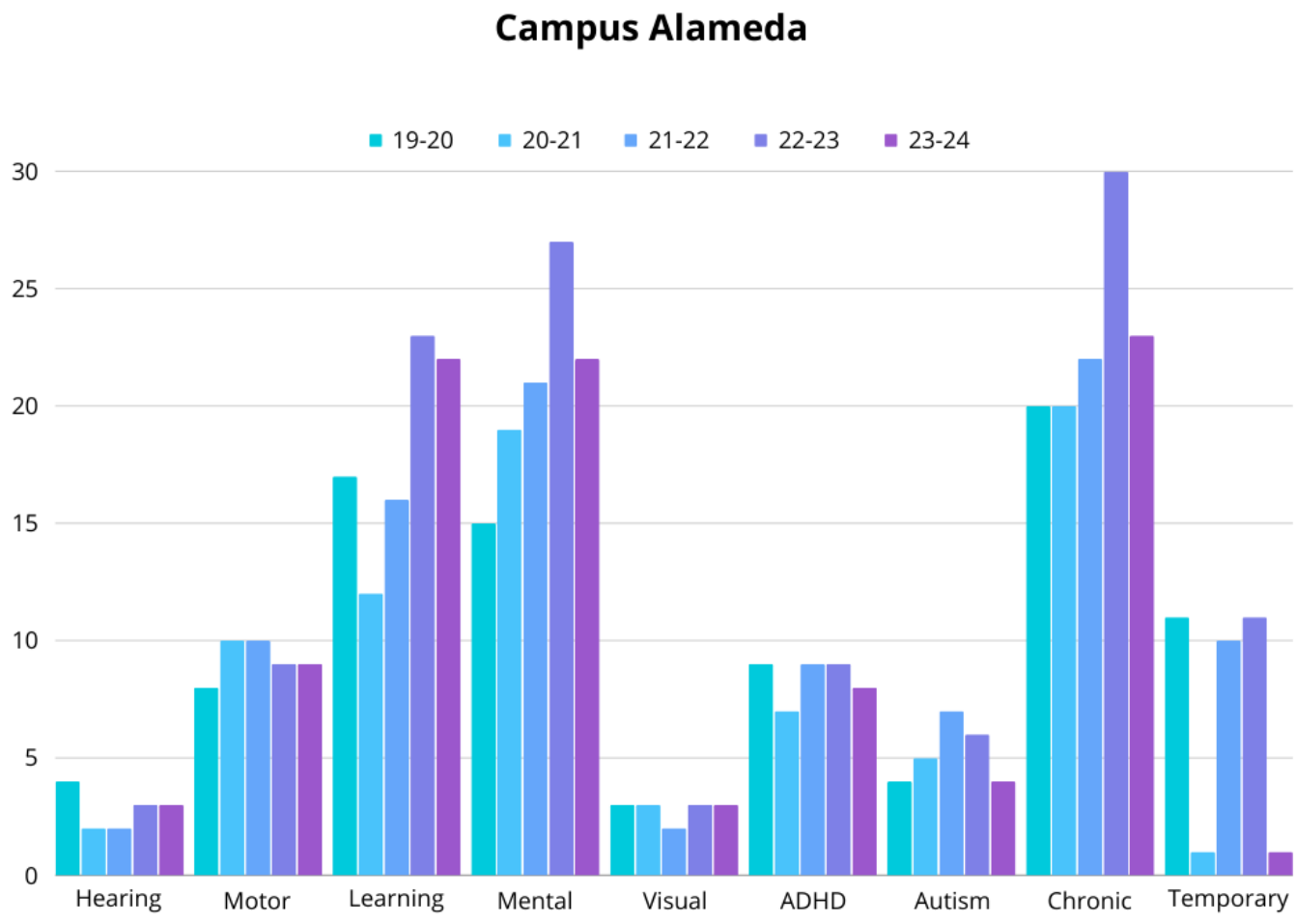


Figure 2. Trend chart students impaired, based over the time interval considered in the study (2019-2020/2023-2024).

Simultaneously, while the analysis of literature and case studies provides an overview of solutions implemented in other institutions, the direct exploratory survey at IST has allowed for an understanding of the specific needs of special needs users within the Higher Education context of IST. The knowledge framework of the institution highlighted the necessity of a participatory and inclusive approach in the design of signage: the importance of integrating the entire academic community in the phases that inform the pilot project of inclusive signage is evident from the analysis of reference writings, just as the urgency to create an internal focus group at the university becomes increasingly clear from the critical analysis of data collected at the institutional level.

The collected and analyzed data refer to the Alameda Campus, where the design intervention is located, covering a period of five academic years (2019-2024) and are related to the distribution over the last five

academic years of special needs cases in the university. The methodological analysis of the data was conducted by discriminating according to the course of study and various impairments according to ten categories of descriptors, including ADHD and learning disorders, motor, visual, and auditory limitations, mental illnesses, chronic and temporary illnesses, and autism.

From the data analysis, a focus group was structured homogeneously to reflect the observed growth trend. The six participants who joined the initiative were carefully selected to represent the categories of impairments with the most significant percentage increase: 35.2% learning disorders, 80% mental diseases, and 50% chronic diseases (the percentage increase is calculated from the academic year 2019/2020 to the last year with finished data (2022/2023), as the current measurement, although relevant, is still ongoing.

The process of forming the focus groups primarily involved the Academic Area Office and required coordination from three other administrative staff members to finalize its organization. The main objective of the focus group investigation was to determine the actual role of signage within the project, considering it not only as a tool for orientation but also as a means to provide information, stories, regulations, and various contents as a mediator between the user and the natural or built environment (Oddone et al., 2021). To achieve this objective, the focus group was organized to establish the most important communicative hierarchies to adopt. The focus group activities were divided into two phases: in the first phase, each member was individually involved in a site visit, while in the second phase, a collective meeting was organized during which various activities were conducted, including exercises to identify examples of accessibility, discussion of critical issues, and brainstorming of key elements for inclusive signage.

Subsequently, the focus group provided a series of fundamental inputs for the creation of a requirement/performance table useful for the implementation of the guideline system. Concurrently, the experimentation of the identified structure is still ongoing in the form of an informal micro-intervention to be placed on the Campus itself.

5. Future Work

As the research evidence obtained thus far concludes at this juncture, the forthcoming steps to be undertaken will be pivotal in informing the subsequent phases of the pilot project: from the analysis of results stemming from the focus group, it will be possible to derive a comprehensive and defined requirements framework, from which to extract the layout of comprehensive guidelines to initiate the design of communicative artifacts themselves. While ensuring the correct level of environmental integration and differentiation, each project should define a reference point from the local context, adding elements of reinterpretation and innovation (Bozzola & De Giorgi, 2017). However, only through a participatory and holistic approach, based on the principles of Universal Design and humanity-centered design, can one aspire to create an educational environment truly accessible to all. This essay has underscored the importance of adopting a participatory and holistic design approach capable of transcending mere integration, aiming to create a university environment that fully respects the needs of all students by promoting practices, policies, and educational environments that are genuinely accessible and inclusive.

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P/REFERENCES OF DESIGN

DESIGN WITH LIVING ORGANISMS. ALTERNATIVE PERSPECTIVES FOR REGENERATIVE ECOLOGIES.

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KEYWORDS | BIODESIGN, BIOFABRICATION, LIVING MATERIALS, REGENERATIVE MATTER, SYMBIOTIC ENGAGEMENT

ABSTRACT | Climate change and natural disasters are causing globally increasing complex issues that require alternative strategies and approaches to design. Addressing the current ecological crisis generates unconventional perspectives that guide research and lead many designers to work in multidisciplinary spaces and collaboration with experts from the biological and natural sciences.

Today we are experiencing the spread of new design practices and approaches such as Biodesign and Regenerative Design, in which, through the integration of biological knowledge into the design process, new research directions and new perspectives are generated for the creation of hybrid artefacts that merge natural and technical systems.

The research initiated in December 2022, conducted at the deMIT 38th cycle PhD, in associated form between the University of Campania “Luigi Vanvitelli” and Iuav University of Venice, aims to critically analyse the intersection of design and biology disciplines. The aim is to investigate how resilient products that respect natural ecosystems and promote ecosystem benefits in urban areas can be developed through the use of living materials.

The research focuses on the development of Nature-based Solutions (NbS) and examines how biofabrication processes, mycelium growth on substrates, and the use of algae and plants can be applied to develop regenerative bio-based products. In particular, it investigates the development of responsive products and systems that can adapt to environmental variations and change their properties in response to specific external stimuli.

The research proceeds and plans to proceed following several phases: preliminary analysis, background, study of the state of the art, formulation of the hypothesis, experimentation and observation, and conclusion. The preliminary phase is useful to define the context of intervention, while the background phase focuses on reviewing the existing scientific literature on the topic. To identify the approaches adopted by designers, the collection and analysis of representative case studies will be started.

The research currently envisages defining the scientific framework of Biodesign practices and developing a BioDesign Tool characterised by a multi-level structure. This tool aims to support designers in the use of biofabrication techniques and facilitate the application of living materials for the development of products capable of reacting and adapting to complex situations in changing environments.

The current hypothesis envisages the creation of an open and scalable conceptual system that will make it possible to organize and make use of the available information. This is aimed at facilitating designers to recognise the specific characteristics of living materials and to design products capable of contrasting changing environmental conditions.

Following the formulation of the hypotheses, the research involves an experimentation and evaluation phase using workshops and tests.

The main objective is to collect data on the application possibilities of the developed model in the design context to formulate conclusions.

These tools could enable designers to acquire skills in the new approach based on cooperation with natural systems and regeneration, overcoming the traditional approach based on the exploitation of resources

1. Introduction: a Necessary Transition

In the current context, it is increasingly evident that there is a necessity to explore new directions of research and to develop actions that aim to effectively address environmental challenges and counter the complexity of ecological issues.
Human activities have caused a series of transformations that impact the entire planet and generate a considerable disruption of ecological dynamics and balance.
The amount of material produced by human activities, known as 'anthropogenic mass,' exceeded for the first time in 2020 the entire living biomass on Earth, which includes plants, bacteria, fungi, archaea, protists, and animals (Elhacham et al., 2020).
To successfully face the challenges of climate change, biodiversity loss, and ecosystem destruction in the coming decade (WEF, 2020), the European Union is implementing policies and plans for ecological transition. In the European Green Deal (European Commission, 2019), development plans converge that set a reference in the resistance to climate change.
Through specific strategies and policies such as the EU Biodiversity Strategy 2030 (European Commission, 2021a) or the EU Strategy on Adaptation to Climate Change (European Commission, 2021b), European governments aim to promote biodiversity and make cities more resilient to climate change.
Furthermore, mitigation and adaptation actions are promoted through the development of solutions that integrate nature into design through Nature-based Solutions (NbS) (EEA, 2021), which are a useful tool to pursue objectives such as the implementation of climate change mitigation actions (European Commission, 2015).

2. Background: Holistic Design Approaches

In recent decades, we have seen a redefinition of the paradigms of sustainability towards a perspective that aims to promote human well-being as well as ecological systems. Current post-anthropocentric visions (Wakkary, 2021) emphasise the creation of prolific systems where progress and improvement are intrinsically linked to the promotion of the health of both human communities and natural ecosystems. In this context, sustainability is no longer seen as a mere adaptation to available resources but as an active commitment to the creation of enabling conditions for interspecies coexistence in the same ecosystem (Latour, 2022).
These attitudes, which encourage an approach of mutual interspecies interdependence (Tsing, 2015), help to promote a deeper connection between society, designed technical artefacts, and the natural environment (Haraway, 2016).
Emerging concepts of sustainability promote a significant transition from an anthropocentric to a more holistic and interconnected perspective through practices that not only mitigate negative impacts on the environment but also actively contribute to the regeneration and empowerment of ecosystems.
The concept of Regenerative Design (Lyle, 1996) represents an approach that attempts to promote material and technological progress toward building systems that prosper in symbiosis with their environment.
This approach aims to guide the development of adaptive regenerative strategies in specific contexts (Gibbons, 2020) to contribute to the long-term well-being of the environment and living systems.
It also (Figure 1.) draws inspiration from the innate capacity of natural systems for self-healing and self-organisation (Mang & Reed, 2020). The methodology addresses the functioning of living systems, attempting to replicate resilience, flexibility, and adaptability. In this sense, biological systems, characterised by adaptive and reactive behaviours developed over time (Haeckel, 1904) and response mechanisms to external stresses and adverse actions (Haeckel, 1866), represent a design paradigm to be investigated to produce artefacts with responsive performance.
To address the complex challenges related to sustainability and the production of sustainable materials, the discipline of design is moving beyond conventional confines, searching for inspiration in the biological models and metabolic processes of nature. To develop new experimental, design, and production scenarios (Oxman, 2016), new practices such as Biodesign (Myers, 2012) emerge, combining design principles with biology, involving living organisms directly in the design process (Myers & Antonelli, 2012).

These are highly collaborative practices (Ito, 2016) that promote multidisciplinary approaches and integrate knowledge and technologies from other disciplines, such as materials engineering and natural and biological sciences, with design (Oxman et al., 2015).
The convergence of design and biology opens new perspectives for innovation and leads designers to access scientific laboratories and equipment (Willet, 2021) and to acquire fundamental skills and knowledge for the integration of biological principles into design (Langella, 2019; Perricone, 2021).
In the last decade, there have emerged several research centers, such as the Hybrid Design Lab, the Material for Transitions (MaDe/Trans), the Wet Lab at the MIT Media Lab, the Waag Society's Open WetLab, the Biodesign Lab, the Atelier Luma, the Biofilia-Base for Biological Arts, the SVA Bio Art Lab, the SilkLab and others, where individuals or organisations come together to collaborate and develop projects through the use of biomaterials and living organisms.
Many designers adopt do-it-yourself (DIY) practices to develop new designs and experiment with alternative techniques. Designers operate in temporary spaces or community bio-workshops, using their design skills to create the tools and machines needed to promote advanced, distributed, and shared production processes (Rognoli et al., 2015).
There is an increasing publication of open-source distributed learning educational programmes that promote recipes and models for the collaborative production of biomaterials through the use of low-tech tools (Ribul, 2013; Duenn, 2018)
At the same time, there is a diffusion of biotechnology movements that aim at the active involvement of ordinary citizens in biotechnology movements, dissemination, and democratisation of biology. Among the community, DIYbio Labs and online bio-networks can be found BioClub, Bioartlab Laboratories Foundation, Biohackerspace, DIYbio, Biologigaragen, DIYbio Belgium, DIYbiosphere, Dutch DIY Bio Group and others (Priola & Manfroni, 2024).

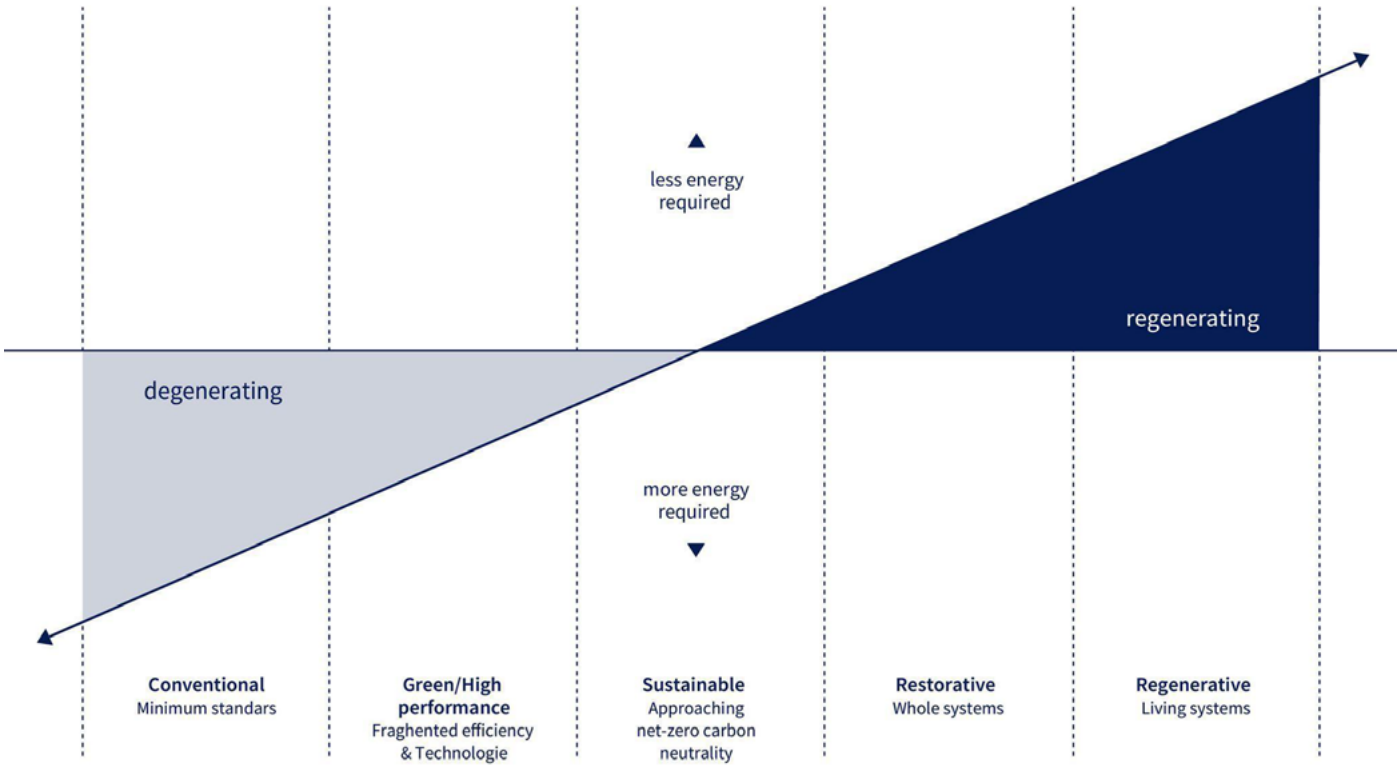


Figure 1. The trajectory of Ecological Design, © Regenesis Group, in (Mang & Reed, 2020).

3. Research Methodology

The research promotes a theoretical and practical change and promotes a design vision based on the interconnection and interdependence between all forms of life and the natural environment. It aims to

examine the intersection between design and biology, with a particular interest in the role of design as a driver of innovation in the development of new sustainable scenarios.
To start a critical reflection on the most recent regenerative research and experimentation practices in Biodesign, this study combines desk and field research methods, which are fundamental to improving the understanding and validity of existing data and results obtained in the different stages of research.
The research focuses on the following primary and secondary questions:

- RQ1. Is it possible to collaborate with living systems and integrate them into the design process to develop products that are biocompatible with changing ecosystem conditions?
- RQ2. Through the adoption of biofabrication techniques, will designers be able to facilitate the development of responsive and regenerative products?

To answer the research questions, it was hypothesised a research approach combining qualitative and quantitative methods, based on the development of six different phases (Table 1.).
Research phases 1, 2, and 3 (Preliminary Analysis; Background; State of the Art) provided an in-depth understanding of biodesign practices in Biodesign, Regenerative Design, and Nature-based Solutions (NbS). The exploratory Desk research approach involved the synthesis of documentary sources, while the literature review consolidated knowledge on relevant topics. The classification and analysis of case studies were crucial to understanding the challenges and opportunities related to the use of biofabrication processes in design.

In the next phase, it is expected to conduct practical experimentation with the prototyping of growth substrates under simulated conditions. Phase 4 (Hypotheses) will focus on the formulation of hypotheses and the development of a BioDesign Tool to deal with complexity in the creation of biofabricated products. Phase 5 (Experimentation and Observation), through workshops and tests, aims to validate the hypotheses by experimenting with solutions in structures that explore the interactions between bio-science and design. Finally, phase 6 (Conclusion) focuses on the discussion of the results that emerged during the research.

Table 1. Methodological approach and research phases.

Preliminary analysis	Context, scope of intervention, questions and research method
Background	Theoretical context framework and review of the Biodesign and Regenerative Design literature
State of art	Classification and analysis of case studies, biofabrication processes, prototyping of living materials substrates and testing in a controlled environment
Hypothesis	Formulation of hypotheses on the phenomenon, development of BioDesign Tool
Experimentation and observation	Experimental verification BioDesign Tool
Conclusion	Processing and delivery of research output

4. State of Art: Living and Regenerative Matter

In recent times, designers have become increasingly interested in investigating new biofabrication techniques to develop compostable and biodegradable materials (Collet, 2017). Bio-based materials (Figure 2.) include living materials, which involve the integration of living organisms and represent alternatives to materials made from fossil sources (Collet, 2021). Organisms such as algae, mycelium, and plants, which are used in these processes, are renewable, compostable, and biodegradable (Trebbi, 2021) and therefore offer new ecological perspectives in product design and production.

In recent years, designers have experimented with project possibilities through the application of alternative biofabrication methods based on living organisms (Cantucci, Ferrara & Lucibello, 2014; Karana et al., 2018; Karana et al., 2023). To identify the relationships and examine the methodological approaches adopted by designers in their research with biofabricated materials, the research identified and analysed international case studies developed since 2010. Specifically, the aim is to provide an overview of the various methodologies adopted in this context and to explore the role that designers play in the use of living materials.

The general objective is to provide an overview of the state of the art by presenting concrete examples and to offer an in-depth interpretation of trends and opportunities. The exploratory approach is based on a desk. Analysis of existing data, which will be organised in a dataset for a more efficient reading of the results. In this specific research phase, there were explored three of the most predominant methods of biofabrication of materials. Example cases were identified for each of the following material categories: algae, mycelium, and plants (Priola 2024). In recent years, algae have emerged as a promising alternative for the creation of products and materials, with examples such as the Algae Platform, Textile Lab, Colour Geographies, and Local Bioplastics developed by Atelier Luma. EcoLogicStudio (Pasquero & Poletto, 2020) contributed to projects such as HORTUS XL Tree.ONE, BIO.tech HUT (Figure 3.) and Photo.Synth.Etica. Plants are the basis of innovative projects such as Microgreen Shoe by Stella Harry Lee (Figure 4.), Rootfull by Zena Holloway, Biolace by Carole Collet, and InterWawe by Diana Scherer.

Mycelium is used to join waste organic fibers. Mogu developed sound absorbing panels, Studio Eric Klarenbeek & Dros the Mycelium Project Print and Grow (Figure 5.), Atelier Luma the Myco Structure, Jonas Edvard the Mycelium: MYX, Sebastian Cox and Ninela Ivaniva the Mycelium+Timber.

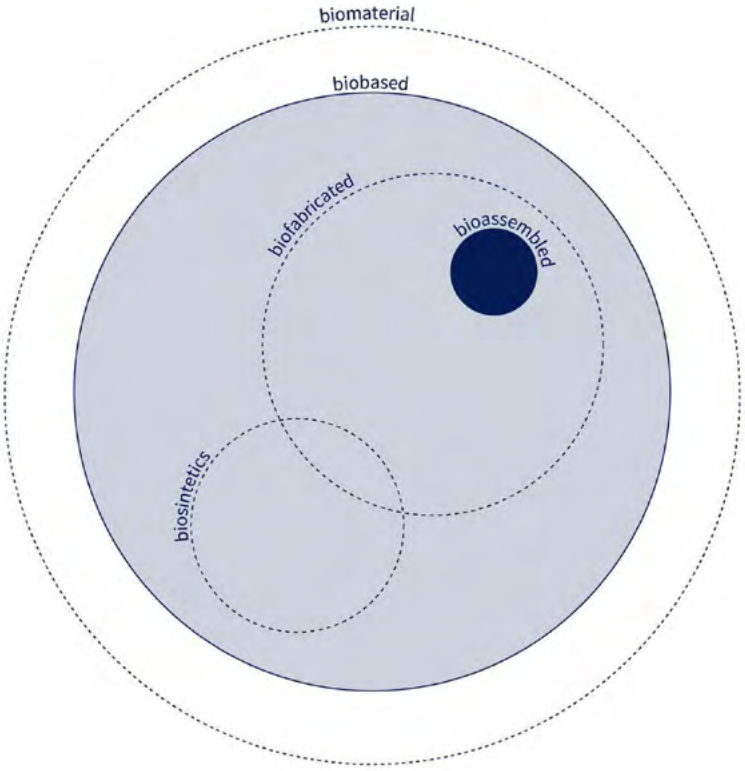


Figure 2. Bio Material Technologies scheme (Lee et al., 2019). Provides a set of terms related to biomaterials and their main production technologies.



Figure 3. BIO.tech HUT, ecoLogicStudio, EXPO 2017 Astana.



Figure 4. Microgreen Shoe, Stella Harry Lee, 2022.

5. Conclusions: Current Results, Future Steps, and Expected Outputs

Currently, the doctoral research, which started in December 2022, has completed the phases of reference literature review and classification and analysis of representative case studies, which have enabled the identification of theoretical and methodological aspects related to Biodesign. The future research phases planned are prototyping living materials substrates and testing in a controlled environment, which is necessary to obtain data useful for the development of the BioDesign Tool. The research currently aims to define the scientific framework of Biodesign and provide a broad overview of the most relevant contemporary practices on the application of biofabrication techniques. Furthermore, it aims to develop support tools for designers in the field of creating regenerative products using living materials. The creation of these tools could provide designers with new skills and promote an approach based on cooperation with natural systems. The application of regenerative strategies in artefact development involves relevant considerations. To effectively address current design challenges while providing benefits for society and biodiversity, two crucial aspects in particular emerge.

The first implication concerns the need to take a multidisciplinary view in analysing phenomena and developing design solutions. This requires the adoption of new methodologies and shared operational tools in the development of Nature-based Solutions (NbS) and responsive products aimed at protecting and recovering ecosystems.

The second aspect concerns the consideration of the time factor, which means the period during which the outcomes of the project actions are expected to manifest themselves. To address the current emergencies and produce positive impacts in the medium and long term, it becomes essential to intensify.
project actions. These should not only aim to mitigate negative impacts but also enhance the regenerative capacities of the systems being addressed. This proactive approach prefigures a clear change of vision from the conventional approaches used in the design process, encouraging the development of solutions that can contribute positively to the future well-being of humans and natural systems.

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P/REFERENCES OF DESIGN

MAPPING INTERACTION BETWEEN DESIGN AND THE THIRD SECTOR IN ITALY. PERSPECTIVES TO PROMOTE SOCIAL INNOVATION.

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KEYWORDS | SOCIAL ENTERPRISES, THIRD SECTOR, DESIGN FOR SOCIAL INNOVATION, DESIGN FOR SOCIAL ENTERPRISES, SOCIAL IMPACT

ABSTRACT | The current socio-economic complexity and the wide challenges that contemporary times present to design open up new opportunities for research in the field of design for social innovation.
In a perspective in which the dimension of environmental and social sustainability of design now appears inescapable, and in a national panorama characterized by the recent affirmation of the Third Sector and the social enterprises, designers operate strategically within complex design networks, generating not only new social forms but also new organizational models. However, the different activities involved in the social economy seem to face some challenges in the development and scalability of their initiatives. This productive sector finds itself responding to a rapid digital transition and reviewing its offer concerning its services as well as their organizational models. Based on these premises, the design could play a strategic role in promoting a cultural and mindset change in the Third Sector, which would enable the development of services, strategies, tools, and organizational models capable of fostering innovation and providing sustainability in the medium to long term.

The research, launched in October 2022 in the 38th cycle of the PhD in Design Sciences at the Iuav University of Venice, aims to investigate the relationship between design for social innovation and the Third Sector in Italy and, through the mapping of social impact enterprises and initiatives active on the territory, to identify the contribution and possibilities of design within these processes. In particular, from the analysis of the selected realities, it is proposed to investigate how and through which approaches methods, and tools designers operate in this field.

The research methodology conducted an initial phase of defining the scope of intervention, analyzing and reviewing the reference scientific literature relating to the social dimension of the design discipline and the current socio-economic context. The investigation continued through the selection of significant case studies through the use of qualitative methods (Desk Research Analysis) aimed at providing an initial overview. This phase aims to obtain significant data regarding which areas of design are most involved by companies, how designers operate within teams, and how much design-driven innovation is internalized in entrepreneurial processes.

Compared to the reference scientific literature, the research intends to offer an advancement in the knowledge of design methods in the field of design for social enterprises in Italy to describe their characteristics, approaches, and supporting tools. Therefore, to deepen how the design approach can be applied to the model of social enterprises, bridging the many organizational gaps and supporting their social mission.

Therefore, the research aims to elaborate a multi-level mapping of the relationship between design for social innovation and the Third Sector in Italy, which can contribute to determining the relevance of the topic in the contemporary panorama, provide new research perspectives, and support the different actors involved in these processes.

1. Introduction: the Social Economy Paradigm and the Relevance of the Italian Third Sector

The emergence of the Social Economy paradigm (Murray, Caulier-Grice, Mulgan, 2010) is assuming great relevance at national and international level.

The European Commission estimates that every day, around 2.8 million social economy activities in Europe offer concrete and innovative solutions to the major challenges facing our times. This potential can be fully exploited through the implementation of appropriate measures and policies (European Commission, 2021). In this sense, a relevant contribution on the topic was recently provided by the United Nations General Assembly through the adoption of the Resolution "Promoting the Social and Solidarity Economy for Sustainable Development" (United Nations, 2023).

This evolution manifests itself in the development of a broad hybrid zone within the socio-economic context, characterised by the proliferation of organisations capable of producing economic value while maintaining a predominant orientation towards the creation of social value and the pursuit of the general interest (Calderini & Gerli, 2020).

However, the different activities involved in the social economy seem to face some difficulties in the development and scalability of their activities and need more support from institutions to increase the production of their economic and social impact. This productive segment needs a rapid transition to digital and green and to review the offer of its services and organisational models without forgetting the need to value and give non-self-referential metrics to its impact (Giunta, 2023).

According to the survey conducted by Fondazione Italia Sociale, Deloitte Private, and TechSoup Italia (AA.VV., 2021)–regarding the need for innovation by Third Sector organizations–96% of the non-profit organisations surveyed perceive a strong need to innovate, with over 70% stating that they invest in innovation both to improve their product and service offerings and to optimize internal processes.
In both cases, the predominant approach is incremental, focusing on improving or adapting existing offerings rather than introducing new services, products, or processes.

In particular, according to the survey, only 20% of the Third Sector organizations involved claim to adopt service design approaches in the design and organization of their services.

Therefore, if Third Sector organizations want to carry out this task effectively, it is necessary to change, both from a cultural and a mindset point of view, to develop strategies, tools, and organizational models capable of promoting innovation.

2. Approaches and Challenges for Design in the Social Field: Design for Social Enterprises

The analysis of contemporary reality highlights the urgent need for the discipline of design to direct its attention towards current social challenges, actively contributing to the promotion of positive change.
In dealing with the current profound crisis, which brings about major changes in the prospects for socio-economic development, the relevance of design for social innovation (Amatullo et al., 2021) and the social sustainability of design represent indispensable issues for contemporary and future designers (Manzini, 2014). The world today has changed; the complexity of current global and social transformations has grown exponentially, and with it, the responsibilities of designers have increased. To make a positive impact on society, the contemporary designer adopts participatory strategies and practices of collective creativity to cooperatively find solutions with communities and generate new ways of acting (Meroni & Selloni, 2022).
Design for social innovation is a field that relates profoundly to the idea of a transition, as it deals with new

ideas (products, services, and models) that, by meeting society's needs, are capable of creating new relationships and collaborations, in other words, innovations that improve society's capacity to act (Caulier-Grice et al. 2012). Although the question of the social value of design is not a recent issue but a deeply rooted urgency within the design world (Sinni, 2020), the discipline's interest in cooperation with activities oriented towards promoting social innovation, such as Third Sector organizations and Social Enterprises, is more recent. Based on these reflections, the distinctive capacity of design for social innovation to create new relationships between different actors, redefining roles and enhancing competences (Tjahja & Yee, 2022), clearly emerges. In the virtuous dynamic of relationships, social enterprises emerge as key actors, participating both as natural agents of social innovation (TEPSIE, 2014) and as direct results of this dynamic process (Figure 1.).

By interweaving design and challenges of common interest, it becomes clear that it is precisely social enterprises that can effectively address these issues in a 'neutral field' (Figure 2.).

Interest in the field of social design focuses on the development of a recent approach known as 'design for social enterprises,' which aims to integrate user communities as catalysts for change (Selloni & Corubolo, 2017). Design for social enterprises incorporates a wide range of cross-cutting approaches, sensibilities, and tools, spanning product, service, communication, interior, interaction, and strategic design. Among these, service design and strategic design emerge as particularly crucial, focusing on the quality of interactions and the creation of innovative partnerships (Rosini & Barbero, 2023).

However, successful implementation of design for social enterprises requires a systemic approach. Through the combination of design methods and tools, it could support innovation within social enterprises, overcome barriers within incubation programmes, activate local entrepreneurial ecosystems, and enable entrepreneurship that is sustainable over time (Kwon, Choi & Lam, 2021).
Although there is evidence of the positive impact of design on social issues, it is necessary to fully understand how the design approach can be applied to the social enterprise model, bridging organizational gaps and supporting their social mission.

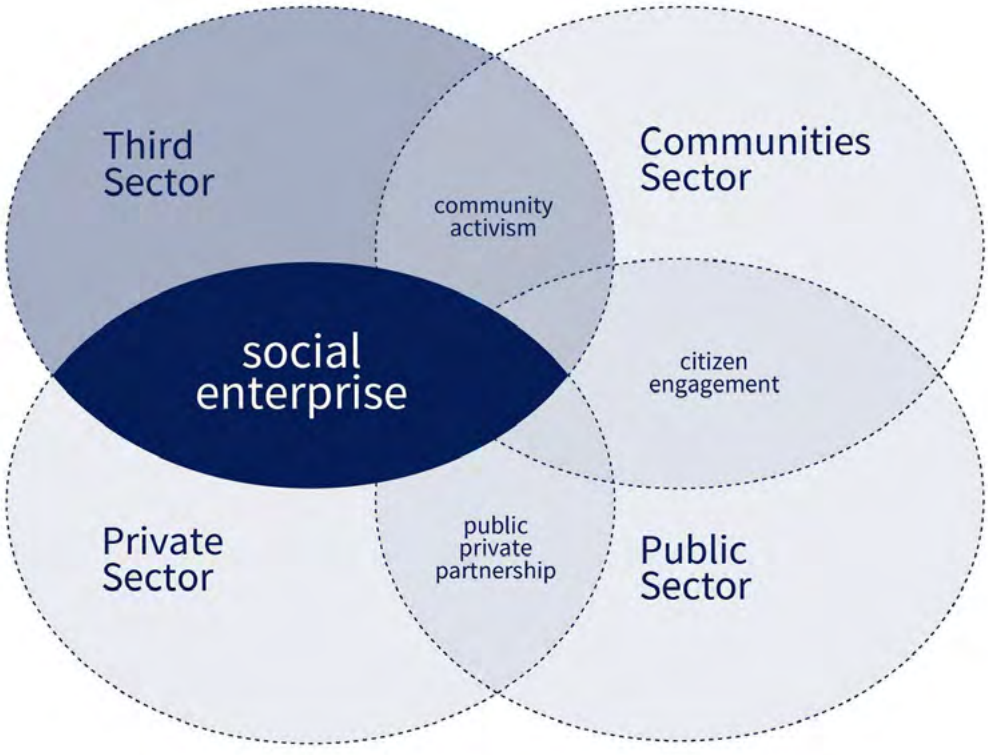


Figure 1. Graphic elaboration from: 'Social Innovator Sectors' (TESPIE, 2014).

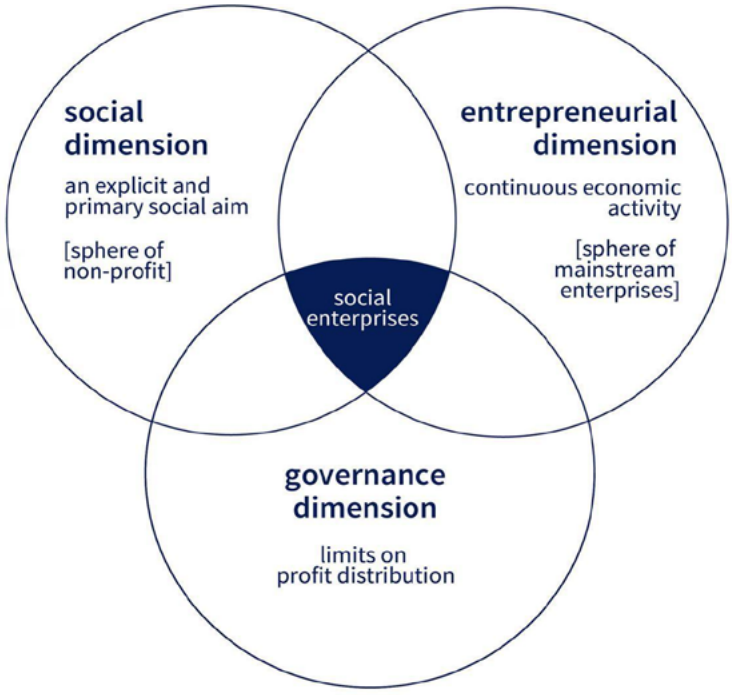


Figure 2. Graphic elaboration from: “The three dimensions of a social enterprise” (European Commission, 2015).

3. Research Methodology: Methodological Approach and Research Questions

The research aims to investigate the relationship between design for social innovation and social entrepreneurship in Italy. In particular, considering the criticalities that the sector encounters in developing longer-term strategies-the intention is to understand how the combination of approaches, methods, and tools related to design can support the development of these enterprises.

The research, therefore, poses the following questions:

1. How does design for social innovation interface with Italian social enterprises and the Third Sector, and what opportunities can be generated?
2. What is the relevance of social entrepreneurship on the national scene, and if or how much design is involved within these processes?
3. What design tools and approaches can be adopted to support and foster the competitiveness, diffusion, and sustainability of social enterprises over time?

To answer the research questions, the research involves advancing according to qualitative and quantitative methods and is structured through the following phases (Table 1.):

Table 1. Research Methodology and Phases.

preliminary analysis	context analysis and definition - scope of intervention	question processing and research method
background	framework and analysis of the scientific field literature	Social Design, Design for Social Innovation, Design for Social Enterprise; Social Economy, Social Innovation, Third Sector, Social Enterprise
state of art	identification and selection of nationally significant (Italian) case studies	social enterprises operating in the field of design for social innovation active in Italy; (desk research) overview
hypothesis	formulation of research hypotheses	definition of analysis tool mapping
testing and observation	field observation in selected realities	focus groups, semi-structured interviews and evaluation workshops; data collection and verification of research hypotheses
conclusions	processing conclusions and output delivery	discussion of results and main findings

Steps 1 and 2 –*preliminary analysis and background*– helped define the scope of intervention and the research topic. A qualitative method was used to examine the relationships between social entrepreneurship and design in both theory and practice.

For this phase of the research, the adoption of an exploratory approach was useful to gather data and information regarding established research and knowledge in this area through the analysis of scientific literature. This phase was useful for defining the state of the art, identifying possible gaps, and understanding possible research opportunities. Phase 3 –*state of the art*– focuses on the identification of significant case studies at a national level through Desk Research, useful to provide an overview of the existing realities in Italy, to which an initial survey questionnaire. It will then be submitted for the collection of primary data, then organised in a dataset. During this phase, ethnographic research will be conducted to understand the real situation in the Italian context. The objectives of this exploratory research are to obtain answers to the research questions and to determine the potential contributions to the study area. Subsequently, based on the established criteria, the most significant realities will be selected in which field research will then be conducted.
Starting with the data obtained from the previous phases, the *research hypothesis* will then be formulated in phase 4. To validate the hypothesis formulated, phase 5 –*verification and observation*– will proceed, during which workshops and tests will be organised, directly involving the previously selected realities. Finally, in phase 6 –*conclusions*– based on the results obtained, the hypothesis will be verified, and research conclusions will be elaborated.

4. Design and the Third Sector in Italy: an Initial Overview of Case Studies

In recent years in Italy, the phenomenon of social impact entrepreneurship has seen a great increase. The outcome of this process is generating a space in which profit and non-profit logics converge, generating a multiplicity of hybrid combinations (Symbola Foundation, 2021). This mapping of design in the Third Sector focuses on the Italian panorama and, through a qualitative-quantitative analysis of design in social impact entrepreneurship processes, aims to understand the relevance of design in this sphere and whether and how the combination of approaches, methods, and tools about design can support the development of such enterprises. In particular, it aims to collect information regarding:

- what is the legal status of the entity (non-profit, mutual, for-profit), and how does this influence the adoption of the design;
- in which areas of design innovation is mainly played out (product, communication, service, and strategic, space, digital, fashion);
- how designers are involved by companies (non-design; design as a driver; design as a process; design as strategy) (Danish Design Centre, 2015);
- how much design-driven innovation is internalized in business processes (in-house, outsourcing, quasi-in-house).

From the analyzed overview, the research identifies four typical modes of interaction between design and the Third Sector (Table 2.): (1) design of, (2) design for, (3) design with e (4) design and:

1. the organization is a social enterprise or a Third Sector entity that is involved in the design and production of products, communication artefacts, and clothing, and it involves designers in its team (*design of*);
2. the reality is a social impact enterprise (for profit) that is based on design and provides design support to the Third Sector through the tools and approaches typical of service design and strategic design (*design for*);
3. the initiative promotes programmes facilitating the matching between the Third Sector and designers, helping to increase the recognizability of the figure of the social designer and the valorizations of their skills (*design with*);
4. the reality develops multidisciplinary incubation processes aimed to finance and grow the social enterprise and enable its development through the adoption of design tools and/or the involvement of designers (*design and*).

As for the *design of* category, the study is investigating realities such as *Terra di Tutti*, a social enterprise specialising in the creation of products from recycled materials, which involves people from migratory backgrounds, social workers, and designers in craft workshops of creative reuse (Figure 3.); *Laboratorio Zanzara*, a social cooperative that encourages integration between designers and people with cognitive and motor disabilities. The designers develop products and communicative artefacts from the ideas of the people involved, which are then marketed in their shop(Figure 4.); *Quid* is a social enterprise that designs and produces clothes from discarded fabrics (95% from fashion surpluses), including people from pathways of labour fragility (60 % of employees). The *design for* category includes companies such as *Studio Shift*, a benefit company that provides research, eco-social business, and design-driven consultancy services for social enterprises and third-sector organizations; *Lama Impresa Sociale*, collaborates with enterprises, institutions, and the third sector to design sustainable processes and services, using design thinking and co-design in complex contexts; *Social Seed,* a company that, through the combination of different skills and approaches to design, supports and experiments with innovative solutions with social enterprises and Third Sector organizations. The *design with* category includes initiatives such as the *Bando Wonder*, aimed at designers and third sector organizations to foster the hybridization of skills, strengthening the connections between the two worlds to generate social innovation; *Design Sprint for ETS*, a project that has planned three co-design events on social innovation topics in 2023, to bring together young designers with expertise in Strategic and Service Design with three Third Sector organizations.

In the *design and* research category, the research is mapping realities such as *SocialFare*, a social enterprise that offers expert consultancy programmes for Third Sector organizations wishing to develop social impact projects in their territories, combining design approaches; *Avanzi-Sostenibilità per azioni*, operating as an ecosystem dedicated to social innovation, is committed to promoting the development of Italian companies facilitating initiatives and actively involving stakeholders.

Table 2. Modalities of interaction between design and the Third Sector: illustrative case studies.

Design of		
Terra di Tutti	Lucca (LU)	https://www.terraditutti.it/
Laboratorio Zanzara	Torino (TO)	https://laboratoriozanzara.it/
Quid	Verona (VN)	https://www.quidorg.it/
Design for		
StudioShift	Morbegno (SO)	https://www.studioshift.it/
Lama Impresa Sociale	Firenze (FI)	https://agenzialama.eu/#
SocialSeed	Bologna (BO)	https://socialseed.eu/
Design with		
Bando Wonder	Torino (TO)	https://www.circolodeldesign.it/progetti-di-impatto/wonder
Design Sprint for ETS	Bergamo (BG) Seregno (MB) Romano di Lombardia (BG)	https://www.designforsocial.it/
Design and		
SocialFare	Torino (TO)	https://socialfare.org/
Avanzi Sostenibilità per azioni	Milano (MI)	https://avanzi.org/

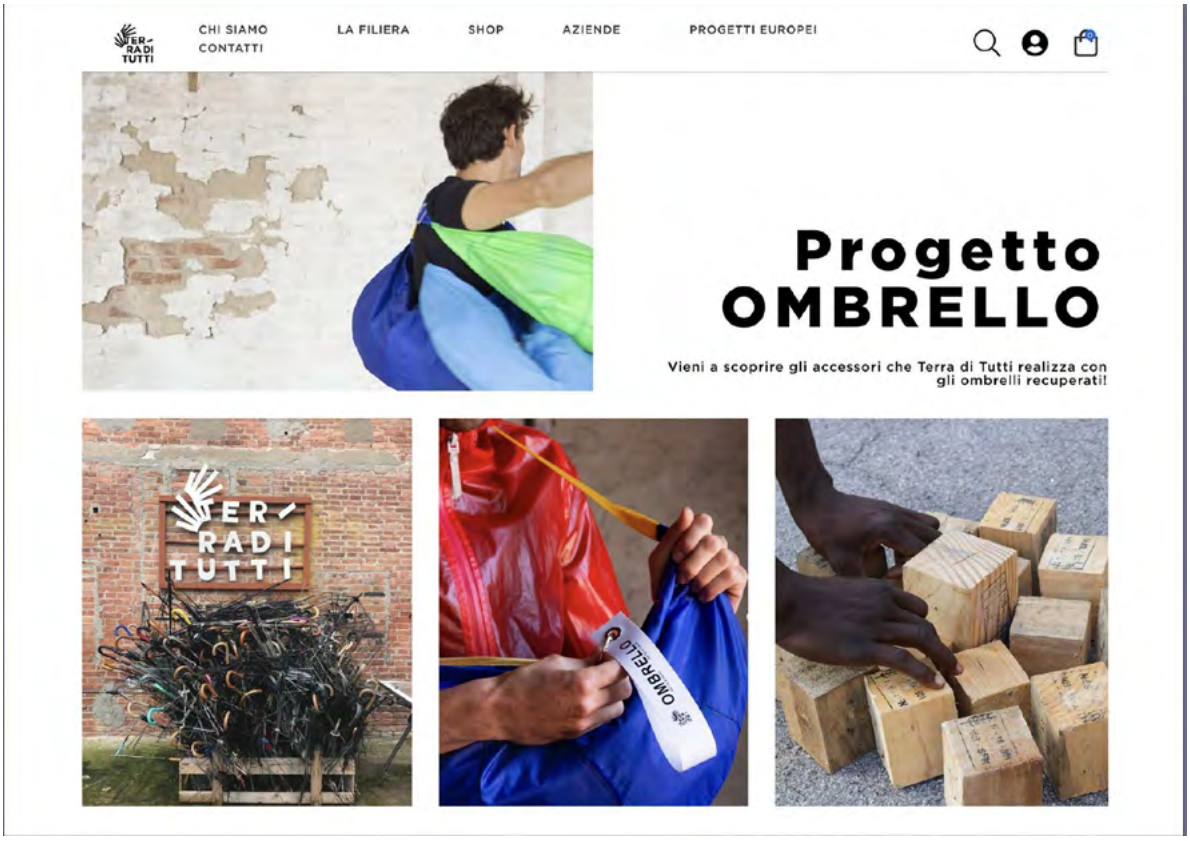


Figure 3. Terra di Tutti, a social enterprise in Lucca, designs and produces products with recycled materials, including people from migratory backgrounds.

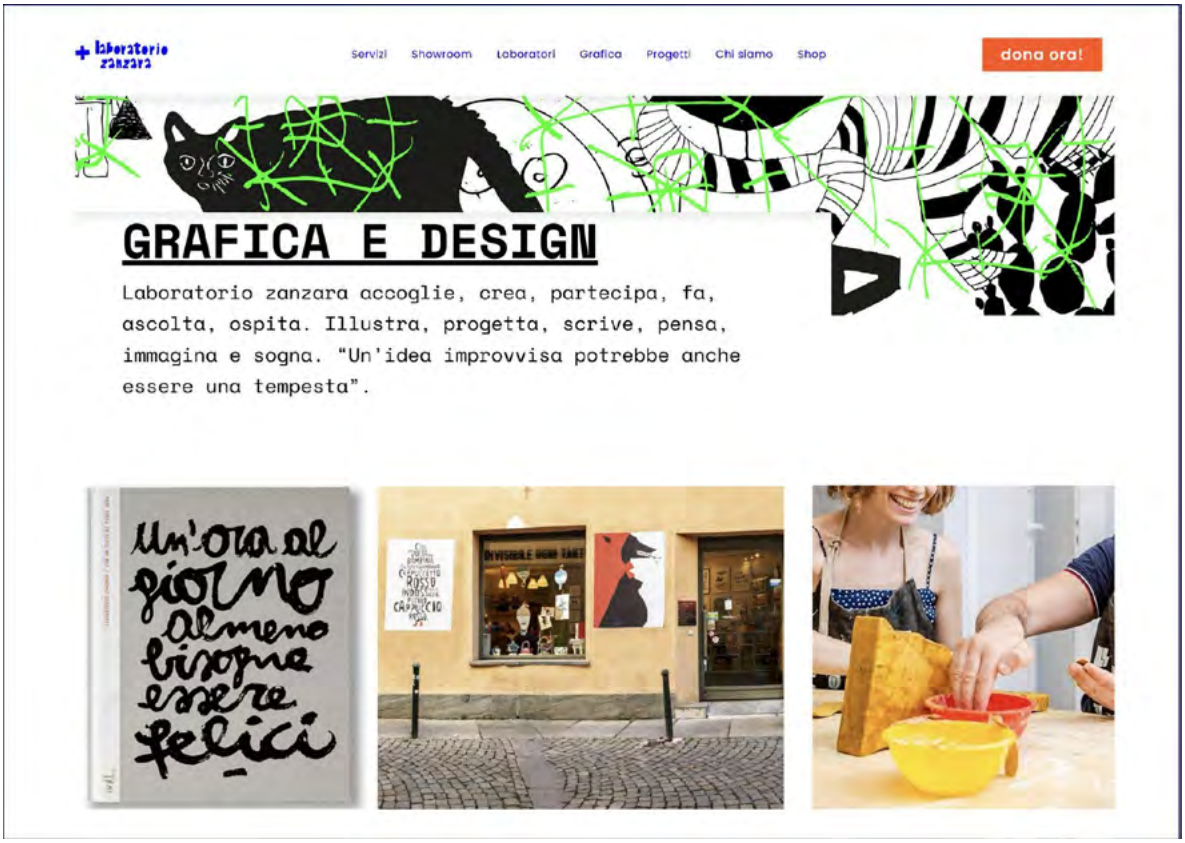


Figure 4. Laboratorio Zanzara, Social Cooperative in Turin, design of communication artefacts including people with cognitive disabilities.

5. Current Results, Expected Outputs, and Future Perspectives

The panorama outlined here is a partial outline of the realities mapped to date, and its dimensions go beyond what has been presented. The research, launched in October 2022, has completed the first phase of analyzing the relevant scientific literature and the state of art through the identification of 60 significant case studies, which were useful in focusing on and understanding the relevance of the topic.

In the future phases, the research will focus on an in-depth analysis of the cases identified in line with the objectives set through the elaboration of a survey questionnaire to be administered to the selected realities to collect the necessary data. In addition, exploratory interviews will be conducted with experts on the topic to identify their role in the development of social enterprises, explore their awareness of the relevance of design, and understand their relationships with other organizations to further develop the mapping and launch further investigations.

The expected research outputs, therefore, aim to provide an advancement of knowledge on the topic of design for social enterprises in Italy and to understand whether and how a design-driven approach could enable organizations to design solutions in a radically different way. However, in assessing the opportunity to connect the non-profit world with the discipline of Design, it is appropriate to identify new directions of development for social enterprises and to expand the recognition of the professional figure of designers working in this field. It is also essential to orient organizations to recognize the relevance of design practice so that it is no longer understood as an occasional activity but as an integrated practice in business activities. In this sense, the aim is to highlight the need to promote widespread awareness of the crucial role of design in the field of social enterprises and the centrality of this issue in the Italian landscape today. Design emerges in this sphere as an essential vehicle for rendering tangible visions of plural futures and bringing such futures to life, creating new ways of exploring and experimenting.

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P/REFERENCES OF DESIGN

PARTICIPATORY DESIGN FOR THE ENHANCEMENT OF CULTURAL HERITAGE AND URBAN PUBLIC SPACES.

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KEYWORDS | PUBLIC SPACES, PARTICIPATORY DESIGN, URBAN ENHANCEMENT, CITY IDENTITY, CIVIC ENGAGEMENT

ABSTRACT | The article addresses the value of participatory design as a methodology to be applied in the enhancement of a territory's cultural heritage and its urban public spaces. The goal is to preserve and promote territorial identity, transforming public spaces into inclusive and vibrant community places that stimulate social interaction.

Urban public space has a significant impact on people's quality of life, contributing to the formation of a community and the dissemination of culture and civic identity. Therefore, through participatory design, the community can closely collaborate with the design team to develop site-specific solutions that respect the characteristics and needs of the local community.

Co-design processes foster mutual learning: the community shares its knowledge and experience, allowing the designers to fully immerse themselves in the territory and its peculiarities. Concurrently, designers contribute to increasing the community's awareness of the value of its cultural heritage and community places. The community does not always recognize these values, which often remain undervalued and underused. For this reason, participatory design aims to overcome this challenge by involving the community in the design process.

The article examines two case studies - Restanza Workshop and RAISE innovation ecosystem - to further explore the role of participatory design between the past and the future and demonstrate how important it is today to generate new processes of territorial and cultural rediscovery and valorization.

1. Introduction

Participatory design is configured as a key methodology to implement during the regeneration and enhancement processes of a territory, its cultural heritage, and its urban public spaces (Gehl, 2010). It is presented as an activity that transcends the mere rational resolution of urban needs; rather, it is a reflexive practice that facilitates both the construction of relationships between stakeholders as well as the creation of new opportunities that positively impact society (Meroni, 2019; Meroni, Selloni, 2022). This methodology, if applied during the various stages of the design process, can foster the creation of more democratic, proactive, and inclusive societies, where the result is not only the realisation and implementation of new products or services but also and, above all, the value of the collaborative process that takes place during their design (Bannon, Ehn, 2012).

Urban public space, as a place of community and a stage for interaction, plays a crucial role in people's quality of life, contributing to the rediscovery or construction of a sense of community, culture, and civic identity (UN-Habitat, 2016). Therefore, its enhancement not only increases its physical and social attractiveness but also contributes to the psycho-physical well-being of the community.

In this scenario, participatory design becomes a precious resource to the community, which, actively involved in the design process and supported by the design team, designs specific solutions that reflect the local context. During participatory urban design processes, mutual learning and enrichment take place: the community, by sharing its experience with the designers, enables them to acquire new knowledge, while the latter, through deep observation and immersion in the context, contributes to increasing the community's awareness of its own cultural heritage and collective spaces.

In fact, despite the wealth of stories, culture, memories, and traditions of a specific place, the community does not always fully grasp the intrinsic and intangible value of its heritage and social spaces, thus not realising that preserving these values is crucial to passing them on to future generations. In co-design processes, therefore, designers assume the role of facilitators, directing and enabling the conditions whereby collaboration between multiple heterogeneous actors can take place (Chambers, 2002).

Notably, since an in-depth knowledge of the local context becomes fundamental for site-specific projects (Tamborrini, Strabellini, 2018), they support the community in highlighting not only the issues but also the potential of its territory, which is an essential value from which to start to intervene on urban public spaces.

The importance of participatory design in territorial valorisation processes emerges in the analysis of two case studies of urban co-design, chosen as exemplary experiences among those in which the author personally took part during her PhD research: *Restanza* workshop, focused on the rediscovery of traces of the past; and *RAISE* innovation ecosystem, aimed at the creation of Smart Cities, on which the author works with the Design research team of the University of Genoa.

2. Restanza Workshop

Restanza represents a paradigmatic experience of participatory design aimed at exploring and enhancing the rich cultural and territorial heritage of the small medieval village of Terzorio, located in the hinterland of the province of Imperia in the region of Liguria. The entire project was curated by a group of PhD students and researchers in design and landscape architecture from the University of Genoa as part of the "*Alfabeto d'Entroterra*" project promoted by the Associazione Radice Comune and winner of the Compagnia di San Paolo Foundation's call for proposals "Guidelines for collaborative practices of active civic participation," obtaining funds for the territorial regeneration of the village.

The title of the workshop emphasises the feeling of being both anchored in a place and disorientated and acting consequently in such a way as to protect it and, at the same time, radically regenerate it (Teti, 2022), working in a direction that counteracts the depopulation of villages.

Indeed, the workshop took place in this village as it was an ideal place to launch a participatory process of territorial regeneration. It is a town with approximately 230 inhabitants, rich in traditions to be perpetuated, stories, and natural beauty, whose peculiarity lies in its immense quietness due to the total lack of services, which had to close during the Covid19 pandemic, leaving residents and tourists without indoor places to socialise and spend their leisure time.

The only public space potentially accessible to the community as a new meeting point was the lower floor of the Medieval Tower, a place where, until a few days before the workshop, there was the village's historical documentation archive, which was in a decidedly dilapidated and irretrievable state due to neglect and infiltration of the Tower.

For the aforementioned reasons, the workshop aimed to promote the territorial regeneration of the village, starting from the enhancement of the cultural heritage, the natural landscape, and the Medieval Tower, the identity symbol of Terzorio, which currently houses the council chamber on the upper floor and a space to be reused and made available to citizenship after the removal of damaged documentation, on the lower floor.

The four-day workshop was held in December 2023 and involved twenty participants from all over Italy, including designers, students, PhD students, and professionals, who stayed in the small village for the entire territorial regeneration process to connect as much as possible with the territory and the local community. A few days before the workshop, the organizing team, supported by the municipal administration, publicized the initiative that would be held shortly thereafter to recruit as many citizens as possible to participate in the project. Thanks to the great ferment in the village, the recruitment phase was easier than expected. From the beginning, some members of the citizenship enthusiastically joined the already large group of participants, thus creating an interdisciplinary co-design team (McKercher, 2020) of about thirty people.

On the first day, through a series of inspections and interviews with citizens (the ones already in the team and others who met in the village streets), the process of documenting, reconstructing, and preserving information on Terzorio's tangible and intangible heritage began. After collecting the data, the hybrid team conducted a focus group during which, using brainstorming and a large canvas to be filled in with post-it notes, four themes of interest were identified: the emblematic stories of the village, places of sociability, rites, and rituals, and culinary traditions, inserting as much information as possible for each category.
As a result of this process, the hybrid team was able to retrieve and map the historical memories and local traditions of Terzorio, which were the foundation of the work that was to follow.

Over the next three days, the co-design team, according to the inclinations of each participant, divided into three sub-groups:

- Graphic Communication: directed by the graphic designer Mauro Bubbico, the participants explored and elaborated the information related to the four topics of interest, creating for each of them a small booklet to be donated to the community as a sign of a rediscovery of cultural heritage and strong territorial identity;
- Land Art Performance: led by landscape architect Fabio Manfredi, the team conceived, realized, and filmed with a drone a symbolic performance among the water cisterns on the Terzorio hillside. It involved all workshop participants and citizens who had not yet taken part in the experience, leaving them an aerial film to rediscover the local tradition of water rationing as well as the beauty of the natural landscape;

- Community furniture creation: supervised by designer Francesco Fusillo, the group applied their know-how to design and construct furniture for the Medieval Tower, starting from simple wooden boards. Benches, bookcases, tables, stairs, and coat racks gave new life to the disused ground floor of the Medieval Tower. Moreover, technical drawings were made for each piece of furniture and were donated to the community to enable them to make new furniture equal to that designed together.

Ultimately, the co-design activity encouraged the creation of a custodian community capable of rediscovering, documenting, and handing down its cultural heritage while at the same time enhancing the space of the Medieval Tower with artefacts that make a place that has long been inaccessibly usable, thus leading to the revitalisation of a village that seemed hibernated in time.



Figure 1. A citizen of Terzorio collaborates in the reconstruction of the historical memory. Photo by Rachele Tonioni.



Figure 2. The realisation of the performance among the cisterns, filmed by a drone. Photo by Rachele Tonioni.



Figure 3. Some citizens work on the creation of wooden furniture for the Medieval Tower. Photo by Rachele Tonioni.



Figure 4. Wooden furniture for the Medieval Tower. Photo by Rachele Tonioni.

3. RAISE Ecosystem

RAISE innovation ecosystem, an acronym of 'Robotics and AI for socio-economic empowerment,' conceived by the National Research Council, the Italian Institute of Technology, and the University of Genoa, financed with MUR funds through the PNRR for the three years 2023-2025 and coordinated by the Liguria Region, aims at promoting regional and national cooperation between the research system, the production system and institutions through the design and commercialization of technological solutions based on robotic systems and artificial intelligence.

In this perspective, RAISE, by actively involving its local resources and expertise, enhances the strengths of the Ligurian territory, responding to the real production and social needs of the Liguria region.

In this project, the research group of the Department of Architecture and Design of the University of Genoa - of which the author is a member - composed of professors, researchers, and PhD students in urban planning, sociology, architecture, and design, participates in Spoke 1 "Accessible and Inclusive Urban Environments and Services," which intends to design and implement intelligent and responsive technologies, devices and services for the urban context, to empower the usability of urban services and increase the perceived sense of wellbeing in city life; in detail, the interdisciplinary team is working on work package 5 "From inclusive technologies to inclusive smart cities," focusing on the identification of design solutions to implement urban regeneration strategies through the active involvement of citizenship in the design processes and a fruitful interaction with public administrations.

During the first year of the project, further to the desk analysis preparatory to the in-depth study of the reference framework concerning urban furniture, installations, smart and responsive products and services for a more inclusive, active, and attractive urban space, both from a physical and social point of view, the UniGE-dAD team started a field analysis focused on the detection of the needs and requirements of residents in the urban environment, by carrying out the *ResponsiveSpaces* workshop. To conduct this analysis, the district of San Salvatore in the municipality of Cogorno, in the province of Genoa, was identified as ideal as zero case study thanks to its heterogeneous characteristics.

San Salvatore is a small-sized urban context, which can be assimilated to the urbanistic concept of the 15-minute city, according to which all the main daily needs of residents can be met by walking or cycling within 15 minutes (Moreno et al., 2021; Manzini, 2021). Moreover, the entire area is particularly interesting as it has numerous services, commercial activities, sports facilities, cycling and nature trails, and historical and ecclesiastical buildings, which make it versatile for analysis in various contexts. Due to its diversified urban structure, the area is well suited to become an incubator for urban prototype solutions that use robotics and artificial intelligence, which can also be subsequently replicated and declined in other contexts of the Ligurian territory. In addition, in the San Salvatore area, there is also the diocesan campus ‘Villaggio del Ragazzo,’ a large organisation that manages educational, social-health, labour, and vocational training services, which has offered its spaces for possible prototype experimentation. Initially, the interdisciplinary team made on-site visits to observe and extrapolate the strengths, weaknesses, opportunities, and threats (SWOT) of the area examined. Subsequently, the *ResponsiveSpaces* workshop was held to identify the major criticalities and needs and possible solutions or wishes of citizens. Around forty stakeholders from the area, citizens, users, or workers in the ‘Villaggio del Ragazzo,’ members of the local administration, and members of the PAs of the surrounding towns actively participated in this workshop.

Initially, the participants were interviewed one by one by the researchers through semi-structured interviews aimed at extrapolating the major needs in the urban environment; subsequently, several focus groups on specific topics were carried out to reason together on which needs to intervene and to think about solutions and design scenarios to be launched with the community in the next months. Ultimately, the active involvement of citizens in this preliminary phase was essential to understand what needs should be met by intelligent and responsive urban devices and furniture and to define a common vision on the next steps to implement.



Figure 5. A focus group with San Salvatore citizens, students, and frequenters of the 'Villaggio del Ragazzo' during the *ResponsiveSpaces* workshop.

4. Conclusions

The successful implementation of participatory design in both case studies generated significant civic engagement for the community, progressively triggering fruitful community reactivation and empowerment (Selloni, 2017), regardless of the outcome obtained.

Within the *Restanza* case study, community involvement was indispensable for the creation of a 'caretaker community' committed to the reconstruction and preservation of the community's historical memory. This approach was an effective tool to mobilize citizens to preserve the past and their cultural heritage while promoting a sense of territorial identity and revitalising community life. In addition, the handing back of the Medieval Tower to the community and its furnishing had a positive impact on the entire village, since today it has become the main meeting point for citizens and local associations.

This workshop has proven to be a successful intervention in the discovery and re-appropriation of territorial peculiarities, so much so that it could become an exportable and scalable model for those villages presenting analogous conditions.

In the RAISE project, on the other hand, the involvement of local stakeholders in the empathisation phase with the territory and the users' needs by carrying out focus groups favored the sharing of future visions for the use of the collective spaces of the Villaggio del Ragazzo and its surroundings. In the next phases of the project, participatory practices will intensify as smart site-specific furniture will be co-designed, prototyped, and tested. This process will lead to the realisation of an urban project that will see intense civic engagement and the building of a more cohesive community aimed at fulfilling the same goal.

Ultimately, the active participation, enthusiasm, and, at times, emotion on behalf of the community members during both participatory processes testify to the effectiveness of this methodology aimed not only at enhancing the cultural heritage and urban public spaces but also at increasing a sense of community, new opportunities, and greater community well-being.

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P/REFERENCES OF DESIGN

BRIDGING DESIGN AND EDUCATION: INNOVATING LIFELONG LEARNING IN THE PUBLIC SECTOR.

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KEYWORDS | LIFELONG LEARNING, PUBLIC SECTOR, SOFT SKILLS, LEARNING TO LEARN, DESIGN PEDAGOGY, SYSTEMIC DESIGN

ABSTRACT | In the information age we are living through, marked by increasing complexity and rapid changes in social and technological contexts, the ability to understand and face reality must always be challenged and nurtured. As humans, the need to dedicate time to lifelong learning of the self is more critical than ever, and there is a need to invest time and resources in improving the education offered by the public sector.

The aim of the research is aimed at assessing the potential role of designers - by nature multifaceted and transdisciplinary - in the ongoing changes in the learning society. Specifically, it aims to study the integration of design methodologies in educational programs dedicated to lifelong learning (LLL) and the development of soft skills aimed at stimulating logical-critical thinking and awareness of one's learning process. A secondary objective moves from problematizing the impact of Service Design and aspires to align design pedagogy with the needs of the public sector.

The preliminary analysis of the existing literature in education takes the European context into account and examines both the push for standard-setting in teaching and assessment from a collective perspective of aligning the skills needed to prepare for the labor world and the opportunities for profiling and adaptability brought by technological evolution. Moreover, from the primary study on the state of the art of designers in the public sector, an imbalance is highlighted between the expectations of service & systemic designer training and actual integration into the job market, even though especially in education-new job figures such as the instructional designer are becoming more popular.

The proposed methodology for initiating the research articulates operations in three phases, each of which envisions expected results. The first phase makes use of tools such as desk analysis and survey research to identify gaps and needs in LLL and soft skills growth programs; the second phase synthesizes in a diagram the intersections between the linguistic analysis of the training objectives of a corpus of design curriculum, the impressions of teachers and learners that emerged from focus group sessions, and the public sector needs found in the first phase; the third phase is concerned with the development through co-design and evaluation through user testing of design-to-public sector bidirectional instructional unit prototypes. By examining the intersection of design and education, this study seeks to elucidate the significance of the designer's role in shaping educational experiences. It also draws parallels with historical movements to contextualize contemporary efforts to innovate educational practices.

In conclusion, doctoral research aims to improve the expertise of design students to prepare them to encounter work in the public sector and aspires to foster interdisciplinary exchange between disciplines, too, first of all, individual and consequently relational and collective improvement in the complex society.

1. Introduction

The world we live in is becoming an increasingly complex and rapidly growing technological ecosystem that risks eluding human understanding (Han, 2022). Approach to reality is as changeable and uncertain as is the infosphere (Floridi, 2020a), and the challenges brought by the information (Fischer, 2000) invite us to never stop our learning process. In the learning society (Field, 2000) in which we are situated, it is necessary to "promote a knowledge capable of grasping global things" (Morin, 2001, p.7).

The need for continuous learning and skill development is more critical than ever. There is a need to "pursue our pedagogical effort" (Meadows, Meadows & Randers, 2022), going beyond the current educational system (Morin, 2015), to provide skills suitable for governing complexity (Gorzeń-Mitka, 2015). In this process, the impact training of educators is imperative due to the transition of the teacher into the role of capacity builder (Black, 2003).

Stating its nature as a complex phenomenon (Avilés, 2023), an urgent field of intervention is education. Traditional educational approaches often fall short in preparing individuals to navigate this complexity, particularly in the workforce of the public sector, where technologies advance rapidly (Farias-Gaytan, Aguaded & Ramirez-Montoya, 2023), while human skill development lags (OECD, 2023a).
Especially in the area of services and information offered by the public sector, workers face "an accelerating rate of change in the knowledge and skills necessary to remain competitive" (Fischer, 2000), and it becomes crucial to train proactive figures capable of empowering, not just teaching.

With its hybrid nature as a third culture (Cross, 1982) agent, the approach of design can become an active actor in this changing process to educational approach and skills development.
This research project aims to explore the multifaceted role of designers in addressing these challenges in the public sector, focusing on two main areas: the integration of design methodologies in educational initiatives to foster lifelong learning (LLL) and soft skills development and the advancement of design pedagogy to better match with public sector needs.

2. Literature Review

2.1 Transformations in the Public Education Context

Since 2018, the European Union has set out guidance for educational operators (e.g., teachers and policymakers) to foster the development of lifelong learning pathways. Eight key competencies have been stated for the structural education of any learner, from primary school to adult and lifelong learning (European Commission, 2019).

The indicated competencies mainly focus on strengthening soft skills suitable for providing the basis "for developing one's knowledge and potential and for participating in society" (OECD, 2023b). The goal of any educator should be to stimulate a critical, resilient learning process (Bocciolesi, 2017), capable of dealing with any change with a systemic vision, given the extremely volatile nature of the labour market nowadays (European Commission, 2011).

Specifically, the three main soft skills identified by the Organization for Economic Co-operation and Development are Curiosity, Systematic Thinking, and Learning to Learn. The latter refers to awareness of one's degree of knowledge and self-organization of one's learning process (Freitas, 2021). Consequently, the directionality of pedagogy is overturned: the learner becomes a trainer of himself, and the teacher "must never degenerate into automatism" (Lucisano & Salerni, 2022, p.27), considering himself a learner to evolve.

In this scenario, assessment models are also being standardized: Bloom's Taxonomy (Bloom, Engelhart, Furst, Hill & Krathwohl, 1956) is a benchmark metric in the assessment of learning objectives described in a formative curriculum. Demonstrating the importance of the Learning Learn soft skills, in one of its latest revisions, Bloom's Taxonomy was updated with the addition of the criteria Metacognitive Knowledge, which states as follows:

> "Metacognitive Knowledge is importance of students being made aware of their metacognitive activity, and then using this knowledge to appropriately adapt how they think and operate." (Krathwohl, 2002, p.124)

While on the one hand, there is a tendency towards the standardization of competencies and assessment models, on the other hand, technological trends are pushing towards the customization of digital training environments (INDIRE, 2023), as well as the emergence of adaptive ecosystems capable of enhancing the individuality of each learner.

2.2 Wicked problem in Design Curricula for the Public Sector

In front of a scenario that is complex, technological, and heavily saturated in innovation, design has always shown itself to adapt "to embrace the theoretical and methodological premises that have enabled innovations" (Riccini, 2013, p.41).

Although designers have begun to be involved in policy-making strategies, there is still a gap between service & systemic design graduates' preparation and actual integration into the job market (Morelli, 2021). Service design can be seen as the framework that has undeniably led to a democratization of design mindset in contexts other than design, but which is nevertheless experiencing a wicked pedagogy problem (Schell, N.D.) for the following reasons:

- risk of reducing the action of design and planning to a form of 'toolism,' i.e., the use of tools not adapted to the needs of the learner or the context (Auricchio & Göransdotter, 2021);
- risk of homologating design methods (Auricchio et al., 2021), disregarding the cultural and ontological differences that could instead enrich the debate and development of methods and thinking in design in general;
- design thinking is often applied in quick sessions but is hardly ever chosen as a long-term training practice (Schell, N.D.)

Furthermore, according to reports from the Service Design Network (Mager, 2016), no discipline specifically trains designers to interact with the public sector.
Yet, given the social and public benefit mission aimed at training the workforce that will need to integrate with the economic sectors of the future, design universities should be one of the key stakeholders in the public sector.

Given these challenges, we need to understand whether universities that offer courses of study in the domain of design, either systemic or service design, are ready to prepare their learners for the encounter with work in the public sector. To validate this, it is necessary to assess both the effectiveness of design methods (Cash, Daalhuizen, Hekkert, 2023) and the learning objectives oriented towards both hard skills and soft skills provided by universities of design (Soares, Carvalho & Dias, 2020). In this search for a pedagogy of design, a possible method of exploration should start from an accurate study of the foundational principles expressed by the founders of the Italian design education (Pansera, 2015). According to Aldo Calò, a school of design should

> "arouse in the students a technological problem that puts them in a position to organize technical-scientific data according to concepts of form and content" (AA.VV., 1972, p.45)

Recalling the demands of European standards concerning teaching strategies to reduce functional illiteracy (United Nations Development Programme, N.D.) and to improve logical skills required by STEM programs.

Only recently, in both the private and public sectors, there has been a growing demand for instructional designers (Fondazione Scuola Beni Attività Culturali, 2024), professionals skilled both in structuring formative content and taking into account their technological implementation.
Understanding whether this trend will be able to take hold in the long term will be important, assessing whether the designer can coordinate and design a learning process. It is essential to understand whether the design has the right credibility to enter into Lifelong learning-oriented programs and the development of soft skills learning paths.

Taking into account the considerations expressed so far, the questions of this doctoral research are the following:

1. Which are the competencies suitable to support the transformation in education by the public sector?
2. Is the designer able to coordinate and design a learning process?
3. How could a designer be trained to support education programs in the public sector?

3. Methodology and Expected Results

To attempt to answer the research questions, the doctoral research is planned following this three phases methodology:

1. Understanding and revealing opportunities
   - Desk analysis and case studies analysis to define a taxonomy of programs of lifelong learning currently carried out in the public sector to foster the development of soft skills in Europe.
   - Choice of three fields of intervention (e.g., policy-making, culture, tourism, justice, health) as research samples, according to which sectors are most in need of soft skills.
   - Survey research to at least one hundred operators from each sampled area in the public sector to detect needs and gaps in current programs.
   - Qualitative interviews with a sample of at least five HEI teachers from each European region to detect opportunities and challenges.

2. Comparing and mixing
   - Language analysis of a corpus composed of a collection of learning outcomes extracted from HEIs study programs in service and systemic design to map the competencies with which design students in Europe are being trained.
   - Diagrammatic model to match goals and needs of competencies revealed by the analysis of the sectors and the competencies revealed in design curricula.

3. Modeling, exchanging, and integrating
   - Pilot of an instructional unit created ad hoc for public sector audiences through co-design techniques with design educators, stakeholders from the public sector, and specialists identified in the previous stages.
   - Pilot of an instructional unit created ad hoc to enhance the curricula of design HEIs and aimed at preparing for work in the public sector through co-design techniques with design educators, stakeholders from public sector, and specialists identified in the previous stages.
   - Prototype development of hybrid environments made by a set of physical and digital products useful for pilot testing.
   - User test to evaluate the prototype and define improvements and scenarios of the model.

At the end of the research path, the expectations are to have investigated how the figure of the designer can be promoted within the public sector and conventional educational environments and to assess the state of the art of design pedagogy in Europe.

4. Conclusion

To conclude, following the steps of this doctoral research could be a stimulating trigger to question the impact of design, even if the inadequacy of design to deal with such a complex context as the public sector, which is different from the private sector with which it is accustomed to deal, might emerge. The scenario envisioned highlights how the role of the designer in the public sector, as a designer of experiences, services, interfaces, physical or digital products, and as an intermediary with data, assumes ethical and political significance. The designer can contribute to creating relational spaces of education and participation in which the user is seen both as a “collective subject" (Deni, 2021, p.63) and as the custodian of his or her own “individual human project” (Floridi, 2020b, p.24). The conjunction between design and pedagogy is in the common nature of applied science: just as the educational decision calls into question a multiplicity of knowledge and sciences with their autonomous statutes (Lucisano et al., 2022), the study and practice of design has resorted to the adoption of different sources and subjects (Pansera, 2015). Nevertheless, it could be pointed out that this is not the first time that these two disciplines have been tried to be juxtaposed. In the 1970s, the radical design and educational movement Global Tools proposed experimental and innovative teaching methods driven by the idea that "life is a permanent and global education" (Borgonuovo & Franceschini, 2018, p.4). Designers should constantly go in search of comparison with other disciplines and present themselves with pride, listening disposition, and respect in disciplinary contexts where so far they are not recognized.

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TOWARDS SEAMLESS HEATED GLOVES PRODUCED BY KNITTING.

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KEYWORDS | SMART TEXTILE, HEATED GLOVES, 3D KNITTING TECHNOLOGY, 3D SCAN, WELL-BEING

ABSTRACT | One of the long-term goals of smart clothing is to adapt the human body, just as regular clothing does. Looking at smart garments from the perspective of their entire life cycle is necessary for their sustainability. 3D technology can be a suitable choice due to its variability and adaptability. The main concept of my paper is the design of two independent gloves, where the subtle inner layer is heated, and the outer one is changeable (sky gloves, city gloves., etc.). The first crucial goal is a suitable solution for integrating the conductive paths without interrupting the yarn is crucial in the research and development of smart heated knitted gloves. The conductive path needs uniform resistance. The conventional knitting technique is not suitable for our goal because the heated segment must be divided into several areas of particular gloves. It means there are some interruptions of the conductive path. A 90° rotation of the glove could solve this problem. The second essential part is to knit the gloves to the customer's specific requirements. It is crucial that the gloves fit perfectly and there is no unnecessary heat loss. 3D scanning obtains data about dimensions and shapes. The following converting into knitting language using a compiler could be a very useful solution. The importance of the compiler is even greater when making gloves for people with atypical dimensions anomaly or people with vascular diseases (Raynaud's syndrome, etc.).

1. Introduction

Smart textiles are an interdisciplinary field where products have to meet a large number of parameters to have the potential to achieve competitiveness. 3D knitting is a very effective and variable technology to produce traditional garments and clothing accessories, but it appears to be a great opportunity for the production of smart garments and smart clothing accessories as well. The advantage of 3D technology is the highly efficient production with minimal waste; garments are fully formed, eliminating the need for sewing and other manufacturing operations. The disadvantage is the difficult and time-consuming programming requiring highly skilled and experienced personnel.

This work focuses on smart heated knitted gloves designed for individuals with vascular diseases, such as Raynaud's syndrome, as well as to increase thermal comfort for sport and everyday gloves as well as work gloves and gloves for well-being. In developing knitted heated gloves, it is necessary to knit a conductive heating element with the uninterrupted yarn. The pattern of the glove is also significant. Most heated gloves are very bulky. The developed glove is intended to be used in the so-called layering approach. It means creating a very subtle inner glove with a seamlessly integrated heating element. It will be possible to wear any other glove over the inner glove, e.g., knitted or woven city gloves, ski gloves, work gloves, or rescue gloves. That´s the reason why the developed heated glove needs to be tailored perfectly. In the field of smart textiles, customization, and personalization (Arora et al., 2008) are necessary features, especially for some products in the field of rehabilitation. (Kettley, 2016) The big potential of 3D knitting is customization. According to the time demands and the final cost, the easiest way of customization is the color change option, then the knit pattern change option. Last but not least is the option of size change to meet the customer's needs; however, that is a rather difficult process. 3D knitting has the potential to be a suitable technology for customized clothing or footwear.

2. Knitting Yarns

Within my research, I am involved in cooperation with a company that manufactures conductive yarns and is currently testing insulated hybrid knitting yarns, which contain light copper-silver plated 30 µm microwires that have not been commercialized yet. The tested yarns are listed in Table 1. The hybrid yarns are plied from textile polymer continuous filaments and metallic microwires. Hybrid yarns have almost the same mechanical properties as textile yarns (can be used for sewing, weaving, and knitting), can be soldered and crimped, can be produced in insulated versions, and have high resistance to wash cycles. Disadvantages are that they are not conducive all around their circumference like metalized threads (sometimes more difficult to contact, better for threads with more wires), stainless and constant threads have higher stiffness deformability and are worse for sewing.

In the picture, there is a knitting pattern where the basis is cotton, and the conductive elements are knitted with the intarsia technology, first also with cotton yarn until the conductive yarn is used after the optimal machine setting. The advantages of knitting are also the almost unlimited possibilities in combining knitting yarns to achieve the desired result. Underlay technology can be used so that the conductive yarn does not touch the skin. Conductive yarns are backed with conventional yarns when knitting hybrid conductive yarns are very similar to conventional knitting yarns, but from the point of view of comfort, backing with, e.g., merino yarn is still preferable but not necessary. This technology allows the insertion of non-textile materials such as lines or tubing. Special materials can also be inserted into the knitted fabric in the form of spacer fabric; this type of weave takes the form of a soft cushion. The great advantage of knitting lies in the possibility of combining these patterning methods within a single sample or product. Hybrid yarns have almost the same mechanical properties as textile yarns (can be used for sewing, weaving, and knitting), can be soldered and crimped, and can be produced in insulated versions with high resistance to washing cycles.

Table 1. Tested conductive threads.

Thread	Ductility	Amount of microwires
53P	18,03	4
143P	16,58	8
144P	29,94	8



Figure 1. Knitted antenna samples with tested conductive and cotton threads.

3. Trends in the Current Garment Manufacturing

3D knitting technology brings many possibilities in design, shaping, and patterning. Knitwear development programs include visualization of garments, but it is now impossible to visualize all pattern and shape elements. The main problem in this area is the difficulty of programming and understanding the knitting technology. Designers and garment students often are not familiar with the technology, and therefore, communication with knitters is difficult. The whole product development is very time-consuming and complex. There is no communication link between the knitting software and the students' or designers' design. A solution to these problems may be the use of a converter, which is currently being developed at Carnegie Mellon University (Narayanan et al., 2018). The converter would cause the data from the 3D scanning or photogrammetry to be used to obtain accurate dimensions and anatomical shapes and then converted into a knitting language and used to create a garment or clothing accessory, in this case, a glove. Small samples ranging from very simple shapes to very complex ones were mainly knitted through these compilers (McCann et al., 2016). The use of such a compiler could lead to the creation of a perfectly fitting

garment accessory and, at the same time, greater automation and simplification, referring to one of the current trends in the fashion industry, namely Fashion 4.0 (Bertola & Teunissen, 2018; Särmäkari & Vänskä, 2021), which is directly based on the principles of Industry 4.0 (Forno et al., 2021). Above all, Industry 4.0 aims to address current challenges: meeting consumer needs sustainably and productively, which includes sustainability, adaptability, agility, and introducing the product on the market (Jin & Shin, 2021). This trend is also, very actual in 3D knitting, where seamless technology eliminates the need for stitching products. This leads to a reduction in the amount of manual labor while increasing the number of programmers and highly trained knitters required. At the same time, this would ideally increase production and, in turn, reduce waste to a minimum.

Another reason why the conversion seems to be the ideal tool is the absolute shape and dimensional customization. Conventional gloves are produced in a certain finger-to-palm ratio. If a person has long fingers or, on the other hand, very short fingers, there is a good chance that the gloves will not fit. The other option is custom glove manufacturing, where the circumference of the palm and the length of the middle finger or the length of the middle finger with the palm is commonly measured. Even this option may not be optimal. Some people also have shape anomalies, extremely oversized or missing finger links. This is a problem with conventional gloves, plus with a heated glove, these problems are multiplied. Since the heated elements do not directly touch the skin, there is the unnecessary heat loss. Therefore, 3D scanning, which can ensure a perfect fitting glove, appears to be an excellent option. In addition, for people with Raynaud's syndrome, which causes decreased blood flow to the fingers or fingertips, an individual approach is also very important in the design of the conductive heating elements so that the heating is located in the most critical areas. In certain places, the heating can be stronger and vice versa.

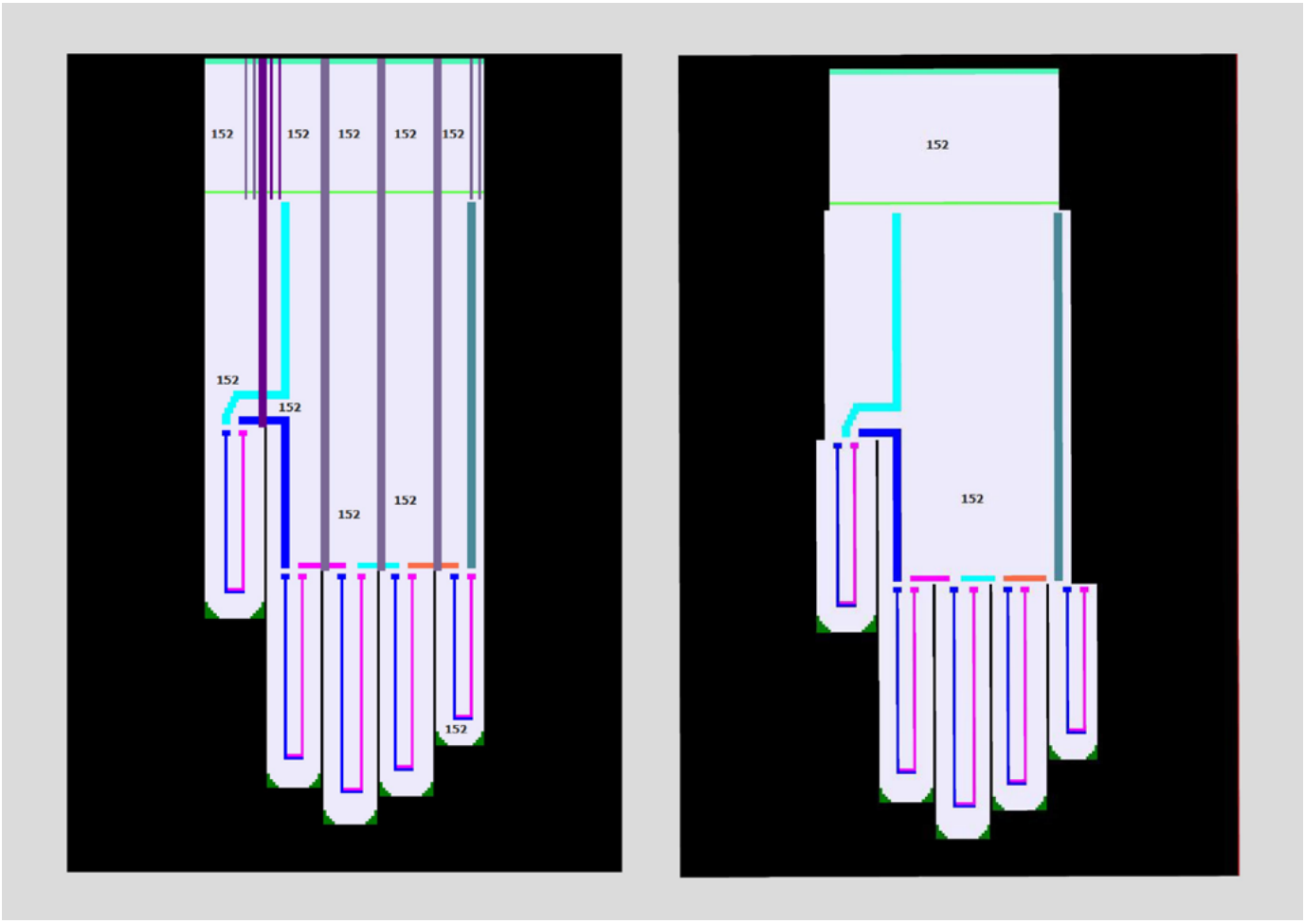


Figure 2. Conductive path design in APEX4. Each color corresponds to a different yarn carrier, i.e., the conductive path is interrupted.

4. Methodology

This work is based on the principles of Engineering Design Science (EDS). EDS is used in engineering to help design and build things. EDS supports engineers and designers in organizing their knowledge and understanding how the different parts of a design fit together. It also helps them solve problems and come up with new ideas. EDS is based on engineering research and experience and is used to streamline the design process. The systematic approach of EDS offers a rational and methodical path for design efforts. (Eder & Hosnedl, S., 2007, 2010a; Eder, 2010b)

Table 2. Scope of sorts of designing (Eder, W.E. and Hosnedl, S., 2008, 2010).

Objectives, Design Conditions	**Design Engineering**	**Artistic – Fashion – Architectural – Industrial Design**
The object to be designed, or the existing (designed) object	Transformation Process and/or Technical System; primary: functioning, performing a task	Tangible Products; primary: appearance, functionality
Representation and analysis of the object as designed, and its captured design intent	Preparing for TS(s) manufacture, assembly, distribution, etc. AI, CAD/CAM/CIM	Rendering for presentation and display, product range decisions
Design process (for the object), methodology, generating the design intent	Theories of designing, Engineering Design Science, formal design methodologies	Intuitive, collaborative, interactive designing
Properties of the object as output of designing	Mediating and Elemental Design properties, to establish observable properties	Observable properties to achieve customer satisfaction
Design phenomenology	Empirical, experimental and implementation studies	Protocol studies
Responsibilities	Professional, ethics, reliability, safety, public legal liability, enterprise, stakeholders	Organisation, stakeholders (Architecture adds organizational and contract responsibility Artistic – Fashion – Architectural – Industrial Design)
Location	Design/Drawing Office	Studio

5. The Development of the Heated Glove

The main objective is a personalized product for a specific person and, above all, the development of the glove with an uninterrupted conductive path to avoid interruption of the electrical circuit. Another goal is the integration of smart technologies to sense human and ambient temperature through embroidery or knitting. The individual adaptation of the glove to the customer's specific needs is important. The product under development may find many potential users to reach a various target group: a very specific group of people with Raynaud's syndrome, medical professionals, or general users who want to increase their thermal comfort at very low temperatures.



Figure 3. Samples of gloves with interrupted conductive paths.

In the first phase of the development, yarns were selected, followed by density testing. When the density was appropriate, we could proceed to the next step of programming the glove: this involved entering dimensions, programming structures, and color patterning, in this case, conductive yarn patterning. The first samples of the gloves were knitted conventionally. At first, the fingers were knitted from the fingertips. Then, the palm was knitted, followed by the thumb, also from the fingertips, and then the glove was knitted up to the hem in the form of a tubular piece. The conductive path was worked in intarsia. Intarsia is a knitting technique that is used for knitting with multiple colors or multiple yarns. In this first method, the conductive path was divided into several areas, namely fingertips, the area where the fingertips meet the palm, and the back of the hand, which was undesirable. For this reason, heating elements were simplified and left only in the fingers´ area. Moreover, when considering that when it comes to heating the hand, the most crucial is the heating of the fingers, where the cold occurs. Thus, the simplification of the glove warming was not a problem. After several further attempts, this method of knitting could not be fine-tuned to avoid interrupting the yarn. It was necessary to find another way to knit. An unusual way was then devised where the glove was turned 90° and knitted in width. The first sample of this knitting method was knitted as a flat sample only. This sample has shown that such a knitting technique would be suitable for knitting the heated glove and should not break the yarn.

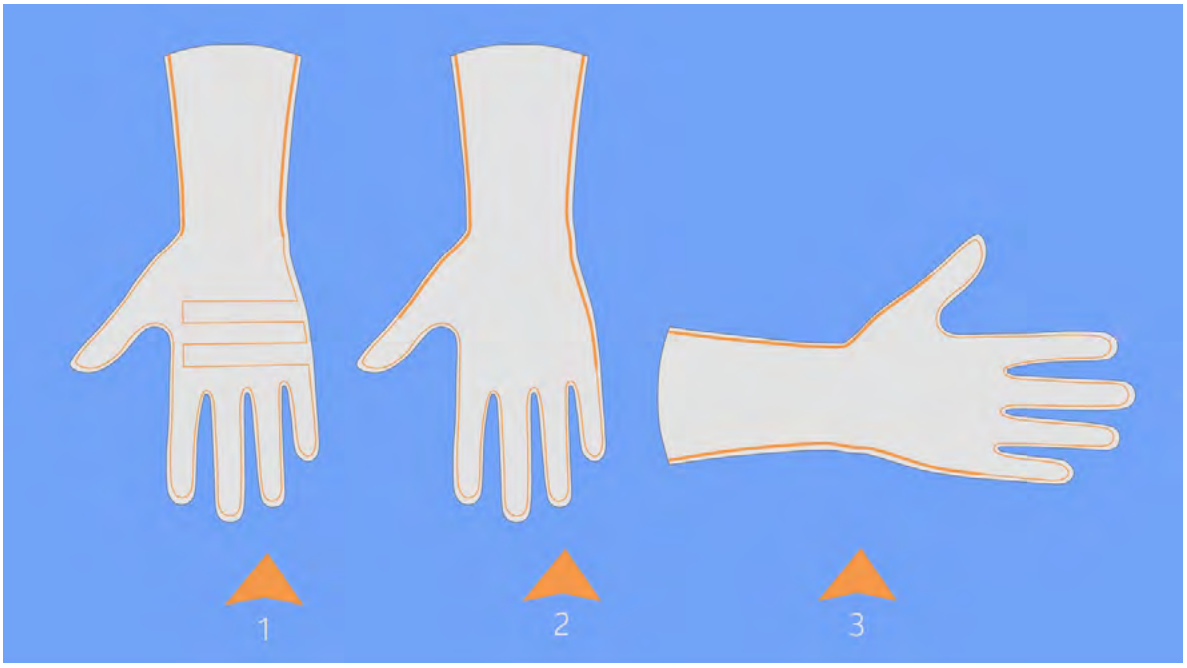


Figure 4. Development of the design of the heated inner glove. (The orange line indicates the heated conductive path. The direction of the arrow shows the direction of knitting.)

The advantage of intarsia is that we can knit thin multi-colored knits, on the other hand, each part is knitted with a different conductor. The heated segment must be designed following these rules so that the conductive path is not interrupted, which would result in resistance breaking, and therefore, unwanted uneven heating or interruptions would have to be encapsulated or ultrasonically welded, which is not desirable.

6. Sustainability

Each conventional glove is designed for a specific activity, and if we wanted to heat each type of glove, a large number of rechargeable batteries would be required as each product usually requires a different battery, which does not seem sustainable. The research and development of the heated glove focuses on the entire life cycle of the product, from raw material sourcing to disposal and recycling. The most important trend not only in this area is quality. The quality of the raw materials, but also the quality of the assisting inputs, the quality of the technology, the quality of the production or the environment, and the quality of disposal and recycling are important. We, therefore, work with high-quality materials and design all components to be replaceable or repairable. The concept of heated one-layer gloves allows us to reduce the number of batteries needed. So, the user only needs 1 or 2 pairs of batteries, and all their gloves can be heated.

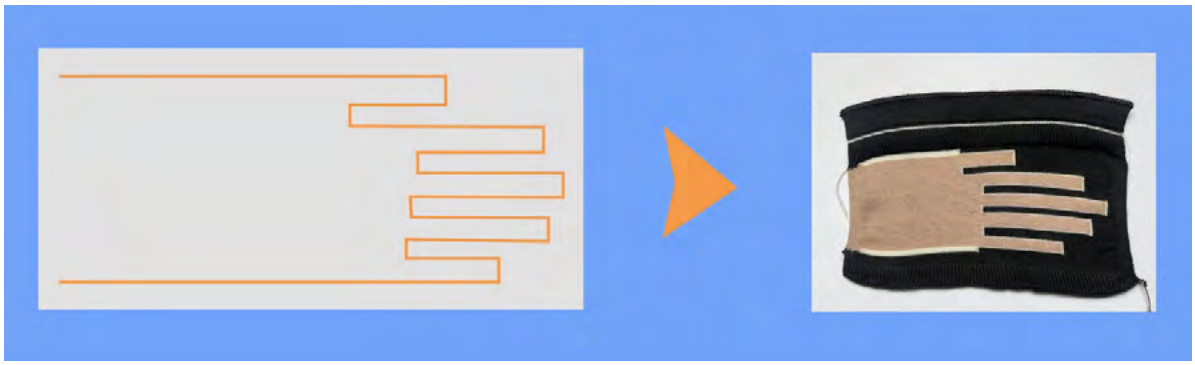


Figure 5. Flat pattern design with conductive path and knitted flat pattern. In this pattern, we used a 90° rotation of the glove.

7. Conclusion

This paper has demonstrated an approach that we want to further enhance the development of heated knitted gloves. The cornerstone is to divide the glove into two separate layers, with the inner layer being heated. In the first phase, one of the optional possibilities is to obtain the dimensions of the hand using a 3D scan, and then the data could be processed by a converter (Narayanan et al., 2018) and used in APEX4 (SHIMA SEIKI, 2023). Once the density tests have been knitted, accurate hand-dimension data can be used. The glove will be knitted unconventionally, i.e., rotated 90° which will allow the use of the intarsia pattern throughout the glove without interrupting the conductive path, as in the flat sample in Figure 5, where the conductive yarn is demonstrated with a white merino yarn.

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P/REFERENCES OF DESIGN

PARTICIPATION THROUGH DESIGN – COLLABORATIVE METHODS SUPPORTING THE SOCIAL INCLUSION OF YOUNG REFUGEES.

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KEYWORDS | INTERCULTURAL COLLABORATION, PARTICIPATORY DESIGN, VISUAL COMMUNICATION, DESIGNING WITH REFUGEES, COMMUNITY-BASED DESIGN

ABSTRACT | This paper explores the potential of intercultural collaboration through design in the context of the social inclusion of refugee youth.

The practice-based aspect of this research is undertaken with Open Doors Hungary, a community-based design project that creates a programme for unaccompanied minor refugees. The aim of Open Doors is to help refugee youth integrate into Hungarian society and develop their means of communication and quality relations with the host society.

Refugee youth arriving in Hungary face serious problems: the loss of home and community, the traumas suffered during the journey, the cultural differences, and the lack of a common language make their social integration extremely challenging. Xenophobia and stereotypes against foreigners exacerbate these challenges. Social inclusion requires frequent contact with the local society, and refugee youth need new tools (cultural knowledge, language skills, intercultural skills) to overcome their disadvantages.

Since 2013, the author has been working with refugee and migrant youth using participatory design tools such as regular creative sessions, workshops, and eight camps based on the integrating role of creativity and art. During these sessions, young refugees and their Hungarian and European peers got to know different visual communication tools and created common messages in the form of videos, animations, photos, posters, booklets, and murals. Through these activities, refugee youth become part of the design process; the result is based on their choices.

Combining the findings of the theoretical research and field experiences, this paper states that design thinking and participatory design methods allow interactive cultural exchange, sharing of values, safe and open discussions, and community building. As a global language, visual communication can be a tool for intercultural communication, storytelling, and self-expression. The opportunity for refugee youth and their Hungarian peers to work in intercultural teams develops new competencies and creates shared ownership and community.

1. Introduction

The ability to work in intercultural teams is an essential skill for anyone in our more and more globalised environment (Murdoch-Kitt & Emans, 2020). For migrants and refugees, it is a basic necessity when they try to settle in a new country.

The global increase in the number of asylum seekers and refugees over the last decade has been one of the challenges for our society. Hungary - due to its geographic location - has been one of the main transit countries towards the European Union (IOM, 2023). Barriers to integration are exacerbated by xenophobia and stereotypes against foreigners present in some parts of Hungarian societies, thus creating conflicts between members of the host society and newcomers. (Gyulai, 2014; Kováts & Soltész, 2022; Sík et al., 2016)

The author - coming from a graphic designer background - together with her architect partner, is the co-founder of Open Doors Hungary, a community-based social design project working for intercultural dialogue with the tools of visual communication, placemaking, and design with refugee and Hungarian youth since 2013.

Unaccompanied minor refugees in Hungary face unique challenges. Protected by the childcare system upon entry before turning 18, their perilous journey and the uncertainty of the asylum process can worsen "post-traumatic stress disorder," often stemming from the loss of roots and human connections. Cultural disparities and language barriers further complicate their social integration. Effective social inclusion demands regular interaction with the local community and the acquisition of new tools like cultural knowledge and language skills (Magyar Helsinki Bizottság, 2023). However, due to their legal status, refugees are excluded from basic democratic processes, and minors living in childcare centers have limited autonomy in decision-making.

This paper, as part of an ongoing PhD-in-practice research, focuses on the participatory aspects of visual communication and design, integrating theory and practice, employing a mixed-methodology approach. It involves a literature review on participatory design methods and intercultural collaboration, alongside examining the experiences of young refugees and their Hungarian peers.

The literature review will establish the context, exploring the role of participatory design and collaborative methods. Additionally, the author draws from 10 years of field experience, employing participatory and community-based design methods. The study aims to comprehend how participatory design can facilitate intercultural collaboration and contribute to the social inclusion process for young refugees.

2. Participatory Design with Refugees

Participatory Design emerged from the social and civil rights movements of the 1960s and 70s, where individuals in Western societies advocated for greater decision-making power (Simonsen & Robertson, 2013; Spinuzzi, 2005). For refugees and migrants, participating in design processes offers a unique opportunity to engage in decision-making, providing valuable lessons about democratic values.
For outsiders - due to language barriers and cultural differences - it is difficult to access refugees' experiences and insights, but it is essential to understand their needs. Participatory design can be a tool to deduce tacit and latent knowledge. (B.-N.Sanders 2002)

Participatory design methods were used successfully with different groups of migrants and refugees: designing refugee shelters (Albadra et al., 2021), language learning tools (Abou-Khalil et al., 2019; Weibert et al., 2019), digital ‘safe spaces’(Bustamante Duarte et al., 2021), or health-related services (Nazzal et al., 2014).

For outsiders - due to language barriers and cultural differences - it is difficult to access refugees' experiences and insights, but it is essential to understand their needs. Participatory design can be a tool to deduce tacit and latent knowledge. (B.-N.Sanders, 2002). Using different digital and physical visualisation tools, they agree that physical prototypes play an important part in finding mutual understanding between different stakeholders (Abou-Khalil et al., 2019; Albadra et al., 2021).
According to the reviewed literature, most co-creation and participatory design workshops with refugees happen within a relatively short, limited timeframe, and usually, they only stay in the research phase or only produce low-fidelity prototypes ((Abou-Khalil et al., 2019; Albadra et al., 2021). It is also found that there is a need for long-term community-based collaboration (Talhouk et al., 2019) and iteration of the process (Spinuzzi, 2005).

The designer's role needs to expand and adapt, serving as a mediator, facilitator, and design professional (Manzini & Rizzo, 2011). Participatory design fosters mutual learning among the designer, participants, and other stakeholders.

While end-user involvement is increasingly vital in various visual communication-related fields like UX/UI research and service design, participatory methods remain relatively neglected in graphic design (Taffe, 2012). Participatory design projects involving refugees and migrants are prevalent in placemaking and human-computer interaction (Abou-Khalil et al., 2019; Albadra et al., 2021; Almohamed et al., 2018; Talhouk et al., 2019; Weibert et al., 2019). Although there are some publications collecting projects created to foster peace and global understanding (Pater, 2016; Smith, 2022), to involve users in the graphic design process and rethink the role of the designer (Armstrong & Stojmirovic, 2011; Pater, 2021), or to collect tools for intercultural collaboration (Murdoch-Kitt & Emans, 2020; Mercer et al., 2023), the potential of using graphic tools directly with refugees remains largely unexplored.

3. Visual Tools in Participatory Design

"Words divide, pictures unite." (Neurath, 1936)

Visual communication, the language of images, has the potential to bridge language barriers and promote intercultural understanding - which is extremely important when the participants of the communication process do not share the same language or culture.

Visuality, as Mitchell (1986) suggests, taps into a primal layer, bypassing the intermediary step of mental images becoming verbal concepts. Unlike words, visuality connects directly to reality. While perceiving and recognizing images is universal, decoding their meaning is not (Kostelnick, 1993). Comprehending visual language is a social process contingent on social, historical, and geographical contexts, as well as prior experience and knowledge.

Visual tools are often used in participatory design projects, and they can be effectively used as conversation subjects, conversation prompts, or experiences to start social dialogue (Manzini, 2015; Manzini & Rizzo, 2011).

4. Practice-Based Collaborative Methods

Over the past decade, the author has organised ten creative camps and countless creative workshops involving young refugees, migrants, and their Hungarian and European peers. Participants learned various visual communication tools and collaborated on crafting shared messages. Through design thinking and the creative process, these gatherings fostered interactive cultural exchange, value-sharing, open discussions, and community building.

These workshops and camps aim to facilitate intercultural collaboration among participants from diverse backgrounds, with creative professionals offering design frameworks and technical guidance. By involving participants in all stages of the design process—from research to ideation to realization—a shared understanding of each design product is ensured. This approach was consistently applied across different projects:

1. *Getting to know each other & team building* - as an important part of the process, non-verbal and visual tools ensured that participants could learn each other's names, learn basic facts about each other, and enable them to talk to each other even though they do not share a common language.
2. *Learning & practice* - each thematic camp and workshop included a learning phase where participants got to know a new technique or visual tool: manual techniques of composition such as painting, drawing or collage, creation of signs and pictograms, large-scale murals, board games, printing techniques such as screen printing, zines, photography, videos, and animations.
3. *Project & presentation* - with the learned tools, youth in mixed groups were able to create projects that enabled them to form messages together and create common products based on shared values.
4. *Evaluation and follow-up* - providing an opportunity for youth to reflect on the learned tools, give feedback, and have ideas about the possible continuation.

During the workshops and participative design projects of Open Doors, we can talk about different levels of participation:

Participant as a consultant

Sharing insights and giving feedback is crucial for refugee youth, where challenges such as differing visual symbols and narrative practices across cultures arise. Involving participants in decision-making fosters mutual understanding and helps avoid harmful stereotypes (Lipton, 2002; Pater, 2016). In the Open Doors, Community members were extensively consulted to ensure events met their needs. During COVID-19 lockdowns, interviews revealed a desire for outdoor programs and cultural exploration. Through co-design, Cultirider—a mobile community space—was created, allowing Open Doors members to visit rural Hungary and collaborate with local communities.



Figure 1. Cultirider mock-up and first Cultirider event in 2022, Ágasegyháza (photos by the author).

Participant as a content producer

The next level of involvement goes beyond participants merely providing insights and sharing needs before the design process; they become creators in the creative process itself. Design offers an open-ended framework where participants contribute content, making the final product a co-creation between the

designer and participants. Using graphic tools like screen printing, participants can personalise pre-prepared patterns, resulting in visually coherent outcomes. These patterns are developed during community brainstorming events, with some incorporating visuals drawn by multiple community members. For example, during the Bokréta Fesztivál in 2019, members of Open Doors Hungary's intercultural community space co-designed frames featuring drawings of each participant's favourite flower, later edited into a single pattern. This technique ensures participants' designs are used with minimal abstraction.



Figure 2. Bokréta Fesztivál screen-printing workshop, 2019 (photos by the author).

Participant as a co-designer

In the third step of the process, participants transition from final users to active collaborative co-designers and co-producers, leveraging their local knowledge, competencies, and solution ideas (Manzini & Rizzo, 2011). Open Doors projects provided refugee, migrant, and Hungarian youth with opportunities to work together in small intercultural teams, co-designing and co-producing various project works. For example, in international media training camps like "Open Doors Youth Voices" and "Change for Media - Media for Change," participants collaborated on producing media products. They acquired technical skills in video and animation production, allowing them to create their project works. Discussions during workshops focused on important life topics, resulting in visual representations. Films such as "Open Doors Stories" portrayed the travel experiences of Hungarian and refugee youth through narrated animations, while "Are we equals?" highlighted the differing journeys of European citizens and refugees. Additionally, "My Big Change" featured honest accounts of significant life changes from young people around the world in the form of a short documentary.



Figure 3. Change for Media-Media for change, media training, 2017 (photos by the author).

Participant as a multiplier

Repeating the design thinking process allows participants to learn and pass on knowledge. Over its 10-year span, Open Doors Hungary has seen refugee youth emerge as workshop leaders, engaging others in the design process. In collaboration with the Artemisszió Foundation, Open Doors initiated the Miradoor Creative Hub to train motivated migrants and refugees in Hungary to lead workshops. These community members have organised workshops for Hungarian and international participants, such as Afghan paper kite making, Nigerian calligraphy, and Somali cooking. Through these workshops, migrant and refugee youth not only share their skills and boost their confidence but also promote their culture, aiding their identity appreciation and inclusion in society.



Figure 4. Afghan paper kite workshop, 2022 (photos by the author).

5. Results

Visual tools - tangible results
The visual tools during the workshops of Open Doors, such as drawings, collages, storyboards, and mockups, proved to be a significant help for intercultural teamwork between refugee youth and their Hungarian and European youth.

Iterative process - long-term commitment
Open Doors has maintained a growing intercultural community since 2013. The long-term relationship with the target group has ensured the improvement of appropriate participatory design methods and communication tools. The iterative process allowed participants to become multipliers of the process and implement design thinking in other areas of their lives.

From participation to community
The long-term work working with the same (but organically growing) community allowed participants to create deeper connections, find friends, and form a diverse community along similar value.

Local projects - global topics
Through the 11 years of its work, Open Doors provided a framework for small-scale local projects involving a diverse community of refugees, foreigners, and Hungarian and European youth coming from different backgrounds to share ideas and find common interests and values so they could become part of a larger network.

6. Conclusion

This practice-based research aimed to explore the potential of participatory design methods in direct work with young refugees and migrants. Existing literature demonstrates the successful use of participatory design methods with refugees, particularly in visualising and prototyping future solutions. However, the involvement of end-users in the graphic design process remains relatively overlooked.

Fieldwork within the Open Doors project revealed a demand for long-term community-based solutions among participants. They can engage in various roles (consultant, content producer, co-designer, multiplier), offering mutual learning opportunities for all stakeholders.

The author plans to summarize the methods and findings in a methodological handbook and a visual communication card pack as the next steps in this ongoing PhD-in-practice research. These resources facilitate collaborative design processes in intercultural teams and can be shared with designers, social workers, and institutions.

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P/REFERENCES OF DESIGN

DESIGN-LED STRATEGIES IN SOCIAL INNOVATION ASSESSMENT: A PATH FOR SOCIALLY RESPONSIBLE TRANSFORMATION.

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ABSTRACT | The present PhD study explores the role of design in social innovation assessment within Italian small and medium enterprises, delving into its dynamics in the corporate culture. The examination deeps the analysis of existing frameworks and methodologies, aiming to develop design-driven assessment approaches for SMEs, leveraging participatory design principles. The study has the goal of understanding how these approaches actively drive organizational changes, foster social innovation, and enhance business competitiveness, developing alternative futures that advance the understanding of shaping more socially sustainable SMEs in the Italian business landscape.

1. Introduction

Small and medium enterprises play a crucial role in driving economic growth, fostering innovation, and creating employment opportunities in Italy (Cataldo et al., 2021). With the evolving business environment, there is an increasing need for SMEs to participate in social innovation.

Considering the urgent societal challenges identified in the United Nations Sustainable Development Goals, there has been a move towards adopting a more sustainable way of life that includes environmental, economic, and social dimensions (Moursellas et al., 2022). In Italy, social innovation is a key factor in the innovation ecosystem. Based on research and innovation policy, it offers great potential for addressing societal problems and promoting advancements toward achieving the Sustainable Development Goals (Eichler & Schwarz, 2019; Piccarozzi, 2017).

As a result, an increasing requirement is to consistently oversee the advancement and outcomes of activities connected to social innovation (Cunha & Benneworth, 2020). This underscores the significance of examining and evaluating its efficiency in facilitating beneficial changes for enduring sustainable prospects. Nonetheless, there are currently insufficient established measures and standards for gauging innovation within the social sphere in contrast to those applied in economic innovation (Wobbe, 2012). Consequently, additional efforts are essential to advance concepts, techniques, and criteria necessary for fostering effective diffusion of social innovation.

This doctoral research investigates the connection and necessity of adopting a design approach for social innovation in corporate environments. Italian small and medium-sized enterprises currently face the dual challenge of adjusting to market requirements while embracing socially sustainable practices (Longo et al., 2005). Therefore, the primary goal of this PhD study is to comprehend the role of social innovation within Italian SMEs and how incorporating design principles could facilitate responsible transformation within these organizations. Through integrating participatory design principles, the study seeks to develop customized assessment strategies tailored to SMEs that highlight their potential to drive organizational changes. The overarching objective is to enhance scholarly comprehension and provide practical implications for SMEs as they transition towards a more sustainable future, thereby contributing to fostering socially sustainable SMEs and promoting resilience and competitiveness in an evolving business landscape.

2. Literature Review

Examining current social innovation frameworks and methods has revealed a necessity for a more thorough evaluation approach that considers the overall societal impact of innovation. Additionally, ongoing exploration and analysis of case studies have underscored the potential of utilizing a design-centered approach to evaluate the success and results of social innovation initiatives.

In design, there is a growing understanding of the need to precisely assess the effects of interventions and effectively communicate these findings (European Commission, 2013; Westcott et al., 2013; Drew, 2017; Björklund et al., 2018). Evaluation is crucial in the design process, allowing designers to analyze the impact of their work and make informed decisions for future projects. Design-driven methods have played a key role in driving innovation, particularly in tackling complex business and societal challenges (Buchanan & Margolin, 1995). Nevertheless, there is continued research into the innovation assessment, with a specific focus on social innovation. Utilizing a design approach to evaluate social impact is beneficial because it emphasizes comprehension of human behavior and user experience, as well as an understanding of the needs and goals within the study's context while considering contextual factors that may affect innovation processes (Foglieni & Villari, 2015; Liedtka, 2017; Foglieni et al., 2018). As a direct consequence, it is crucial in the design field for social innovation. Integrating design principles into the assessment of social innovation can improve the process to be more focused on users and responsive to specific contexts (Yu &

Sangiorgi, 2018), leading to a deeper understanding of impact and effectiveness, ultimately guiding the development of more impactful strategies. Incorporating design-centric methods into evaluating the effects of social innovation can improve comprehension of how these endeavors tackle societal issues and advance socially responsible behaviors.

Similarly, effective promotion of social innovation in Italy and coincidental contexts necessitates a thorough understanding of the dynamics, catalysts, and barriers involved. This entails conducting interdisciplinary research incorporating insights from various fields, such as sociology, psychology, economics, and political science (Foglieni & Villari, 2015). Adopting this interdisciplinary approach facilitates a more holistic comprehension of social innovation and its potential impact on society. Moreover, it allows for examining diverse factors that influence the success and expansion of social innovation endeavors. Consequently, researching evaluation and assessment begins with acquiring profound knowledge about tools and methodologies extending beyond those typically associated with design discipline.

Assessment and evaluation practices within the design industry are still fragmented and contentious despite emerging issues that call for project monitoring related to design. The design field often lacks a formal evaluation component, yet empirical evidence demonstrates its potential to enhance outcomes and overall processes (Björklund et al., 2018). Consequently, there is an increasing need in the design discipline to develop more robust methods for demonstrating its value both before and after implementation. Presently, evaluating the impact of design applications primarily takes a formative approach to reflecting on and enhancing outcomes and the designing process (Drew, 2017). However, incorporating evaluation into the design field largely revolves around rationalizing it as a strategic approach to success and innovation (Foglieni et al., 2018). Despite its growing importance, measuring the effects and impact of design outcomes continues to be an area with implications that have not been thoroughly explored in theory or practice (Foglieni & Villari, 2015).

As design becomes increasingly integrated into strategic organizational processes, new challenges exist in demonstrating its business value. This involves developing and applying suitable metrics, thorough evaluations, and early integration of evaluation practices into the design process.

A robust approach to evaluation in the design field is still lacking. While some efforts have been made to address measurement within the discipline, they have not yet produced well-established and widely recognized results. Moreover, there appears to be a predominant focus on proving that something works (summative evaluation) rather than learning what works and improving what doesn't (formative evaluation), which should take precedence (Drew, 2017). The current shift from using quantitative measures to more qualitative ones for assessing outcomes is worth noting, especially in service design (Foglieni et al., 2018). This undefined nature provides an important opportunity for further exploration of the subject matter, contributing towards establishing and reinforcing an evaluative culture within the design community. This is crucial for pushing the boundaries of the discipline and affirming its role as a driver of innovation.

3. Methodology

To meet the research goals, research through design and a qualitative method incorporating participatory design principles will be utilized. The investigation will involve detailed interviews with important figures in Italian SMEs to gain insight into their views on social innovation and the feasibility of integrating its assessment into organizational operations. Criteria for selection will consider industry sector, location, and company scale to capture a broad spectrum of viewpoints.

The research will employ a case study approach to investigate particular Italian SMEs that have adopted social innovation initiatives. Data collection will include on-site visits, observation of organizational procedures, and interviews with staff members at various hierarchical levels within the companies. The

insights obtained from these interviews and case studies will be thematically analyzed and coded to uncover significant themes and recurring patterns associated with social innovation in Italian SMEs. These outcomes will form the groundwork for creating evaluation techniques and prototypes, building on a design-driven assessment framework as the outcome to foster social innovation and facilitate conscientious evolution.

The current research examines and analyzes established social innovation assessment frameworks, methods, and models to pinpoint areas for a design-driven assessment approach. The aim is to establish a solid theoretical groundwork and backing for the conclusions and suggestions. The literature review covers research on social innovation in small and medium-sized enterprises, the impact of design on organizational change, sustainable practices within SMEs, and existing tools for gauging social innovation effectiveness derived from academic studies, industry reports, and best practices.

Introducing social innovation in small and medium-sized enterprises and implementing participatory design principles as a method to develop a comprehensive assessment framework may result in a more thorough assessment approach. The qualitative approach will enhance the comprehension of social innovation dynamics and its impact on the sustainability of SMEs. Additionally, by analyzing its particular context, this research aims to offer valuable insights into the obstacles and opportunities encountered when developing social innovation projects while proposing recommendations for promoting social innovation understanding within this setting. The anticipated outcomes of the study aim to provide practical implications that could aid in advancing socially sustainable business environments in Italy, promoting resilience and competitiveness amid evolving business conditions while addressing the lack of understanding regarding how design can be systematically incorporated into social innovation assessment processes within businesses.

4. Discussion

The anticipated outcomes and planned progression of the PhD research are segmented into three stages: initial exploration, in-depth analysis, and practical application. The first stage entails addressing the initial research sub-question (What are the key components and the current comprehensive frameworks that can capture the nature and understanding of social innovation within companies?) through an extensive review of literature and examination of existing social innovation models to acquire a comprehensive grasp of the

research subject. This phase also involves investigating essential elements and current frameworks for social innovation assessment within organizational contexts. Ultimately, this stage is designed to formulate a matrix for social innovation that delineates crucial components within corporate settings, offering a systematic method for understanding and articulating strategies applicable to business environments.

The in-depth analysis phase explores the second research sub-question (How can the insights, current applications, and best practices from existing frameworks in other domains be leveraged to enhance the design and effectiveness of a design-driven social innovation assessment within corporate contexts?) regarding the perspectives, current implementations, and effective strategies from established models in different disciplines that can enrich a design-driven social innovation evaluation framework within business environments. This phase would entail semi-structured interviews with small and medium-sized enterprises in Italy to delve into their experiences, obstacles, and accomplishments in adopting social innovation practices. It will also involve a comprehensive review of existing assessment frameworks to emphasize their main characteristics, methodologies, and constraints for initial indicators when applying design-oriented approaches to evaluating social innovation.

The last stage, application, will involve prototyping the design-driven assessment framework for social innovation in Italy's SMEs. Building on previous phases, this stage aims to answer the last sub-research question: how design perspectives, tools, methods, and strategies can aid companies in assessing social innovation initiatives within corporate settings. The goal is to evaluate the practicality, effectiveness, and

feasibility of implementing the framework in real-world scenarios while offering practical guidance and resources for companies navigating the complexities of evaluating social innovation. Additionally, this process aims to enhance understanding of the role of design within this context.

From a design viewpoint, these stages will facilitate examining different perspectives on evaluating social innovation in corporate settings and craft a new perspective on the topic, particularly within an Italian context. The sub-inquiries focus on creating a matrix for social innovation, incorporating ideas from current frameworks, and evaluating a design-oriented approach to social innovation assessment. These aspects contribute to the broader research objective of addressing how the assessment of design-driven social innovation can encourage transformations in small and medium enterprises and guide companies toward adopting proactive and responsible changes in their practices.

The outcomes of this study will contribute to a more holistic comprehension of social innovation dynamics in Italian small and medium-sized enterprises, as well as its influence on sustainability. Although the research is still underway, it is crucial to note that initial observations have provided key insights into the significance of social innovation within business environments. The ongoing assessment and scrutiny of established social innovation frameworks, methods, and instances have unveiled significant prospects for an evaluation approach guided by design principles.

Companies have often relied on key performance indicators to evaluate the efficiency and innovativeness of their initiatives (Cisero et al., 2017). However, a crucial consideration is the ongoing shift towards appraising performance and innovation from a design standpoint by moving beyond traditional strategic KPIs. This involves quantifying and assessing the "softer" aspects and results of project processes using concrete metrics and qualitative measures (Drew, 2017). As the PhD progresses, research into evaluation and assessment will support this paradigm. Instead of suggesting a one-time assessment at the end of each project, as seen in other approaches (Foglieni et al., 2018), it will be viewed as an iterative process integrated into continuous improvement. This iterative approach to evaluation and assessment will ensure that social innovation strategies are consistently evolving and adjusting to changing conditions.

5. Conclusion

This research explores the interconnectedness of design, social innovation, and Italian SMEs. It highlights the necessity for SMEs to adopt social innovation to stay competitive in changing market environments. By incorporating design principles into assessment strategies, customized approaches can be formulated to facilitate organizational change effectively. Despite facing challenges in establishing thorough evaluation methods, the study highlights the pertinence of a design evaluation approach to promote socially sustainable business development at a local level. As an outcome, this investigation seeks to contribute to a holistic comprehension of social innovation dynamics within Italian SMEs by underscoring the transformative role of design in driving sustainable organizational practices and enhancing resilience in the business ecosystem.

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P/REFERENCES OF DESIGN

INTERACTION LEVELS OF DIGITAL INTERFACE METAPHORS IN MUSEUMS – LEARNING OUTCOME AND DISTRIBUTION OF ATTENTION.

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KEYWORDS | DIGITAL INSTALLATION, MUSEUM INFORMAL LEARNING, HUMAN-COMPUTER INTERACTION, INTERFACE METAPHOR, INTERACTION LEVEL

ABSTRACT | The striking difference between digital interpretative tools compared to earlier analog modes is their dynamism, which takes visitor interaction to a more complex level – from passive recipient to active interpretive participant. Digital installations in cultural heritage sites are a kaleidoscopic phenomenon: they can be structured along several largely independent dimensions and used for several functions, not to mention the richness of technological combinations in its implementation.

This research focuses exclusively on digital installations mounted in the physical space of the exhibition as 'standalone' kiosks. As additional classification criteria, levels of interaction and interface metaphors are both particularly important for this research. The focus will be on teenagers and young adults, as the deployment of museum technology is driven by the demand to engage them as future visitors. There is little empirical research on digital installations of cultural heritage, and the results so far tend to focus on usage or visitors' attitudes toward technology, but only in the general overview of informal learning.

Therefore, we wish to measure the learning outcomes of digital installations and their impact on the attention paid to artefacts and other modalities presented in the exhibition environment. We aim to investigate the use of digital installations through 3 case studies in cultural heritage institutions in Budapest (Petőfi Literary Museum, House of Music, Skanzen).

This short paper introduces a pilot study that was carried out last autumn at the Petőfi Literary Museum; we draw methodological lessons and some observations concerning our research questions.

1. Introduction

1.1 Characteristics of Digital Installations

The digital installations in cultural heritage sites are a kaleidoscopic phenomenon: they can be structured along several largely independent dimensions and used for several functions, not to mention the richness of technological combinations in its implementation. In exhibitions – here explicitly in museums and exhibition centers – primary usage conditions of digital installations are positioning in location and duration of visit, number of users, intellectual/physical challenge, visitor content production, and creative contribution by visitors (Ruttkay & Bényei, 2018).

While intended function may be one (or several) of the following:

- arousing interest to motivate visitors,
- multimodality to integrate visual and other (audio, tactile, motor) channels in the transfer of knowledge,
- playful learning and participation to address visitors in active involvement,
- personalisation of visit,
- outreaching beyond the museum walls in time and space (Ruttkay, 2020).
- Narrative positioning,
- contextual representation of space and time of the exhibition's theme,
- express an emotional charge (Studio Louter, 2024).

In the discipline of Human-Computer Interaction, digital installations in museums are categorized in two ways. Firstly, according to realisation in space: as standalone (kiosk), mobile (portable), and assemblies (comprehensively installed). Secondly, based on the degree of augmentation, contextually embedded and embodied (related to space in an objectified form), extended reality content (AR/VR/XR) and multisensorial (affecting different modalities) can be distinguished (Hornecker & Ciolfi, 2019).

As additional classification criteria, **levels of interaction** and **interface metaphors** are both particularly important for this research.

1.2 Complexity of Interactions and Interface Metaphors

The striking difference of digital interpretive tools compared to earlier analog modes is their dynamism, which takes visitor interaction to a more complex level – from passive recipient to active interpretive participant.

In our definition, **complex-level interaction** of digital installation combines three, but at least two, of the cognitive, affective, and psychomotor learning domains of Bloom's taxonomy (Bloom, 1956). Whereas, at a **low-level interaction**, the handling condition of the installation relies predominantly on one type of these learning domains to convey its messages.

For example, watching a video projection has neither psychomotor (imitation, manipulation, etc.) nor cognitive (analysis, synthesis, application, etc.) requirements for use, relying solely on affective domain of reception. In the 'Letterpress' installation, psychomotor manipulation (sorting letters) and affective value selection (giving headlines) are combined (Figure 1).

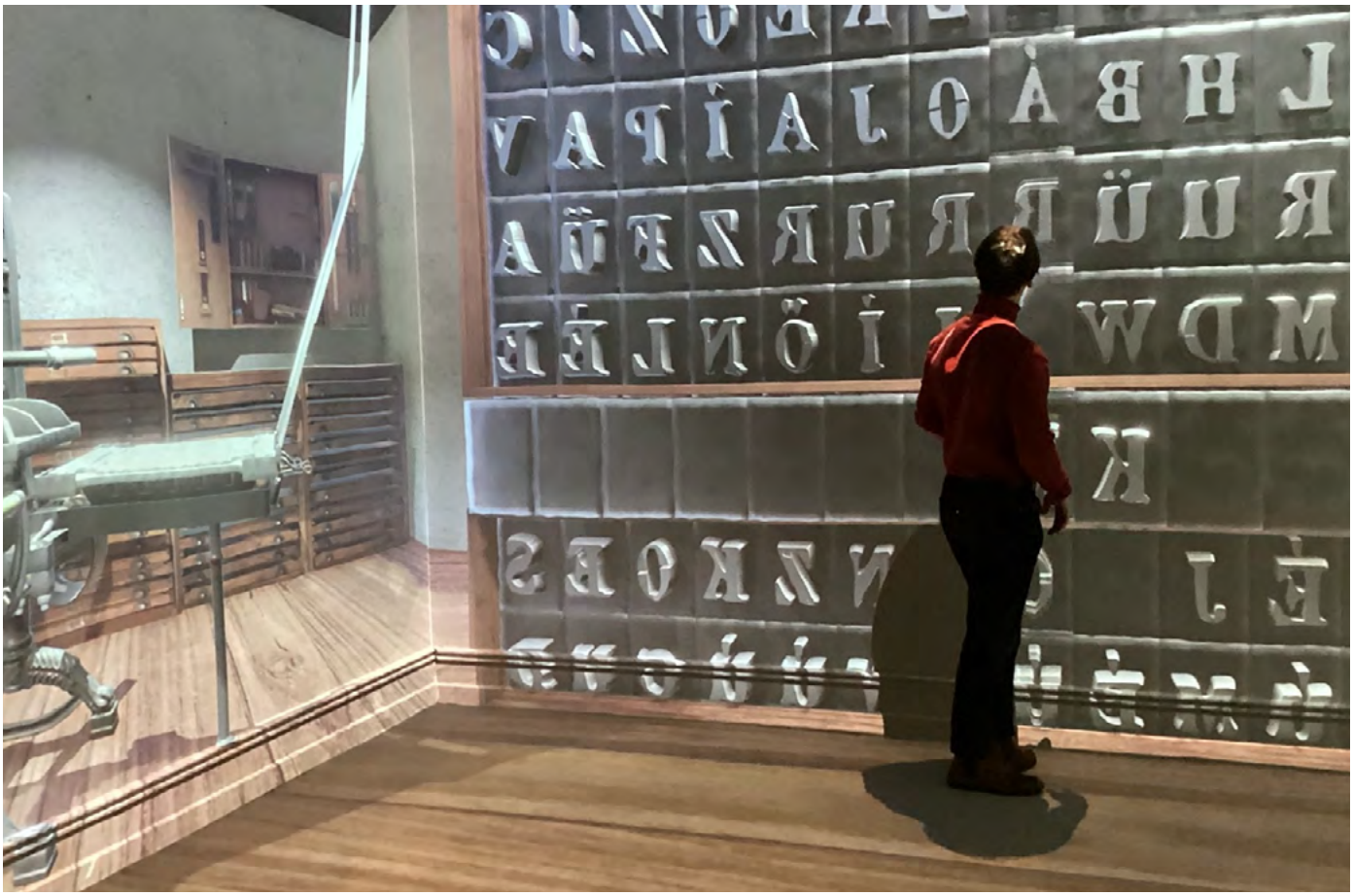


Figure 1 Example of complex-level interaction from the pilot study: "Printing press" implements a media metaphor to challenge participants by sorting the letters to create newspaper headlines.

Interface metaphors are technologies embedded in everyday objects to accelerate the initial familiarity in visitors (Carrol et al., 1988) – just as frames, lenses, vehicles, media, or maps in museums. This proposed list (Table 1) does not aim to be exhaustive, but it provides an overview of the main characteristics. Yet, without playfulness or implemented as a low-level interaction (e.g., launching videos), interface metaphors could be reduced to mere scenery if visitors are left as passive recipients.

Table 1. Interface metaphors of digital installations in exhibitions.

Metaphor	Connotation	Object Extenstion
Frames	border, in and out, casing, framework	window, gate, painting, mirror
Lenses	scaling, reduce, expand speed up, slow down	glasses, telescope, microscope, scanner, door viewer
Vehicles	motion, shifting, navigation, progress	carriage, boat, bicycle, car, aeroplane, spaceship
Media	communication, information knowledge, verification	printing press, book, journal telegraph, radio, television
Maps	coordinates of place and time, background, context	diorama, interactive map, datavisualization

1.3 Earlier Empirical Research on Usage and Effect

The diversity of media technologies and heterogeneous content create unique challenges for evaluation (Diamond et al., 2016). There is little empirical research on digital installations of cultural heritage, and the results so far tend to focus on usage (Hinrichs & Carpendale, 2011) or visitor attitudes toward technology (Hanko et al., 2014) but only in general overview on learning outcomes (Pallud, 2016) or evaluation of it (Kontiza et al., 2020).

Comparisons between graphical and manipulative (tangible) interfaces showed that the latter are more frequently tried, especially by children. In both cases, involving multiple participants leads to significantly longer interaction (Horn et al., 2009). The absolute and relative location of visitor paths influences the attention paid to digital installations proved by installation usage's time spent compared to visitor paths in Chopin Museum (Knast, 2017).
While in vitro design research rooted in HCI (Höök et al., 2003) has turned to in situ evaluation (Galani & Kidd, 2019) to adapt its criteria to the museum's informal learning environment (Bekele & Champion, 2019).

In the Mesch project, researchers evaluated how visitors use digital and non-digital exhibition elements (museum objects, digital replicas, labels, multimedia) by integrating personal meaning maps to measure visitors' informal learning (Damala et al., 2016). Pre- and post-visit mapping helps to assess visitors' knowledge of a broad range of exhibition topics (Falk et al., 2010).
Engagement and learning were examined in two natural history museums, where interactive *tree of life* with 70,000 species was presented on a touch table. A bigger proportion of visitors who used the digital installation understood evolution concepts compared to those who watched overlapping video content in the same time frame (Horn et al., 2016).

2. Own Research Agenda

Our research focuses exclusively on digital installations mounted in the physical space of the exhibition as 'standalone' kiosks. The scope will be on teenagers and young adults (10–19- and 20–25-year-olds) as the deployment of museum technology is driven by the demand to engage them as future visitors. We wish to measure learning outcomes of digital installations and their impact on the attention paid to artefacts and other modalities presented in the exhibition environment. We aim to investigate the use of digital installations through 3 case studies in cultural heritage institutions in Budapest (Petőfi Literary Museum, House of Music, Skanzen).

2.1 Research Questions

1. How does digital installation usage effects visitors' attention distribution in the same exhibition space compared to non-users?

    a) Do digital installation users pay less attention to the collection's objects?
    b) Do digital installation users pay less attention to other presentation modalities?

2. Do users grasp the message conveyed by the digital installations?

    a) How is the recall of digital installations' content right after the visit related to the extensiveness of the usage of the installation?
    b) How is the recall of digital installations' content 4-6 weeks later after the visit related to the extensiveness of the usage of the installation?

3. Comparing complex to low-level interaction usage, which induces a higher proportion of

    a) the involvement of fellow visitors in interaction?
    b) more positive emotional state?
    c) telling about their experience with digital installation to others in 4-6 weeks after the visit?

2.2 Hypotheses

1. Digital installations' users are not paying less attention to the objects or the presentation modes in proximity compared to non-users.

2. Long-term knowledge transfer is only can be conveyed through exhaustive usage.

3. Usage of complex-level interaction-based digital installations compared to low-level based, induce

    a) larger proportion failed to try
    b) more exhaustive exploration of content
    c) higher proportion of fellow visitor involvement
    d) emotional intensity (less neutral state).

4. Experience with complex-level interaction-based digital installations are more often told to others in 4-6 weeks after the visit.

3. Empirical Research Methodology

3.1 Entry Questionnaire – Visitor Profile, Knowledge Brought

To evaluate digital installations' learning outcomes, we apply combined quality and quantity research (Malik et al., 2023). In order to profile the visitors, we use a demographic questionnaire before the exhibition. It is also surveys visiting habits and pre-knowledge of digital installations and exhibition themes, adapting the aforementioned personal meaning mapping method (Falk et al., 2010). Participants are asked to pin up a badge (Figure 2), which links the measurement phases with an anonymous code (Y02=yellow badge+second measurement).

3.2 'In the Wild' Observation – Mode and Circumstances of Use

The guided and covert observations could be 'shadowing' or 'point tracking' depending on the floorplan. To ensure consistency of logging, intercoder agreement should established on the relative values observed, and each observer is expected to record trials before substantive sampling.

The following aspects of usage are observed and coded.

- interaction's duration
- whether it is used alone or with a partner
- degree of usage (try but give up/ask for help/use successfully, etc.)
- extent of usage (amount of discovered content offered)
- attention paid to artifacts or presentation modes(object-descriptions/wall-signs/ QR-codes)
- displayed emotions
- general attitude (experience-seeker/in-hurry/wandering).



Figure 2. Research supplies: badges, artifact photos, and personal meaning maps.

3.3 Exit Interview – Paid Attention to Installations, Artworks, and Texts

At the exit interview, laminated photographs could be handed out (Figure 2) to help identify artworks and evaluate digital installations based on user experiences and the distribution of attention. We ask them to formulate the main message of the digital installations they have engaged. We also ask them to identify which object they recognize and whether they can name the person associated with it from its description.

3.4 Online Questionnaire – Long-Term Knowledge

The follow-up online questionnaire is designed to shed light on the long-term knowledge gain therefore, we ask respondents about their recollection of the installations 4-6 weeks after the visit with questions like: Have they talked about digital installations since? Do they remember digital installations' specific content? How well can they recall displayed objects in the proximity of a digital installation?

4. A Pilot Study

In Petőfi Literary Museum *Petőfi 200 To be or not to be a poet?* permanent exhibition, a pilot study was carried out in the fall of 2023. In design and purpose, [three] significantly different digital installations were chosen, the remaining 13 were not the subject of the research due to their repetitive format or lack of learning function.

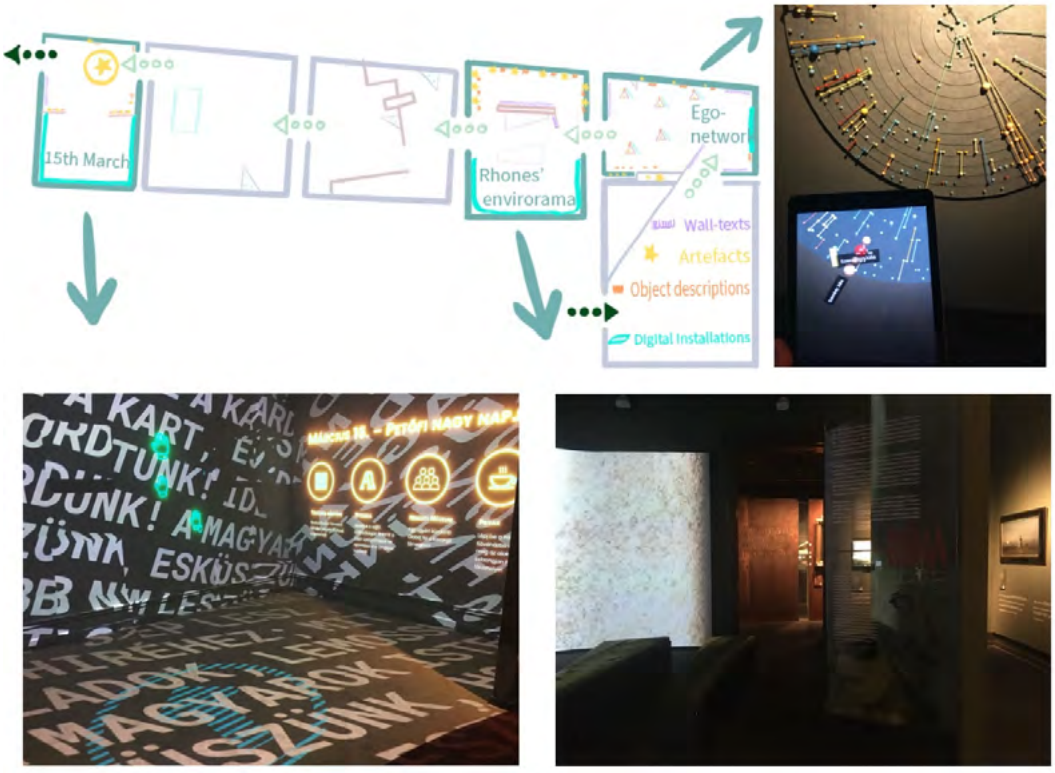


Figure 3. Digital installations on floorplan (top left), Ego-network (top right), Rhone's Envirorama (bottom right), and 15th March (bottom left).

Ego-network (Figure 3) was the kick-off installation, which promotes exploratory learning in layered content - combining data visualization and augmented reality tools (Figure 3). It is aim to reveal who was important to the poet.

Rhone's Envirorama (Figure 3) is an immersive, large-scale projection from the center for relaxation and contemplation. By definition, envirorama is a new generation of the diorama, except it shapes the environment to include visitors as part of it: "Being 'in' a walk-through reconstruction quite directly makes a visitor feel 'part of' the display" (Roppola, 2018, p.151).

15th March (Figure 3) is the final digital installation in the exhibition. Projections of the embayment do not provide narrative factual knowledge; rather, it helps to situate the participant in the milieu of the period. To address schoolchildren at the end of the content-rich exhibition requires full bodily gestures via motion sensors.

The pilot aimed to fine-tune the methodology. Therefore, we applied convenience sampling (n=52), where the gender ratio was 35-65% in favor of females. The vast majority already have used a digital installation in museums (81%), came with family or friends (68%), and were from Budapest (65%).

4.1 Improvements, Limitations, Results

Lessons learned concerning methodology

The major difference between 'shadow-' and 'point-tracking' is that the latter allows more relevant data to be collected in a shorter time; however, the risk of data loss is higher due to the number of observers. Personal meaning maps should be selected that do not appear in any other representation in the exhibition to ensure that the digital installations alone could provide access to learning about the concept.
The small sample size and limitation of the target population did not allow us to get significant answers to the research questions. Moreover, to compare the types of installations, it will be necessary to observe more applications – yet results can be considered indicative for future research.

Some observations about the research questions

1. There is no evidence that those who used the digital installation tended to pay less attention to the artworks or the descriptions.
2. The shorter the time users spent watching Rhone's Envirorama, the more time they spent looking at the artwork. While different relationship was identified for the other complex-level interaction-based installations, more attentive usage was associated with more careful observation of the artworks.
3. More than 75% of respondents mentioned digital installations; complex installations emerged as the most prominent.
4. More positive emotions were monitored during complex-level interaction.

This research makes useful steps in strengthening the evaluation practice of the Hungarian museum scene and also helps digital curators and design practitioners to fine-tune the iteration process in cultural heritage institutions since design practice and -research is built on knowledge advancement and exchange between them.

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P/REFERENCES OF DESIGN

AN INQUIRY ON PARTICIPATORY DESIGN FOR A DIVERSE, EQUITABLE, AND INCLUSIVE PUBLIC SECTOR.

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KEYWORDS | CO-DESIGN, SERVICE DESIGN, SOCIAL INNOVATION, SOCIAL INCLUSION, DEI PRINCIPLES

ABSTRACT | Exploring the potential of co-design methodology to enhance diversity, equity, and inclusion (DEI) in public sector services, this doctoral research emphasizes the need to integrate vulnerable communities into service development processes. The main objective is to understand whether and how co-design and participatory design methods can address DEI challenges, enhance public service delivery, and effectively involve vulnerable communities and public administration in the definition of public services. The research process started with a literature review, defining the concepts of social diversity, equity, and inclusivity. At the same time, the state of the art in the context of co-design and participatory design methodologies was analyzed concerning the public sector. A selection of case studies of socially relevant practices was conducted to assess the implications and effectiveness of participatory and co-design practices together with a variety of vulnerable categories. The analysis of the case studies highlighted the numerous gaps in the services provided by public administration for many communities, which led to the development of bottom-up services that would fill in the gaps and cater to the needs of disadvantaged citizens. Moreover, it emphasized the social relevance of participatory design and co-design approaches in developing solutions for their specific needs. This research serves as a starting point for a future investigation into how the use of such co-design practices with citizens from vulnerable groups can be relevant at the level of public administration and how the public administration itself can adopt such methodologies to provide citizens with the services they need and ultimately what is the role of the designer in this process.

1. Introduction

Social diversity, equity, and inclusivity are crucial in public administration, yet struggles with their implementation are evident due to indecision and delays in the application of just policies.
Public sector managers often lack a deep understanding of organizational diversity, highlighting the need for incorporating social equity principles. (Dooley, 2020) Achieving equity in the public sector involves more than just ensuring equal access to resources and opportunities: it calls for diverse, equal, and inclusive representation in government and decision-making jobs. This may involve reevaluating existing policies and practices through a gender mainstream (Booth & Bennett, 2002; Pollack & Hafner-Burton, 2000) and an inclusive approach to identify and eliminate any biases or discriminatory factors. It also requires addressing systemic barriers that perpetuate inequality faced by marginalized communities, such as people of color, individuals with disabilities, and those from low-income backgrounds, as well as categories of users that are not considered marginalized but still face systemic issues such as women, pregnant people, or members of LGBTQIA+ community. By recognizing these barriers, it will be possible to work towards creating more inclusive policies and services that effectively address the diverse needs of the community.

As this contribution delves deeper into the social implications of diversity, equality, and inclusivity, it sets the starting point of a research on how service design can effectively overcome barriers, promote unbiased approaches, and implement participative strategies to achieve a more just environment for all individuals.

2. Principles of Diversity, Equity, and Inclusion

Diversity, Equity, and Inclusion are essential principles that uphold the values of fairness, justice, and equal opportunities in society. This group of principles, often abbreviated in DEI, are "organizational frameworks which seek to promote the fair treatment and full participation of all people, particularly groups who have historically been underrepresented or subject to discrimination based on identity or disability." ("Diversity, Equity, and Inclusion," 2024)

Diversity refers to the variety within a group regarding identity (i.e., gender, culture, ethnicity, religion, disability, class, etc.), characteristics, or opinion. Its declinations are numerous, such as gender diversity, the composition of men, women, and nonbinary people; age diversity: differences in age groups and generations; ethnic diversity, sharing of common national or cultural traditions or representation of different backgrounds; physical ability and neurodiversity: perspectives of people with disabilities, whether apparent or not. (McKinsey & Company, 2022) Considering this issue in the setting of public administration, it is evident that each of the above-mentioned characteristics and values must be considered in the definition of public services, as each of them might face barriers in different touchpoints of their experiences.

Equity is intended to ensure that everyone has access to the same resources, benefits, and opportunities regardless of their background or circumstances. In the context of public sector services, it is concerned with the measurement and achievement of fairness in the provision of governmental policies and services and emphasizes the impact of the distribution of opportunities, services, and goods on individual well-being. (Cepiku & Mastrodascio, 2021) In this sense, the term can assume two distinct meanings. With "Horizontal equity (equality), everyone receives the same public benefit following the concept of social equity." (Yuan et al., 2017, p. 2) This approach can be controversial, as offering the same tools to individuals with different means and possibilities will lead to uneven results. "Vertical equity," on the other hand, is "based on the different ability and demand of various social groups, whereby the specific socially vulnerable groups receive disproportionately more benefits." (Yuan et al., 2017, p. 2) This side can also bring to light some issues since it can be argued that providing more attention to one specific category could leave out others. Moreover, providing a service for only one category can lead to a ghettoization of it.

Finally, the term inclusion refers to actively creating an environment that embraces diversity and values the contributions of all individuals, making sure that no one is excluded or marginalized. In recent years, there has been a growing emphasis on evaluating the social value of public services: as societies become increasingly diverse, it is crucial for public sector organizations to ensure that their services are accessible and available to all individuals, regardless of their background or circumstances, and to shift away from "managing diversity" in favor of a more proactive approach that involves "managing for diversity" (Chavez & Weisinger, 2008).

One of the goals of this doctoral research is to inquire into the impact of service design methodologies in the public sector, aiming to assimilate and incorporate the principles just outlined into the definition of proper solutions.

3. Service Design in the Public Sector

Co-design and participatory practices in service design are pivotal in the public sector to foster inclusivity and equity, as they actively involve individuals from various organizations or backgrounds to collaborate, sharing and combining ideas and knowledge (Steen, 2013), and ensuring that services will cater for their needs and desires. This inclusive approach is particularly beneficial when designing services for vulnerable consumers. It empowers them to contribute actively, making policies and service delivery more effective and responsive (Dietrich et al., 2017; Fisk et al., 2018; Jakobsen & Andersen, 2013). In the setting of the public sector, the participating actors would represent not only end-users such as citizens (non-citizens as well) but also public employees, administrations, and institutions. The inclusion of the latter presents certainly a challenge and a limitation, and this study proposes future inquiries into methods and approaches to do so.

A distinction between co-design and participatory design is necessary, as they focus on two distinct aspects of collaboration between designers and actors. Participatory design "entails acquiring feedback as the product is being built" (Peacock, 2022). In this way, the creation process is leaner for designers who hold the role of decision-makers: actors engage in advanced stages of the creative process, and their opinions are picked and selected when needed. This approach presents the risk of ability bias as a "tendency to design based on our abilities, and thus, we might bias the feedback we are given"(Peacock, 2022) and of tokenism showing only symbolic effort to be inclusive to members of minority groups rather than allowing them to truly influence the research direction. Co-design, on the other hand, involves the actors from the initial stages until the end of the creative process. In this case, it is necessary to establish an equalitarian relationship between actors and designers, allowing citizens to become designers (Manzini & Rizzo, 2011) and designers to become mediators and facilitators (Melles et al., 2011) rather than leaders.

Many co-design techniques and tools require skills, expertise, and processes that rely on certain levels of communication, cognitive, and creative skills on the part of the participants. (Rodgers, 2018, p. 192) This could lead to the necessity to use specific tools to cooperate with certain vulnerable categories, such as people with mental or physical impairments.

Using both participatory and co-designing techniques allows the designer to access valuable data and knowledge that is ingrained in people's everyday experiences, being citizens, workers, or service providers, granting rich evidence of "real rather than assumed behaviours" (O'Rafferty et al., 2017, p. 16). As described by Blomkamp (2018), "methods such as diaries, collages, card sorts, model building, and various forms of mapping and roleplaying can help to reveal knowledge that is non-verbal, holistic, non-linear, emotional, or intuitive, and which may not be uncovered by other methods." (Blomkamp, 2018, p. 733) Moreover, co-design sessions, such as living labs, provide an open platform for exploring everyday experiences and social phenomena "combined with controlled activities, technical set up, support and data collection." (Kanstrup et al., 2010)

4. Diverse, Equitable, and Inclusive Services: Case Studies

By examining case studies of successful diverse, equal, and inclusive initiatives at the local level, we can gain a deeper understanding of the challenges and opportunities in implementing inclusive services and practices within public sector organizations.

4.1 CAPE – Civic Agency in Public E-services Innovation (2020, Denmark, Finland, Sweden)

The CAPE project tackles marginalized users who lack digital skills. It grants public libraries a more active role as Civic Innovation Centers (CICs), where citizens can be engaged in the improvement of current e-services, as well as in the development of new services. Through a group of volunteers, CAPE aids citizens, the majority of whom are elderly and struggling with digital services. Although this bottom-up effort began as a research project, it has developed into a communication bridge between the general population and the public administration they interact with.

4.2 PYCIPEDIA (2019, Sweden)

Pycipedia is a participative web-based platform for social workers who are certified in providing parenting skills training and support for parents with intellectual disabilities or learning difficulties. This service allows social workers to share, edit, and discuss instructional materials for neo-parents. The adoption of a co-design method to develop an inclusive service for people with disabilities is particularly relevant for research. It serves as a perfect example of how participative design practices may target the individual working on the service itself rather than the vulnerable category.

4.3 GULLIVER (2013, Germany)

Started as a project with the students at Köln International School of Design, in 2001, Gulliver opened as a social facility. It offers a meeting point for homeless men and women to maintain a mailbox and have a dormitory to sleep in during the day and a dressing room for personal hygiene, affordable snacks, and hot drinks. In this case, the co-design approach granted a vulnerable category, such as homeless people, a service that caters to their basic needs but, most importantly, offers crucial support in participating in society with the dignity they deserve. This service closes a gap in the net of Cologne's social facilities.

4.4 HER BARKING (2019, United Kingdom)

Acknowledging the difficulties of vulnerable categories in dangerous areas of the city, a women-led movement was funded, experimenting to collaboratively design and test low-cost interventions to make streets and spaces feel safe. The initiative engaged residents to identify spaces where people do not feel safe and collaboratively design and evaluate several installations. This bottom-up initiative was born from the need of women, older people, and disabled people to safely walk across dangerous streets in the city. Engaging citizens as both data gatherers and solution-providers, this project empowered the community and filled a gap in the urban context.

4.5 CICLOUFFICINA SOCIALE – Social Bicycle Workshop (2013, Italy)

The initiative combines rehabilitation work in supporting people in disadvantaged conditions with manual and cycle-mechanics practice. In the maintenance laboratory, bicycles are repaired and manufactured, emphasizing the recovery of abandoned bicycles. This project's relevance for the community is double since it offers support to vulnerable categories in acquiring manual skills and, therefore, being able to join the workforce. At the same time, it promotes accessibility to cheap means of transport for people in economic difficulties.

5. Conclusions

This doctoral research stems from investigating the public sector under the lens of DEI and its social implications. A study has been conducted on the meaning of these three terms, delving into their declination in the public sector. Subsequently, after a study on the theme of co-design and participatory design, a selection of case studies was conducted analyzing the contribution and the categories to which it is addressed, as well as relevance for research.

The study aims to define how service design approaches DEI issues and how - and if - co-design and participatory design techniques can be a solution for redefining or creating different, equal, inclusive services. There are clear areas for improvement in the inclusion of certain categories in public sector services today. Many of the services analyzed as case studies start as bottom-up projects from academic research or non-profit organizations. In addition, all these projects are either a buffer service (filling the gaps in the public administration) or a bridge service (mediator) between citizens and public administration, highlighting the need for direct government intervention to fill these gaps. On the other hand, it emerged that progress in this direction is possible by including participatory design practices and co-design.

In light of these considerations, how can service design develop empowering strategies in the public sector to support and uplift vulnerable communities without imposing tension on the public administration?
The outcomes of this research pave the way for a deep investigation into the role of service designers and participative methodologies in the public sector to define tools and methods to co-design diverse, equal, and inclusive public services together with the citizens and the public administration.
Finally, future steps will aim to understand the critical role of designers in this collaborative process, questioning how their expertise and approach can facilitate the adoption by the public administration of such methods to improve service delivery and ensure that it is just and fair to all segments of society.

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P/REFERENCES OF DESIGN

DESIGN ECOSYSTEM: FUNCTIONING, DIALECTIC, AND BODIES OF KNOWLEDGE.

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KEYWORDS | DESIGN THEORY, DESIGN RESEARCH, DESIGN PHILOSOPHY, TOTAL DESIGN, METADESIGN

ABSTRACT | This paper aims to advance Design research methods by introducing the four propositions of the 'Dialectic of Design' and understanding the oscillatory tension between Total Design and Metadesign based on the 'Functioning of Design' . It argues for a more holistic perspective on Design to genuinely research its discipline. The developed theory is supported by Flusser's (2012) Design philosophy and guided by Design's inherently anthropocentrism (Archer, 1979), which emerged in prehistory (Margolin, 2017). It advocates for a paradigm shift inside Design research methods, from a 'designer-centric' perspective to a 'human-centric' one. This paper proposes a 'Design Ecosystem' as a theoretical framework converging Design within itself and with Science and Humanities. It is divided according to the theory's three main structures, concluding with the 'Ecosystem' formulation. A previous MA dissertation (Baldaia, 2021) and the ongoing PhD thesis, Total Design and Metadesign: Implications of a Conceptual and Technological Expansion, support the entirety of this research.

1. Introduction

Design needs a unifying theory. There are increasingly more specialised Design fields, boxing designers into narrower specialisations and struggling to integrate our time's necessary permeability and flexibility. Today's fragmented and often 'designer-centric' perspective on Design (formulated since the discipline began) is problematic. We need a paradigm shift in understanding Design, decentralising it, and taking a more holistic view of Design. This paper proposes a 'Design Ecosystem' as a unifying and more stable theoretical framework, contributing to the advancement of Design research methods. The theory is structured as follows: 'Functioning of Design,' 'Dialectic of Design,' Bodies of Knowledge, and 'Design Ecosystem.'

The 'Functioning' supports the 'Dialectic,' establishing a more comprehensive perspective. The 'Dialectic' configures the 'Design Ecosystem' as a framework for converging Design within and with other bodies of knowledge. Bruce Archer (1979) argued that Design may be a third body of knowledge besides the Sciences and the Humanities, occupied with the material culture and the executive skills that make them. Moreover, he provides an anthropocentric approach towards Design instead of a 'designer-centric' one. Through this multi-level theory, we can holistically frame Design, advancing its research methods and allowing for further investigation of the discipline.

2. Methodology

The theory has a corpus of texts identified by searching for 'total design,' 'metadesign,' 'design ecosystem,' and 'design discipline' (in English and Portuguese) in Design journals such as *Design Issues* and *DRS Digital Library* and also Google Scholar and thesis repositories. It was also considered the broader academic literature, and any reference after 2000 was selected whenever possible. The corpus was analysed following Bürdek's (2015) hermeneutics, focusing on the history and conceptualisations of Total Design and Metadesign. On the triangular frameworks of Design, Costa's (2007) paper helped to compile the most relevant references to cross-reference. Flusser's (2012) insights on Design philosophy also strongly support the theory.

3. Background Research

3.1 Total Design and Metadesign

Total Design traces back to the Arts and Crafts (Margolin, 2017). Nuances exist in recent perspectives. Cruz (2006) links it to blurring natural/artificial boundaries, while Wigley (1998) describes it as 'implosive' and 'explosive,' stating that "all design is total design." Meredith (2008) critiques Wigley, citing the Bouroullec brothers' installations as rejecting totalisation. Holder (2019) expands on Wigley's ideas, suggesting that "all design is interior design," meaning a homogenisation of collective imagination. Ortega (2017) introduces the notion of a 'total designer' as a meta-systematiser, converging Design and technology.

Metadesign's founding interpretations include predating object production (Van Onck, 1965), dematerialisation (Baudrillard, 1981), transcending the anthropogenic (Virilio, 1996), and as an evolutionary process akin to autopoiesis (Maturana, 1997). Wood (2008, 2013, 2022) and Vassão (2008, 2017, 2021) see Metadesign as creating paradigm shifts. The concept lacks a coherent theory, facing issues of vagueness and ambiguity (Giaccardi, 2003; Bentz & Franzato, 2017). Nold (2022) argues for its relevance as a self-reflexive attempt to rethink Design, reacting to contemporary crises (Giaccardi & Fischer, 2008; Backwell & Wood, 2011). Metadesign is used to problematise ecosystems, technology, transition, and decolonisation in Design (Irwin, 2015; Escobar, 2018; Sacchetti, 2022; Colombo et al., 2022).

There is an overall conceptual proximity between Total Design and Metadesign, which is relevant for analysing the expanding discipline and the contemporary role of designers. Chapter 5 explores the dialogical relation between both concepts, contributing to formulating a 'Design Ecosystem.'

3.2 Triangular Frameworks

Many authors have framed Design's discipline through triangular approaches. Vitruvius' (1st Century) *Firmitas – Utilitas – Venustas*[3] concepts and Aristotle's three types of activity diagram (after Keitsch modified it in 2006) may be the oldest triangular conceptions at our disposal. Costa's (2007) book chapter helps to compile the most relevant references of triangular frameworks based on Vitruvius/Alberti: Mijksenaar (2001), Kazmierczak (2003), Leiro (2006), and Providência (2003, 2012)[4]. In this regard, Leerberg's (2009) diagram was also considered. In order to develop a more holistic perspective on Design, the frameworks were cross-referenced on top of Archer's (1979) diagram. The result is explored in Chapter 6.

4. The 'Functioning of Design'

Design is modeling (Archer, 1979) and projecting simultaneously; one cannot exist without the other. It is a ballistic human activity of throwing artifices into the world (Flusser, 2012). Since prehistory, humans have become highly skilled in throwing things, becoming the best throwers of any species to ever walk on Earth. Researching Design is analysing the way and the attitude in which we transpose any idea to the world, e.g., how we think of a chair until we make/do it. Throwing the idea out of the human mind/spirit is the ballistic essence of Design (modelling/projecting), ending up having to have its own defined body of knowledge (Archer, 1979).

Design functions through three levels (Figure 1): 'Irradiation', 'Extension', and 'Amplitude' (Baldaia, 2023). 'Irradiation' is modeling/projecting itself, making 'things' and 'non-things'[5] appear in the world (pp. 84, 85). 'Extension' is Design's phenomenological and praxiological presence, the territory occupied by every 'Irradiation' (pp. 85, 86). Design is more 'Extensive' the more humanity designs; the more humanity designs, the more it designs over time. Ultimately, this exponential relation also means an exponential rise in cultural complexity. 'Amplitude' is the modeling/projecting strength of designing, as each model/project opens new possibilities. It is where we glimpse, design, and meta-design the future (pp. 86, 87). Design is more 'Ample' the more 'Extensive' it is.

[3] This triangular framework is, in fact, more Albertian (1452) than Vitruvian.
[4] His triangular framework was later analysed by Branco (2014) and by both authors in 2018.
[5] Everything human-made that is not physical or "impossible to get hold of […] only open to decoding" (Flusser, 2012, p. 86).

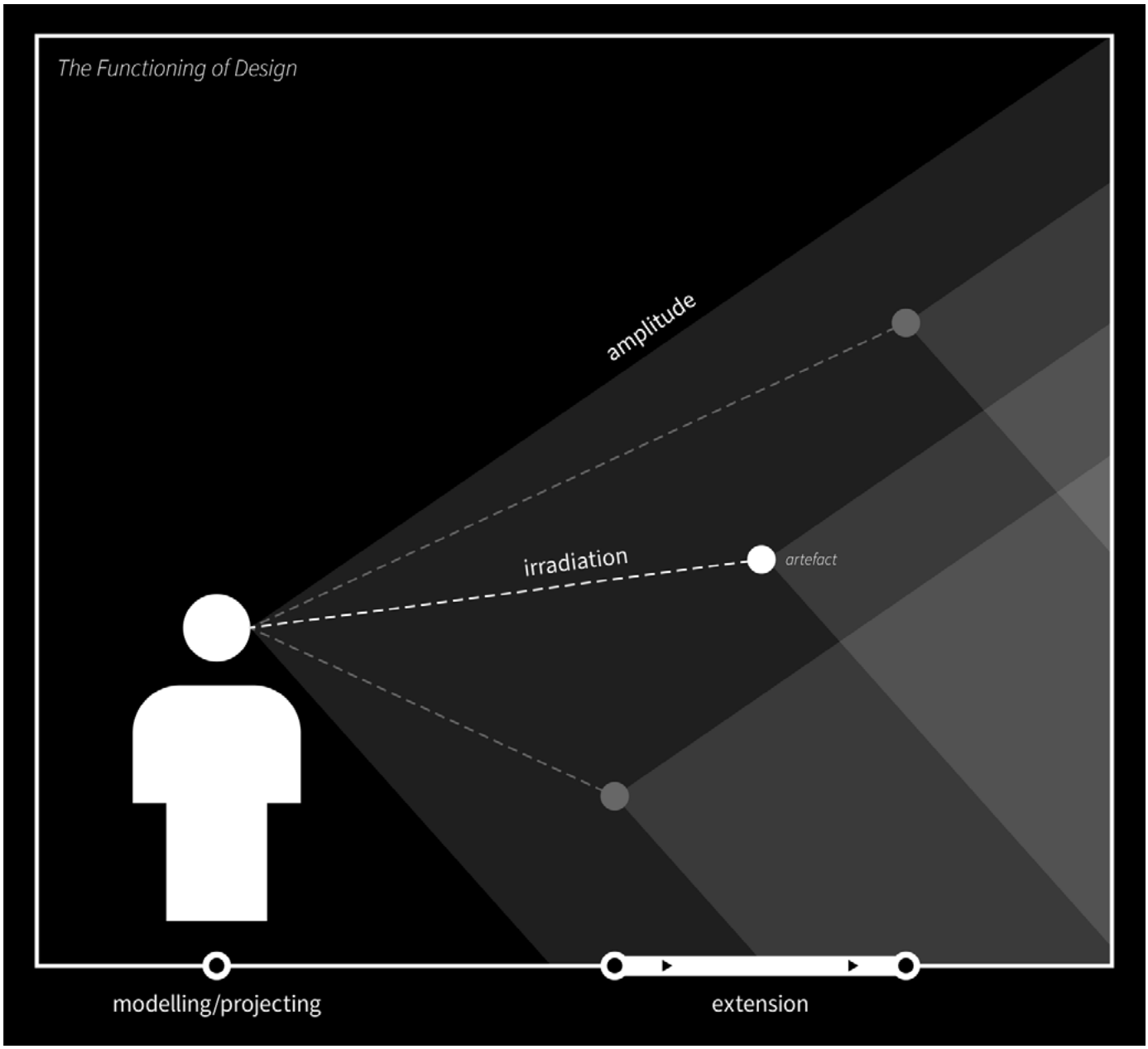


Figure 1. The 'Functioning of Design' through 'Irradiation,' 'Extension,' and 'Amplitude,' beginning with modeling/projecting.

5. The 'Dialectic of Design'

The ballistic 'Functioning of Design' defines the basis of the two fundamental attitudes of Design (Baldaia, 2023; Baldaia & Velez, 2023): Total Design and Metadesign (Figure 2). Total Design exists through the exponential colonising capacity of Design in the world and humanity. Metadesign is mainly present in designing forward while looking both backward and forwards. It is a more dynamic and oscillatory attitude than Total Design, which is usually more linear, conquering new territory without ever losing previous ground.

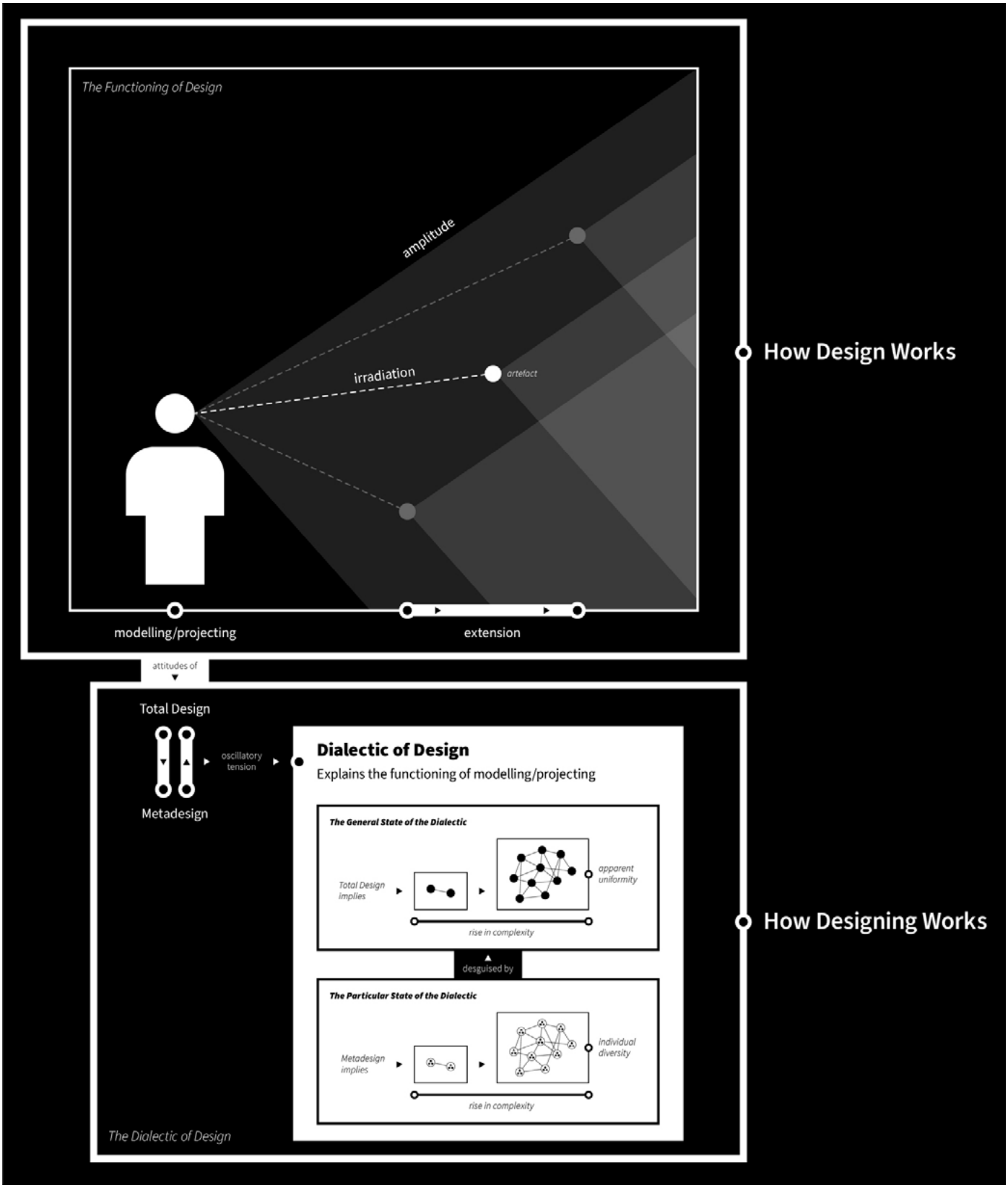


Figure 2. The 'Functioning' and the 'Dialectic' of Design are interconnected.

While modeling/projecting, these two fundamental attitudes relate to themselves through an oscillatory tension (or feedback loop) (Baldaia & Velez, 2023). The result is the 'Dialectic of Design' (Figure 3), which is ever-present while designing. It explains how designing works, another aspect of what Design is, and how it works, integrating the 'Functioning of Design' as a whole. Ultimately, the 'Dialectic' reconciles Total Design and Metadesign towards a synthesis between uniformity and diversity, a more stable homogenisation, and a dynamic heterogenisation.

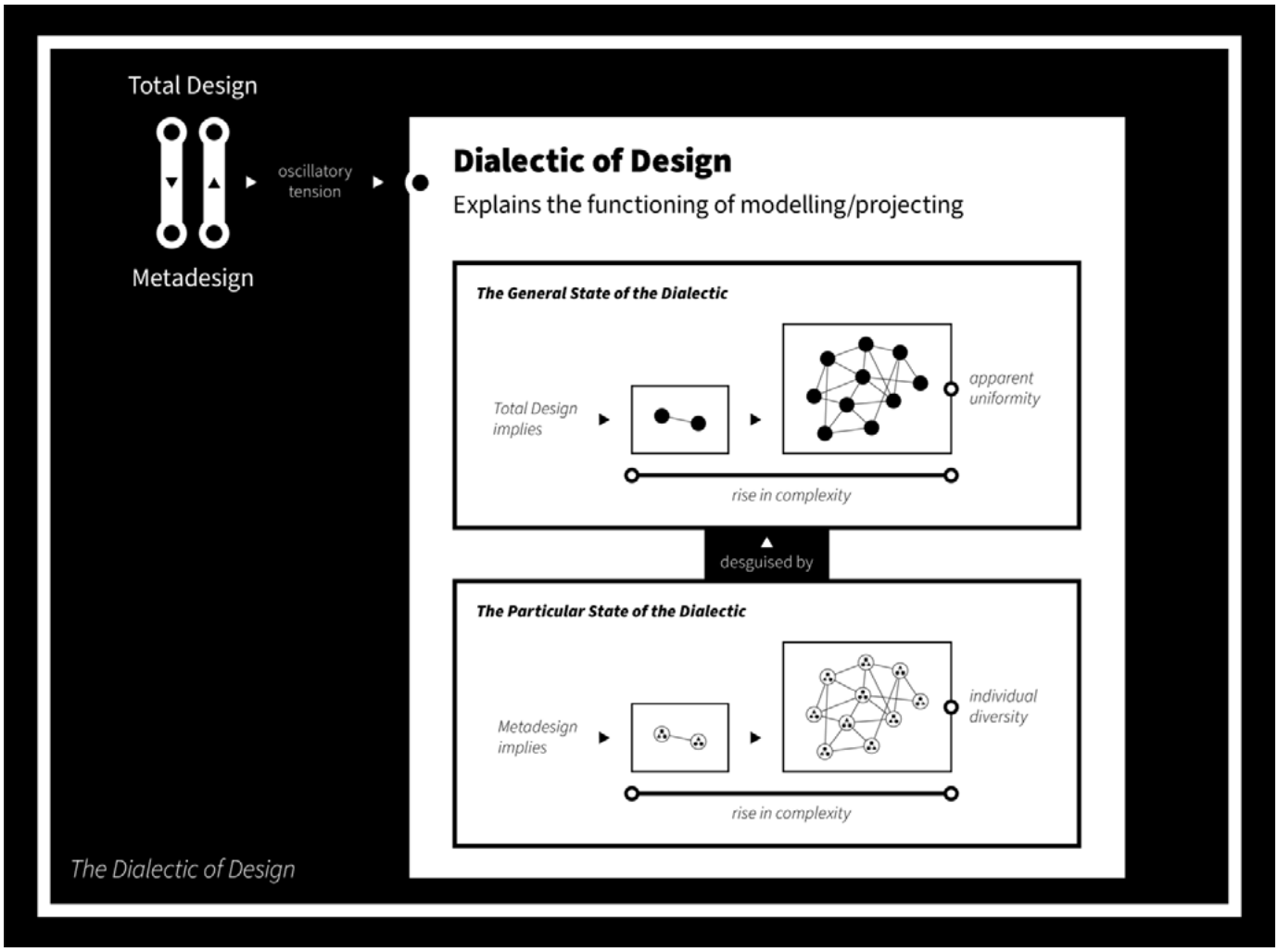


Figure 3. The fundamental states of the 'Dialectic of Design' (second and third propositions).

On the one hand, "all Design is Total Design" (Wigley, 1998), modeling/projecting as a totalizing attitude towards the artificial and cultural world we create, ever-expanding and reaching new possibilities, colonising everything "from the teaspoon to the town" (Rogers, 1952)[6], "from jeans to genes" (Hal Foster, 2011). On the other hand, Metadesign involves collaboration and participation between multiple parts. It functions as an attitude of self-reflection towards remaking and rethinking traditional Design. The etymology of '-meta'[7] may indicate that Metadesign has a dynamic attitude while designing. It allows plurality/diversity, dealing with complexity, and expanding Design in a participatory/collaborative way, ultimately supporting a self-reflective perspective towards Design.

Total Design and Metadesign's oscillatory tension support the 'Dialectic' configured by the following propositions:

1. The 'Dialectic of Design' is defined by Total Design and Metadesign's oscillatory tension.
2. **The General State of the 'Dialectic':** Total Design implies a rise in complexity and apparent uniformity.
3. **The Particular State of the 'Dialectic':** Metadesign implies a rise in complexity and individual diversity disguised by apparent uniformity.
4. The oscillatory tension between the 'General' and 'Particular' states of the 'Dialectic' supports the emergence of creative synergies.

[6] In its original Italian, "Dal cucchiaio alla citta". It was a slogan created in the Charta of Athens, explaining the typical approach of a Milanese architect.
[7] It simultaneously means above, behind, or beyond, configuring the dynamic attribute of Metadesign.

The 'Dialectic' inherits entropy's logic: the tendency of energy (Design) to spread out and reach an equilibrium. The 'General State' explains the apparent uniformity in all human-made objects through Total Design. We can witness this in any brand's/designer's ecosystem, proving inner coherence and even an influence on other designs. It is essential because the 'Particular State' discloses what is underlying it. Metadesign allows us to inspect the inner diversity of a model/project's system. Any Design is made of different parts (methods, graphics, materials, or people), and the appearance of uniformity and coherency disguises them all. This oscillatory tension supports the continuous 'Functioning of Design' over time through the emergence of creative synergies.

6. The Bodies of Knowledge

The 'Ecosystem' also depends on what surrounds Design and its inner 'Dialectic,' i.e., the other bodies of knowledge (Science and Humanities) that permeably relate to Design and vice versa. On top of Archer's (1979) triangular diagram, 'Three Bodies of Knowledge,' we can cross-reference various triangular frameworks attempting to structure Design's discipline or to converge Design with other bodies of knowledge, allowing us to develop a more holistic perspective on Design.

Since it is reasonable to overlap *Utilitas* on Archer's Design and *Firmitas* on Science, let us focus on the *Venustas* edge. Being more related to aesthetics and beauty, *Venustas* would not correctly overlap the Humanities. Instead, we may rename it '*Significatio*' (meaning expression, manifestation, and signification), which better represents the Humanities and what that body of knowledge proposes to do and research. Overlapping Aristotle's three types of activity (Keitsch, 2006) allows us to find a middle ground between *Utilitas*/'*Significatio*' (*Práxis*), *Utilitas*/*Firmitas* (*Poíesis*), and '*Significatio*'/*Firmitas* (*Theoría*) (Figure 4).

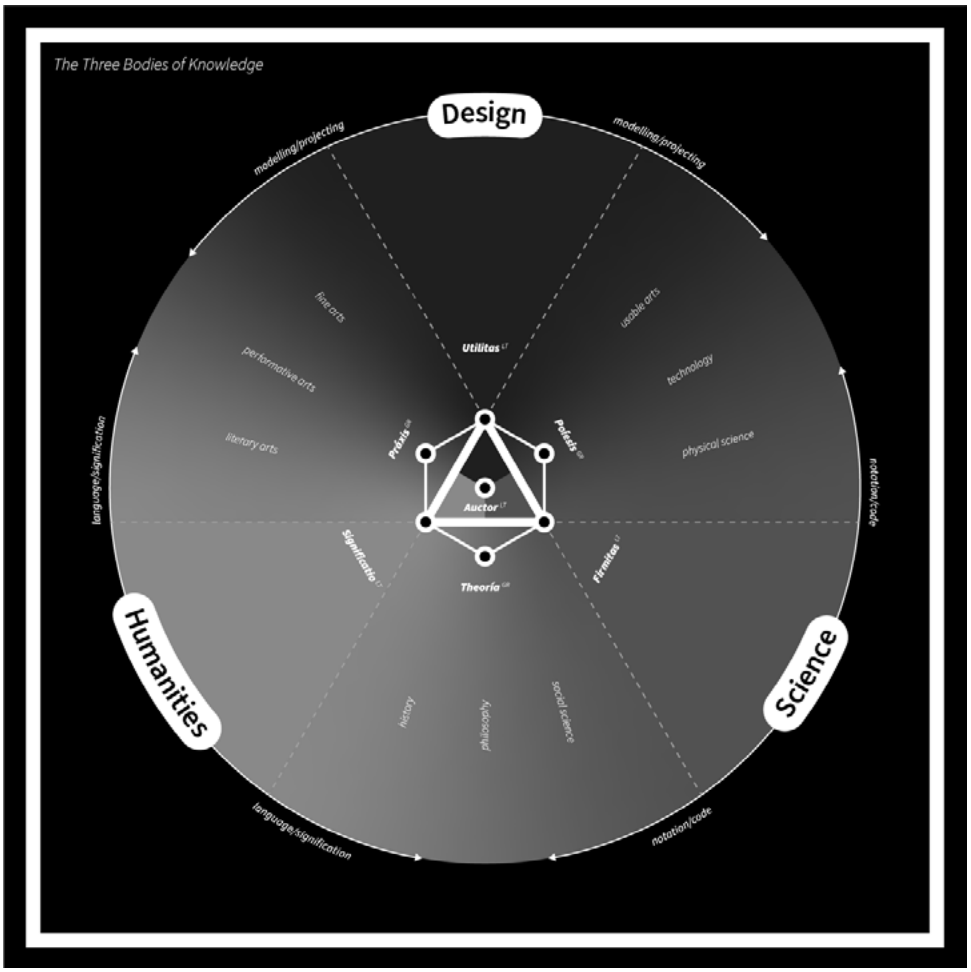


Figure 4. The bodies of knowledge are in an open, interconnected, and expansive system of permeable relations.

Because an author is the one who creates or, as the Latines interpreted it, the one who conquers new territory, it must be at the centre of the diagram representing whoever acts in and through any body of knowledge. Therefore, we have established alongside Archer (1979) how Design is located concerning Science and the Humanities and that the plane of theory (*Theoría*) is what Design continually pursues (Figure 5). Theory may be seen as the archetype of any designer's utopic Design, i.e., the grand model/project in which any other Design could fit without gaps as a perfect Total Design:

> "Strong Design presupposes strong theory. Design is […] the appearance of theory. […] After all, theory is itself an artwork, something designed. Theorists such as Vitruvius and Alberti insist that the ordering and structure of their respective treatises match that which they prescribe for buildings." (Wigley, 1998)

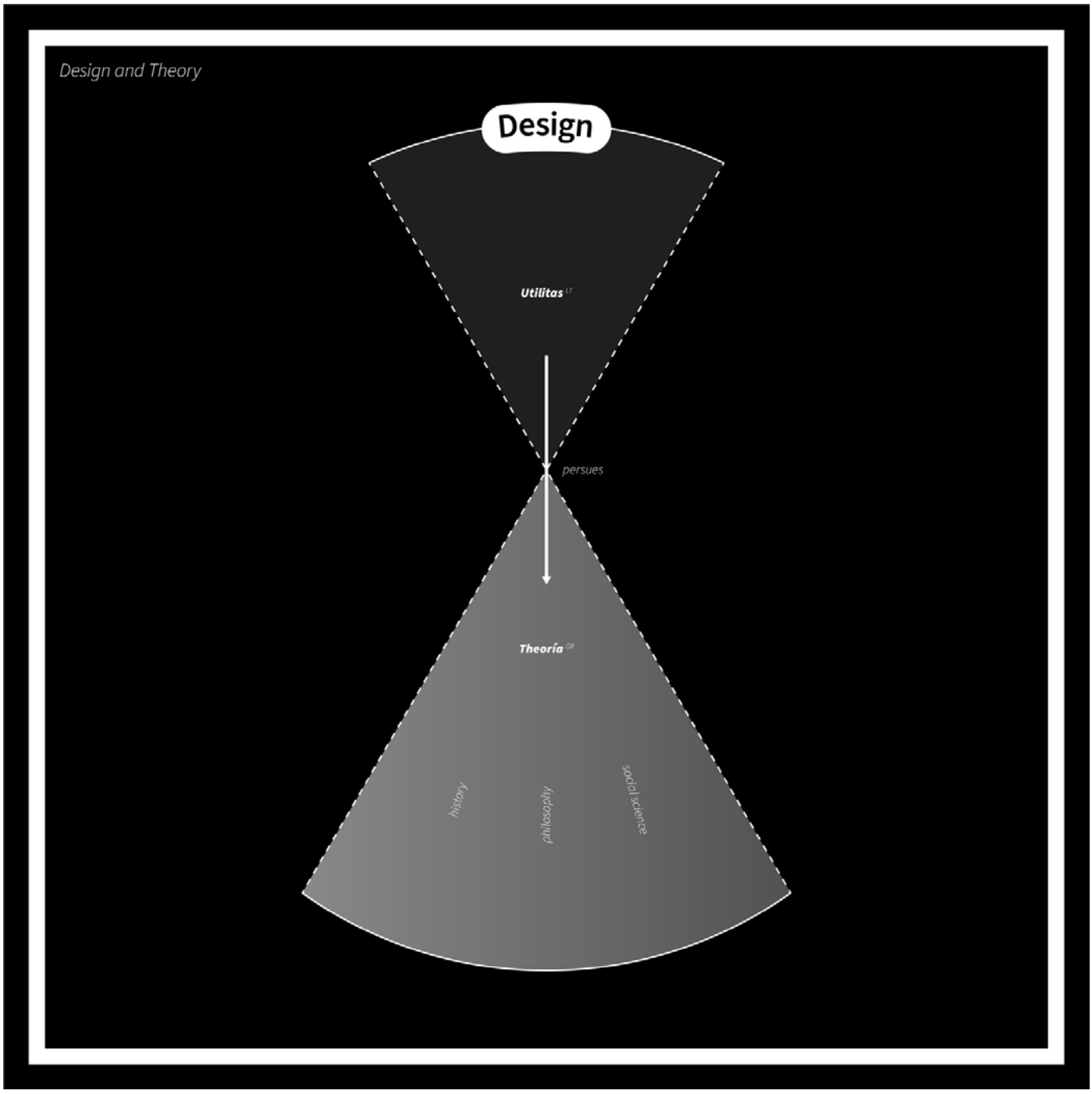


Figure 5. The plane of Design (*Utilitas*) pursues what is mainly theoretical (*Theoría*).

7. Conclusion: A ‘Design Ecosystem’

One can finally and fully framework a ‘Design Ecosystem’ (Figure 6), allowing for further research, e.g., on how design research works within the ‘Ecosystem’ and where/how one could map the discipline and its functioning. The ‘Ecosystem’ embraces all the inner aspects of Design and its relationship with what surrounds it.

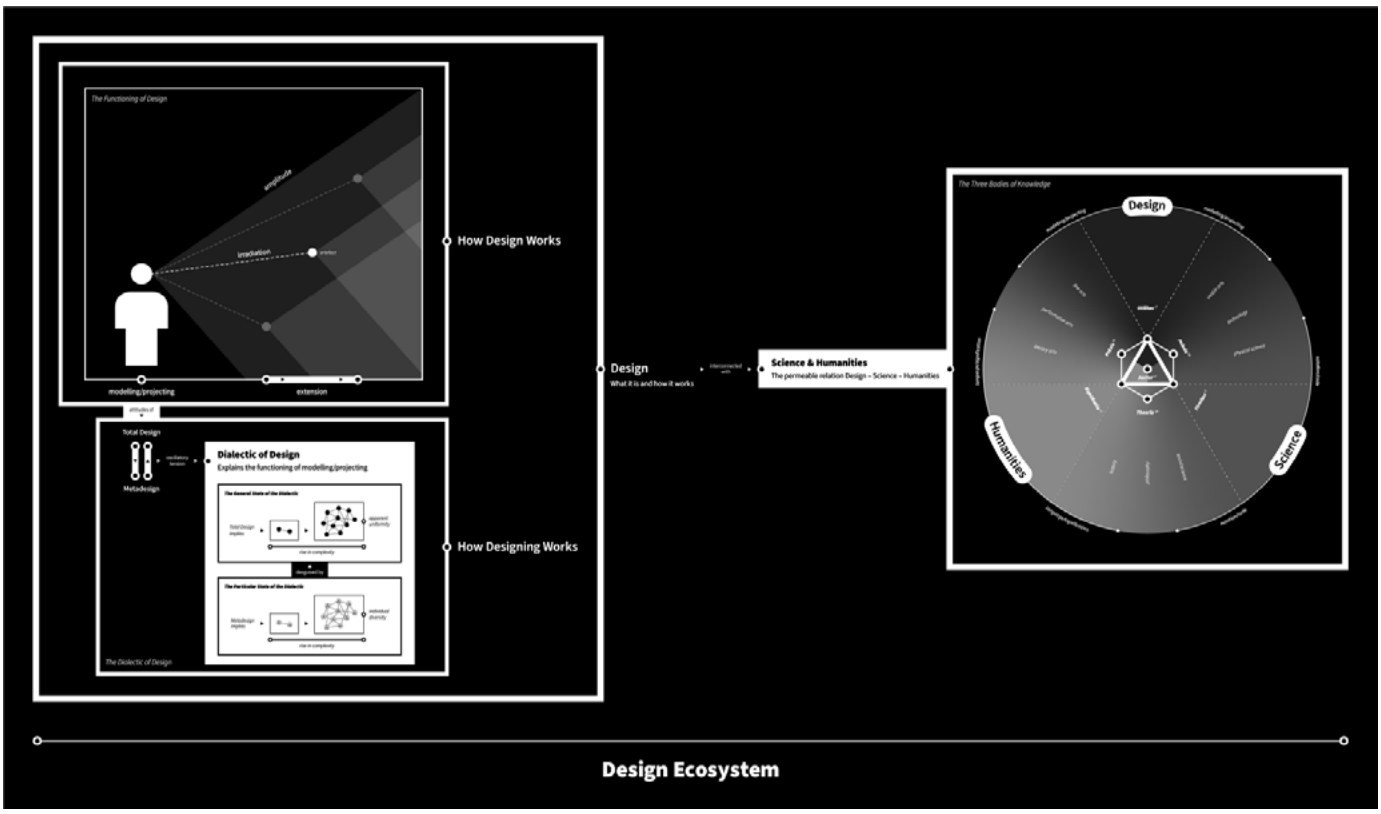


Figure 6. The ‘Design Ecosystem’.

Similarly to biology, the ‘Design Ecosystem’ is an ‘imaginary geography’ (Moura, 2011) where living and non-living parts work together. Its functioning is deeply interconnected to the fact that every individual system is permeable with every other, being intrinsically holistic. While Design is a complex system with its inner functions and oscillatory relations underlying every designing act, it is also inherently interconnected with Science and the Humanities. Designing is not being inside a box labeled ‘Design’ but navigating the other bodies of knowledge, cooperating and contributing while also letting others inside. Even though a broad discipline dedicated to organising and structuring Design’s body of knowledge exists, the ‘Ecosystem’ decentralises it from the ‘expert’ designer (Manzini, 2015) because any human being designs. For a gradual convergence inside Design, every specialised discipline needs a shared core theoretical framework for a more robust and flexible discipline.

Further research is needed to establish a more unified Design theory and true interconnectedness between the bodies of knowledge. We may even involve academics and professionals from other disciplines in this process. Moreover, this theory invokes and supports research on framing the actual Design discipline, its body of knowledge, its methodologies, its practices, and the implications of a conceptual and technological expansion.

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P/REFERENCES OF DESIGN

SERVICE DESIGN FOR THE INTERCULTURAL ADAPTATION EXPERIENCE OF CHINESE POSTGRADUATE TAUGHT (PGT) STUDENTS IN THE UK.

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KEYWORDS | CHINESE INTERNATIONAL STUDENTS, INTERCULTURAL ADAPTATION, PSYCHOLOGICAL AND PHYSICAL CHALLENGES, SERVICE DESIGN

ABSTRACT | Chinese postgraduate taught (PGT) students experience various psychological and physical challenges during their intercultural adaptation process in the UK. Existing studies have proposed some theoretical or conceptual intervention guidelines to support international students' intercultural adaptation. However, very little research has been considered to help service providers, i.e., Higher Education Institutions (HEIs), to effectively apply the theoretical guidance in their practical service design regarding Chinese PGT students' intercultural adaptation experience in the UK. Service design research also rarely explores the design context of intercultural adaptation. This study aims to explore the comprehensive adaptation experiences of Chinese PGT students, identify their difficulties and needs, and then propose practical service design implications for HEIs. Semi-structured interviews with 24 Chinese PGT students were used to explore in detail their adaptation experiences and service needs from psychological, socio-cultural, and academic perspectives. The results show that Chinese PGT students experienced psychological challenges throughout their adaptation process, particularly in the first few weeks in the UK. These were related to unfamiliarity with the new environment, poor communication experiences, and confusion with academic values or systems (especially in the first academic term). Some implications for service design within HEIs were then developed, such as pre-departure education, more support services in the first few weeks, extension language support services, and more explanation and guidance on the academic values of the host country. This study provides insights for HEIs in supporting Chinese PGT students' adaptation experience and reducing their psychological stress. As the service design approach is at the core of this research, the main knowledge contribution will be in the field of service design.

1. Introduction

Research Background

Intercultural adaptation can be defined as individuals changing their original cultural behaviors to facilitate effective communication in cross-cultural interactions (Cai & Rodriguez, 1997). International students often face challenges when they adapt to an unfamiliar cultural environment due to cultural differences (Dodd, 1998). They may experience prejudice and discrimination, as well as homesickness, disappointment, confusion, and loneliness (Hechanova-Alampay et al., 2002; Brislin & Yoshida, 1994). This psychological stress causes people to have difficulties learning a new culture, solving problems, and making decisions (Xia, 2009), which may affect international students' social integration and academic performance and increase mental health problems.

Some research has seen higher education institutions (HEIs) as the service providers responsible for supporting students' problems and needs (e.g., Gill, 2007; Gu & Maley, 2008; Wang et al., 2012). As HEIs rely on international student enrolments to increase their income (Marshall, 2005), and international students come to the UK motivated by the pursuit of an academic degree; this study agrees that HEIs should be seen as service providers who should support international students' adaptation experience, ensure their wellbeing and help them achieve their academic goals.

Among all international students in the UK, Chinese students are the largest group, not only diversifying campuses but also contributing to academic research in HEIs (UKCOSA 2004). Compared with other international students, Chinese students often have poorer intercultural adaptation experiences, such as bad mental health in general (Leong, 2015). Chinese postgraduate taught (PGT) students face more significant challenges due to their limited study (adaptation) time of one year. Therefore, Chinese international PGT students are the focus of this study.

Intercultural Adaptation

Current studies on Chinese international students' intercultural adaptation in the UK largely focus on students' adaptation processes and influencing factors and then suggest intervention guidelines. For example, Lu (1990) found that Chinese international students often felt homesick as they adapted to the UK academic environment. Gill (2007) argued that the adaptation process of Chinese students in the UK is a learning process and suggested that HEIs should provide them with a facilitative, supportive, inclusive, and culturally interactive environment. Gu and Maley (2008) and Ye and Edwards (2015) suggested that teachers' abilities, such as empathy and sympathy, can be helpful to Chinese students' intercultural adaptation. Zhou and Todman (2008) suggest that 'matching pedagogical expectations' plays a crucial role in Chinese students' intercultural adaptation. An example of pedagogical expectation is that HEIs strongly encourage their students to be independent and become critical thinkers, whereas Chinese universities usually require their students to accept authority (Zhou et al., 2011).

The proposed intervention guidelines, however, are mainly theoretical or conceptual, and few consider the service provider's perspectives to propose practical suggestions based on everyday practices regarding Chinese international students. Furthermore, the guidelines also tend to emphasise the achievement of students' academic adaptation and pay less attention to students' psychological and socio-cultural adaptation, which is important for student's mental health and personal development in the long term.

Service Design

Service design is a practical approach to creating and improving what organisations offer, following the core design activities of research, ideation, prototyping, and implementation to develop experiences that meet the needs of the organisation, the customer, and other stakeholders (Stickdorn, 2018). This means that the interests of both HEIs and Chinese PGT students could be taken into consideration. The principle of

service design also implies the need to focus on students' complete needs rather than superficial symptoms (Stickdorn, 2018).

However, many service designs are complicated because service providers and service recipients may have different views of service concepts (Goldstein et al., 2002), for example, international students may view the concept of services they expect as the whole experience of being supported during their adaptation journey, rather than some specific services (e.g., language or wellbeing support). Although the principles of service design show potential benefits in intercultural adaptation, current service design research is, to my knowledge, rarely explored in this context. Service design is also a relatively new concept to the HEIs (Baranova et al., 2011).

Research Objective

This study aims to provide insights for HEIs to design better services to support the adaptation experience of Chinese PGT students. As the first phase of a larger project, this study focuses on exploring the adaptation experience of Chinese PGT students, identifying their psychological and physical difficulties and needs, and then proposing initial service design implications for HEIs.

2. Research Methodology

The study used semi-structured interviews because it allowed the researcher to gain a deeper understanding of the interviewees' perspectives on their lives, experiences, or situations (Taylor & Bogdan, 1984) during their adaptation journey. In the data analysis stage, thematic analysis was used as it can highlight the common themes in the data set (Braun & Clarke, 2006), which could help to better understand the common adaptation experience of Chinese PGT students in the UK. The data was collected between November 2022 and February 2023.

The final sample consisted of twenty-four Chinese PGT students in the UK: fifteen females and nine males. All participants were Chinese PGT students who came from mainland China, used Chinese as their primary language, and experienced the host culture environment in the UK. Ten participants stayed in the UK for 1-3 months, four participants stayed for 4-6 months and then stayed for over six months. Over half of the participants studied in England (n=18), a quarter in Scotland (n=5), and the rest in Wales (n=1).

The interview questions were created using the J-curve model and three types of sojourner adaptation (psychological, sociocultural, and academic adaptation). The J-curve model, which was suggested by Collins (2021), describes the adaptation process as three stages: the 'cultural challenges' stage, the 'adjustment' stage, and the 'mastery' stage. The J-curve model is based on short-term adaptation studies and focuses primarily on the international students' adaptation process, which is the most applicable to this study. Two fundamental types of sojourner adaptation are identified by Ward and colleagues: psychological adjustment and sociocultural adaptation (Searle & Ward, 1990; Ward & Kennedy, 1992; Ward, 1996). In addition, some researchers who focus on the student's academic adaptation found that psychological mood could change with the academic calendar during students' adaptation process (Golden, 1973; Selby &Woods,1966). Therefore, three types of sojourner adaptation (psychological, socio-cultural, and academic) were used to investigate students' comprehensive adaptation experiences from multiple perspectives.

3. Summary and Discussion of Findings

The results of the Chinese PGT students' adaptation experiences are presented in the following categories: psychological challenges throughout the adaptation process, new cultural environment and communication difficulties, and unfamiliarity with the host country's academic values. Based on the results, four main implications in service design for intercultural adaptation are suggested (see Table 1).

3.1 Chinese PGT Students' Adaptation Experience in the UK

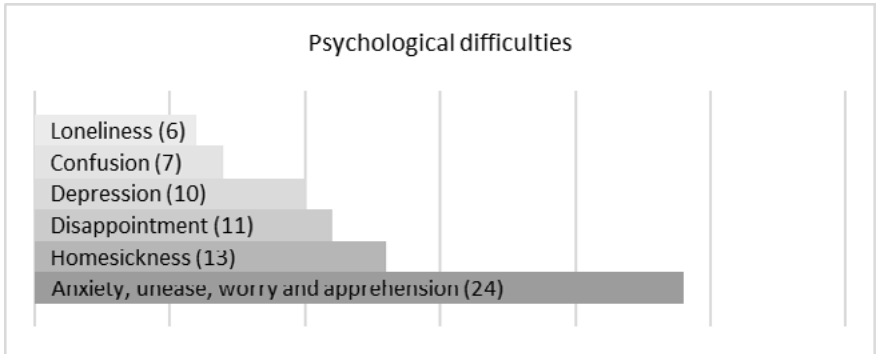
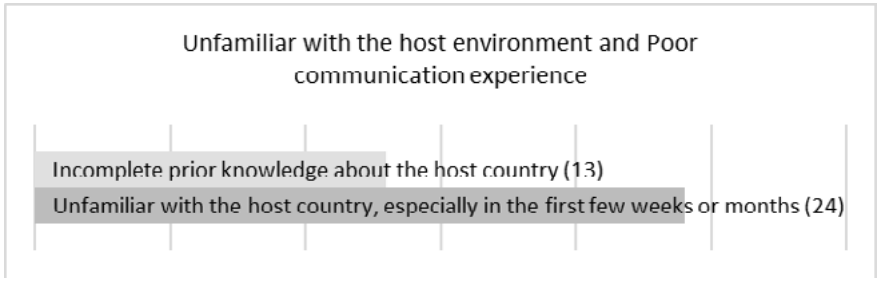
Psychological challenges throughout the adaptation process

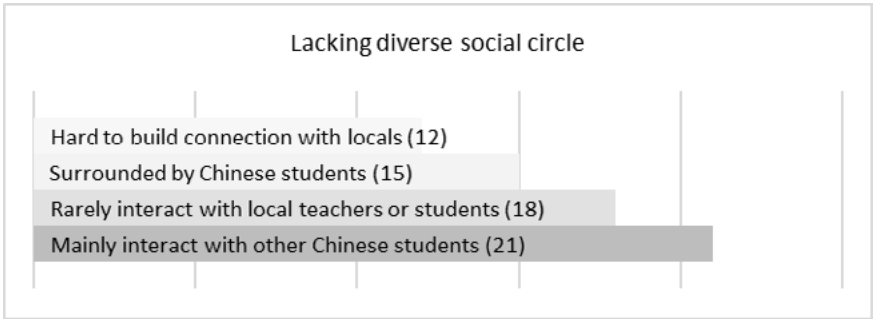
Participants reported experiencing a mixture of positive and negative emotions before arriving in the host country. After arriving in the host country, participants' positive emotions (e.g., excitement and curiosity) were concentrated in the first few weeks in the host country, mainly related to a new cultural environment. However, some negative emotions (e.g., anxiety, worry, disappointment, and depression) also seemed to be mentioned more often in the first few months and, especially, in the first one to three weeks. This was because they were in an unfamiliar cultural environment with academic pressures and a lack of social support. When participants approached graduation, they began to feel anxiety and stress about finding future career or study opportunities because of concerns about available visas, unfamiliar environments, or lack of a helpful social network.

New cultural environment and communication difficulties

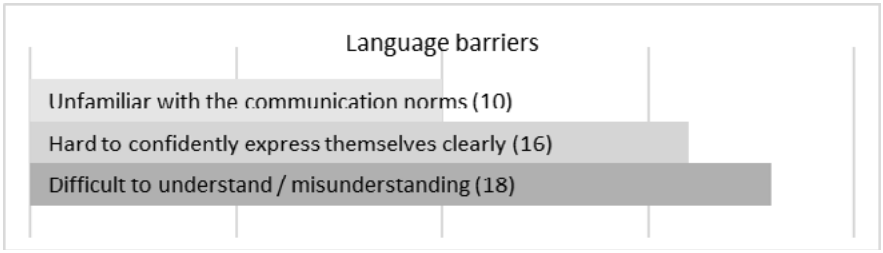
Most participants did not have a comprehensive understanding of the host country before arriving and even had certain prejudices and stereotypes. After arriving in the host country, they found that they were not familiar with the environment, especially the local service system (e.g., banks and General Practitioners (GPs)), which caused a lot of inconveniences and increased their psychological stress. Lack of communication skills and opportunities appeared to be a significant challenge. Most participants preferred to interact within their own culture and rarely communicated with people from other cultures. They felt uncertain about communicating in English, had difficulty expressing themselves clearly, and were confused when interacting with their teachers or other locals. Some participants also mentioned that they were surrounded by Chinese students and rarely had the opportunity to interact with people from other ethnic backgrounds.

Table 1. The results of Chinese PGT students' adaptation experiences and the implications for service design.

Three types of adaptation	Chinese PGT students' adaptation experience in the UK (number of participants)	Implications in service design
Psychological challenges throughout the adaptation process, especially in the first few weeks (psychological adaptation)		More support for socio-cultural and academic adaptation experience (psychological difficulties were highly relevant to their socio-cultural and academic adaptation experiences)
New cultural environment and communication difficulties (socio-cultural adaptation)		Pre-departure education More support services in the first few weeks

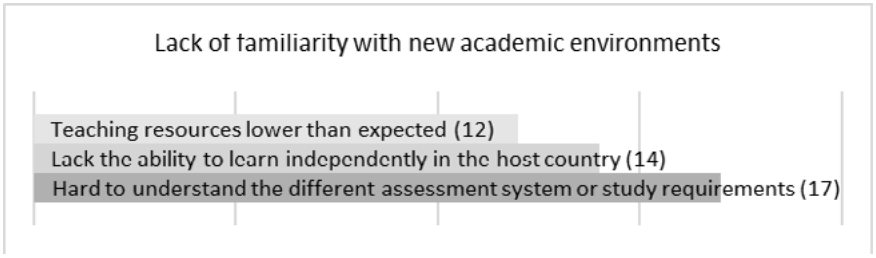


(A hidden potential crisis has also been identified – an over-representation of Chinese students in certain subjects in some schools)

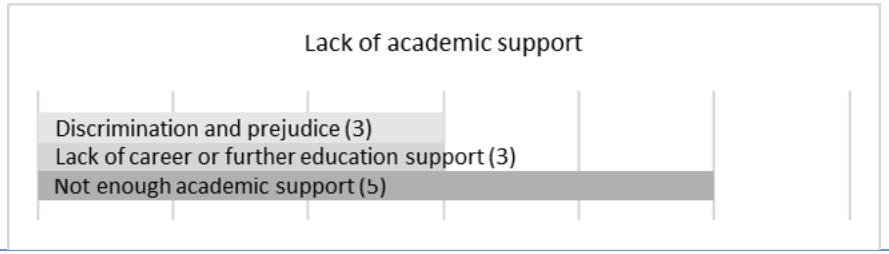


Expand language support services

Unfamiliarity with the host academic values (academic adaptation)



More explanations and guidance on the host academic values



Unfamiliarity with the host academic values

Participants usually felt unfamiliar with and confused by the new academic environment. The academic requirements and assessments were the most mentioned. Some participants said that they did not understand teachers' expectations or how to achieve higher scores. Combined with their communication difficulties, it is usually difficult for them to know how to adapt to the new academic environment and adjust their study methods until they receive formal written feedback after the first academic term. Some participants also mentioned that independent learning was a challenge because their home country's education system was more teacher-centered. Therefore, many participants were dissatisfied that teachers did not actively impart more knowledge, did not provide enough guidance and support, and required them to search for information and organise their own study time.

3.2 Implications in Service Design for Intercultural Adaptation

Pre-departure education

Improving knowledge about the host country in the pre-departure stage may be a viable solution to reduce Chinese students' negative emotions and difficulties caused by unfamiliarity with the host culture, as it can reduce Chinese PGT students' prejudices, stereotypes, and culture shock. This could help Chinese students establish realistic service expectations, which is a key factor influencing their satisfaction with service quality (Zeithaml et al., 1990).

More support services in the first few weeks

It might be useful to provide more services to help Chinese PGT students understand the local service system in their early adaptation period, such as more guidance on registering with a GP and applying for a bank card. Although the school provided relevant guidance services, Chinese students continued to find it difficult to access these local service systems.

Participants experienced high negative emotions in the first three months, according to the J-curve model (Collins et al., 2021). However, this study identified that participants felt particularly high negative emotions in the first few weeks, which provides a more specific time for when Chinese PGT students need the most support.

Expand language support services

Chinese students' low confidence in expressing themselves in English and uncertainty about the local etiquette required the most attention, especially in academic situations. For example, in the UK educational environment, the power distance between teachers and students was not as pronounced as in Chinese culture, and positive encouragement and recognition from teachers helped Chinese students to express their ideas and interact confidently with teachers, but some of the indirect 'polite' terms used in the local culture can be confusing for Chinese students. As one participant said: "Teachers were so polite. I thought that putting it in the Chinese context means that I don't need to pay much attention to the exam… I didn't expect that I would fail the final exam". Therefore, language support could also be extended to teach cultural language norms.

A hidden potential crisis has also been identified. Chinese students have been the largest international student group in the UK since 2003 (Gu, 2011), leading to an over-representation of Chinese students in certain subjects in some schools. This 'un-diverse' environment meant that students lacked opportunities for English language communication and multicultural interaction, which could lead to their dissatisfaction and poor adaptation experiences. This issue was rarely mentioned in the current research, but it deserves attention as the feedback from these Chinese students may affect the reputation of the HEIs.

More explanations and guidance on the host academic values

Most of the Chinese students had never experienced alternative teaching and learning styles before, which led them to have misunderstandings and extra pressure (Gu & Maley, 2008), especially in their first academic term. At the same time, the host academic system was more inclined to allow students to learn and explore independently, which leads to students' lack of guidance and support in this regard and exacerbates their difficulty in adapting to the local academic life. Without guidance, it was also difficult for Chinese students to understand the benefits of the host academic values, resulting in some Chinese PGT students interpreting 'self-directed learning' as 'low-quality teaching' and 'lack of academic support.' Therefore, providing Chinese PGT students with more guidance on host academic values in the first term may help them to adapt more effectively to local academic life and better achieve their academic goals.

4. Conclusion

Current research lacks practical service design suggestions for HEIs, and little research explores service design in the context of intercultural adaptation. The findings of this study provide insights for HEIs to better design their services to support and facilitate the intercultural adaptation process and reduce psychological stress, especially for Chinese PGT students. This study, as part of a larger project, explored the research step of service design in the context of intercultural adaptation. The next step will be further research into service provider perspectives, idea and prototype development, and testing, which could lead to more detailed contributions to the field of service design for intercultural adaptation.

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P/REFERENCES OF DESIGN

DIGITAL TWINS IN THE PUBLIC SECTOR AND THE ROLE OF THE SERVICE DESIGNER.

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KEYWORDS | DIGITAL TWIN APPLICATIONS, DIGITAL TRANSFORMATION, PUBLIC SERVICES, PUBLIC ADMINISTRATION, HUMAN-CENTERED DESIGN

ABSTRACT | Digital Twins are increasingly being discussed in the literature of industrial, smart cities, and smart healthcare fields, but what if this technology was also applied to the Public Sector? This research aims to identify possible uses of the Digital Twin approach in public services and understand what role the Service Designer can play in the process of integrating this solution. The Digital Twin is already actively used in the industrial context, healthcare, or smart cities thanks to its capabilities for real-time prediction, optimization, monitoring, controlling, and improved decision-making. At the same time, digital transformation has become one of the needs in the Public Sector, and even if many countries are taking significant steps to implement it, many opportunities remain unrealized. The Digital Twin solution can be considered one of the technologies that improve public services, but so far, research on this topic is limited. From a few studies on this topic, one can highlight the Digital Twin Bureaucracy, which is a digital replica of the bureaucracy in the physical world. Simultaneously, there is currently no Service Design literature on this topic, although it can be useful in integrating such technologies due to the design's ability to deal with complexity and the Human-centered approach.

To explore technology applications and design capacity in this topic, this study uses a Literature review and Case studies analysis based on articles and cases that touch on concepts of Digital transformation, Human-centered design, Public services, and Public administration. The study presents a list of possible applications of the Digital Twin in the Public Sector and the role of the designer in this process. Possible uses of this technology in the public services identified in the research are accelerated prototyping and redesigning systems, optimization of organizational resources, forecasting problems, systems planning, and Public Engagement. The Service Designer's role in Digital Twin integration may be characterized as an expert who thinks through the experience of stakeholders based on their needs and improves the interactions between them and technologies.

Future studies will address the following questions: What other uses can a Digital Twin have in the Public Sector? How can Service Design adapt this approach to meet stakeholder needs in public services? How can design make information from this technology accessible and personalized to stakeholders in this context? To answer these questions, the PhD research aims to identify trends and cases of using Digital Twin in the Public Sector, understand the dynamics of one Italian public service that can be improved by applying this technology, develop a prototype of its interfaces, and create guidelines for Service Designers.

1. Introduction

Digital Twin solutions help to effectively plan and optimize processes in various areas of industry, smart cities, and smart healthcare. Could it also be useful for improving the quality of public services from the point of view of the citizens and state employees? This PhD research explores how the Digital Twin can be integrated into public services to improve the efficiency and stakeholders' satisfaction with these services and what is the role of Service Design in this process.

2. Digital Twin: Definition, History, and Benefits

The Digital Twin, according to Rasheed et al. (2020), is defined as a virtual representation of a physical asset that can be used for better decision-making, real-time prediction, optimization, monitoring, and controlling via data and simulators. The idea of a Digital Twin appeared before it gained popularity, namely in 2002 by Grieves, who came up with the “Mirrored Spaces Model” associated with Product Lifecycle Management and consisting of real space, virtual space, and a mechanism for connecting the data flow between them. A decade before this, there was a similar idea called “Mirror Worlds” by David Gelernter, in which software models simulate reality based on information from the physical world. The name Digital Twin itself originated from NASA in 2010 and was designed for flying vehicles (Singh et al., 2021). Singh et al. (2021) also pointed out the benefits of using Digital Twin in different areas.

1. Acceleration of prototyping and product redesign as the Digital Twin allows exploration of a range of scenarios.
2. Economic benefit, since mostly virtual resources are used to create a Digital Twin.
3. Forecasting problems and planning the system in future states of the physical twin.
4. Optimization of solutions through several scenario options proposed by virtual twins.
5. Accessibility is due to the ability to manage and monitor a physical device remotely.
6. Consolidating documentation and communication around the Digital Twin in one place, such as data scattered across different software applications, databases, etc.

3. Digital Twin in the Public Sector and Other Fields

These benefits have already been proven in fields where the Digital Twin is actively used, namely, industry, smart cities, and smart healthcare. On these topics in recent years, numerous articles can be found in the literature. In the industrial sphere, Digital Twins are most popular in the field of Prognostics and Health Management, in smart cities in agriculture, urban transport, urban health management, and security, while in healthcare in personal health management and precision medicine (Yang et al., 2021).

At the same time, digital transformation is a necessity for public organisations, and although some government functions have made significant progress, the full potential of digital transformation remains untapped (Alvarenga et al., 2020). This is why the use of a Digital Twin approach in the Public Sector can be considered, and there are even concepts of using it to deal with bureaucracy, public policy, and optimization of financial data. Eom (2022) speaks about a Digital Twin bureaucracy, which is defined as a digital replica of a bureaucracy in the physical world that will control the physical bureaucracy through autonomous decision-making on matters of government affairs. Another article explores the integration of Digital Twin technologies into public policy-making, looking at a scenario for a public bike-sharing system. Its result highlights the benefits of the implication of Digital Twin simulation modeling to make intelligent public policy decisions (Hwang and Choi, 2023). It is important to emphasize that these two studies above were done for Sejong City in South Korea. Lynch, Issa, and Anumba 2023 discuss how a Financial Digital Twin (Figure 1) can be applied to Public Sector Capital Projects, integrating fund allocation, project execution, and rules-based knowledge management in real-time. This automation ensures compliance and optimizes the use of financial data throughout the asset lifecycle.

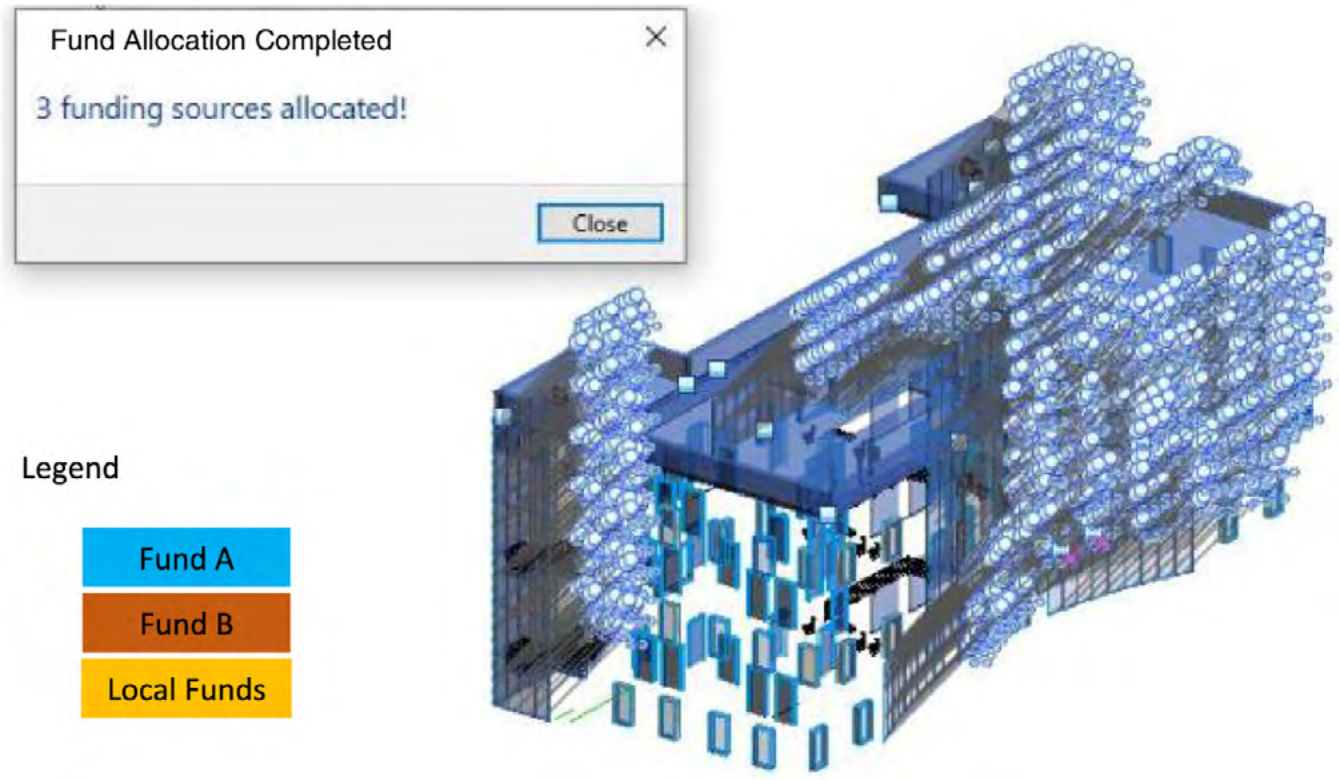


Figure 1. Sample output of prototype plug-in that is used to support funding distribution on an integrated BIM model.

Since there is still little practice on the use of Digital Twin in the Public Sector, we can identify numerous case studies from other fields that may be adapted for the Public Sector.

Kroger Co. and NVIDIA envision using the Store Digital Twin (figure 2) to optimize store efficiency and processes, such as simulating changes and their impacts, for example, removing cashiers and adding self-service lines (NVIDIA Newsroom, 2024).



Figure 2. Simulation of self-checkout and cashier-assisted checkout lines in Store Digital Twin.

Azure Digital Twins (Figure 3) offers the ability to optimize supply chain efficiency by providing real-time tracking, actionable insights, and flexible modeling (Eightify, 2023).



Figure 3. Global map of suppliers, manufacturers, transportation, warehouses, and retailers in Azure Digital Twin.

Twinzo launched a Digital Twin of smart offices (Figure 4) in buildings in London, Bratislava, and Budapest, which allows the client to monitor the movements of employees and visualize the occupancy of desks and rooms and data from the environment. In addition, security workers, in dangerous situations, such as during a fire alarm, can understand where workers are in the office for their evacuation (Twinzo, 2023).



Figure 4. A view of a floor of the smart offices Digital Twin demonstrating the reservation of a workspace in a specific room.

The Docklands area in Dublin, Ireland, has a Digital Twin smart city for citizen feedback, the 3D model of which can be published online for citizens, where they can provide feedback on planned changes in the city and can also interact with components to mark problems in their area. Such a Digital Twin will facilitate the dissemination of information and provide transparency to the public before decisions are put into practice (White et al., 2021).

As shown in Figure 5, features from each of these four case studies may be easily transferred into solutions of Digital Twin for the Public Sector.

Industry and smart city application		Possible features of a Digital Twin in the Public Sector	
Store Digital Twin (NVIDIA Newsroom 2024)	• Optimization of store efficiency and processes • Simulating changes and their impacts	**Calculation of employees in a public office**	• Simulation of an office and citizen traffic with different numbers of employees
Digital Twin of industry supply chain (Eightify 2023)	• Providing real-time tracking and valuable insights • Flexible modeling • Optimize supply chain	**Document tracking**	• Providing real-time tracking of documents
Digital Twin of smart office (Twinzo 2023)	• Monitoring the movement of employees • Visualization of table and rooms occupancy • Data from the environment • Help during emergency situation	**Public Office Digital Twin**	• Monitoring the movement of employees • Visualization of table and rooms occupancy • Data from the environment • Help during emergency situation
Digital Twin for citizen feedback (White et al. 2021)	• Providing citizens feedback • Mark problems in the urban area	**Citizen feedback on policy changes**	• Gathering feedback on policy changes

Figure 5. Possible features of the Digital Twin in the Public Sector by analogy with other areas.

As has been seen in several case studies, there are many opportunities that the Digital Twin can provide to the Public Sector, some of them are:

- accelerated prototyping and redesigning systems using the Digital Twin to explore several scenarios, for example, to create a new service in the Public Sector;
- optimization of Public Sector efficiency and processes in terms of all organizational resources: staffing (for example, monitoring the movement of employees); fiscal resources (for instance, controlling the movement and use of financial resources); facilities, equipment, and technology (such as the visualization of table and rooms occupancy or data from the environment, or even the help during an emergency); informational resources and materials (for example, consolidating documentation and communication in one place, providing real-time tracking of documents or even using of the Digital Twin bureaucracy concept);
- forecasting problems and system planning in future phases of the physical twin;
- Public Engagement, namely, gathering feedback on planned changes in the Public Sector, for example, to the policy.

4. The Role of Service Design for the Implementation of the Digital Twin in the Public Sector

The studies above confirm the possibility of using the Digital Twin in the Public Sector, but what is the role of the Service Designer in this process?

To answer this question, it is important to understand the context that the PhD research will focus on, namely the Italian Public Sector. Various studies highlight the inefficiency and dissatisfaction of citizens with public services. For example, one European study shows citizens' satisfaction with services such as electricity and postal services. The results show that satisfaction levels are lowest in Italy and highest in Denmark and Ireland (Ferrari and Manzi, 2014).
Another research demonstrates how many days were lost to bureaucracy in the G7 countries, and Italy has the highest average (Datta, Walker, and Amarilli, 2020). This study also shows that the complexity of the Italian population lies in the diversity of political views and traditions that exist in a democratic society. The authors emphasize that to make digital transformation effective, the Italian population must accept digital transformation.

In this context, Service Design, with its ability to face complexity and find a Human-centered approach, can be useful for creating flexible solutions. As Manzini affirms, a designer's role within social innovation initiatives might function as an expert, triggering and facilitating various design conversations (Manzini, 2015). Several governmental organizations are already interested in using Service Design methodologies for the Public Sector, such as Design Thinking and Co-design. For instance, the Design Thinking methodology has helped some public managers explore new policy development methods (Mortati, Schmidt, and Mullagh, 2022). The introduction of Design Thinking and Service Design methodologies into Italian public administration through digital services was done in the Italia Login project. The collaborative and open-source models present an opportunity to reconsider public service communication in a context that encourages sharing between public managers and designers for public benefit (Sinni, 2017).

Despite these few practices of using Service Design in the Public Sector, there is no Service Design literature yet on the integration of the Digital Twin in this area. Therefore, it is important to plan future research on this topic.

5. PhD Research

The PhD research (Figure 6) is devoted to the integration of the Digital Twin into the Italian Public Sector. In order to comprehend and face these challenges, the study will address the following questions.

1. What uses can a Digital Twin have in the Public Sector?
2. How can Service Design adapt Digital Twin technology to meet stakeholder (state employees and citizens) needs in the Public Sector?
3. How can Service Design make information from a Digital Twin accessible and personalized to stakeholders in this context?

Based on the identified applications and design opportunities, the research project aims to understand how to effectively integrate the Digital Twin into the Public Sector while taking into account the needs of stakeholders. The specific objectives of the research are to:

1. identify trends and cases of using Digital Twin in the Public sector;
2. understand the dynamics of one Italian public service that can be improved by applying Digital Twin; namely, determine the characteristics and problems of this service, taking into consideration different types of citizens and state employees involved in this service; develop a

prototype of interfaces for selected public service with the Digital Twin and create guidelines for Service Designers on applying Digital Twin in this context.

The research plan consists of three main phases, which will employ various tools and methods typical to Service Design.

1. Preliminary research through Literature review, Case studies, and Field research resulted in the mapping of case studies from Italy and from abroad.
2. Ethnographic research through the creation and application of an ethnographic toolkit, followed by a report of summarized findings with different Service design tools (Personas, Journey Map, etc).
3. The experiment phase with prototyping and testing Digital Twin interfaces leads to the creation of guidelines for Service Designers on applying Digital Twin in the Public Sector.

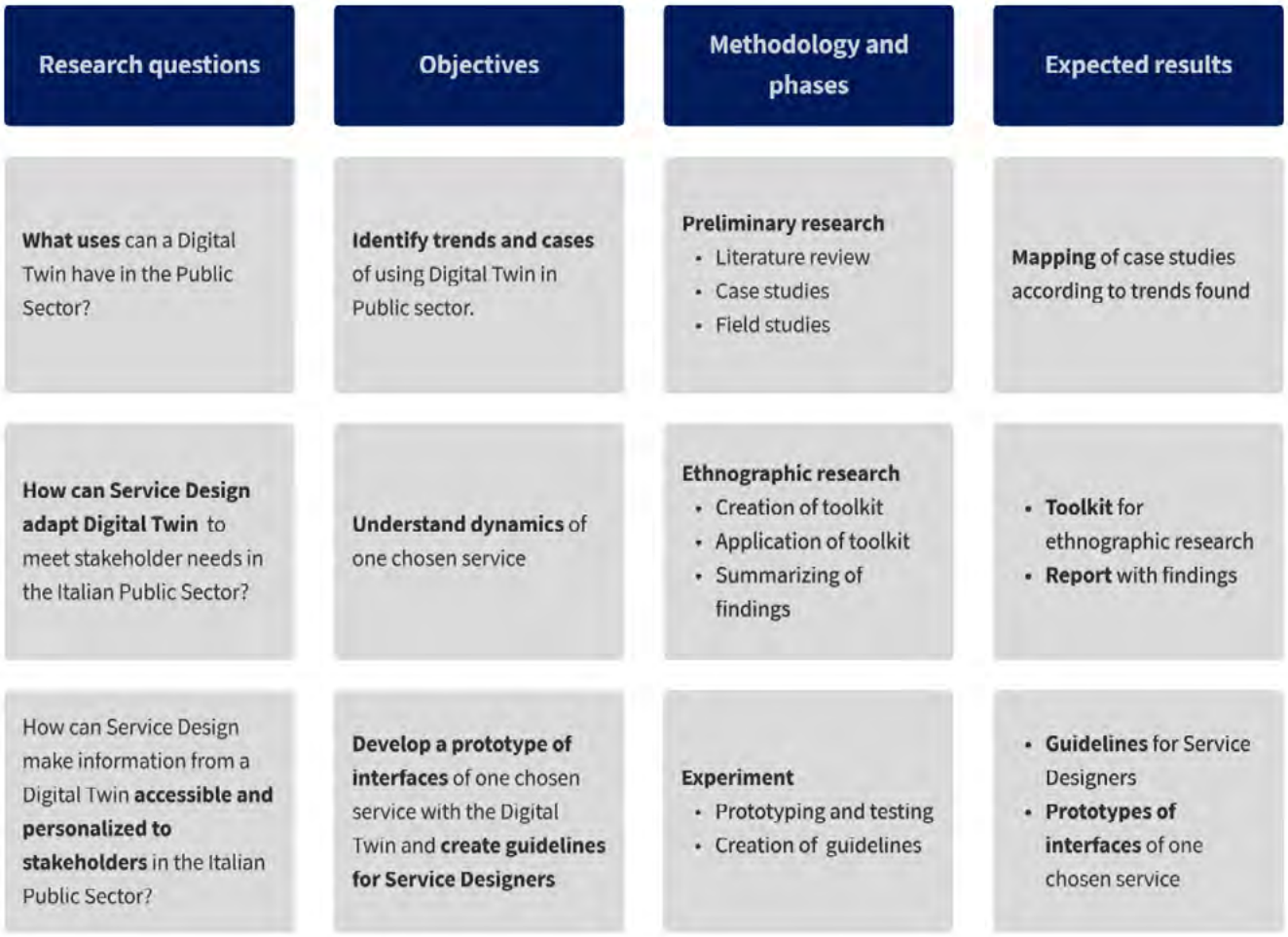


Figure 6. PhD research.

6. Conclusion

This article, through an initial Literature review and Case studies, identified possible applications of the Digital Twin in the Public Sector. The role of the Service Designer in this process can be defined as an expert who thinks through the experience of stakeholders based on their needs and improves the interactions between them and technologies. The research has already shown that the Digital Twin approach in the Public Sector can bring economic benefits due to the use of mostly virtual resources, time benefits through faster prototyping or redesign, transparency, and quality thanks to Public Engagement.

The future research and the PhD research proposal can cover the following questions. How can the Digital Twin be integrated in the context of the Italian Public Sector? What challenges could there be in integrating the Digital Twin into the Public Sector, including ethical, legal, social, and technological challenges?

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P/REFERENCES OF DESIGN

DESIGN FOR THE ENHANCEMENT OF THE AGRIFOOD SUPPLY CHAIN. TOWARDS THE TRANSFORMATION OF CEREAL WASTE INTO A COMPETITIVE INDUSTRIAL PRODUCT.

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KEYWORDS | OUTPUT-INPUT SYNERGY, WASTE ENHANCEMENT PROCESSES, INTERSECTION OF SUPPLY CHAINS, SYSTEMIC AND REGENERATIVE DESIGN, INDUSTRIAL SYMBIOSIS

ABSTRACT | Investigating the food system towards goals of stability and sustainability, the research aims to explore – through the specificities of the systemic design approach, able to jointly consider multiple and different information, actors, and strategies – the possibilities and development potential of agro-food waste regeneration processes in a logic of co-evolution (Fassio & Tecco, 2022) oriented towards the development of industrial constructive and restorative solutions, able to influence the environmental, economic and social dimension (Antonelli & Tannir, 2019) of the supply chain on which it works.

Intending to increase the enhancement of the agri-food chain and reduce environmental impacts, the research proposes a qualitative investigation in the field of the transformation of industrial cereal waste into competitive industrial products within which the different design approaches – related to experiments with the matter, Material Design; to technologies and methods for the design of products, Product Design; and to the optimisation and transformation of production processes, Process Design – can synergistically and strategically collaborate through the use of the systemic design approach.

Through systematising the literature and analysing case studies, the research investigates the characteristics of agro-food waste, the reuse processes, and the companies/start-ups that process them. A series of representative and interpretative diagrams will clarify tools, methods, and practices, enriching the research contribution. The emerging solicitations will induce a phase of direct and indirect experimentation with specific research centers and production contexts whose socio-environmental impact on the territory will be assessed.

The final goal of the research is to enhance agro-food waste into a competitive industrial product realised through hybrid innovation practices. Among these, industrial symbiosis processes between companies in the same agrifood chain are critical.

The theorization and prefiguration of industrial symbiosis between different production supply chains represent a further departure from originality.

The possible merger between the identified cereal supply chain and other Italian production chains with a high environmental impact is proposed both as one of the challenging goals of the research and as a prospect of originality.

1. Foreword: Food System and Ecological Transition

Taking as the premise of the research the complexity of the food system – evident in issues such as the fragmentation of relations between supply chains, partially interconnected with each other, the extension of the scope of action able to act on a local and/or global scale (Pauli, 2017) – embedded in a condition made critical by the effects of climate change and the uncontrolled exploitation of environmental resources (Peppoloni & Di Capua, 2022), the research investigated the socio-cultural context and design practices to contribute to the enhancement of the agri-food supply chain through the reuse of its waste.

Food, indeed, as a mediator of human relations able to involve the individual, the community, and governance, takes on in this context the features of strategic, transdisciplinary, and multifocal projecting areas (Descola, 2005), explorable at many levels, from the socio-political to the economic to the environmental.
In each of these, waste plays a role as a characterising part of the production, transformation, and consumption processes.

Various International Institutions have discussed the peculiarities, potential, and extension of projects related to food and, more generally, the agro-food supply chain.
European Commission (EU) with the Farm to Fork strategy (European Commission, 2020; European Commission, 2021) contained within the broader Green Deal; United Nations (UN) with the 17 Sustainable Development Goals SDGs (Agenda 2030, 2021; European Commission, 2017) of the 2030 Agenda; and Food and Agriculture Organisation (FAO) with the Urban Food Agenda (Marino et al, 2020 p.10; FAO, 2019) have promoted projects and programmes that have also highlighted the potential generated by the reuse of agro-food waste (European Commission, 2017).

The Italian Department for Cohesion Policies, with suggestions, guidelines, and regulations on the Bioeconomy, has also converged along these lines.
Some of the proposed strategies suggested strengthening the sustainable production of waste and its conversion into industrial products through integration between sectors, systems, actors, and institutions (Agenzia per la Coesione Territoriale, 2016) by promoting industrial symbiosis interventions (European Commission, 2022), therefore promoting the merging of two or more industrial sectors.
Industrial symbiosis has been a resource-use optimization strategy involving industries to generate competitive benefits for companies through different approaches, including transferring resources, such as matter, energy, space, technology, skills, etc. (Renner, 1947; Chertow, 2007).

From the point of view of design, the approach that most relates to industrial symbiosis is systemic design. In this context, the area investigated is that of micro-small companies (MPI), which, in addition to being a constitutive element of the Italian production system, are also characterised by flexibility and adaptation to changes and innovations (Barbero, 2016).

The systemic approach, condensed in Table 1 (below), makes it possible to interpret the relationship between territory and community by enabling the development of design actions that favour the triggering of sustainable enhancement processes of local resources (Gaiardo et al., 2022) or to act as a mediator by stimulating the meeting between different knowledge and expertise to promote contamination, participation, and collaboration between them; or to use data as raw material to create new forms of value that push design to understand the context and take on the role of activator of experiences (RIBA and ARUP, 2013).

Table 1. Interpretative diagram of design action through the systemic approach.

DESIGN ROLE	ACTION	GOALS
Interpreter	Projects between Territory and Community	It **Triggers** Processes of Enhancing Local Resource
Mediator	Encounter between Knowledge	It **Promotes** Contamination, Participation and Collaboration
Enabler	Data as Raw Material	It **Understands** the Framework and Proposes Experience

Design actions within the agrifood supply chain interpret and adapt the specificities of the systemic approach to the context, the company, and the reference actors.
In this context, systemic action promotes interventions able to take into account the causal relationships between the actors and the feedback flows between the elements of the supply chain, operating syntheses of the interactions emerged from the mapping of systems (Acaroglu, 2017), which offer possibilities for design actions (Figure 1).

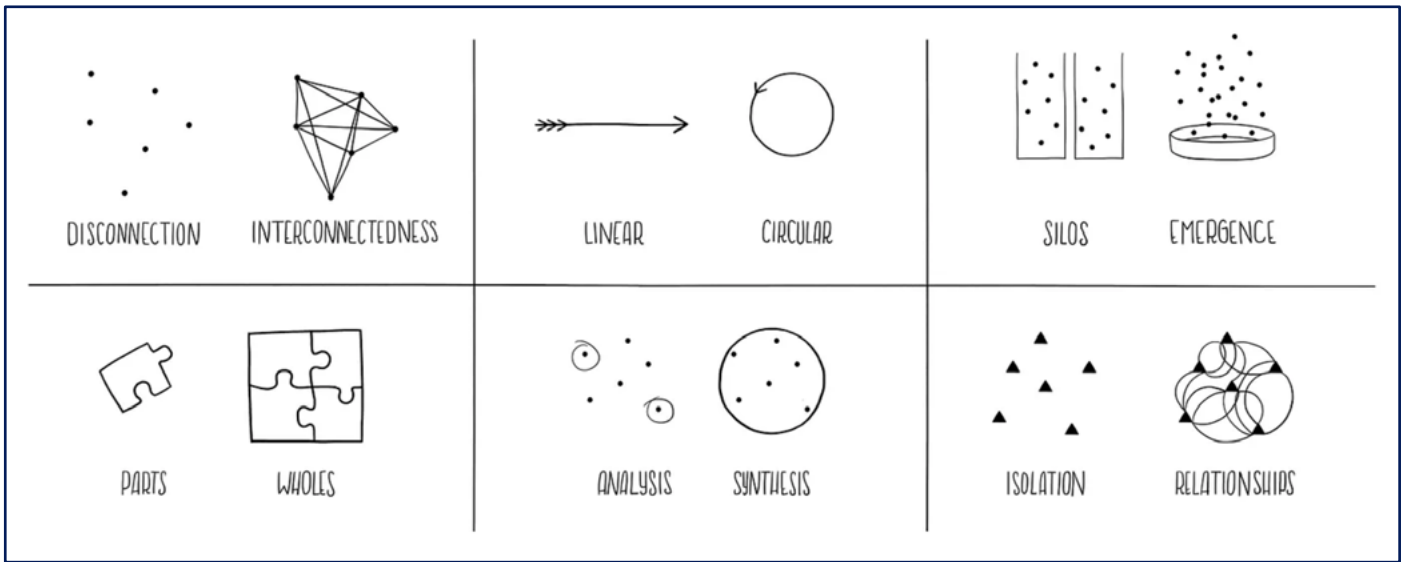


Figure 1. Interpretative diagram of design action through the systems approach. Credits: Segal, E. (Illustrator). (2017, 7 September). Tools of a system thinker [digital image]. Extract from https://medium.com/disruptive-design/tools-for-systems-thinkers-the-6-fundamental-concepts-of-systems-thinking-379cdac3dc6a .

Within the industrial sphere, a field investigated explicitly by the research, these characteristics can be declined on the analysis of industrial processes aimed at their optimisation (Jones, 2014), on the verification of input-output processes to limit waste and reduce environmental impacts (Bistagnino, 2012; Meadows, 2008), or on the reuse of production waste to operate in open and collaborative systems (Capra and Luisi, 2014).

The research proposes scenarios for the enhancement of the agrifood supply chain identified through the study of the transformation of the industrial waste it produces, the analysis of the potential and development limits of waste enhancement processes, the testing of stakeholders and their synergies, and

the identification of supply chains to be enhanced in a logic of environmental and economic co-evolution. Research also includes the reuse of waste within Life Cycle Assessments (LCA) to reduce the environmental impact of the supply chain (Vinci, 2022) and, in parallel, promote open supply chain strategies (Bertalanffy, 1968).

2. Field and Goals: Waste as a Resource

The triggering of transformative waste processes creates the conditions for configuring competitive and bio-based industrial products to enhance the agro-food chain.
In pursuing this goal, the research uses a systemic analysis of agro-food waste, critically ordered through parameters, categories, and qualitative and quantitative characteristics, to identify the supply chain to work on.
The analysis of the present condition makes it possible to identify the cereal chain as the one on which to work at an experimental level thanks to the physical characteristics of the waste due to the reduced environmental impact of the transformation processes and the possibilities of maximizing enhancement actions, overcoming what usually happens.
To date, cereal waste, the result of industrial processes, if disposed of, increases environmental pollution and generates only a minimal contribution to the supply chain if transformed into animal feed.

By implementing processes for the regeneration of industrial cereal waste into industrial products through adopting traditional and local transformation processes, the experimental phase proposes the prefiguration of scenarios to enhance the supply chain.
Operating at a local level, with low environmental impact transformation strategies and waste regeneration projects, it acts within open supply chains to generate a high economic impact and increase the value of the companies involved, the supply chain, and the territory.

3. Methodology: The Systemic Approach to Waste Enhancement

Taking as its basis the necessity to adopt a trans-disciplinary and interdisciplinary approach to the contemporary context, the research moves by examining socioeconomic, governance, and environmental conditions, investigating scientific studies and territorial inclusive policies, and exploring, through the methodology of systemic design, areas of action and design practices.

In the first phase of the explorative research, in which the activities of literature review and selection of case studies, sometimes consequential and sometimes parallel, allow us to understand the state of the art and define the field of investigation, a second interpretative phase is inserted through which we proceed to the critical reading of the case studies and to the individuation of the supply chain on which to carry out the subsequent experimental phase, still partially being defined.

3.1 Explorative and Interpretative Phase: From Literature Review to Database Construction

The literature review was based on investigating four research fields: social sciences, international politics, industrial symbiosis processes, and systemic design. The literature review made it possible to identify concepts, trends, and strategies for each and relate them as part of a system (Figure 2).

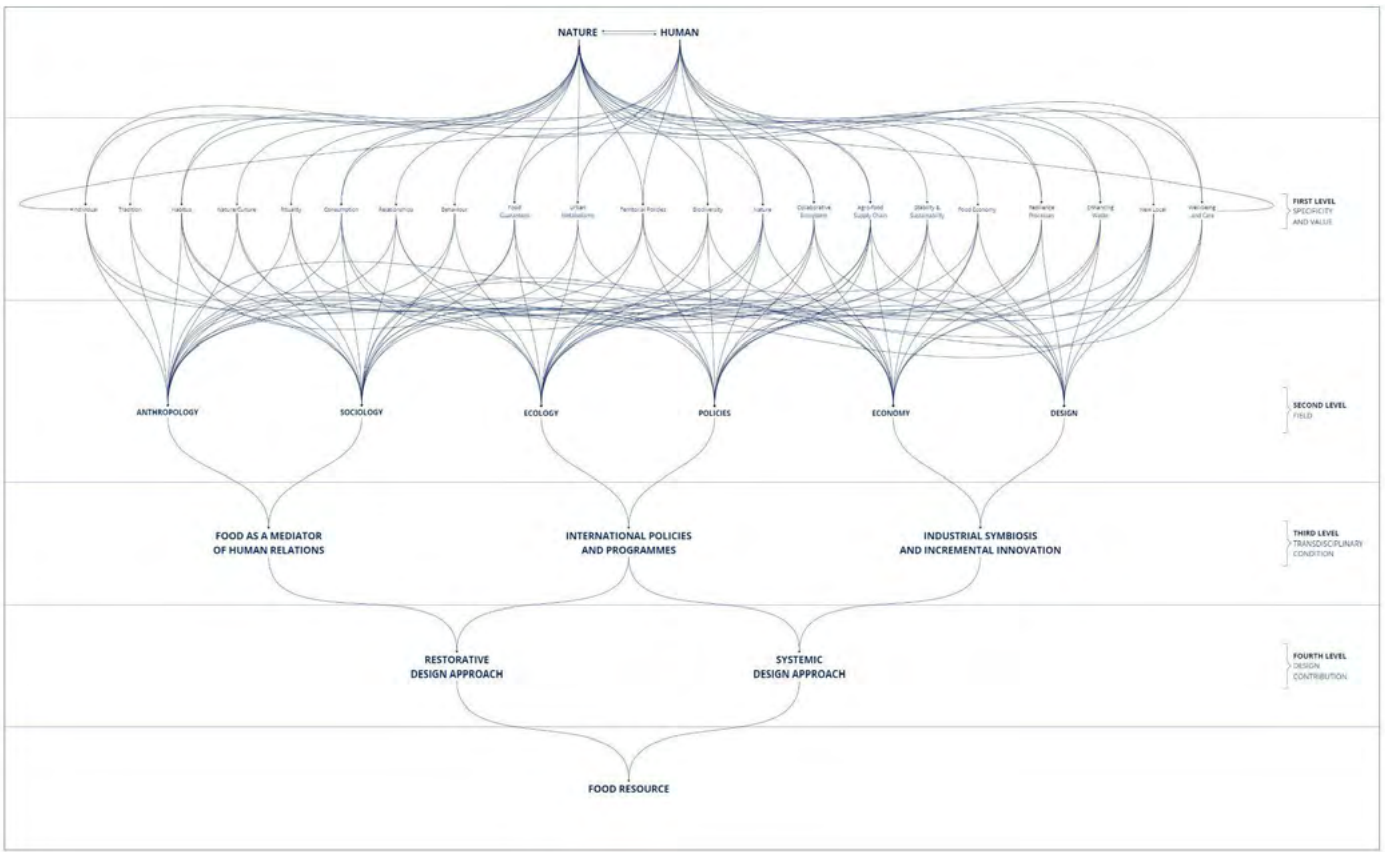


Figure 2. Interpretative diagram showing the existing correlations within the reference literature. Credits: Francesca Ambrogio.

The setting up of a qualitative database defined and systematised the research framework within the real context.
An early survey collected 128 case studies found through desk research that could be clustered into surplus recovery processes, participative guarantee forms, and waste reuse processes.
The focus on waste reuse processes reduced the selection to 43. The cases were then cross-referenced with the reference literature and with what emerged during the previous analyses.
For each case, the qualitative characteristics of waste, its processability, the possible transformation processes, and the interlocutors were then noted.

The selection of the case studies was finalized by organising a database (LINK[1]) composed of four parts, defined according to specific parameters that emerged from the literature review and case study research.

Given the goal of the research, aimed at the enhancement of the agro-food supply chain, the creation of the database served to draw up a mapping of the waste transformation processes on the Italian territory to understand the approaches that generated the origin of these processes and how they work; and to identify the actors of possible technology transfer that can be activated within the agro-food supply chain or between different supply chains.

A critical interpretation of the database made it possible to identify the sustainability level of waste transformation processes and final products to understand what forms of relations and what network formalizations exist among supply chains and actors, to understand how waste transformation methods are influenced by their qualitative characteristics; to map out the general motivations that push towards the definition of agro-food waste reuse processes, the specific motivations that concern the reuse of waste within the supply chain that generated the waste as well as those that concern transformation processes aimed at other supply chains.

3.2 Experimental Phase: Towards Reuse Scenarios

Once the supply chain to carry out the experimentation has been identified, the research includes an interview, verification, and field test phase. Interviews will be conducted in selected companies to verify their production processes and the consequent waste generation.
These will be succeeded by interviews in research laboratories aimed at understanding the properties of the waste and the reusable processes that can be adopted.

Subsequently, a dialogue will be established with product designers to identify design possibilities and solutions based on the chemical, physical, and aesthetic characteristics of the material.

Further in-company discussion and verification with experts in the specific field will support and promote the effective prefiguration of reuse design scenarios. The verification phase of the results will bring to the definition of the industrial process for the reuse of waste, the environmental and economic impact of which can be measured, and the open supply chain LCA verified.

4. Conclusion

The approach promoted by systemic design applied to the verification of industrial input-output processes of the agro-food chain to contain waste and reduce environmental impacts encourages the development of an overall supply chain enhancement strategy.

The enhancement of waste derived from agro-food industrial production transformed into input for another production process can also be compared with other production supply chains by promoting new relations between actors towards developing products with a low environmental impact.

4.1. Deliverables and Impact of the Research

The research gives the scientific and professional community the reconstruction of the theoretical framework related to the identified topic, integrated through the construction of representative and interpretative diagrams.

In the explorative and interpretative phases, the research produces a database focused on agro-food waste, which can be interrogated and implemented as a source and tool for further research and projects.

The database supports the work of design researchers, who can find aggregated qualitative information on materials, production processes, and products. It broadens the choice of materials usually used by designers, who, by interrogating the database, can identify bio-based alternatives to materials of extractive origin.

In the experimental phase, it prefigures scenarios of socio-economic enhancement of the food supply chain in a process shared between researchers and companies.
Through the study and in-depth study of waste processing and transformation processes, the company virtuously uses waste for the industrial production of products with a low environmental impact.

Notes

1. The database, being a tool and a source for research, is currently only in visualisation and in Italian. The use of the Italian language was oriented by the wish to also use this database to interact with local actors and local situations with whom it would not have been possible to use an English language tool.

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DESIGN STRATEGIES FOR THE COMMUNICATION OF MEDICINE AND HEALTH PROMOTION IN SCIENCE MUSEUMS.

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KEYWORDS | SCIENCE EXHIBIT, HUMAN BODY, MEDICINE, HEALTH DATAFICATION, SCIENCE MUSEUM

ABSTRACT | The doctoral research presented in this paper explores the relationship between design and scientific communication in medicine and health museums. In particular, the thesis aims to define methods, principles, and scenarios useful for the design of scientific exhibits that display visitor information by redefining the human body metaphors. The challenges of contemporary society include the need to facilitate access to the latest results of medical research for an ever-wider public to contrast the growing phenomenon of disinformation about these topics. Medical sciences are exhibited in science museums concerning medicine, health, and hygiene and science centres using different exhibition strategies. Generally, designers and curators work simultaneously to design exhibitions and exhibits, but in this context, there emerges a lack of involvement of designer profiles in the visitor experience design and also a loss of appropriation of these issues by the discipline. It was necessary to complement the design literature review – that is particularly limited – with the analysis of the wider literature in the sectors of museography, museology, scientific communication, and public health. The review was supported by visits to European museums that revealed a panorama where visitor involvement by exploring their data increases engagement. In this way, users feel more involved even but sometimes this is at the expense of awareness. A mapping of usable data was returned. It brings out problematic design aspects and new design scenarios for health datafication. To reconsider these themes considering scientific and technological development is both necessary and urgent because design has an increasingly important function to interpreting and transferring scientific knowledge to society by creating engaging, inclusive, and exciting experiences. In this regard, the doctoral thesis intends to provide the groundwork for reflecting on science exhibits and exhibitions that incorporate visitor data inside the design discipline to stimulate reconsideration of the relationship between designers and science and technology museums reciprocally and innovatively. This is considered necessary to get the design back on body and interaction issues in these contexts.

1. Scientific Background and Purpose

The doctoral thesis presented in this contribution investigates the relationship between design, scientific communication, and the museum to understand the contribution of design in health science museums. Specifically, it examines the exhibition of the human body and medical sciences in science and technology museums (UNESCO/STC/Q/853, 1984) based on an analysis of the contemporary exhibition scenario. The need to promote knowledge of these themes to an ever-widening public in a manner appropriate to the contemporary techno-scientific scene is recognised as a founding mission of these institutions that responds to an emerging need in contemporary society. In fact, in a 2021 report on the economic and social impacts of health systems, the World Health Organisation reported that a population consciously educated on health-related issues has access to considerable social and economic benefits (WHO, 2021). Recently, however, the COVID-19 pandemic has highlighted a problem of public misinformation about medical prevention because people are frequently unable to distinguish between credible sources and fake news (Sala & Scaglioni 2020). Therefore, the function played by museums that illustrates scientific methods and progress by narrating and exploring knowledge and offering a dynamic perspective to the dissemination and production of knowledge is becoming increasingly important. However, the surveys on the number of visitors to Italian museums (ISTAT, 2020; 2022) show how museum institutions still address only a small part of society even though they act as an engine for the construction of cultural identity. Science museums must, therefore, reach out to the public distant from scientific culture by translating and making medical-scientific phenomena and principles more accessible. This change involves several disciplines associated with museological and museographic management and design. These include the designer as a strategic actor in designing the cultural experience inside and outside the museum using exhibitions, visitor paths, installations, and interactive exhibits. Currently, medical sciences and the human body are displayed in their everyday functions using virtual and augmented reality, 3D animations, and interactive and hands-on models by linking medical-scientific knowledge to social and cultural sources of care and support, with focus on the stories of people and the ethical-behavioural sphere of individuals.

In the last few decades, the development of advanced medical imaging techniques and processes, nanotechnologies, biosensors, and telematic and digital communication technologies have made possible a very advanced level of acquisition, transmission, and representation of the human body. Body digitalisation also profoundly changes the relationship of individuals with their bodies because it transforms the way we perceive, manage, and communicate health through new models, technologies, and metaphors. In the history of medical museology, technoscientific innovations in medicine have often driven the development of new ways of displaying the body (Canadelli, 2011).

In connection with the foregoing and the multiple intentions of science museums, the importance of interpreting medical sciences to inform audiences about health promotion is evident (Batterham et al. 2016; Christensen et al. 2014). However, even today, many people are critical about learning in modern science centres and science museums and often classify them as exclusively playful contexts. Concerning the correct design of interactive exhibits, several contributions have informed the discussion in science museology since the 1980s (Merzagora & Rodari, 2007). These papers cannot be found in the research in design but in the other disciplines involved in museums. This suggests that museums while using design science in different ways, do not directly and consciously involve the figure of the designer. Moreover, the inappropriate and sometimes missing status of these disciplines in the statutes and regulations of museums and museum associations show that they are not institutionally recognised (Celi et al., 2013). The relationship between design and museums should be even more evident in science museums, which, by their specific identity, are responsible for connecting scientific-technological advances with society in which design plays a strategic role. Design and science are related in many ways. They are two mutually intersecting and co-evolving units, and design is often used to interpret and communicate concepts effectively to science (Langella, 2019). There is, therefore, an urgent need to investigate the contemporary museum context to understand which practices we are moving towards. The research topic, therefore, is located at the intersection between fields of investigation that in recent decades have been attracting increasing interest from various international scientific communities, such as health promotion, digital

technologies for modelling and representing the body, digital health, exhibit design, interaction design and design for the communication of science. The doctoral research was developed starting from a series of theoretical-methodological and applicative questions: in contemporary society, what are the most effective semantic, metaphorical, and linguistic codes for representing the human body? How does the use of electronic and digital technologies influence the exhibition of the human body and medicine? How can design contribute to the dissemination of medical science and health promotion in science museums? What are the relationships between design and other disciplines in science museums, and what role does it play? What is the role of design in designing experiences involving scientific phenomena and principles related to health and medicine? How can scientific phenomena and principles relating to health and medicine be translated and made more understandable and accessible?

2. Design Strategies for Health Promotion and Medical Sciences: Showing Visitor's Data

The doctoral research explores, therefore, the present scenario of museums covering the topics of the body, public health, and medical progress using a multitude of practices and representations of the human body. The aim is to reduce the distances between scientific and design areas by converging them in the design of interactive exhibits. To achieve this, it is necessary to start with the establishment of scientific literature that is currently severely lacking in the design area. The lack of contributions in design made it necessary to define broader selection criteria than the design domain by including articles from other areas such as public health, health education, museology and scientific museology, history of medicine and history of science, communication of science and science education, information and communication technologies, medicine, social sciences, psychology of perception and learning, media studies and design. The literature review shows that in museums aimed at the general audience, such as health exhibitions, technologies are currently used to make visitors aware to engage and discover themselves. There is a trend towards the use of devices that gather data from the visitor's body to induce them to think about their body and its functions in everyday life contexts to influence correct lifestyles and good behaviour (Garneau & Hostetler, 2010; Canadelli, 2011; Saab et al., 2013; Rivera-Gutierrez et al. 2014; Sandholdt & Achiam, 2018; Bønnelycke, Sandholdt & Jespersen, 2018; Lykke, Skov & Jantzen, 2021). Evaluation studies show its opportunities and limitations, especially about learning in informal settings and health promotion. Contextualising the visitor's data and information in a personal everyday or pathological life scenario promotes learning and reflection. The design essays highlight the interdisciplinary nature of these issues and the close relationship between design and science. Their limited number, combined with their geographical concentration, shows that design has not yet appropriated adequately, in theoretical terms, the design of scientific exhibitions and exhibits on the body, medicine, and health. This does not allow for an appropriate assessment of the involvement of designers in practice.

For this reason, the analysis of the state of the art is complemented by the investigation of exhibitions and museums on site. Therefore, a mapping of the exhibition strategies and technologies used, the approaches used to exhibit, and the relationships museum institutions establish with the scientific community is proposed. This study was carried out by identifying the main European science centres and science museums. From these, eight museum facilities were selected in Europe in the geographical areas that have historically played a primary role in medicine and medical museology – Italy, the United Kingdom, the Netherlands, and Germany. In this way, more traditional institutions dealing with the body and medicine were intercepted in the same areas.

The analysis focused on exhibition practices that display personal data and information related to the visitor's body, identity, and health that are captured in real-time with digital or analogue techniques. Visitors, therefore, can observe, monitor, measure, and listen to themselves through the exhibits to acquire new knowledge and reflect on sensitive issues such as health. From being more or less passive users of communication, depending on the context, bodies become subjects of representation themselves. Sometimes, the information is collected for scientific purposes, contributing to the progress of research and experimenting with novel practices of health datafication (Ruckenstein & Dow Schu, 2017).

In this regard, case study analysis and confrontation provided the starting point for the doctoral research and set the stage for a critical reading of the transition as to how the exhibited body is the visitor's body and opens up reflection on not only technological but also cultural and ethical issues. The systematisation of these aspects supported the definition of strategic directions for the design of exhibits displaying the body of visitors for the dissemination of medical science and health promotion in museums in three categories: methods and tools, design principles, and possible scenarios. The result is a detailed mapping of the exhibition possibilities in terms of data and detectable information, opening up reflection on ethical issues regarding the management and use of data within the museum. It revealed a few critical aspects concerning scientificity, the relationship to the visitor's path, and the way of interaction. It highlighted a strong standardisation of exhibits, which has been intercepted in the literature as a tradition in these contexts. New exhibition opportunities have also emerged from exhibits and exhibitions designed in collaboration with companies and research centres that open the way to new project scenarios in which the exhibit is conceived as a tool for research, diagnosis, meeting with society and the scientific community, and creating new experiences. In the panorama of scientific museology, the actors involved converge in affirming that for the construction of the Museum of the Third Millennium, it is necessary to reach new audiences and be more inclusive not only in terms of physical and social accessibility but also to create an open and collaborative multidisciplinary community. Bron, Leroy, and Merzagora (2018) describe a vision in which science museums can and should take on the role of knowledge production devices, as well as communication or public engagement devices, through initiatives useful for specific aspects of academic, industrial, or citizen-driven research. In this sense, the possible scenarios identified involve exhibits that go "outside the museum" to involve people; exhibits that collect data from visitors contributing to research - providing a large and heterogeneous sample; exhibits that involve visitors in a citizen science perspective; exhibits that incorporate medical diagnostic tools - as user interfaces to explore notions and concepts or as actual diagnostic tools; exhibits that promote prevention and health promotion actions in collaboration with medical departments; exhibits that collect data to create new content in a generative way; exhibits that use personal or museum wearable devices to simplify data creation and management. According to the proposed scenarios, it is considered essential to consider exhibition design strategically to make the place of the visiting and learning experience, in its configurational aspects and interactive components, a tool not only for communication but also for investigation.

In this view, design has an interpretative role and is responsible for translating scientific information and curatorial vision to audiences, providing technical and communication skills to engage visitors in the exhibit and exhibition experience. The relationships between design, medical sciences, and scientific museology also reveal new scenarios and opportunities in terms of new occupations in which it can be difficult to distinguish the boundaries of intervention and expertise to which we have been used. To make design consciously and widely appropriate to this area and to increase professional possibilities in both qualitative and quantitative terms, design schools need to approach this challenge proactively by offering students appropriate and ad hoc training courses that enable them to effectively integrate scientific understanding and interpretation into their projects.

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P/REFERENCES OF DESIGN

CHRONO-DISRUPTION: ANARCHAFEMINIST (GAME) DESIGN FOR SOCIAL INNOVATION.

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KEYWORDS | DESIGN FOR SOCIAL INNOVATION, ANARCHAFEMINISM, TEMPORALITY, GAME DESIGN

ABSTRACT | In discussions of social change, the temporal dimension often remains a silent observer, flattened by a singular focus on future outcomes that bypasses a richer canvas for designing and enacting impactful innovations.

With this short theoretical reflection, I want to underscore the pivotal role of time (and its disruption) in Design for Social Innovation (DSI), critiquing its prevalent forward-gazing narrative deeply entrenched in a linear model of progress aligned with neoliberal and colonial imaginaries. And yet, at the same time, radical critiques, while effective in challenging dominant discourses and deconstructing current social hegemonies, keep the analysis anchored in the past, creating a space-and-time stalemate of inaction.

Amidst this seemly irreconcilable temporal tension between the futurist-futuring projection of DSI and the over-backward gaze of critique, I found anarchafeminist perspectives as crucial and long overdue alter-narratives of change. On the one hand, the anarchist component, by advocating for the immediate enactment of future ideals (prefiguration) and repurposing of past elements for contemporary use (constitutionalising), seeks to collapse traditional temporal boundaries in the here-and-now. On the other hand, the contemporary feminist and queer calls to engage with the 'queer time' of performativity and 'stay with the trouble' invites us to reimagine social innovations within novel fluid temporal dimensions and, still, grounded into actionable presents.

Central to this anarchafeminist exploration of DSI theory, which harmonizes the lessons of the past, the urgencies of the present, and the possibilities of the future, is, therefore, the quest for coherent methodological orientations. In this sense, I conclude by advancing the application of games and play as time warp machines, enabling explorations and performances of social change not as a distant ideal or a static critique but as a lived reality co-created in the spirit of anarchafeminist play.

1. Premise: from Research to (Design) Practice to Theory Again

This theoretical reflection is part of a broader exploration of grassroots social innovations through a playful design approach, which evolved almost ‘organically’ during my ongoing PhD research into London’s housing precarity.

The critical quest for a term overcoming the ideologically constructed notion of "housing crisis" (White & Nandedkar, 2021; Klein, 2007) led me to 'precarity,' highlighting the political nature of injustice (Waite, 2009) and gender’s overlooked aspect. This political, feminist, and queer perspective guided my inquiry, with Butler's work on precariousness and vulnerability (2004, 2010; Butler et al., 2016) providing a theoretical anchor on the potential of shared conditions of vulnerable uncertainty to unite radical and care-based struggles.

I realized that design for social innovation (DSI), particularly in reclaiming its original subversive and grassroots discourse (Godin, 2012; Srinivas, 2023), could have benefited from inhabiting the uncertain condition of precarity-vulnerability (Zechner &Cobo-Guevara, 2017) to disrupt its 'business-as-usual' and reorient actions and strategies for social change—not just to design a social change that reacts to disruption but rather one that acts through disruption.

This exploration first led me to reflect on my role as a researcher critically. I realized that the traditional academic path to participatory research is too often driven by philanthropic 'good' intentions (Volpi et al., 2024), which unintentionally perpetuated saviour dynamics and corporate-like efficiencies at the expense of genuine horizontal collaboration. As a result, I adopted the explicit feminist, situated, and autoethnographic 'I' (Young, 1997), stepping back from the expert's podium with my design co-participants (and therefore refusing on these pages the impersonal ‘objective’ voice too), to embrace the vulnerable role of the 'unsure,' —one that I had always tried to conceal in my migrant/gendered academic position where I thought I needed to hide any fragility that could call my rational 'authority' into question.

The deliberate shift towards embracing 'disruption' as a research compass revealed many unquestioned academic practices of embedded epistemic injustice, not only in language but also in methods and timelines that I, as a researcher, was perpetuating. How could I promote new forms of discontinuity instead of reproducing them? I started undoing the 'participatory' design plans I unilaterally made to reconceive a collective methodology with more uncertain, voluntary, and relational dynamics. Surprisingly, this 'ineffective' ongoing turn became a strength rather than a limitation—a change in perspective resonating with the ludic principle of "meaningful inefficiencies": players are given goals and face unnecessary obstacles, and it is precisely those unnecessary obstacles that make their game’s efforts meaningful (Gordon & Walter, 2019).

This approach necessitated reconsidering temporal dynamics, too, for a more fluid, co-created process. "As academics, we knew that our lives were structured by time as a vector of power, from minutiae, such as class schedules, through annual reviews and milestones, such as merit steps and promotions, through the larger temporal systems that govern invisibly, which Michel Foucault ([1975] 1995) understood as the heart of discipline and which one of us calls ‘chrononormativity’ (Freeman 2010)" (Samuels & Freeman 2021, p. 245). Navigating temporal tensions was not just about rethinking how time could be managed in a caring manner, shielding my co-researchers from academic pressure to unambiguously ‘manage and finalise’ the project, but about reimagining ambiguous time altogether.

Ludic principles permeated our collaboration and evolved into playful projects and then methodologically oriented tools. This enabled us to use time as a canvas for creative exploration of alternative forms of social change and temporal experience. Through this approach, we created spaces to envision future societies, reflect on and revise the past, and deeply engage with the complexities of the present in a participatory manner. This new form of social innovation, rooted in the manipulation of time, allows for a radical and inherent transformation in participatory processes underpinned by anarchafeminist principles.

But an anarchafeminist praxis means not just bringing theory into practice but 'dragging' the personal and practical into the theoretical again. "The personal is theoretical. Theory itself is often assumed to be abstract: something is more theoretical, the more abstract it is, the more it is abstracted from everyday life. To abstract is to drag away, detach, pull away, or divert. We might then have to drag theory back, to bring theory back to life" (Ahmed, 2017, p. 9-10).

This short contribution aims, therefore, to open up a discussion in DSI theory and engage with time more deeply.

2. Time and Change: All About the Future

Time is increasingly recognized as a fundamental concept in social sciences, and disability and queer studies (Samuels & Freeman, 2021; Freeman, 2010; Muñoz, 2009) are particularly emphasizing its crucial role in transcending normative and colonial biases to liberate the collective imagination.

> "Just as the foundational works of queer theory revealed that gender, sexuality, and race/ethnicity are not natural or inevitable but social and conventional—and hence ethical and political—these time-(dis)oriented works of queer theory demonstrate that even seemingly commonsensical categories such as past, present, and future are no less culturally constructed and no less intimately bound up with the (il)logics of desire and power" (Moore et al., 2018, p.3).

And yet, temporal dimensions in DSI theory are frequently overlooked despite their crucial role in shaping our understanding of social change and its binding relationship with power discourses.
Despite DSI's commendable intentions to address societal challenges while fostering equitable and sustainable community-centered initiatives, current mainstream theoretical directions and applications are increasingly coming under scrutiny. On the one hand, the design thinking approach to social change aims to move beyond current wicked problems towards future transformative solutions urgently, and in this 'rush' risks overlooking communities' immediate realities -and informal responses; on the other hand, DSI in the last decade demonstrated a certain susceptibility to neoliberal co-optation and elite capture (Táíwò, 2022), and I argue, here, that this co-optation strongly reflects an insufficient engagement with temporal discussion.

SI's unquestioned tendency towards a linear and progress-oriented view of change is embedded within colonial and northern-Western epistemologies (Tunstall, 2013; 2023) and notions of progress that, by emphasising market-driven solutions, are sidelining more radical, grassroots efforts that operate outside the conventional market logic. More poignantly, despite the approach's focus on the future, it can be argued that SI fictional expectations (Beckert, 2016) are not different from the present, and while "design fictions articulate desires for new futures of the everyday life, (…) their fictional status bring forth desires that bear no accountability in the present" (Gonzatto et al., 2013, p. 36).
In other words, the futures of neoliberal innovators are colonising other forms of creative agency (Ziegler, 2019, p.165) and potential social arrangements proceeding through trials, errors, and vulnerable coalitions, pointing to significant gaps in DSI frameworks: a lack of critical underpinnings that could challenge current power structures and a lack of imagination towards alternative futures beyond the status quo.

In response to these critiques, design futuring emerges as an attempt to infuse DSI with a needed dose of speculative thinking and criticality.
The concept of the future is gaining great academic traction (Andersson, 2018; Beckert, 2016; Beckert & Bronk, 2018; Bryant & Knight, 2019; Urry, 2016; Oomen et al., 2022), rooted in the rich theoretical soil of utopian studies with their focus on ideal societies and transformative visions. Design futuring tries to catch up with philosophical discussions and extend *social innovations* beyond practical solutions to engage with the realm of the possible by drawing on utopian *anticipation* (Wagner-Lawlor, 2017) and leveraging its visionary scope to inspire radical innovations that are both speculative and actionable; yet, this future-only orientation also encapsulates the crux of the challenge. Both DSI and a certain brand of speculative-

utopian blueprints that leaves no room for the messy, iterative processes of real-world change tend to privilege ideal novelty over proven informal methods, thus still prioritise future outcomes at the expense of present imperfect realities, and still “need greater plurality” (Howell et al., 2021).

In sum, while the future-directed trajectories of DSI, design futuring, and utopian studies offer powerful frameworks for imagining and striving towards better societies, they also underscore the need for a balanced engagement with time, recognizing that meaningful social innovation must weave together and problematise the threads of past experiences to create a tapestry of change that is both visionary and critically grounded.

3. Stuck in the Past

In examining social change, dissecting it through the complex layers of history that have shaped our current societal conditions, and putting the ideological construction of alternatives in power and discursive contexts, critical methodologies such as genealogy offer incredibly deep insights.

Genealogy, as developed by Foucault (1977), serves, in fact, as an invaluable tool for excavating the origins and transformations of social practices and power dynamics. By tracing the historical lineage of present-day realities, genealogy uncovers the contingent and often arbitrary nature of what we take for granted as 'natural' or immutable, but it would be wrong to think about genealogies as mere historical analysis; rather their “intent is to problematize the present by revealing the power relations upon which it depends and the contingent processes that have brought it into being” (Garland, 2014, p.372) and contextualize social changes within a broader evolution of the ideological framework.

Yet, while genealogy and other critical discourse analyses excel in deconstructing historical and narrative social change, they may lack a *constructive* dimension and thus lead to a state of paralysis where design hesitates to commit to concrete, actionable social innovations.

To foster meaningful innovation, I believe it is key to move beyond a retrospective limbo of perpetual critique as much as a futurist forward-gazing discourse and rather leverage novel approaches that not only dissect the past and inspire the future but crucially engage with the uncertain present.

4. Here-and-Now: Anarchism and Feminism Collapsing Time

To move beyond future-focused visions or past-static critiques, I often question why design overlooks anarchism (Graeber, 2004) and why DSI, in particular, ignores anarchafeminist valuable insights. The synthesis of anarchism's commitment to dismantling interlocking hierarchies and feminism's focus on gender and social justice that “practices what anarchism preaches” (Tanenbaum, 2016, p.13; Bottici, 2022) offers a unique perspective to approach and understand social change in a new temporal and profoundly agentic dimension.

Anarchism’s relation with the past, through processes of anarchist *constitutionalising* (Kinna et al. 2019a; 2019b), revisits and repurposes historical elements to better fit contemporary contexts and activists’ networks. But it is not just the past to pass through the lens of temporal disruption: it is the future, too. The concept of *prefiguration* (Boggs, 1977; Maeckelbergh, 2011) posits that the future we strive for cannot be a distant horizon but must be enacted in the present, embodying the changes we wish to see. This means rejecting the notion that power can be granted by "enlightened experts” (Long & Villareal, 1993, p.160) while maintaining the same asymmetrical power dynamics (Boje & Rosile, 2001; Gruber & Trickett, 1987) and instead directly committing to being the change. Prefiguration, in other words, does not await a perfect future, designed and implemented by experts and representatives; rather, it creates spaces for present-day horizontal decision-making processes and living experiments of alternative social orders where failure and trial are also embraced as part of the process (Antebi et al. 2007).

Prefiguration thus becomes a method of '"collapsing the future into the present" (Swain 2019, p. 55), offering a direct challenge to the status quo by integrating critiques from the past and future ideals into the fabric of current action.

The idea that the future is real “to the extent that it is performed” in the present (Butler, 1988, p. 527) has a significant impact on contemporary feminist thought as well. *Performativity* (Butler, 1990), which emphasizes the importance of social actors’ performances “of the future which have an effect on others’ actions in the present” (Tutton, 2017, p. 483) can be seen as another form of praxis that corrects historical biases (e.g. Edelman, 1985) by the enactment (Burke, 1969; Ezrahi, 2012) of a queer time that disrupts and reconfigures the future (Halberstam, 2005; Arruzza, 2015). This aligns with anarchism, which asserts that we can challenge normative temporalities and social orders through conscious acts of defiance and prefiguration. At the same time, enacting alternative social relations and structures in the here and now, demonstrating a direct engagement with the complexities and urgencies of the present moment, and avoiding the pitfalls of deferring change to a distant future resonates in Haraway's notion of *staying with the trouble* (2016).

An increasing number of critical texts argue that design has an ideological impact and shapes society (Dunne & Raby, 2013). Anarchafeminist's contribution to DSI lies in this debate, rejecting solutionist thinking, positivist universal ontologies, and Northern-Western epistemologies, and rather opting for “trouble, situated knowledges and intimate futures [which] (…) cannot and should not be captured” (Sondergaard, 2018). In some ways, anarchafeminist temporal disruptions already reflect Erlhoff and Rezai’s idea that design must “never yield to stability, but rather to indulge in the intersections of incongruities, uncertainties, and complexities” (2021).

The questions that I am trying to answer are, therefore, how (design) research can thrive in the uncertain, and which interactive design medium can serve as a sandbox for experimenting with the principles of anarchafeminist DSI?

5. Conclusion: Playful Time Warp Machines for DSI?

My research is currently exploring games as novel, playful arenas where the anarchafeminist collapsing of time is not only possible but inherent.
Design literature already recognizes the potential of games to envision democratic scenarios, renegotiate power dynamics, and foster collaboration (Brandt & Messeter, 2004; Eriksen et al., 2014; Khaled & Vasalou, 2014; Brandt. 2006), and games are also increasingly being explored as catalyzers of social innovations (Bayrak. 2019; Gomes et al., 2021; Swain. 2007). However, I believe that games’ main strength lies in their ability to offer a unique medium for critiquing, exploring, and reimagining social realities within fluid temporal dimensions.

Time is a tool that can be manipulated by game designers (Tychsen & Hitchens, 2009), and yet, designers are not the only agents involved in temporality. Indeed, game temporalities, as mechanisms of organizing time within games, are intricately formed through the ongoing performance of routinized behaviours, mutual expectations, and norms shaped by players' actions and agency (Rapp, 2019; Nguyen, 2020).

This dynamic interplay highlights how games can offer diverse ways to experience and manipulate time, emphasizing the role of both designers and players in continuously shaping and disrupting temporal planes, thus offering a practical application of anarchafeminist principles in DSI that challenge the linear progression of time and encourages a more holistic and democratic understanding of social change.

I am presently collaborating with East London housing activists to design together a political board game about the London Olympic Legacy that not only serves as a cultural, entertaining, and socialising medium but as a time warp machine. The participatory game design phase allows us to reflect and rewrite the betrayal of Olympic Legacy promises (Wainwright, 2022) to disrupt the past; its cooperative play phase

provides an opportunity to practice alternative solutions to the current dehumanizing and alienating housing and social cleansing issues. Lastly, the iterative playtesting phase continuously (re)shapes future-oriented practices of rule-bending, broadens the participatory spectrum, and disrupts dominant fictional expectations through grassroots actionable knowledge production (Boje et al., 2004, p. 1).

The dynamic nature of play and games is thus a poly-vocal *ante-narrative*: a "fragmented, non-linear, incoherent, collective, unplotted, and improper storytelling" (Boje, 2011, p. 1) that bridges the "static dominant narrative of the past with the dynamic 'lived story' of the present to enable reflective (past-oriented) and prospective (future-oriented) sense-making" (Boje, 2008, pp. 6-13; Jones et al., 2016).

As I have explored the intersection of temporality, social innovation, and radical critique through an anarchafeminist lens, advocating for a deeper engagement with time in the design and implementation of social innovations, I hope to continue to further investigate how games and play can operationalize anarchafeminist principles, and I look forward to witnessing these principles being applied by other researchers in a variety of design contexts, such as evaluating their 'impact' on community involvement, self-empowerment, and the creation of just and sustainable social realities.
As we continue to navigate the complexities of social change, the playful exploration of time offers a promising path toward more inclusive and transformative social innovations. And, after all, to paraphrase a famous Italian pun[1], the problems are wicked but not serious.

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[1] "In Italy the political situation is grave, but it is not serious" wrote Ennio Flaiano in 1956 in his *Night Diary*.

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P/REFERENCES OF DESIGN

THE MATERIAL SAMPLE AS A DESIGN AID FOR MATERIAL SELECTION IN THE PRACTICE-BASED RESEARCH.

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KEYWORDS | MATERIAL SELECTION, SAMPLE, CLASSIFICATION, DESIGN ARTIFACT, NON-EXPERT USER

ABSTRACT | This article introduces design-led doctoral research focusing on material's classification in the context of a new Parisian-based material library. Selection methods such as the Ashby diagram are useful for materials experts and can be used to select materials early in the design process. But are these selection methods suitable for non-expert users? Given the diversity of training courses in fashion, applied arts, and design in the Parisian area, we want to highlight an educational continuity in materials selection between these disciplines. In addition, the use of material samples enables a dialogue between the different actors involved in a design project by providing both information and a physical representation of a material. We therefore suggest that the material sample is necessary to understand the material specification from the point of view of non-expert users such as craftsmen, designers, or architects, and we consider the role of the material sample in the design process.

1. Introduction

The article sets the stage for an exploration of the role of one particular design artifact, the material sample, in the design process. Artifacts such as material samples, models, and prototypes serve as markers of a project's progress (Camburn et al., 2017), aiding in the dialogue and evaluation of technical, functional, and sensory aspects (Bassereau et al., 2015; Jeantet, 1998). While they do not constitute the final product, they play a crucial role in guiding design decisions.

Documentation associated with material samples is emphasized as vital for representing material attributes and guiding selection. This documentation provides a common language rooted in design methodologies and material knowledge, facilitating comparison between different materials. This documentation is linked to the role of material samples during the project phase through multi-criteria approaches and dedicated design methodologies based on metrics (Ashby et Johnson, 2014). Are these methods, such as the Ashby diagram, made for expert users such as engineers, would be useful in the design practices of non-expert users?

The focus is on the nature of material samples as mediators in the design process (Gentès, 2022), with specific experiential knowledge for specific users (Romani et al., 2023), namely reflective practitioners (Schön, 1992). Drawing parallels with scientific research and industrial production, material samples represent a snapshot of information that must be accessible, understood, and adaptable as projects evolve. To define the role of material samples, the methodology is constructed on two aspects, first, as practice-based research (Koskinen et al., 2012) conducting the program of a material library, the article will present an overview of the future users of the material library. It considers the importance of structuring information for various users, from students in fashion, applied art, and design sectors.

Simultaneously crossed with materials education teaching experience at the École des Arts Décoratifs in the bachelor program, the article will provide a case study: a specific project of a supervised workshop focused on made-to-measure bio-based materials. In this study, the role of the material sample is at the forefront of the design project as a design aid in practice and as a facilitator of the translation of knowledge into design practices and project outcomes.

The purpose of crossing quantitative and qualitative data (Gray et Mallins, 2014) is to redefine the place and the role of material samples during the design process because of their strong influence on the material library system. Linking know-how, sensory qualities, and technical properties could allow bringing the gap between knowing and making, i.e., material sciences and design practices, and be useful for non-expert users to improve understanding through experiential knowledge.

2. From Boundary Object to Material Classification

2.1 The Material Sample

In delineating between matter and material (De Visscher, 2023), the material sample emerges as the representation of a "single class" material, including properties information (Bréchet, 2015). This information based on scientific experiences and measures serves to simulate and predict material behavior, material sample is therefore used for application and performance. Considering the material sample as a limited representation helps us to see it as an intermediary of embedded information between agency and ontology concepts. The material sample is, therefore, an agent and a boundary object (Koskinen, 2006), i.e., a snapshot in a becoming process (Di Paolo, 2023) and an intermediate across design and media disciplines (Gentès, 2022).

It generally stands as a Semi-finished good (SFG), providing an objective representation of a material's surface aspects and properties. This representation encompasses technical, sensory, environmental, and aesthetic qualities, as well as potential shaping processes and know-how. Material samples, alongside other artifact like models and prototypes, serve as structural representations within a project, facilitating dialogue and decision-making among stakeholders (Bassereau et al., 2015). Particularly, material samples are valuable in the assessment of sensory qualities and surface aspects, crucial for understanding the emotional dimensions of the final product (Karana et al., 2015).

These samples play a pivotal role in enabling the comparison of materials based on a theoretical state, thus assisting both technical and non-technical users in material selection and creation during the design phase. The documentation accompanying material samples serves to codify their properties into a common language, which is essential for all involved in the project. The material sample acts as evidence (Schuppli, 2020), i.e., a model of scientific objectivity drawn by materials science and circumstantiated to expert material users in a constructed objectivity (Friedman et Krauthausen, 2023; Datson et Gallison, 2007) with the aim that users could produce an exercised judgment.

However, questions arise regarding the representativeness of material samples, as they inherently embody a fragment of a whole material. Despite their scientific nature, they provide a fixed state of information that needs to be interpreted and contextualized within the design project, thus functioning as an input for knowledge through making (Mäkelä, 2007). This dual nature of material samples, as both a design tool based on perception theory (Luyat et Regia-Corte, 2009; Gibson, 1986) and a model of data objectivity, underscores their significance in facilitating material-related decisions in the design process.

2.2 The Material Library

Material libraries serve as spaces where samples and their characteristics are made accessible, typically organized according to a classification system. These venues, prevalent in architecture and design agencies, offer expertise and facilitate interactions between users and suppliers (Akın et Pedgley, 2016). Material libraries cater to two main audiences: those with theoretical knowledge who utilize them for simulation and prediction and those without prior knowledge who use them as entry points to understand materials. Through classification methodologies, material libraries aid researchers in navigating and selecting materials based on project requirements and criteria.

The classification system within material libraries fosters a systematic comparative logic, facilitating the exploration of material families and their properties. They serve as practical tools for project development, distinct from laboratories or workshops, by organizing a wealth of materials and knowledge into accessible formats. Various types of material libraries exist, each emphasizing different aspects such as material life cycles, shaping processes, innovation, or specialization in particular trades or heritages (Akın et Pedgley, 2016). While some professions may rely on theoretical knowledge and databases for material selection, the emergence of design methodologies underscores the importance of a transdisciplinary language on materials, bridging practitioner profiles, and material-oriented approaches (Romani et al., 2023).

2.3 The Future Users of the Campus Mode, Métiers d'Art & Design

In envisioning a reference and classification system tailored to the needs of its users within a material library, a connection is established between material users, design methodologies, and data processing, encompassing materials in all their states. The focus shifts to the creation of a material library as a device that proposes a classification corresponding to the singularities of its users.

The future users of the material library of the Manufacture des Gobelins are students undertaking fashion, applied art, and design training across schools in the Paris and Créteil academic regions.

Visual representations of enrollment data from secondary to higher education are used as graphic tools to aid analysis and decision-making (fig.01; Fig. 02) (Gorkovenko et al., 2023; Bihanic, 2015). Distinctions are drawn between fashion, arts and crafts, and design courses, showcasing the distribution and proportion of enrollments and the types of careers they prepare students for. Data analysis makes it apparent that design training constitutes a significant majority, with a focus on generalist design disciplines such as graphic design, objects, and space. The visualizations also highlight the continuity in training between those professions, underlining the common language built around shared practices.

The sample, as an object for design, is governed by selection criteria based on characteristics requiring classification. It caters to the specific needs of material users, who operate within a common language bridging crafts and design. Looking at design and selection methodologies used in engineering provides insights into how theoretical knowledge can be enhanced. Overall, this approach emphasizes the importance of tailoring material libraries and design methodologies to the specific needs and backgrounds of users, particularly within the context of fashion, art, and design education. By leveraging data visualization and understanding the interconnectedness of design disciplines, material libraries can effectively serve as hubs for knowledge exchange and innovation (De Giorgi et al., 2020).

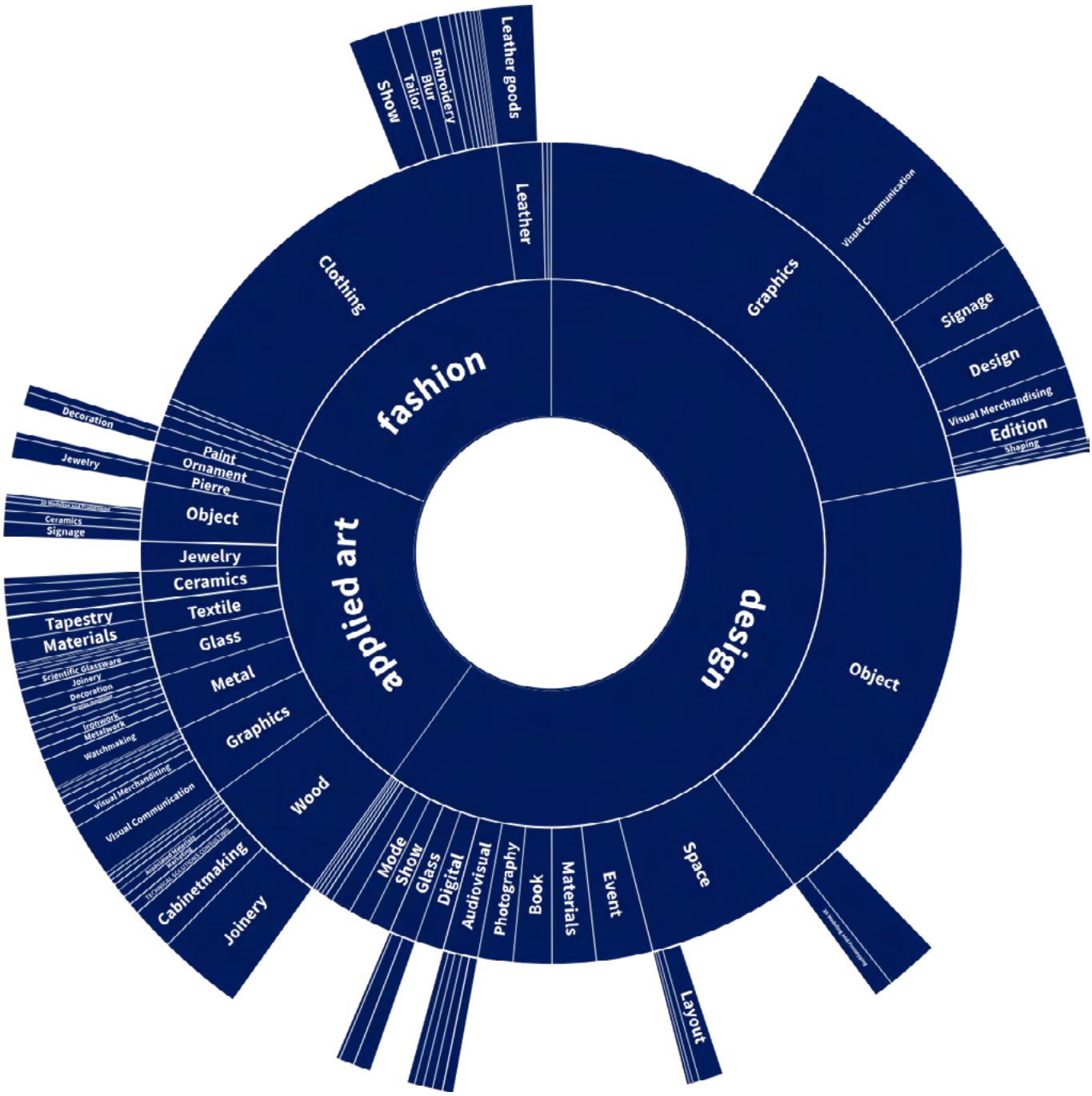


Figure 1. Students from fashion applied art, and design sectors by professional area in the Paris area during the academic year 2022-2023 (future users of the material library) (thesis context). Source: Number of students per training institution and fields of training [dataset]. Ministry of Education, France (2023).

Note: the difference between design and applied arts can be highlighted, you'll find many specifications in the applied arts sectors related to jobs and manufacturing, whereas in the design sector, categorizations depend on general fields.

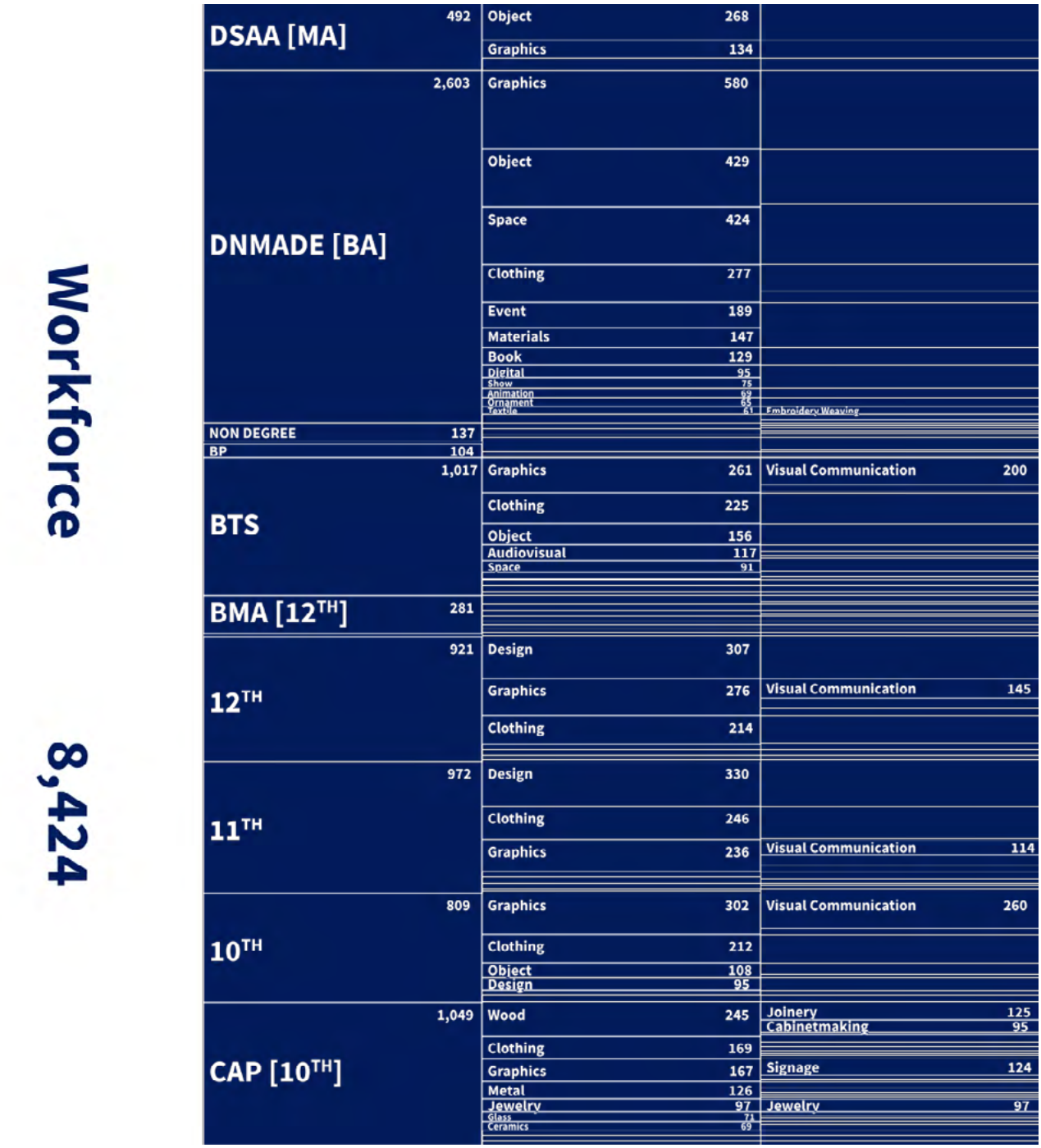


Figure 2. Students from fashion applied art, and design sectors by grade in the Paris area during the academic year 2022-2023 (future users of the material library) (thesis context). Source: Number of students per training institution and fields of training [dataset]. Ministry of Education, France (2023).

3. Material Selection in Design Methodologies

3.1 Selecting Materials

In the process of establishing a classification system for materials, especially when faced with an abundance of options, it becomes essential to differentiate between them based on their properties (Ashby et Johnson, 2014). Drawing from design sciences, material selection methods prioritize properties, ranking their importance relative to each other. The Ashby method, for instance, utilizes metrics to compare material properties, aiding in their differentiation. This method involves graphically representing material families by comparing two technical properties on a common matrix, facilitating the decision-making process for material selection based on technical characteristics. However, it's important to note that the selection method in product design relies on a material's ability to meet performance requirements, which may sometimes be contradictory. This has led to the emergence of tailor-made and structured materials like composites and sandwich materials, which cannot simply be selected from a catalog but require detailed analysis and specification. While the Ashby method provides a controlled knowledge of materials through their properties, it may not be suitable for all design situations, e.g., the emergence of material libraries (Akın et Pedgley, 2016). Mastering selection criteria is crucial for such a method to be effective, allowing for the association of constraints and properties. Moreover, while selection requires knowledge of associated properties, it's not limited to them. Classifying these properties enables a connection between different types of knowledge, facilitating interdisciplinary collaboration.

Multi-criteria design is significant as it considers various constraints, accommodating different perspectives within project specifications. To align multi-criteria selection with a broader range of users, the classification of materials must incorporate a common language, including design methods and materials geometry, to facilitate dialogue across disciplines. Additionally, the integration of multi-scale modeling with multi-criteria design is necessary to establish a shared understanding among different users of materials (Bréchet, 2015). However, it is important to acknowledge that these design methods, while valuable, still stem from a linear industrial production system that warrants further examination (Menu, 2022).

3.2 Design Requirements

While research and industry have historically focused on developing tailor-made materials to address industrial challenges (Friedman et Krauthausen, 2023), there is a growing emphasis on responsible design practices. This includes considerations of material criticality, life cycle, and recyclability. New research methodologies rooted in a resilient approach are emerging, placing materials at the forefront of project management (Mosse et Bassereau, 2019). Material Driven Design (MDD) highlights the central role of materials in creating meaningful, emotional experiences within specific performance contexts (Karana et al., 2015; Chapman, 2009).

Materials are increasingly viewed in conjunction with boundary disciplines like chemistry, biology, and robotics, driving innovation in project management (De Giorgi et al., 2020). This approach underscores the importance of considering materials not in isolation but in their production processes, shaping the expertise of all stakeholders involved in the design process.

By integrating materials science upstream in the design and creation phases, design students from École des Arts Décoratifs have explored innovative approaches to material selection and application. These workshops focused on sustainable design practices, such as recycling industrial waste or maximizing the recyclability of textiles, demonstrating the value of considering materials as boundary artifacts in the design process. These workshops fostered experimentation and applied design practices, encouraging students through experiential knowledge to develop resilient solutions that minimize waste and maximize resource efficiency (Dew et Rosner, 2019).



Figure 3. Adamiak, A. & Menival M. (2022). Sciuratine Project [Photography]. École des Arts Décoratifs.

Note: close-up of final experimentation of the project realized in the Biomaterials and Ornaments workshop directed by the author. The students have tried to master a linoleum recipe based on their know-how and experience, they have also improved their knowledge of material dedicated to their discipline.

3.3 Material Driven — Design Practice

In the workshop titled Biomaterials and Ornaments, codirected with the design studio Hors Studio (Rebecca Fezard et Élodie Michaud), students explored the recycling of materials, waste, and offcuts from the materials bank Precious Kitchen (part of Hors Studio activities). The aim was to create composite, bio-based, and mono-materials by incorporating offcuts into new compositions, adding value to otherwise discarded materials. The Sciuratine project (Alek Adamiak et Marie Menival, 2022) used sawdust, a feedstock, and bovine gelatin as a binder to produce sheets akin to linoleum. Through experimentation, students refined the material's properties to make it suitable for linocutting, resulting in a textured aesthetic for their project.

Throughout the project, the students learn to master the transformation process, which works by repeating and adapting a gesture, a documented craft production in which the material is adjusted to meet technical properties and plastic qualities. This approach is said to be experiential in the sense that the production of material is mastered empirically, and it is only at the end of the experiments that the process is stabilized and mastered, not in an explanatory way but by empirical imitation. The material itself becomes an object of reflection based on how samples function as a medium for design and research. The role of the samples in this process is to enable their comparison based on plastic qualities to the made-to-measure materials that the students are used to working with. This method is different from the use of a database, where the information is only shown to people who know how to interrogate through technical properties.

4. Discussion

Does the material experimented with upstream of the design stage play a mediating role in the sampling process specific to the design? It's a question of a single material that can take on multi-material forms. In the workshop, the material being worked on represents a body of practical knowledge, as well as perceptible sensory qualities as a support for a practical process. When it comes to designing a made-to-measure material, all the information is needed. We propose that, in the case of engineering, it is a question comparing properties, whereas in the field of design and craft, knowledge comes through the practice of a gesture (Ingold, 2001), and that this empirical method also allows materials to be compared with each other, related to experiential knowledge. This experiential knowledge, and if it was not mastered, gives rise to experiments aimed at learning about the material through its reactions and effects. The place of materials upstream in the project and the technical data are mastered and guessed at through experimentation without recourse to theoretical knowledge. This is an inductive approach in which experiential knowledge is refined so that the parameters can be controlled by the practitioner.

The role of material samples in the design process highlights their function as medium artifact and their implications for design methodologies. The workshop focused on designing with waste, presenting different approaches to material experimentation and application. As composites, these experienced mono-materials are characterized by their limited recyclability (Karell, 2021). The material samples serve as a medium for reflection and experimentation, allowing designers to explore properties, sensory qualities, and practical know-how. This approach emphasizes the practical aspect of material exploration, where knowledge is gained through hands-on experience rather than theoretical understanding alone. These experiments emphasize the need for sensitive design methods that bridge technical properties with creative approaches, ultimately leading to new forms of materials and research.

In conclusion, the material sample plays a crucial role in the design process, serving as a mediator between theory and practice. Its role in facilitating knowledge transfer and guiding design decisions underscores the importance of considering its link with users and the properties of materials within a coherent, structured system.

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About the Authors:

Antoine Tour's practice-based research focuses on classification of samples and material selection: a material-oriented language based on different user expertise across applied arts and design sciences in the context of the creation of a material library.

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P/REFERENCES OF DESIGN

CULTIVATING RESILIENCE: A PARTICIPATORY APPROACH TO PERMACULTURE FOR MARGINAL FARMERS IN INDIA.

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KEYWORDS | PERMACULTURE, FARMERS, AGRICULTURAL RESILIENCE, PARTICIPATORY DESIGN

ABSTRACT | Permaculture farming is a pivotal solution to the pressing global challenges of climate change, resource depletion, and food security. In India, where over 80% of the farming community comprises marginal farmers, transitioning to sustainable practices is crucial yet challenging. The primary barrier to this transformation is the significant knowledge gap these farmers face in integrating permaculture principles into their agricultural practices. A year-long study engaging directly with farming families, explores the intricacies and obstacles encountered by marginal Indian farmers transitioning to sustainable permaculture farming. The research identifies a critical knowledge gap as a major impediment to adopting permaculture, leading to the development of a participatory-based permaculture toolkit. This toolkit aims to revolutionize sustainable agricultural practices among marginal Indian farmers who confront the dual challenges of ecological degradation and economic vulnerability. Employing a participatory design methodology (Sanders, 2012), the study involved farmers co-creating a toolkit that amalgamates permaculture principles with localized agricultural practices. The research provided deep insights into the farmers' needs, preferences, and specific challenges through workshops, interviews, and hands-on sessions. The findings highlight the toolkit's success in enhancing the farmers' understanding and implementation of sustainable practices, evidenced by their understanding of permaculture farm design collaboratively. Also, the initiative fostered stronger community ties, promoting knowledge exchange and mutual support among participants. This research not only underscores the tangible benefits of a participatory approach to permaculture in enhancing the livelihoods of marginal farmers but also contributes to the discourse on sustainable agriculture globally by offering a model that is both scalable and adaptable. The successful field study underlines the potential of participatory-based tools in empowering farmers towards ecological resilience and a sustainable agricultural future, facilitating sustainable farm designs, community building, and localizing food and resources. This initiative represents a significant step towards addressing current challenges and encouraging the widespread adoption of sustainable agriculture practices.

1. Introduction

The primary aim of this research was to comprehensively investigate the challenges and opportunities associated with the adoption of sustainable permaculture farming practices among marginal Indian farmers. This research delves into the complexities and hurdles faced by marginal Indian farmers during their journey towards sustainable permaculture farming. Through a year-long research conducted in collaboration with farming families, we aim to identify the major challenges faced by these farmers during the transition period. Our primary focus is on the knowledge gap and its impact on permaculture adoption. In response, this research has led to the development of participatory-based research. This innovative initiative empowers marginal Indian farmers to design sustainable farms, build resilient communities, and support the localization of food and resources, which is essential for long-term sustainability. By addressing the knowledge gap, this approach not only offers hope for overcoming immediate challenges but also contributes to the broader adoption of sustainable agriculture, strengthening the path towards global sustainability.

Sustainable agriculture has emerged as a critical solution to some of the most pressing global challenges of the 21st century (CEEW 2021). These challenges include climate change, resource depletion, and ensuring food security for a growing global population (Rockström et al., 2017). At the core of this transition lie the fundamental principles of sustainable farming, focusing on optimising land utilisation, reducing environmental harm, and ensuring a consistent food source. Sustainable agriculture is not merely a goal. It is imperative for the welfare of our planet and the well-being of generations to come. A significant and integral part of the global agricultural community, particularly in the Indian subcontinent, comprises marginal farmers. India has over 90 million farmers, and 80% are small and marginal and have less than 2 hectares of farmland (Ministry of Agriculture & Farmers Welfare, 2020). These farmers, who own or cultivate small parcels of land, often struggle to make ends meet, facing many challenges, including limited access to resources, uncertain weather patterns, and economic constraints (Shiva, 1991). In sustainable agriculture, the role of Indian marginal farmers is important. They contribute significantly to the nation's food production and hold the key to addressing broader sustainability concerns.

The challenges faced by these marginal farmers are multifaceted. Their small landholdings often result in lower economies of scale, making technological investments less feasible (World Bank, 2019). Lack of access to credit and modern farming techniques, coupled with dependency on erratic monsoons due to inadequate irrigation facilities, further exacerbates their vulnerabilities (Ranganathan, 2011). Price volatility in agricultural produce and a lack of bargaining power in the market further diminish their earning potential (Chand, R., & Srivastava, S. K., 2014). Additionally, they often grapple with land degradation due to continuous farming with chemicals, fertilizers and pesticides without adequate knowledge or resources for soil health replenishment (FAO, 2018). However, adopting sustainable permaculture farming practices among marginal Indian farmers is far from straightforward. Transitioning from conventional farming to permaculture is complex and challenging (Sharma, 2023). One of the primary impediments to this transition is a substantial knowledge gap. The knowledge gap arises from a lack of awareness and understanding of permaculture principles and sustainable farming techniques (Altieri, 2002). Although rooted in historical and regional contexts, traditional farming methods often fail to address modern environmental and economic challenges (CEEW 2021). The transition to sustainable agriculture, specifically permaculture (Mollison, 1988), offers a promising solution. The inherent complexity of permaculture and its scientific underpinnings present a formidable learning curve for these farmers. Bridging this gap is difficult for marginal farmers, who often rely on conventional practices and chemical-based farming. As a result, the adoption of permaculture principles, which promise more resilient and sustainable farming systems, is hampered. To effectively promote sustainable agriculture among marginal Indian farmers, addressing this knowledge gap and providing them with the tools and resources needed for a successful transition is imperative. To achieve this overarching goal, the research has been structured around the following specific objectives. Firstly, a comprehensive examination of their current knowledge levels, awareness, and perceptions regarding permaculture principles and sustainable farming techniques. Secondly, the research seeks to investigate the multifaceted challenges these farmers face during their transition to sustainable

permaculture farming. This involves conducting detailed interviews, surveys, and on-site observations, as well as participatory workshops to pinpoint the specific barriers, including limited access to resources, economic constraints, and social factors, that hinder the adoption of sustainable practices. Building on these insights, the third objective involves the development of a participatory toolkit to bridge the identified knowledge gap and address the challenges faced by marginal Indian farmers.

2. Literature Review

2.1 Sustainable Agriculture and Permaculture

Sustainable agriculture, as defined by (Pretty, 2008), is a holistic approach prioritizing environmentally sound, economically viable, and socially responsible farming practices to ensure current and future generations can meet their food needs, highlighting the significance of soil health, water conservation, pollution reduction, and biodiversity enhancement. The Food and Agriculture Organization (FAO, 2018) underscores the global imperative for sustainable agriculture, emphasising its role in achieving the Sustainable Development Goals (SDGs) related to hunger, food security, nutrition, and sustainable agricultural practices. Permaculture, introduced by (Mollison and Holmgren, 1978), embodies a design philosophy for sustainable habitats, emphasising care for the earth and people and the redistribution of surplus through the development of agriculturally productive ecosystems mimicking natural systems' diversity and resilience. Yet, (Altieri, 2002) and (Shiva, 1991) notes the challenges in adopting such sustainable practices in developing countries like India, where a significant knowledge gap, reliance on chemical inputs, inadequate market access, and climate change impacts pose barriers to small and marginal farmers, who form over 80% of the farming community (Sharma, 2023). This confluence of sustainable agricultural principles and the unique challenges faced in implementing permaculture in developing nations underscores the urgent need for tailored solutions that address specific local challenges to foster environmental sustainability, food security, and economic viability.

2.2 Marginal Farmers in India

Marginal farmers, who own less than one hectare of land, form an essential part of Indian agriculture, accounting for over 80% of all farmers (Ministry of Agriculture & Farmers Welfare, 2020). These farmers are pivotal in sustaining agricultural biodiversity and contributing significantly to the rural economy despite facing multifaceted challenges. Economically, they struggle with limited access to credit (Verma, 2021), market volatility, and inadequate irrigation, which enhances their vulnerability to monsoon variability (Sharma, B. R., Rao, K. V., Vittal, K. P. R., & Amarasinghe, U., 2010). Environmentally, challenges like land degradation due to the overuse of chemicals and climate-induced extreme weather events threaten their agricultural productivity and food security (Bhattacharyya et al., 2020). Socially, the scenario is compounded by limited access to education on sustainable farming and gender inequality in community building, which restricts their capacity to adopt sustainable agricultural practices (Rajbhandari, 2015). This intricate array of economic, environmental, and social challenges highlights the urgent need for comprehensive support and interventions to bolster the sustainability and resilience of marginal farmers within the Indian agricultural framework.

3. Methodology

The methodology of this study utilised a participatory design approach, chosen for its effectiveness in actively engaging stakeholders, in this case, farming families, in the research process. This approach aligns with the objectives by ensuring that the development of the permaculture toolkit is grounded in the real-world experiences and needs of the target population, thereby enhancing the relevance and applicability of the research outcomes. Sampling involved a carefully structured selection process to represent a diverse cross-section of the farming community, focusing on marginal farmers most impacted by the challenges

the study aims to address. Data collection methods were multi-faceted: Structured interviews were designed around key themes, such as current farming practices, knowledge of permaculture, and barriers to sustainable agriculture, to delve deep into the participants' experiences and perspectives. Workshops and hands-on sessions were conducted to facilitate active learning and engagement, focusing on permaculture design principles and sustainable farming techniques and creating a community of practice among participants, expecting to foster a collaborative learning environment and tangible skill development. To quantify the prevalence of certain practices and perspectives within the sample, surveys complemented these methods by covering a broad range of areas, including demographic information, farming practices, and attitudes toward sustainability. Analysis of the collected data employed qualitative techniques to interpret the rich, narrative data from interviews and workshops, alongside quantitative analysis of survey responses to identify patterns and trends that could inform the toolkit's development and the broader research findings. We conducted several participatory workshops to co-create and test the toolkit (Sanders, 2012). This toolkit was very useful for the farmers to design and plan their permaculture farms collaboratively. Toolkit also helped farmers to articulate their tacit needs and translate them into design decisions. This comprehensive methodological framework was designed to provide a holistic understanding of the challenges and opportunities associated with adopting sustainable permaculture practices among marginal farmers, facilitating the creation of a targeted, effective intervention.

4. Findings

The research findings have led to the development of a transformative participatory-based permaculture toolkit aimed at enhancing sustainable agricultural practices among marginal farmers in India. Through an extensive year-long study, we meticulously mapped out the various activities involved in permaculture farming (see Figure 1), identified farmers' understanding of permaculture principles, and uncovered their tacit knowledge of sustainable farming practices. A significant revelation from the study was that while farmers may not initially be familiar with permaculture principles, they demonstrate a remarkable ability to grasp the concepts when provided with explanations and guidance. Workshops, interviews, and hands-on sessions were instrumental in deepening farmers' knowledge of sustainable farming techniques and permaculture design principles, empowering them to make well-informed decisions about farm management. We conducted several workshops to co-create the toolkit with farmers to understand its nuances. The participatory-based toolkit facilitated farmers in articulating their needs and sharing their knowledge with the community to collaboratively design the farm and devise strategic plans. Also, the critical role of the social aspect of sustainability in agriculture often overlooked. Through the toolkit, farmers not only learned to design and maintain their farms but also cultivated a sense of community, promoting the localization of the food system. Farmer’s participation in workshops fostered a heightened sense of community and empowerment among farmers, facilitating knowledge exchange, mutual support, and a shared sense of purpose. This collaborative ethos not only strengthened social bonds but also bolstered the sustainability of farming practices adopted by promoting localized food system and community development. Our findings underscore the effectiveness of a participatory-based approach in addressing knowledge gaps and overcoming barriers to sustainable agriculture among marginal farmers. By equipping farmers with the necessary knowledge and tools for sustainable farming, the toolkit has the potential to catalyze broader adoption of permaculture principles and contribute to the resilience and sustainability of agricultural systems, both in India and beyond.

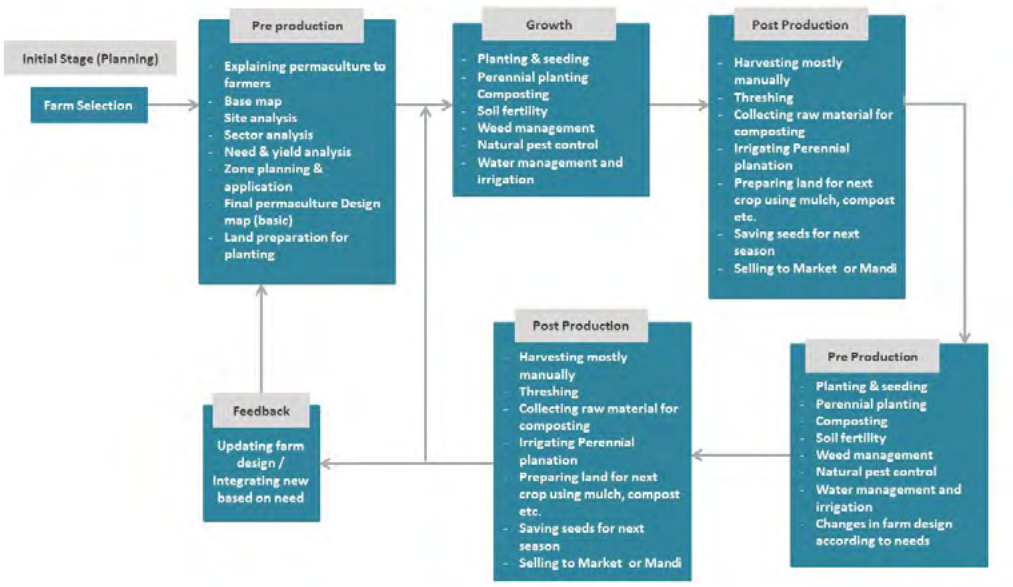


Figure 1. Map of various activities at different stages in permaculture farming. (Source: Author: Sharma, 2023).



Figure 2. Sensitizing kit “Know your Farm” in the local language (Gujarati) to understand farmers’ needs and existing farms.



Figure 3. Participatory-based permaculture toolkit for farmers to design farms using permaculture principles and ethics.



Figure 4. Learning from Permaculture design course at Aranya Permaculture farm.



Figure 5. Participatory workshop with the farmers to design permaculture farm using the toolkit developed.

5. Conclusion

The study successfully bridged the significant knowledge gap among marginal farmers in India regarding permaculture and sustainable agricultural practices, underscoring the efficacy of a participatory design approach in fostering an understanding and implementation of these practices. This research not only identified the initial knowledge levels and perceptions around permaculture but also meticulously documented the multifaceted challenges faced by farmers during their transition to sustainable farming. The development and utilisation of a participatory-based toolkit, co-created with the farmers, directly addressed these challenges and knowledge gaps, demonstrating a practical application of theory to real-world circumstances. The findings from this research highlight the critical role of community engagement and participatory methodologies in enhancing the knowledge base, thereby facilitating the adoption of sustainable practices among marginal farming communities. Also, the study contributes significantly to the global discourse on sustainable agriculture by illustrating a scalable and adaptable model of community-based learning and adaptation. Recommendations for future research include exploring the long-term impacts of toolkit implementation on farming sustainability and productivity, assessing the toolkit's applicability in different agricultural contexts, and expanding the participatory approach to include a wider range of stakeholders. The potential areas for the toolkit's application are vast, encompassing diverse agricultural settings and varied socio-economic contexts, thereby offering a valuable resource for promoting sustainable agriculture practices worldwide. This study lays the groundwork for future initiatives to empower farmers with the knowledge and tools necessary for sustainable farming, paving the way for a more resilient and food-secure future.

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P/REFERENCES OF DESIGN

THE DESIGN APPROACH FOR INTEGRATING CROSS-SECTOR PROCESSES. APPLICATION OF TANGIBLE/ INTANGIBLE RESOURCES FROM THE TERRITORY TO A CO-PARTICIPATED SUPPLY CHAIN MODEL.

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KEYWORDS | DESIGN FOR TERRITORIES, SYSTEMIC APPROACH, CO-PARTICIPATED SUPPLY CHAIN, SYMBIOTIC SUSTAINABLE DEVELOPMENT, MADE IN ITALY

ABSTRACT | The intervention priorities of the Recovery and Resilience Plan (PNRR), introduced by the European Union following the pandemic, represent an opportunity for economic recovery for Made in Italy and the country's production chains. Key sectors such as agri-food, automotive, furniture, and clothing constitute the manufacturing sectors primarily interested in implementing sustainable, economic, and social development initiatives. In this context, the Green & Digital Transitions guide and shape the future of societies, highlighting the need to overturn the linear economic paradigm in favor of restructuring value chains that integrate the principles of sustainable development, innovation in business models, sector-specific skills, and production processes, with their re-centralization in the territories. The Italian manufacturing system, characterized by micro-small enterprises, sometimes organized in districts and production chains, aligned to the concept of the soft economy, constitutes fertile ground for initiating design-oriented systemic strategies capable of combining local resources and productions while maintaining the integrity of natural ecosystems.

In this scenario, the research project aims to develop a strategic model of co-participated production chains, aiming to establish productive symbiosis relationships and integrate tangible and intangible resources of the territories in a systemic and circular perspective across different manufacturing sectors of Made in Italy concerning agri-food chains and the cosmetic sector. The research intends to explore various implementation scales of the co-participated model, involving local manufacturing through business audit activities, incorporating already ongoing sustainable production processes, and utilizing Industry 4.0 technologies through collaboration between enterprises, research centers, and Innovation hubs present in the territory. Through field research, the bottom-up detection methodology identifies initiatives, needs, and emerging issues from territorial production contexts, evaluating possible collaborative match-making strategies. The project's results are directed towards enhancing the excellence of Made in Italy, engaging and strengthening links between productive communities (micro-small enterprises), and experimenting with innovative products that synergize local know-how and design-oriented strategies. The co-participated model's experimentation aims to test collaborative production between companies in the agri-food and cosmetic sectors present in the Campania region. The outcomes of the experimentation will determine the verification of the co-participated chain model, the identification of replicability requirements, and the development of a disciplinary tool for creating new synergies between different production sectors. The paper describes the theoretical background, project objectives, methodology, and initial outcomes of the doctoral research conducted during the 1st year of the National Interest Ph.D. in Design for Made in Italy (XXXVIII cycle) at the University of Campania "Luigi Vanvitelli."

1. Background and Objectives of the Research Project

The field of the research project investigates design-oriented strategies for sustainable development in territories, aiming to enhance Made in Italy supply chains through co-participation among various manufacturing sectors. In the Italian production landscape, Industry 4.0 is guiding regional economic systems toward adopting new approaches to promote territories and excellence. To preserve the identity linked to specific geographical contexts, manufacturing, and local know-how, micro and small enterprises are identifying new opportunities for valorization through collaboration with other production entities and community relationships. A collaborative society, promoting dialogue and confrontation, follows an alternative economic model with positive impacts on territories and communities (Bistagnino, 2016). This model, incorporating the concept of a soft economy based on community cohesion, aligns with the programmatic strategies of the 2030 Agenda for sustainable development, directing societies towards integration between the production-economic system and the socio-institutional system.

From this scenario and the analysis of project experiences in symbiotic processes of closed-loop supply chains and based on the priorities identified in the National Recovery Plan (PNRR - investment 5.2: Competitiveness and Resilience of Production Chains), the research project aims to develop a strategic co-participatory supply chain model. This model aims to create productive and collaborative processes in a systemic and circular perspective, focusing on agri-food excellence and cosmetic companies in the Campania region. The model intends to activate synergistic actions between the two sectors, involving the know-how of supply chains in the selection of secondary raw materials and activating symbiotic processes among companies, local producers, research centers, and innovation hubs. The project results target the protection of Made in Italy excellences and the creation and enhancement of multi-sectoral, innovative, and sustainable aggregation processes. The outcomes of the experimentation in the Campania region (Italy) will determine the verification of the co-participatory model and the project requirements for defining replicability in other production sectors. Within the field of the research project, design considers the territory as an intermediate substrate on which to initiate processes of innovation, whether it is understood as an "object" or as a "context" (Parente et al., 2016) of design practices. From this scenario, the doctoral research project conducted during the 1st year of the National Interest Ph.D. in Design for Made in Italy (XXXVIII cycle) at the University University of Campania “Luigi Vanvitelli,” investigates the following macro-areas of research:

- Strategies and research projects in the field of design for territorial development and design-driven innovation through the analysis of systemic design approaches, circular design, and participatory design practices.
- Investment priorities of Mission 1, "Digitalization, Innovation, Competitiveness, Culture, and Tourism," and Mission 4, "Education and Research" of the National Recovery and Resilience Plan (PNRR).
- International and national funding programs for territorial development (LEADER, EUI, LDEI) and integrated supply chain projects (PIF).
- Opportunities, challenges, and emerging needs in Made in Italy production chains through consultation of reports and databases from Unionfiliere, Italian District Federations, Confcommercio, and Confindustria, monitoring the productivity and trends of the country's production sectors.
- Sustainable production processes and business models of Industry 4.0 through projects promoted by platforms such as Circularity, ENEA, Symbiosis, ECEP, and ICESP.

The analysis of existing literature on territorial sustainable development projects has revealed a gap in the systematization of symbiotic processes among productive sectors of different economic activities.

Two main aspects emerge from this analysis: firstly, the absence of a regulatory framework governing the aggregation between different production chains; secondly, the lack of a coherent procedural path aligned with regulatory aspects that facilitates the encounter and collaboration between different sectors. These premises have contributed to defining the research objectives through which the project intends to address the identified scientific problem.

- Construct a replicable co-participatory supply chain model, designing guidelines that instruct and facilitate the integration among companies for the development of co-participated production processes.
- Establish a multisectoral network that synergizes territorial resources, companies, and productive communities through co-design experiences.
- Iterate symbiotic productions and cross-fertilization processes involving productive communities, manufacturing, and local know-how.
- Activate systemic actions among territorial productions to optimize resources used and enhance the value of secondary raw materials.
- Reduce the ecological footprint of production processes by introducing or strengthening closed-loop product systems.
- Enable productive entities for Industry 4.0 technologies, integrating training programs within Innovation hubs and research centers to promote the development of new business models.

2. Research Framework

From the in-depth exploration of the research background, three main areas of investigation have emerged. The first focus involves the research and critical analysis of case studies in the field of systemic design concerning sustainable and socially responsible development of territories. The projects were selected and evaluated according to criteria relevant to the research project's objectives, such as collaboration between companies and the territory, support for the local economy, reduction of environmental impact, innovation in production processes, optimization of resources, valorization of waste, and the production of secondary products. The second focus of the research centers on the examination of experiences of productive symbiosis already experimented in the territory through the analysis of closed-loop production processes, both within the same sector and between sectors of different economic activities. The selected case studies were cataloged in synthesis tables to create a mapping based on the following analysis criteria: geographical area, type of promoting company, number of partner companies, involved productive sectors and economic activities, types of funding, collaboration results, limitations, challenges, and future replicability. The third focus of the research concerns the analysis of integrated supply chain projects, in which productive collaborations have been established among companies belonging to the same sector or different productive sectors. To examine the strategies, methodologies, and results of such collaborations, similarly, to focus 2, reference case studies were identified and subsequently cataloged in synthesis tables according to the following criteria: geographical location, number of partners, type of supply chain, sector of affiliation, involved economic activities, partner supply chains, type of funding, collaboration results, limitations, challenges, and possibilities of future replicability.

2.1 Methodology

The research adopts a bottom-up research-action methodology that, starting from the analysis of the territory, identifies the needs perceived by local communities to transfer them to the co-participated supply chain model. The four phases of the research, named Discover, Detect, Define, and Develop, consist of tasks for acquiring information and data, intending to provide concrete results. Each phase identifies a step towards achieving one or more research project objectives, for which different design methods and approaches will be used. The community-centered approach and co-design practices will be adopted to

identify emerging needs and challenges in the territory, as well as to identify collaborative processes between companies, communities, and stakeholders. Simultaneously, systemic design and circular design will be employed to facilitate the transfer of inputs and outputs between the productive realities of different sectors, adopting a "cradle to cradle" perspective.

- The first phase, called "Discover," conducted during the first semester of the doctoral research, focused on building the theoretical foundations of the project and the state of the art of design practices in the territorial context through literature review activities and the exploration of case studies. Subsequently, national and regional funding programs were examined, along with the current regulatory framework concerning productive chains.
- The second phase, called "Detect," involves field research to identify agri-food and cosmetic companies in the Campania region. These companies will be subsequently analyzed to identify matchmaking opportunities and experiment with the co-participated supply chain model. The selection will take place through the analysis of databases from the entities identified in the research background and will involve companies more inclined towards building a collaborative, productive network. The collection of qualitative and quantitative data from the companies will be conducted through questionnaires and one-to-one interviews to investigate the relationships between the companies, the territory, and the community; the skills involved in the company's production activities; the resources used and production waste; emerging challenges and perceived needs.
- The third phase, called "Define," involves organizing workshops that will engage the companies interviewed in the previous phase to identify collaboration opportunities through discussion and sharing activities. The results of the field data collection and the analysis of the workshop outcomes will form the basis for the project phase of the co-participated model and identify possible achievable matches.
- The fourth phase, called "Develop," concerns the project development and experimental application of the co-participated supply chain model in the Campania region. Sample companies operating in the agri-food and cosmetic sectors will be selected based on the interpretation of the collected data and the matching opportunities that emerged from the workshops. The outcomes of co-design meetings will constitute the requirements for defining a disciplinary tool that facilitates collaborative synergies and the creation of innovative and sustainable supply chain products.

3. Results and Conclusions

The first year of research concluded with the achievement of the objectives outlined in the initial phase, and its outcomes have brought forth considerations related to the investigated theme. Specifically, the results of the conducted activities have impacted various aspects of the project, including the in-depth exploration of research background topics and the identification of primary focus areas; the compilation of the reference bibliography and the creation of the state-of-the-art methodologies and approaches of design for the sustainable development of territories; the research and cataloging of case studies related to productive symbiosis and integrated supply chains, along with their interpretative parameters; the selection of international and national funding programs, followed by an analysis of their respective guidelines. Based on the insights derived from the theoretical background, the construction of the state-of-the-art, and the analysis of case studies, research questions have been formulated that the project aims to address.

RQ 1. What design-oriented strategies can be considered most effective in promoting sustainable development in territories from a collaborative perspective?

RQ 2. What approaches, methods, and design tools can be employed to facilitate multisectoral integration between productive supply chains and territories?

RQ 3. Which design practices can contribute to regulating organizational aspects of multisectoral collaborations within participatory production processes?

The activities planned for the current semester will involve the research and selection of companies operating in the agri-food and cosmetic supply chains in the Campania region. This will be followed by planning the field investigation phase, which will include conducting questionnaires and interviews for

Data collection. The results of these activities will subsequently be presented through the development of interpretative maps for effective visualization of the collected data. The paper aims to share the idea that the diversity of productive sectors present in the Italian territory constitutes a distinctive feature globally. This diversification and excellence specialization, combined with the high manufacturing specialization of the Made in Italy system, can represent a significant resource for the realization of design-oriented sustainable development strategies and new transition models. These strategies aim to combine economic competitiveness with social cohesion, drawing strength from local communities and surrounding territories (Cianciullo & Realacci, 2005).

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P/REFERENCES OF DESIGN

DIGITAL EDUCATION ECOSYSTEMS AND SEAMLESS INTEGRATION: PREREQUISITES, OBJECTIVES, AND REALITY.

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KEYWORDS | DIGITAL TRANSFORMATION, POLICIES, EDUCATION & TRAINING, LEARNERS, INNOVATION

ABSTRACT | Digital transformation is anticipated to have a major influence on a global scale. The use of digital technology in education and its integration has become a national priority for many countries, with leaders in education and policymakers targeting institutions to become operationally efficient and act promptly to implement changes deemed to enable digital innovation. However, it appears that the digital transformation in education is part of a more complex and intricate system. A lack of clarity, requirements, and well-defined objectives necessitate the active collaboration of all relevant stakeholders and decision-makers across sectors to co-create and lay a strong basis for the development of a systemic approach to address this pressing issue. This calls for solutions capable of proactively navigating this renovation, ensuring that ongoing assessment, flexible thinking systems, and analysis of the long-term implications for the claimed shift align with pedagogical goals, enhance student engagement, and ultimately improve learning outcomes. This short paper must be seen as a conversation starter that aims to clarify the urgency of digital transformation for public education and pinpoint the critical components that hinder effective digital transformational change. By following a holistic approach to targeting systemic change, the scope of future research is to identify the trajectory of technology policy for education within the digital educational landscape and possibly address the present and recent history to set the groundwork for an analysis of feasible and successful digital service design solutions that meet the set objectives.

1. Introduction

Fostering the development of a high-performing digital education ecosystem and enhancing digital skills and competencies has become a key priority around Europe. This short paper is intended to clarify, initially, the urgency and meaning of digital transformation in public education. It will then focus on selected challenges faced by all stakeholders involved in the educational ecosystem and how they are currently addressing those challenges while also highlighting some of the conditions that can make those initiatives feasible. Finally, it will suggest opportunities for the education and training community, such as teachers and students, policymakers, academia, and researchers on a national, EU, and international level, to contribute to an effective digital transformational change.

1.1 Digital Transformation

A rich body of literature contributes to the understanding of the benefits as well as the challenges associated with digital transformation at multiple levels. As Vial (2019) states, digital transformation is

> "A process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies." (p.118)

Accordingly,

> "Innovation is focused on the moment of invention and the implementation of that invention," but "digital transition is an extended process of change that may have multiple goals." (Gobble, 2018, p.57)

Controversially, it is still unclear whether, in the context of education, this means introducing or replacing outdated technologies, guaranteeing digital infrastructure and security, aiming at green transactions and resource efficiency, and integrating digital approaches into the curriculum to help students thrive in the new economy, or all of the above (Arinushkina et al., 2023).

What is extensively understood is that digital transformation completely revolutionizes the current economic setting (Majchrzak et al., 2016), and there is a common consensus that building a digital transition for education is significant and will soon serve as a driving force (Negreiro et al., 2019; Hashim et al., 2022; European Commission, 2018; United Nations, 2023). However, school leaders and policymakers have to define the term "digital transformation" to establish a foundation upon which to build a shared vision (Haleem et al., 2022). For this short paper, it makes sense to use the term digital transformation to refer to the transformation that takes advantage of the new opportunities created by the new information and communication technologies in education.

1.2 Digital Transformation in Education

Currently, the digitalization of education is significantly transforming the traditional classroom and administrative processes, creating more engaging learning experiences and improving operational efficiency. With the introduction of technology-assisted learning tools like learning platforms, educational apps, interactive digital content, virtual laboratories, mobile devices, tablets, laptops, smartboards, MOOCs, simulations, and dynamic visualizations, the learning process is transforming, becoming more personalized, inclusive, dynamic, and data-driven (Arinushkina et al., 2023; Al-Emran et al., 2020). These digital platforms and media are said to act as catalysts for a learner-centric model, expanding the alternatives for the delivery and accessibility of educational content everywhere and at any time; students can access resources, participate in discussions, and submit assignments online (Grenčíková, 2021). However, this comes with its risks. It is argued that the claimed change goes beyond just integrating digital

tools; rather, it radically redefines the nature and methods of education (OECD, 2021). Teachers must be equipped to deliver innovative approaches and learning designs that hold the possibility of a safe and meaningful digital transformation (Fisher et al., 2023; Hanelt et al., 2021). This calls for leaders capable of proactively navigating this renovation, ensuring that technology integration aligns with explicit pedagogical goals, enhances student engagement, and ultimately improves learning outcomes (Bush et al., 2019). Hence, additional research on the impact of digital technology on innovative teaching and learning implementation is essential.

1.3 Challenges of Educational Digital Transition

Digital transformation is a process that continually adapts to rapidly emerging digital innovations; as such, it demands agility and has no clear ending. According to McCarthy et al. (2023),

> "it needs consideration of industry research reports when envisioning what is required for successful digital transformation, particularly in the areas of strategy and people development, leveraging best practices in the approaches to technical deployment and user experiences."

Furthermore, there is a necessity to reduce the digital divide and provide equitable access to technology (UNESCO, 2018; Rose et al., 2015). This requires investigating how these emerging technologies might interact with the existing social contexts of education and what the experiences of young people and instructors alike are inside and outside the school eco-system.

In this regard, research argues that the significantly outdated European public digital education programs need to be rapidly updated, from preschools to universities (Global Education Monitoring Report, 2020). The public offering must renovate its curricula to satisfy the demands of the evolving labour market and emerging technologies while guaranteeing access for all. Although technology has proven to play an essential role in shaping the future of education, it also has potential pitfalls. The advent of Industry 4.0 has highlighted the lack of skilled students equipped for the digital and green transition and labor markets (European Commission, 2018) and is claiming a broader and cutting-edge education framework. As more and more job positions become knowledge- and skill-intensive, it will become necessary to be able to transfer existing skills from one industry or occupation to another (Cedefop, 2015a, 2018a; McGuinness et al., 2018). In response to the demands of both individuals and industries, education delivery must simultaneously become more digital, adaptable, and customized (OECD, 2023).

1.4 Strengthening Key Enabling Factors

The urge of digital transformation has led the European Commission (2020) to formulate an updated version of the Digital Education Action Plan (2021–2027) that calls for high-quality, inclusive, and accessible digital education in Europe, especially for the achievement of the European Green Deal objectives, the 2030 Digital Compass, and for reaching climate neutrality by 2050. However, member states have not yet succeeded in bringing about a systemic digital transformation in education and training. They continue to face challenges in securing adequate funding for digital education and training infrastructure, equipment, and digital education content, digital training of educators and staff, and monitoring and evaluation of digital education and training policies (European Commission, 2023). Inevitably, this calls for internal organizational and governance reforms, enabling partnerships with civil society and the market sector, and providing substantial investments in connectivity and new educational initiatives for professors and teachers, ensuring that they have the know-how to effectively use digital tools and to value the importance of digital connection in their practice (Johnson et al., 2016).

A major concern is how quickly schools may develop innovative service models to meet the demands of the rapidly changing digital landscape, especially with the prominence of AI and automation tools, while evaluating the effectiveness of the implementation of new digital solutions for the user's value creation process (Facer et al., 2021). Ongoing assessment, flexible thinking systems, and analysis of the long-term

implications for the shift to digital technology and, ultimately, for the growth of students must be provided. Consequently, collaborating with technology experts, educators, and students is becoming vital in making informed decisions about technology integration. Furthermore, cross-sectoral policies, a shift from standardization to customization, the participation and cooperation of numerous stakeholders, and a determined push for the policy uptake of the schools to address inequality are all necessary (Burns et al., 2018; Cedefop, 2022). In this regard, a new creative architectural blueprint design, a network for research and policy creation that promotes sustainable practices, reporting systems, and the implications for leadership could be tested.

2. Discussion

The significance of the research study, which will be part of a PhD in Service Design for Public Sector at the Sapienza University of Rome, is the analysis of the scientific literature and case studies, such as the Digivisio 2030 program, EIT Digital, EURASHE's strategic framework, and the CoSn consortium, that could enable in-depth, multifaceted assessments of digital issues relating to educational settings and pedagogy.

The aim is to identify the trajectory of technology policy for education within the digital educational landscape, with particular attention to the Italian context, and possibly address the present and recent history.

Of Higher Education to lay the groundwork for an analysis of feasible and successful digital service design solutions. For example, the most recent "Piano scuola.4" strategy plan for schools which foresees the implementation of innovative learning environments integrated with digital, physical, and virtual technologies as part of Italy's educational digital transition (Piano Nazionale di ripresa e resilienza missione 4: istruzione e Ricerca, 2023), defines and sets out a range of possibilities for technology-related provision within the curriculum, and schools are required to proactively respond to it. However, according to the OECD 2023 report,

> "due to the somewhat decentralized and highly devolved nature of governance, ensuring the equity of access and use of digital infrastructure and solutions in schools is a challenge," and more concerning is that "just a few of the publicly provided digital solutions and resources in Italy are mandatory, and schools have significant autonomy to choose and acquire additional components of their digital infrastructure." (OECD, 2023)

Future research on the topic may zoom in on specific challenges upon which to intervene.

By the considerations made so far, the Research questions is: how do and can Italian public schools allow for digital innovation to continue to improve and update the educational ecosystem?

By following a holistic approach to targeting systemic change, the research project will be conducted by employing an interdisciplinary mode that incorporates information, data, techniques, tools, views, concepts, and theories from multiple fields to meet the set objectives. Through the exploration of how digital innovation diffuses in targeted Italian schools' organisations at the local, regional, and national scale, the research may define their morphology, including their capacity for change, adaptation, inclusivity, interactivity, and pedagogical facilitation. The collection of data among students and teaching staff, using tools such as EUSurvey, could lead to strategic directions that can form the basis for the detection of challenges and opportunities upon which to intervene and may help educational leaders effectively guide their institutions through the digital transformation, ensuring that the move toward digital education is seamless, effective, and beneficial for all stakeholders involved.

In this scenario, the capability of the service design approach, which involves the students, schools, and all stakeholders orchestrating the backstage and frontstage of the educational service, seems beneficial (Trischler et al., 2022). It presents the idea of bottom-up initiatives to establish both a long-term vision and

short-term achievable goals through the "analysis of other sub-factors, such as infrastructure and spaces, school culture, planning strategies, professional development, and teacher ICT - Information Communication Technology-efficacy and ICT integration competence" (Wu et al., 2019, p.1221).

The resulting findings will serve as the theoretical and methodological foundation for the definition of service design approaches and suggestions on the critical characteristics of upcoming innovative educational ecosystems.

3. Conclusion

Building a digital transition for education is acknowledged to be significant and will soon serve as a driving force. Digital transformation involves changing inclusive processes and procedures. Yet, a broad understanding must be made of a sustainable vision of a digital school (Haleem et al., 2022). Challenges detected but for which solutions remain difficult to scale include advancing digital equity, equipping educators, and adapting traditional organizational models to more flexible designs that advance the future of the workplace. To justify digital transformation, policies need to be complemented with a methodical approach that includes explicit priorities and agreed models for growing and sustaining.
The project aims to tackle these issues by linking three main areas: policies (objectives and priorities), virtual space and technology (online/network-based learning and teaching), and social aspects (local, national, and global community). It seeks to define new public educational design services that are co-created collaboratively by actively involving end-users both locally and worldwide in promoting their experiences and sharing data. The network/space will be a living entity with iterations and interactions between students, teachers, and educational leaders that assist schools in the value creation of digital transformation.

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P/REFERENCES OF DESIGN

INFORMATION DESIGN AND DATA VISUALIZATION IN THE ITSERR PROJECT.

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KEYWORDS | RELIGIOUS STUDIES, DIGITAL HUMANITIES, DATA VISUALIZATION, DIGITAL ARCHIVES, UX RESEARCH

ABSTRACT | Resilience, as the first European research infrastructure for Religious Sciences, establishes its foundational framework through the collaborative efforts of the ITSERR research team – Italian Strengthening of the ESFRI RI Resilience. The objective of this project is to develop new visualization tools and systems aimed at providing support to the scientific community engaged in Digital Humanities for Religious Studies. Employing an experimental and interdisciplinary design approach within the ITSERR ecosystem, the research explores visual strategies in Information Design and Data Visualization. The aim is to preserve both tangible and intangible religious corpora's heritage. To analyze visualization systems created by Christian and Islamic scholars in theological, historiographical, scientific, and graphic-visual contexts, it is necessary to study several infographic representations and their evolution over time. According to the academic perspective, De Christiana Doctrina by St. Augustine emphasizes the necessity of combining exegetical examination of sacred texts with historiographical and scientific pursuits (Brotton, 2017). An essential tool for providing support and guidance through the phases of research and graphic design is a multidisciplinary glossary that can be established as a collaborative space accommodating various disciplines.

Within the multidisciplinary milieu of ITSERR, the integration of qualitative techniques in the design process is deemed essential for an exhaustive comprehension of individuals' activities and the influence of environmental factors, as articulated by Norman (2019). Methodologies such as structured interviews, focus groups, and VARK questionnaires serve as guiding tools, steering designers toward creating designs that facilitate a more congenial learning experience for users through dynamic and multichannel audio-visual modalities. As a result, the ITSERR project's amalgamation of concepts from history, theology, and science creates a complex network of data and information. The translation of this intricate web requires the use of strategic communication design methodologies.

1. Introduction

1.1 ITSERR: a Transdisciplinary Research Platform

Within the ESFRI, the European Strategic Forum on Research Infrastructures, ITSERR has emerged as a strategic instrument fostering scientific research in Europe and fortifying the diffusion and internationalization of Religious Studies. Within ITSERR, the convergence of memory and science preserves the past through memory reconstruction and new interpretations, particularly within religious corpora, where sacred texts become "places of memory." In the religious corpora, the word becomes "omnipresent": the sacred texts, as timeless "places of memory," are mnestic archives that connect the history of both God and man (Assmann, 1997). A transdisciplinary design approach is a means to develop innovative visual strategies for the preservation of both material and immaterial heritage described within the narrative space of the corpora and their linguistic toponyms.

The ITSERR's research ecosystem is paramount for the Resilience project, involving different disciplines, departments, and Italian universities as project collaborators (the University of Modena and Reggio Emilia, Turin, Naples L'Orientale, the University of Palermo with Departments of Architecture, Culture and Society, Law, Engineering, Mathematics, and Computer Science). The core of this framework is the amalgamation of knowledge and expertise to support comparative studies and advance scientific research. In this context, a specialized team of designers comprised of an associate professor, a researcher, and a Ph.D. student is working in the field of Religious Studies to connect Information Design, Data Visualization, and Digital Humanities.

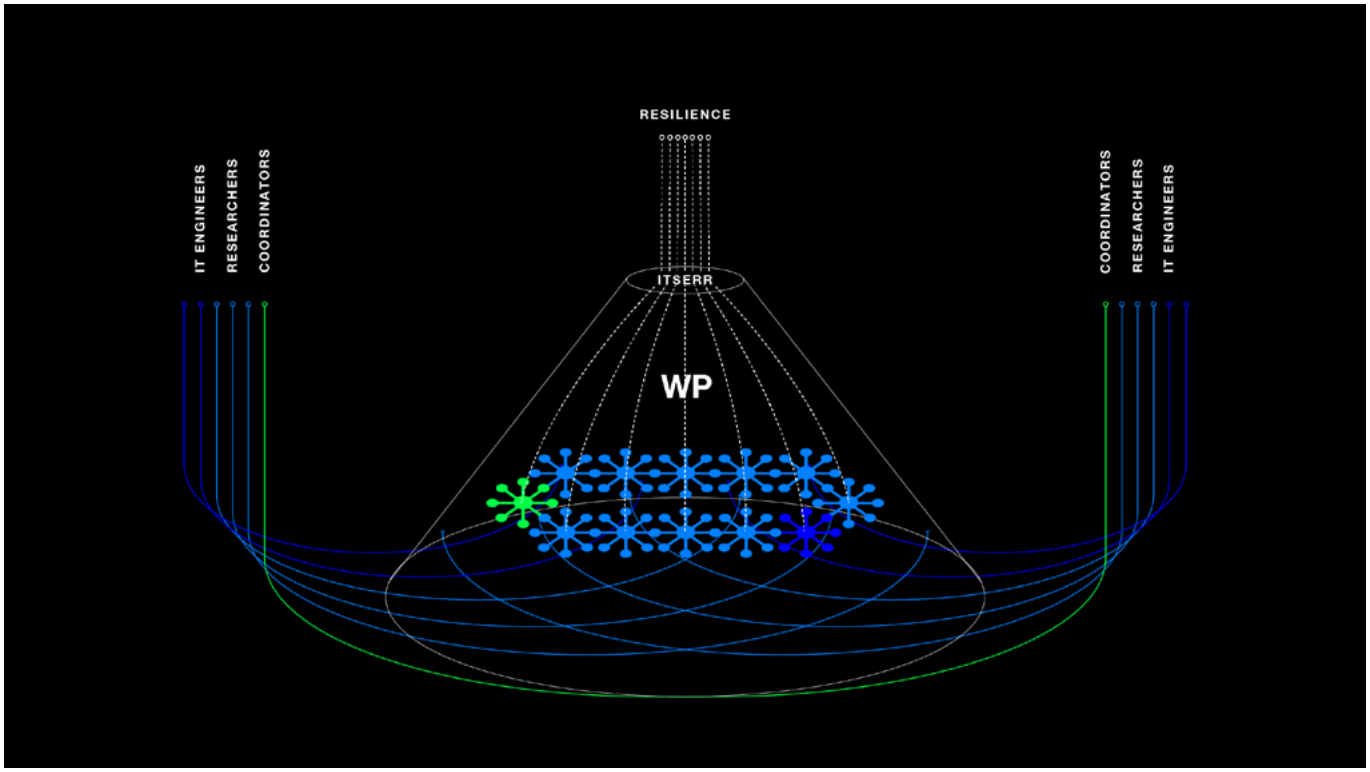


Figure 1. ITSERR ecosystem.

1.2 Research Questions and Objectives

To devise more effective visualization systems and conserve the material and immaterial heritage embedded in religious corpora, the research aims to explore new visual strategies within Data Visualization. The primary focus is enhancing the processes of consultation, archiving, and data utilization

within the humanistic discipline of Digital Humanities. Key questions include selecting, designing, and creating tools to construct a multidisciplinary design language. Integral queries involve identifying, designing, and generating tools to create a comprehensive multidisciplinary design language. In addition, the study explores the intricate dynamics of how design contributes to the realms of communication and content dissemination, allowing for the visualization of new semantic, syntactic, and morphological configurations.

2. Methodology

2.1 Anthropocentric Design

To ensure the seamless integration of scientific knowledge into the design process, it is essential to establish a methodological framework that is meticulously tailored to various research and project phases (Maldonado, 2015). Ubiquity's scope encompasses a defined methodological approach that incorporates techniques from allied disciplines in harmony with the project's transdisciplinary nature. In a collaborative setting, philologists, historians, computer scientists, engineers, and designers work together to develop new methodologies and tools.

The influence of Human Factors (Sinico, 2012) in the design process requires the implementation of interdisciplinary methodologies, pushing research into novel realms and elevating communication design to unprecedented heights. According to Human-Centered Design (Norman, 2019) and Humanity Design-Centered (Norman, 2023), qualitative research methodologies prioritize understanding human needs, capabilities, and behaviors as a guideline for adaptive design strategies. Anthropocentric design is emerging as a means of tracking a design trajectory, with observation as the primary method for collecting data on non-verbal behavior (Corbetta, 2015). Acquiring knowledge requires listening, and the user is both a researcher and a consumer of content. The design process is enhanced by the researcher/user's active involvement throughout the project phases, which ensures that the resulting products are authentic, comprehensible, and user-friendly (Norman, 2019).

2.2 Researcher's Work: An Inquiry into Methods and Tools for Humanities Research

Structured interviews and focus groups are essential in qualitative anthropological-social research, as they help to understand the analyzed environments and contexts and provide insights into the characteristics of representative interviews.
The use of a tool like Google Form, which was intended for structured interviews, is utilized to gather information from ITSERR researchers in humanistic disciplines. The interview format, which is broken down into four thematic groups (Spaces, Tools, Time, and Knowledge) and uses both open-ended and closed-ended questions, allows for capturing the expressed needs, requirements, and desires of the scientific community. Notably, the incorporation of open-ended questions enables the detailed documentation of the intricate aspects of the researchers' activities. After being collected, the results were reworked and standardized in an Excel matrix. This has resulted in the creation of a first representative sample and the attainment of valid qualitative results, which can be utilized to extrapolate new research ideas.
Furthermore, a retrospective review of previous studies demonstrates the distinct cognitive modalities employed by each individual in information assimilation (Claxton & Murrel, 1987). The different ways in which individuals acquire, process, interpret, and elaborate on information are delineated by cognitive-personal, info-processual, socio-interactive, and didactic-preferential models (Curry, 1983).

Analyzing individual learning styles is essential for recognizing diverse cognitive approaches in information acquisition and processing. The VARK system, conceptualized by Fleming (1987) – an acronym for Visual, Aural, Read, and Kinesthetic – facilitates the identification of preferred didactic patterns utilized by individuals. This encompasses four sensory learning modalities: non-verbal visual, auditory, verbal-visual, and kinesthetic. Through these modalities, information is acquired using non-verbal visual aids like

diagrams and graphic visualizations, auditory aids such as recordings, verbal-visual aids encompassing texts, annotations, and writing, and kinesthetic aids involving practical and laboratory activities. The VARK model, introduced by Fleming to enhance the learning experiences of his students, aims to scrutinize the ways and strategies through which data and information are recorded and processed. To achieve this, a questionnaire based on Fleming's framework (1992) was devised to comprehend the learning styles employed most frequently and the channels through which researchers acquire new knowledge.

3. Results

3.1 Learning Styles: Methods and Strategies in the Acquisition and Personal Elaboration of Information

The observations and collected data underscore the necessity of designing more effective and intuitive tools to enhance data and content utilization in scientific research. According to the Vark questionnaires (figure 2-3), humanist researchers are more likely to use visual channels (verbal and non-verbal) for annotation and information acquisition. Notes, annotations, lists, definitions, and customizable signs can be useful tools for the user/researcher to enhance the use and dissemination of textual and paratextual data and information. This prompts new questions about the subject being investigated and demonstrates how analog tools can aid in the better organization of information by utilizing personal visual codes. The obtained data not only uncover novel inquiries relevant to the investigated theme but also affirm the indispensable nature of dialogue and collaboration among researchers and industry professionals as tools for knowledge enrichment.
From this, it emerges how it is essential to design more efficient and intuitive tools that can improve the use of data and content in the scientific research of Digital Humanities.

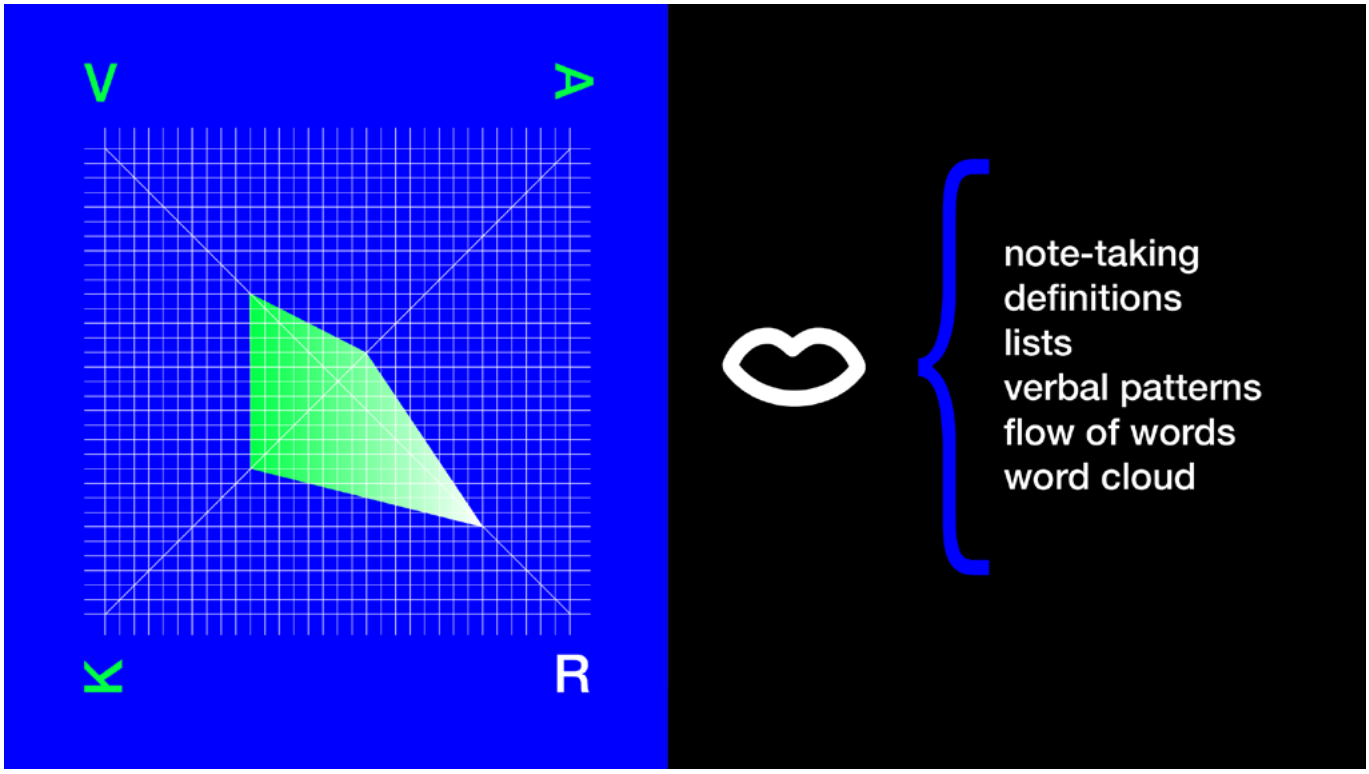


Figure 2. The graph illustrates the learning strategies employed by humanist researchers to acquire data and information: verbal strategies such as creating word lists, using definitions to clarify concepts, word streams, and annotations are preferred by researchers who have identified significant responses in the visual verb channel (R=read and write).

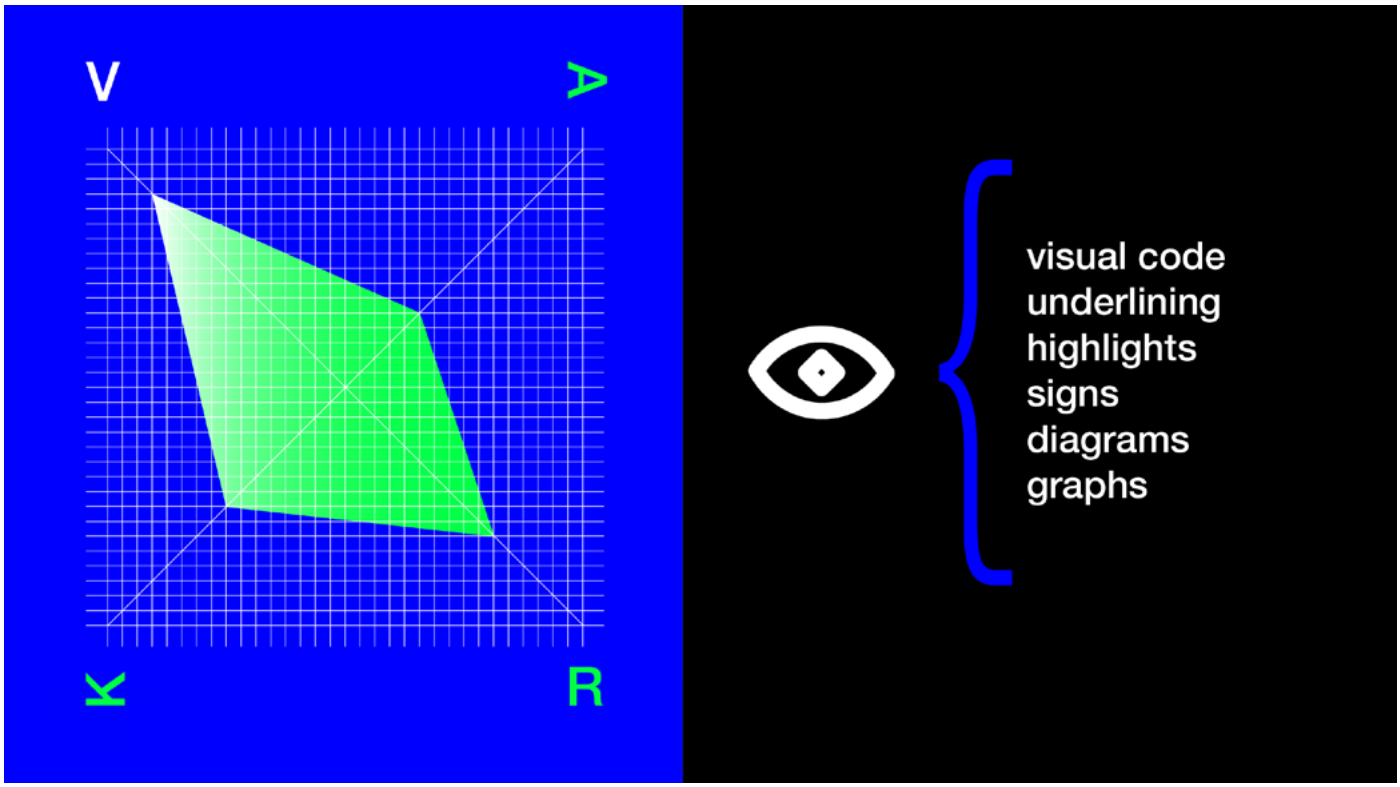


Figure 3. The graph illustrates the learning strategies employed by humanist researchers to acquire data and information: verbal strategies, such as creating visual code using underlining signs and highlights, are preferred by researchers who have identified significant responses in the visual nonverb channel (V=visual).

Analysis of the documented responses reveals a predilection among researchers for recording qualitative and quantitative data using personalized visual-verbal codes and analog annotation methods. Subsequently, these acquired insights undergo processing through digital annotation tools. Digital tools contribute to a hierarchical and structured organization of concepts, thereby accelerating document production and significantly curtailing compilation time. The mechanization of processes, coupled with data and metadata storage, in conjunction with the potential for multi-spatial and instrumental pole connections, ensures the production of complex, precise, and easily disseminable documents.

On the other hand, analog tools retain a pivotal role in transcribing acquired information. The capacity to craft visual-verbal visualizations inherent in writing is limited by the deficiency of mechanically annotating data through digital devices, such as computers. Perondi and Romei (2010) pointed out that computerized writing has reintroduced a linearist bias, making it more difficult to compose non-rigidly sequential texts. The inability to incorporate characters beyond the basic set, coupled with the inability to dynamically organize text in space, results in semantic impoverishment. The reevaluation of data and information through visual-verbal connections, encompassing arrangement, orientation, size, etc., bestows an enhanced value and meaning to the written word, with space emerging as "one of the central dimensions of writing [...] that could allow for the most interesting developments" (Perondi, 2023).

Furthermore, the inherent flexibility of analog writing tools (pen, pencil, etc.) and the swift, fluid gestures inherent to the act of writing position calligraphic writing as a particularly apt means for the transcription of thought. However, in a novel rendition, contemporary devices like the iPad Pro offer an experience closely mirroring analog writing. This experience is characterized by "allowing the spatial organization of writing and a user experience that captures the text as a whole," surpassing the capabilities of digital platforms utilizing AI systems for the spatial organization of content (Perondi & Romei, 2010). The enhanced ability to trace data within text and reprocess extracted information utilizing customizable visualization tools persists as a central and unavoidable concern for accurate design. To transform this into a novel source of knowledge, it is necessary to develop more adaptable writing tools to ensure an improved approach to the written text (Perondi, 2023).

4. Conclusions

4.1 Future Scenarios for Religious Studies

Mapping information involves simplification and abstraction and uses graphic configurations derived from cultural and social conventions, which vary across different cultures. According to Barthes, images have significant expressive value as a sign or element of a communication system (quoted by Polano, 2018, p.10). Using visualization through images, specific concepts can be communicated using iconographic models that are shared within collective memories and knowledge. However, Polano introduces the caveat that "unlike writing or language, the image presents itself globally, making it difficult to determine the context. Thus, what the image gains in expressiveness, it often loses clarity." Images are always accompanied by words, whether they are in the form of captions, comments, or detailed explanations. Sinsemic relationships established between text and image within a specific context, defined as the graphic space of representation, influence the meaning attributed to the elements they reference. Data visualization through images and visual analogies can emerge as an influential tool for generating and communicating new meanings (Perondi, 2023).

At the same time, the design of spatial and temporal visualization systems incorporating multiple graphic representations, such as iconography and typography, culminates in outcomes that, when translated into interactive and hypertextual systems, unveil novel visual configurations.

This exploration goes beyond the realm of knowledge:

- Space: The primary dimension discussed pertains to spatiality, delving into different visualization systems that consider synthetic relationships between text and image as tools for knowledge and semantic enrichment.
- Time: After spatial considerations, the fourth dimension of knowledge, temporality, is examined through timeline construction. This facilitates the visualization of a dense network of relationships that intertwines the history of terrestrial and celestial locations with figures from biblical and Quranic contexts, Church Fathers, and theologians within commentaries and religious texts.
- Knowledge: The dimension of scientific knowledge is meticulously constructed using established tools and methods, some well-established in design and others bespoke to cater to multidisciplinary teams. Creating a shared glossary within the Ubiquity team transforms it into a research tool, facilitating the study and connection of terms across diverse disciplines. The process involves defining diverse domains that can be further broken down into disciplinary subdomains: design, religious studies, and computer science.

Graphically visualizing concepts, content, and words and capturing logical-transversal connections significantly enhances research efficacy. By utilizing customizable graphic configurations and the ability to trace direct and indirect information hierarchically across multiple reading levels, research can be elevated by facilitating text comparisons and expediting meticulous analysis. The exploration of novel visualization strategies within the domain of data visualization and information design for Religious Studies, aligned with the adoption of transdisciplinary methodologies, steers design efforts toward crafting profound multimedia and immersive narrative systems. According to this approach, infographics are invaluable memory aids and powerful tools for exploring and constructing new knowledge (Yates & Gombrich, 2007).

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Péter Bogyó:
The Pattern

Éva Darabos:
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