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DESIGN ACROSS BORDERS UNITED IN CREATIVITY

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DESIGN ACROSS BORDERS
UNITED IN CREATIVITY

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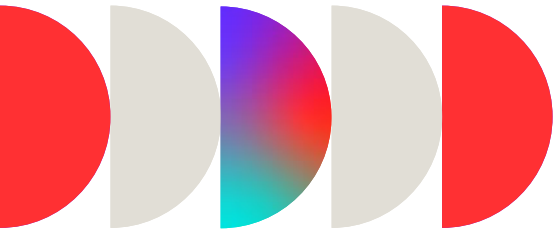


Preface

In a world shaped by constant transformation and global interconnectedness, design emerges as a bridge between people, places, and ideas. Cumulus Monterrey 2024: Design Across Borders – United in Creativity invited the international design community to reflect on the profound potential of design to transcend cultural, geographic, and disciplinary boundaries, uniting us in the shared pursuit of innovation, inclusion, and positive change.

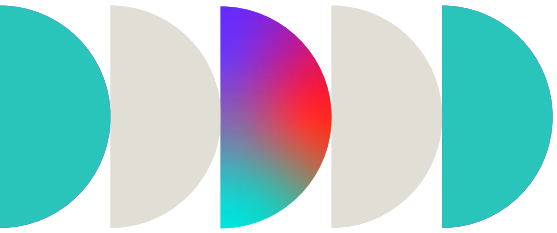
This edition of the Cumulus Proceedings gathers contributions that respond to urgent questions: How can design foster empathy and intercultural understanding? In what ways does it become a catalyst for social transformation in a complex, globalized world? Can design truly become a universal language—and what are the challenges in achieving that ideal?

The richness of perspectives represented in these proceedings speaks to the global nature of the Cumulus network. Authors, researchers, educators, and practitioners from across continents have come together to share insights, experiences, and provocations within four thematic tracks:

- Design for Change explores design's role in social innovation, sustainability, equity, and the circular economy—highlighting projects that place co-creation and inclusion at their core.
- Speculative Futures ventures into emerging territories shaped by technology, artificial intelligence, and immersive experiences, imagining the future of creative practice.
- Education in Art and Design focuses on pedagogical innovation, interdisciplinarity, and the challenges and opportunities of digital transformation in global learning environments.
- Translocality brings critical attention to issues of migration, decolonization, and the Global South, recognizing the importance of diverse voices and perspectives in shaping a more equitable world through design.

Together, these contributions reflect a collective commitment to harnessing creativity as a force that transcends barriers—linguistic, political, cultural—and brings people together around shared values and visions.

We are proud to present this volume as a testament to the power of design to imagine, inspire, and unite. May it serve not only as a record of this important moment in time but also as a spark for continued dialogue, collaboration, and transformation in the global design community.



Design Across Borders: United in Creativity

Lorenzo Imbesi
Full Professor, Sapienza University of Rome
President, Cumulus Association

The Cumulus Monterrey 2024 Conference marked a timely and vital moment in the global conversation about the role of design in shaping a better world. Hosted at the prestigious design institutions of Tecnológico de Monterrey and Universidad de Monterrey (UDEM), the international gathering has been further enhanced by the unique Monterrey's rich heritage and cultural identity, contributing to a thriving ecosystem of creative exchange for scholars, researchers, and practitioners across various design disciplines.

The central theme of the conference, "Design Across Borders: United in Creativity," provided an inspiring gateway for exploring how design holds the possibility to transcend geographical, cultural, and disciplinary boundaries. In particular, the conference was framed by four imperative trajectories: "Design for Change," investigating how design practices can drive social innovation and sustainable development; "Design Futures," exploring the interplay between technology and creativity, immersive experiences, virtual realities, and the implications of artificial intelligence; "Education in Art and Design," investigating pedagogical approaches in the field; and "Translocality," addressing complex issues of migration, decolonisation, and North-South dynamics. Themes highlight the broad scope of contemporary artistic and design pursuits.

At the heart of the conference was a shared recognition that design can be a dynamic force for empathetic understanding and intercultural dialogue. Through a rich program of keynote lectures, panel discussions, workshops, exhibitions, and informal exchanges, the international community demonstrated determination to work collaboratively across geographical and cultural divides, confirming the foundational premises of the conference: that creativity knows no boundaries, and through design, we can forge connections that transcend the limitations of space, time, and cultural difference. In an era of unprecedented global challenges, from climate change to technological acceleration, from cultural conflicts to social inequities, designing without boundaries means identifying areas of commonality, intersection, and convergence, highlighting them in ways that resonate with and reflect the spirit of our transborder region. As traditional confines between nations, disciplines, and cultural contexts become increasingly permeable, the design community must find itself uniquely equipped to harness this fluidity. Rather than resisting uncertainty, design must embrace it, transforming constraints into opportunities for innovative problem-solving and cross-cultural exchange.

The proceedings collected in this edition offer an extensive variety of perspectives on the ideas and projects discussed at the event. They include case studies, speculative work, educational reflections, and practical strategies, all pointing to the evolving role of design to shape societal interactions, encouraging intercultural dialogue, and building a more harmonious and interconnected world. However, these proceedings capture only a portion of the energy and insight shared during the conference, with the remaining impact continuing to reverberate through ongoing collaborations and dialogues within our global community.

As we move forward, the conversations from Cumulus Monterrey 2024 remind us that creativity thrives not in isolation, but in community. And in a time marked by division and uncertainty, design, when practiced with care and intention, can truly serve as a bridge. One that brings us together to learn, to act, and to imagine a positive change.

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MULTIDIMENSIONAL ARTISTIC PROCESSES AND STRATEGIES FOR CONVERSATIONAL PRACTICES BETWEEN WOMEN

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ABSTRACT | This paper explores how conversations through multidimensional artistic processes and strategies enable empowerment for women across borders, race, sexuality, and class. These conversations are not just daily interactions but integral to forming solidarity and supporting the collective fight against oppression. While conversations as method and methodology have been discussed in feminist research, the role of global justice for women within artistic research has been less explored. My aim is to interweave artistic and feminist practices, showing how female agents organize bottom-up resistance through spatial practices in conversations. The research draws on feminist theories and practices by Elke Krasny, Françoise Vergès, and Chandra Talpade Mohanty to highlight how conversations create shared meanings and address injustices. This study looks at historical shifts and feminist discourses, highlighting how claiming spaces through female interactions is crucial for collective empowerment. The research introduces Multidimensional Conversational Processes and Strategies to link individual experiences with collective action, dismantling oppressive structures and systemic injustices. Visual frameworks titled Entangled Video Setups and Mappings highlight the transformative power of conversations in art and design research. These processes and strategies encourage women to navigate and refine conversational practices. They contribute their own expertise and collectively grow their ability to engage with multidiverse perspectives. The study calls for engagement with Imaginaries of Multidimensional Conversations as an ongoing journey for sociopolitical transformation, building on contemporary art projects, feminist research and activism. This approach points to the importance of interweaving multidiverse voices and experiences to build global solidarity in the ongoing fight for global justice and liberation.

KEYWORDS | MULTIDIMENSIONAL CONVERSATIONS, FEMINIST SOLIDARITY, ARTISTIC AND FEMINIST RESEARCH, MULTIDIVERSE VOICES AND EXPERIENCES, INTERSECTIONAL EMPOWERMENT

“The social dimension of the conversational mode can be understood as a production of shared meaning. The political dimension of the conversational mode can be understood as a practice of giving equal importance to all speakers. Shared meaning, as we understand it, is connected to matters of public concern and common interest.“ — Elke Krasny, Jane da Mosto and Liza Fior (2017, p.160)

“A feminist cannot claim to possess the theory and the method; she seeks to be multidimensional and intersecting. She asks herself what she does not see, she seeks to deconstruct the malignance of school education that has taught her to not to see, feel, or know how to read, but to suffocate her senses, be divided within herself and be separated from her world.“ — Françoise Vergés (2019, p.20)

“I choose ’feminism without borders’, then, to stress that our most expansive and inclusive visions of feminism need to be attentive to borders while learning to transcend them.“ — Chandra Talpade Mohanty (2003, p.2)

1. Conversations as Everyday Feminist Practices

This contribution shares conversational processes and strategies to deconstruct power dynamics, prejudices, and systemic inequalities in neoliberal capitalist orders. Through conversations women explore differences and commonalities in their experiences of living under misogyny and patriarchy. Introduced conversational strategies enable learning and unlearning processes that promote an understanding of complex multidimensional challenges. I argue that sharing knowledge and experiences between women, while valuing the plurality of narratives and perspectives, engages in political action through collective artistic journeys. These conversations, which circulate between private and public spheres, intervene in urban environments and enable togetherness beyond categories of race, sexuality, and class. The idea is to tackle dominances through intersecting frameworks, interweaving voices of female agents organizing in bottom-up resistance as vibrant formations. I focus on sharing conversational processes rather than tools and techniques, seeing them as part of an ongoing project of interconnectedness between women. This contribution points out the potential of conversational research engaging with women's individual and collective struggles, while recognizing various lived realities.

As a female designer, artist, and researcher, conversational practices help me navigate experiences in my everyday life. I understand conversations as resilient bonds leading to interwoven resistance between women. These daily conversational practices create spaces for sharing thoughts and feelings that lead to alternative knowledge production. Everyday feminist practices form strength and resilience, sustaining meaningful relationships to which I contribute through artistic approaches and research. Drawing upon personal conversations, I examine how co-creating images with women catalyzes political action, with a focus on understanding struggles through an intersectional lens. Artistic and feminist research provide the opportunity to engage deeply with multidiverse realities as a multiplicity of global solidarity and empowerment. By dissolving the boundaries between private and political spheres, informal and formal notions, individual and collective actions, this research reshapes conversations into meaning for anti-discriminating, anti-racist, and anti-colonial learnings and unlearnings through creative processes and strategies. It investigates the potential of artistic and conversational interactions, examining how they shift between theoretical and practical frameworks, manifesting at the intersection within artistic, design, and feminist research.

My engagement lies in creating environments for conversations where women feel heard, seen, and understood, allowing space for softness, vulnerability, and emotions. The potential of these affective spaces embraces genuine connections in societies that often lack reflective practices and environments. Ann Cvetkovich looks into the transformation of public values through affect and how it can produce intellectual networks, such as relationships and kinship. She emphasizes the importance of the production of spaces that enable emotional energies to connect and think collectively. Cvetkovich argues for raising awareness for the entanglement of feelings, culture and, politics for alternative knowledge production (Cvetkovich, 2010, p. 1–12). Building on Cvetkovich's writings, I believe that integrating artistic research with conversational practices that embrace vulnerability, emotions, and feelings can be essential for dismantling oppressive structures and rethinking futures grounded in justice and equality. Similarly, Sara Ahmed investigates how emotions play a crucial role and are not just personal, but deeply social and political world making (Ahmed, 2004, p. 1–12). By creating spaces where emotional expressions are valued, women challenge existing power dynamics, generating transformative thoughts and actions. Referring to the strong emotional bonds between women, I center the role of emotions and feelings in conversational practices, particularly in daily encounters. Deeply connecting emotionally with diverse lived female experiences, conversations serve as a commitment to multiplicity for social change.

Examining the history of women's conversational practices shows how this powerful practice has always been systematically undermined and targeted as a means of oppression for centuries. The term 'gossip', originally derived from the Old English words 'god' and 'sibb' (meaning 'godparents'), initially referred to social bonds and close kinship. However, by the 16th century, official regulations began to prohibit gatherings of women and reinforcing patriarchal dominances. This shift punished any acts of independence and aimed to exclude women from communal activities, increasing the underrepresentation of women in public life. Silvia Federici examines how 'gossip' had been a form of interconnected communication and community building between women for centuries. She describes that, "It was in this context that 'gossip' turned from a word of friendship and affection into a word of denigration and ridicule" (Federici, 2018, p. 35–44). What was once a means of sharing knowledge, telling stories, and learning strategies for life became, under misogynistic pressures, a target for silencing women. Building on this historical context, I explore how women's conversations can bridge individual experiences to collective actions to address global injustices and discrimination in our global world. In Reina Gattuso's words, "… women and other marginalized people have to share information that formal systems—politics, education, and the media—often won't consider or share" (Gattuso, 2023). Oppressed communities can use their relationships and networks to develop an

ongoing journey to build spaces to grow together, which are essential for supportive environments. Gattuso observes, "At most revolutionary, we can understand gossip as 'weaponized intimacy'" (Gattuso, 2023). When personal conversations are transformed into public discourses, these interventions tackle systemic injustices as interconnected political actions and movements between women.

2. Multidimensional Approaches: Empowering Women Across Borders, Race, Sexuality, and Class

Following the argument of transformative empowerment for global justice and liberation for women, it is necessary to include decolonial and feminist theory to conversational research. To challenge existing narratives and to disrupt Eurocentric perspectives we must consider knowledge production from the Global North and Global South. Gloria Anzaldúa argues that a new way of understanding borders requires overcoming binary thinking and acknowledge complexity and fluidity. This shift is crucial for addressing and resolving cross-border conflicts effectively, as it allows us to challenge and transcend the rigid opposing frameworks that control our perceptions and interactions. The solution to global conflicts, she writes, "lies in healing the split that originates in the very foundation of our lives, our culture, our languages, our thoughts" (Anzaldúa, 1987, p. 80). Even though global neoliberal capitalist systems often make borders invisible, they persist through deportations, segregation, marginalization, and criminalization. Recognizing and embracing the intersecting identities and experiences that shape our understanding of these boundaries is crucial for addressing the complexities of border thinking (Gržinić, 2018, p. 13–16). This concept of 'border thinking' calls for moving beyond traditional approaches. It requires the development of inventive methods and political strategies that place awareness of social injustices at the center. Including 'border thinking' into artistic research supports critical building of connections and relations. To transform dominant perspectives, we must integrate dimensions across borders with a critical lens on our intertwined histories and knowledge production. 'Border thinking' rewrites and retells our entangled histories, embracing relationships that collectively resist capitalist and oppressive systems. It crosses both physical and non-physical boundaries through thought and involves people with international histories. Consequently, the research must address these complexities, challenge rigid biases, and promote anti-colonial and anti-racist liberation across borders.

The book Feminist Futures of Spatial Practice offers valuable insights that incorporate decolonial and feminist theory, presenting "new forms of activism, expanding dialogues, engaging materialisms, transforming pedagogies, and projecting alternatives." The research challenges social orders intervening in spaces through creativity and social engagement to imagine possible futures

(Schalk, Kristiansson, and Mazé, 2017, p. 13–23). The contribution by Liza Fior, Elke Krasny, and Jane da Mosto, titled Making Time for Conversations as Resistance, explores how conversational dimensions shape feminist futures and how collaboration evolves into a dialogue that engages in meaningful change" (Fior, Krasny, and da Mosto, 2017, p. 159–168). They draw on Chandra Talpade Mohanty's concept of 'imagined communities', which suggests political action through building connections between women. Mohanty argues that resistance must be rooted in historical and political contexts and emphasizes challenging conventional categories of identity through nonhegemonic feminist practices across cultures, genders, nations, and classes (Mohanty, 2003, 10–24; 46). Mohanty's work offers the opportunity to develop a deeper understanding of how to think and act intersectional, "…feminism need to be attentive to border while learning to transcend them." She critiques white feminism and academic supremacy, highlighting struggles beyond borders, drawing from her own experiences of navigating boundaries that both excluded and empowered her. The politics of solidarity is one central focus of her work which "involves profound transformation of self, community, and governance structures" (Mohanty, 1984, p. 333–358) (Mohanty, 2003, p. 1–13). Intertwining the described approaches inspires me to view conversations as a critical practice for rethinking and reshaping artistic research. Additionally, I take on the responsibility of critical self-reflection regarding my positionality. This encourages me to reflect my position as a white artist and researcher, addressing power dynamics and privileges in my work. These reflections navigate me toward refining a more transformative approach within the context of decolonial and feminist methodologies.

Afterall, multidiverse backgrounds, histories, and narratives unfold multidimensional links for building conversational practices and spaces for women beyond borders. Conversations are multilayered acts of empowerment that enable collective movements, challenging social problems and conflicts. Audre Lorde's writings highlight the importance of including interwoven interactions in feminist discourses, "Interdependency between women is the way to a freedom which allows the I to be, not to be used, but in order to be creative. This is a difference between the passive be and the active being" (Lorde, 1984, p. 89–93). For organizing these feminist spatial conversations, I focus on a contemporary multidimensional approach, which addresses various spatial and dimensional aspects for complex reflexive practices. Françoise Vergès's contribution to decolonial feminism describes a multidimensional analysis that deconstructs links and connections that exist in heteronormative orders. Vergès writes, "Decolonial feminism is a feminism that offers a multidimensional analysis of oppression and refuses to divide race, sexuality, and class into mutually exclusive categories" (Vergès, 2019, p. 19–20). Her approach enables new ways to address social injustices by supporting anti-imperial re-imaginaries.

She stresses the importance of dismantling capitalist and imperialist power structures illuminating "a kaleidoscopic narrative encompassing broad swathes of time and territory" (Vergès, 2019, p. ix). Working with Vergès's ideas helps to build frameworks for artistic approaches that engage with spatial, transnational, and multidiverse interactions. It allows relating with multidiverse contexts, making it particularly effective in artistic research. Dimensions beyond categories of race, sexuality, and class enrich artworks by adding complexity and depth, allowing for more meaningful reflective interactions of varied experiences. Multidimensionality navigates complex interdependencies, contributing kinships and allyships across borders with women. Feminist conversations as multidimensional practices across borders contribute to understanding women's lives by recognizing interconnected liberation.

3. Image Production for Future Visions: Engaging in Global Feminist Struggle and Justice

The question of how image production engages in global feminist struggle and global justice arises from the interest in past, present, and future conversations. During my research, I was deeply moved when I came across a historical photograph of three young female scholars – Esther Cooper, Alice Dritz, and Vidya Kanuga – involved in an intimate conversation during the 1945 World Federation of Democracy. Their meeting is marked by their collective fight against patriarchy, violence, and capitalism, highlighting their active role in global movements. Elisabeth Armstrong features the photograph in her article, questioning, "What does this memory mean for us now as we imagine our future?" Her question invites us to reflect not on the photograph's exemplary meaning but on its role in a particular moment in time. It challenges us to consider how we can shape our own gatherings and conversations in the present (Armstrong, 2023, 156–162). Armstrong's article, featured in The Kohl Journal, addresses Anticolonial Feminist Imaginaries, focusing on body and gender research in the Middle East, Southwest Asia, and North Africa. Under the framework of Speculative Conversation, how to 'fill the blank spaces of histories of revolution, and also re-imagine and re-capture lost, unheard, and erased voices' (Sajed & Salem, 2023, p. 1–8) is further explored. For my research, the term 'speculate' is particularly relevant, deriving from the Latin specere ('to observe, watch, look at'). I connect this notion of 'looking at' with past, present, and future narratives and the production of images. Artistic conversational practices are used to explore, challenge, and reshape these imaginaries, thereby rewriting of understanding interrelating global contexts of women.

Recognizing the importance of creating and maintaining spaces to share stories and experiences for women, I began exploring how my practical artistic work could connect with feminist and political action. By participating in symposia on 'Feminist Methodologies' organized by Elke Krasny

at the Academy of Fine Arts Vienna, I met feminist scholars from Austria, Italy, the Czech Republic, Russia, or Brazil. Despite our diverse backgrounds and fields, we shared feminist perspectives on various topics on care, solidarity, space, ecologies, decoloniality, or memory. During breaks from the presentations, talks, panel discussions, and workshops, we gathered in informal settings by sharing lunch at the market, sitting around a playground table, or relaxing in public spaces while drinking juice in the sun. This is where I began conceptualizing conversations using artistic, design, and feminist strategies. In these times, I conceptualized conversation and videos settings, seeing the potential to learn from personal stories and interactions. These experimental conversations reshaped my evolving research on how artistic environments could actively develop into transformative collective action. I discussed with feminist scholars how these conversational practices could be processed as feminist methods and methodologies, which are created, practiced, shared, and reshaped by women. The support I experienced deepened my commitment to feminist research. It strengthened my affirmation to build on existing feminist research, multiplying the transformative power of collective feminist action.

Through these research exchanges with scholars, I realized that my background in artistic approaches intertwined with conversational practices could contribute to feminist futures. Artistic and design practices highlight personal and subjective experiences that offer new possibilities to build multidiverse entanglements in depth. This intersectional approach has the power to provoke individual thought, build collective empathy, and mobilize shared action for women. Recent shifts in social and cultural research present an increasing focus on diverse methods, such as including the use of photographs, tape recorders, or anecdotes (Lury & Wakeford, 2012, p. 1–24). The implementation of alternative practices in research engages in an openness to creativity, challenging normative research methods. The field of artistic research, as an interdisciplinary approach, uses creative processes to generate new knowledge and insights. Emma Cocker's approach, for example, involves dialogue, transcription, distillation, and presentation, aligning with the research into how conversational practices in art can be a powerful tool. Cocker's concept of conversation-as-material specifically focuses on capturing and expressing aesthetic co-creation through dialogue in the context of a language-based artistic research practice and phenomenological writing (Cocker, 2022, p. 202–231). My contribution shows how artistic perspectives through image and multimedia-based formats can commit to multiplicity for conversation building multidiverse environments. It shows how artistic research can learn from feminist practices and theories and vice versa, highlighting how both forms of research can mutually benefit each other by challenging existing heteronormative norms and structures with openness to emotional and cognitive levels.

My research relies on diverse learning environments, including artworks, museums, and exhibitions, which play a key role in my research practice. By exploring global projects, I gain complex understandings that shape the creative and social actions within my work. For instance, in Pristina, Kosovo, the interdisciplinary artist Alicja Rogalska presents an alternative blueprint for the so-called 'Brother Houses' at Manifesta. By creating collaborative situations and processes, she offers a meeting place for local women to seek advice and support from experts on domestic violence. Her project, Sister Flats, is a hybrid installation showcasing videos, images, and objects created through group processes and dialogues (Rogalska, 2022). In Turkey, Oda Projesi, a feminist artist collaborative, aims to intervene in daily life through art practices, building connectivity between artists, non-artists, institutions, and communities in a three-room apartment in Istanbul's Galata district. They provide interactions that encourage dialogue and cooperation with neighbors, creating 'blank spaces' and 'holes' for social processes. As Claire Bishop writes, "By working directly with their neighbors to organize workshops and events, they evidently wished to produce a more creative and participatory social fabric" (Bishop, 2012, p. 20). In Germany, the Fem_Arc collective explores community work that exchanges personal struggles within urban transformations. The project City of Gossip deals with (informal) conversations as an urban strategy of resistance, presenting conversations from a feminist perspective in Berlin. Their window installation looks at caring participatory practice that "enables mutual help, exchanges goods and knowledge, and provides space" (ARCH+, 2023, p. 146). These interactions with artistic environments broaden my conversational practices within individual and collective feminist movements. Furthermore, I want to highlight the importance of conversations in women's fight for social change across diverse contexts within my artistic practices.

4. Sharing Processes and Strategies in the Intersection of Artistic and Feminist Research

Through conversational activities, experiences, and practices, I have expanded existing multidimensional feminist research with experimental approaches. Meeting women in my daily life has led me to evaluate spaces where women share struggles and empower each other to face challenges in collective meaning. These daily conversations have become sources of support, resilience, and strength, highlighting the importance of personal connections and growth for women in everyday environments. Additionally, participating in cultural and art spaces has allowed me to connect with women in creative discussions about past, present, and future thinking. In these settings, women learn new practices and experiment with creative ideas together. Lastly, building relationships through conversations with women from different countries through international workshops, journeys, and projects has been transformative for my feminist research. This plurality of interactions has been integral to

my approach to feminist actions, which aims to interweave women across various contexts. The shared experiences have enabled me to build global networks that acknowledge and overcome categories, boundaries, and borders. By participating in these multilayered interactions, both for this research and for myself as a woman, I aim to learn, unlearn, and build solidarity, growing my cross-border perspectives on women's struggles across race, sex, and class.

Conversational experiments practiced with women in everyday environments informed and enriched my research. Through critical reflexive practices and co-created conversations with women, I propose visualized frameworks for multimedia-based conversations rooted in intersecting artistic, design, and feminist research. I introduce Multidimensional Conversational Processes and Strategies that include Entangled Video Setups and Mappings, which transform the production of images and conversations into key elements for women to create interconnections and to increase awareness of multidiverse truths. The core of the project encourages individuals to rethink their own beliefs and build collective relations, resulting in interconnected meanings through conversational practices resulting in an ongoing process. This research aims to break the boundaries of normative thinking through speaking, listening, feeling, and participating to address the intersectional struggles of women. By discussing both differences and commonalities, this contribution provides mutual learning from diverse lived realities and cross-border experiences. The multimedia co-production of images highlights the transformative potential of artistic practices in challenging norms through inclusive thinking and dialogues. Through multimedia approaches, individuals represent themselves and become part of a collective understanding of entangled realities and the links between us. Multidimensional Conversational Processes and Strategies contributes to a broader understanding of how multidiverse worlds can be experienced across disciplines, fields, and borders, resulting in resistance and resilience for women.

In my practice-based research, I engage in multidimensional conversations with women across borders. These conversations lead me to share the following four visualized frameworks: (1) Spatial Video Practices, (2) Interconnecting Fields, (3) Navigating Conversations, and (4) Interweaving Texts. Figure 1 illustrates Spatial Video Practices to create a conversational environment without hierarchical dominance. In this setup, participants can operate the camera with shared responsibility and decide the image's composition and frame. The personal space provides women with a safe environment that supports personal interaction, with the overarching goal of togetherness as a figure. Figure 2 presents Interconnecting Fields, which functions as an expandable map of related fields, terms, and discourses. This map allows women to select, connect, or rewrite concepts, contributing to the research framework. Figure 3, Navigating Conversations, outlines conversational learning frameworks that

empower women to practice conversation and to contribute their own insights. This map invites participants to navigate and refine conversational practices, growing their ability to engage with multidiverse perspectives. Finally, Figure 4, Interweaving Texts, presents an expanding text, which documents the notions and thoughts produced during conversations using an open keyword-based approach. The four processes and strategies developed together with women provide conversational practices useful for non-artists, artists, non-researchers and researchers and others. They result in Imaginaries of Multidimensional Conversations, inviting women to join in global justice practices, actions, and movements for women.

Figure 1, Spatial Video Practices: The setup presents a conversational environment without hierarchies

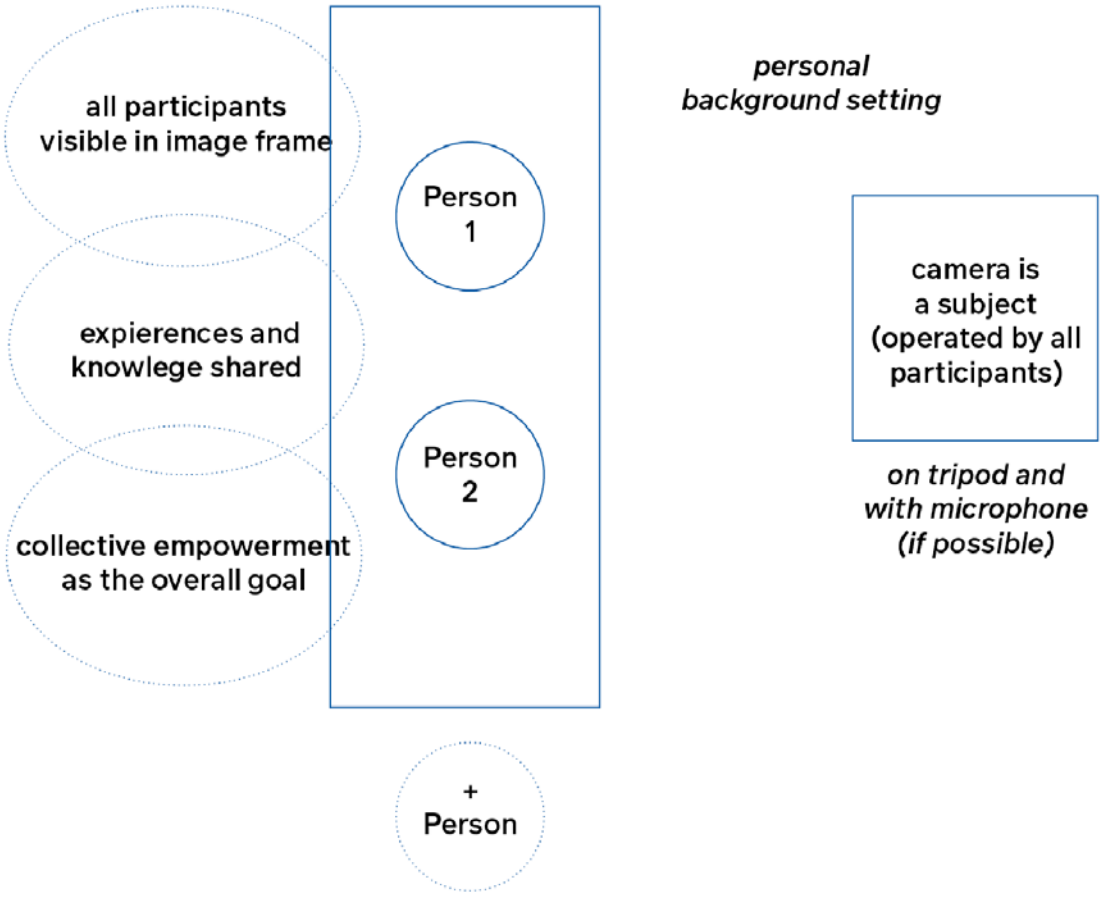

Figure 2, Interconnecting Fields: The map is an expandable field enabling participants to connect with

Figure 3, Navigating Conversations: The conversational framework engages with multidiverse perspectives

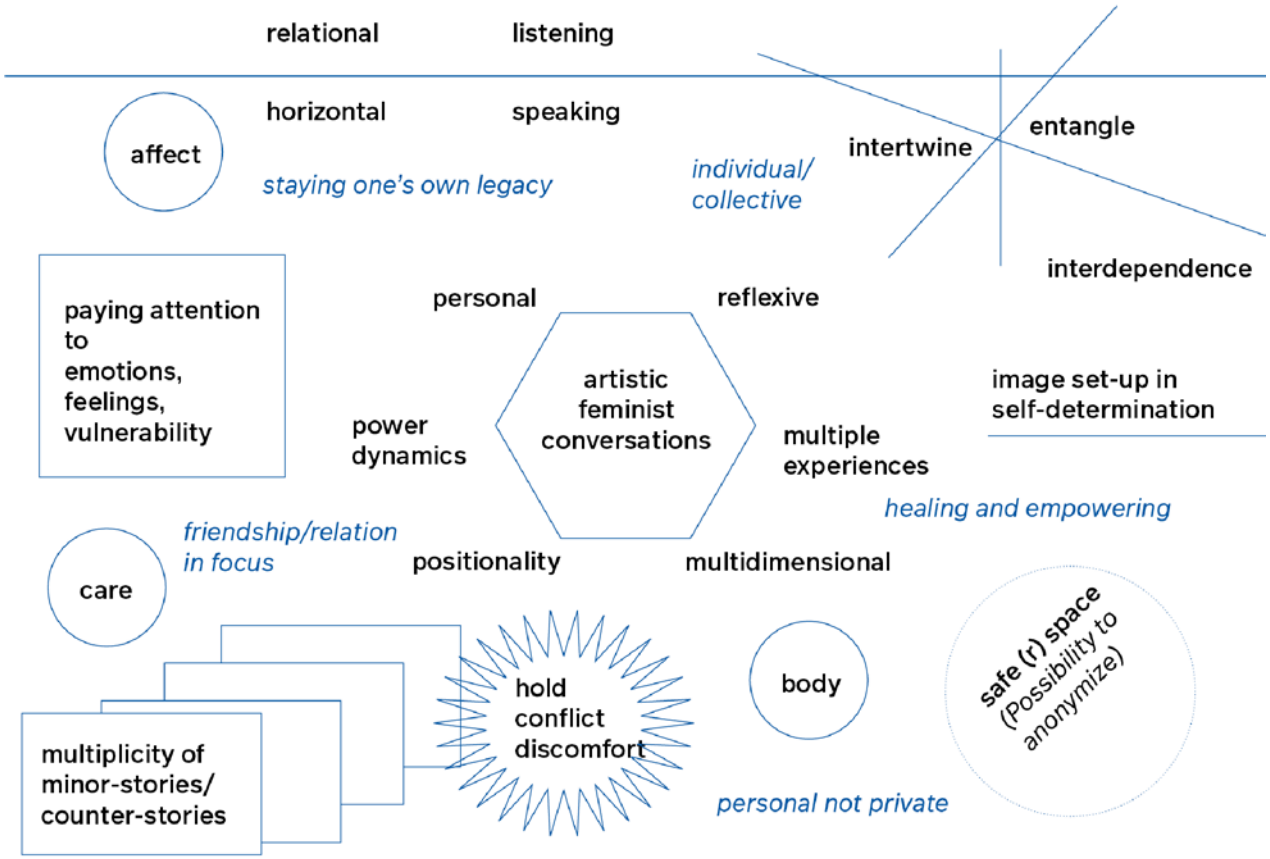

Figure 4, Interweaving Texts: The open keyword method documents new produced thoughts

#connections #conversations #togetherness #multiplicity #feminist #transnational #intersection #experience #relations #resistance #temporarily #space #entanglement #notions #interdependence #interwoven #care #affect #bodies #anti-colonial #decolonial #anti-racist #anti-capitalist #anti-sexist #space #multidimensional #dimensions #potential #resistance #commoning #transdimensional #troubling #uncomfortable #transborder #borderthinking #speculative #support #imaginaries #care #sensitivity #non-imperial #anti-imperial #responsibility #collective #collaborative #embodied #awareness #un/learning #reflection #self-reflection #engagement #activist #struggles #story #possibilities #travel #border #transborder #exploitation #discrimination #transnational #femalegaze #feministgaze #relational #tofeelseen #emotions #affect #engagement #legacies #agencies #carrierbag #anti-hero #fictional #queeringtime #time #vulnerability #healing #dissolving #troubling #courage #memories #gossip #resistance #vulnerability #artisticfilm #circulating #body #sphere #legacies #agencies #positionality #situatedness #newterm

4. Invitation in Imaginaries for Ongoing Multidimensional Conversations

This paper addresses the role of intersecting artistic, design, and feminist studies, focusing on the potential of how these fields provide empowerment for women. Conversational practices are central to my daily life, guiding personal experiences and interconnectedness between women across borders. They serve as resilient connections, shaping strategies and emotions as intertwined forms of resistance and togetherness. By integrating decolonial feminist approaches to artistic practices, I explore how conversational practices engage with multidiverse perspectives to provide global equity and collective processes for justice. Overall, this approach emphasizes the importance of engaging with cross-border experiences to support individual and collective resistance. In my research, conversational practices become political acts of solidarity centralizing feminist stories and their multiple meanings. The approach outlines the complex use of conversations as multimedia-based methods and methodologies that create learning environments in the fight for social justice. These conversational practices reconsider conventional methods by providing interwoven interactions between diverse groups that highlight personal experiences to find commonalities and differences. I pay attention to the transformative power of conversation, leading to societal change for living together. Through these moments of connection, I aim to build on existing feminist spaces of resistance, finding alternative environments for learning and togetherness.

This contribution interconnects multidimensional multimedia-based approaches with feminist research; it emerges as a powerful practice that makes visible the entanglements of women's voices. Firstly, the paper discusses how everyday conversations between women across borders promote solidarity, friendship, and empowerment. These interactions form resilient relations, allowing women to engage in strategies that provide mutual empowerment and resistance against oppressive structures. Secondly, the research presents feminist multidimensional

approaches that provide inclusivity and intersectionality while addressing feminist struggles and self-reflection through spatial conversational practices to transform perspectives across borders, race, sexuality, and class. It respects and transcends physical and non-physical borders, integrating perspectives from people with diverse international stories. Thirdly, the text draws out how conversations practiced through artistic research involve creating collective images that serve as resistance against dominant power dynamics. The artistic strategies harness the transformative power of conversations by enabling affective interactions that emphasize vulnerability and emotions, thus turning everyday encounters into opportunities for transformative thoughts and actions. Finally, the contribution points out visualized processes and strategies which invite women to engage in conversation with equal participation, trustbuilding, and empathy for various experiences. These processes and strategies are made accessible as visualized frameworks to organize conversational feminist practices and political actions – open to changes and revisions as an ongoing journey.

The project presents as an outcome visualized Multidimensional Conversational Processes and Strategies for practicing conversations between women. The conversational strategies are crucial for intervening in social structures and transformative processes. The frameworks emerge from Entangled Video Setups and Mappings: (1) Spatial Video Practices, (2) Interconnecting Fields, (3) Navigating Conversations, and (4) Interweaving Texts. These visualized frameworks demonstrate how conversations can act as powerful tactics for resistance, helping to navigate and challenge power dynamics. The artistic frameworks present how Multidimensional Conversational Practices commit to women's fight for social change and political transformation through shared meaning and alternative knowledge production. Focusing on the interconnection between individuals and communities necessitates traversing narratives for new forms of subjectivity and connection. The contribution invites women to be part of Imaginaries of Multidimensional Conversations as an ongoing journey of conversational practices for interconnected relations. Afterall, the project's focus on creating inclusive and intersectional spaces for women and advancing social justice for future-focused visions by sharing processes as an ongoing exploration of global solidarity and liberation.

References

Ahmed, S. (2004). The cultural politics of emotion. Routledge. https://doi.org/10.4324/9780203700372.

Anzaldúa, G. (1987). Borderlands/La Frontera: The new mestiza. Aunt Lute Books.

Armstrong, E. (2023). A conversation about the future. Kohl: A Journal for Body and Gender Research, 9 (1), 156-162.

Bishop, C. (2012). Artificial hells: Participatory art and the politics of spectatorship. Verso.

Cocker, E. (2022). Conversation-as-material. In Special Issue: Phenomenological and Artistic Research Practices. Phenomenology & Practice, 17(1), 201-231. https://doi.org/10.29173/pandpr29475.

hooks, b. (1994). Teaching to transgress: Education as the practice of freedom. Routledge.

hooks, b. (2001). All About Love: New Visions. William Morrow, an imprint of HarperCollins Publishers.

Cvetkovich, A., et al. (2010). Political emotions. New Agendas in Communication. Routledge.

Federici, S. (2018). Witches, witch-hunting, and women. PM Press.

Fem_arc Kollektiv. (2021). City of Gossip: Zuhören als urbane Strategie des Widerstands. ARCH+ Zeitschrift für Architektur und Urbanistik, Zeitgenössische Feministische Raumpraxis, 54, 146.

Fior, L., Krasny, E., & da Mosto, J. (2017). Conversation as resistance. In M. Schalk, T. Kristiansson, & R. Mazé (Eds.), Feminist futures of spatial practice: Materialisms, activisms, dialogues, pedagogies, projections (pp. 159-168). Spurbuchverlag.

Gattuso, R. (2016). Gossip as an act of resistance. Feministing. Retrieved January 21, 2024, from https://www.feministing.com/2016/08/23/gossip-as-an-act-of-resistance/

Gržinić, M. (2018). Border thinking: Disassembling histories of racialized violence. Sternberg Press.

Lorde, A. (2017). The master's tools will never dismantle the master's house (1984). In Your silence will not protect you. Silver Press.

Lury, C., & Wakeford, N. (Eds.). (2012). Inventive methods: The happening of the social. Routledge.

Mohanty, C. T. (1984). Under Western eyes: Feminist scholarship and colonial discourses. Boundary 2, http://dx.doi.org/10.1057/fr.1988.42.

Mohanty, C. T. (2003). Feminism without borders: Decolonizing theory, practicing solidarity. Duke University Press.

Rogalska, A. (2022) Alicja Rogalska is an interdisciplinary artist based between Berlin and London. Retrieved August 4, 2024, from https://manifesta14.org/participant/alicja-rogalska/

Sajed, A., & Salem, S. (2023). Anticolonial feminist imaginaries: Past struggles and imagined futures. In Kohl: a Journal for Body and Gender Research, 9 (1), 1-8.

Vergès, F., et al. (2021). A decolonial feminism. Pluto Press.

PACKAGING AND CULTURAL ACCESSIBILITY. DESIGNING PRODUCT COMPREHENSIBILITY FOR ALL USERS

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ABSTRACT | Our society is becoming increasingly complex and diversified, comprising individuals of diverse geographical origins, new first and second-generation citizens with their own cultures, and social groups diversified by age or specific physical and cognitive abilities.

The issue of accessibility to products, services and environments is therefore becoming increasingly visible and widespread issue, no longer confined to niches of users with specific needs. In this scenario, the aim of this contribution is to explore the accessibility of packaging, with particular reference to the dimension of cultural accessibility, which is more related to cognitive and communication design aspects.

To date, the topic of accessibility in the packaging industry has been the subject of considerable theoretical and experimental reflection in relation to its physical-sensory component. However, solutions that make packaging also cognitively inclusive for culturally differentiated audiences still deserve to be further investigated and explored.

The article proposes, through a comparative analysis of different attitudes and interpretations of accessibility in packaging, an in-depth exploration and categorisation of the communicative-informative characteristics. Particular attention is paid to the consideration of the cultural background of the target users, which we define as cultural accessibility.

This analysis specifically aims to implement an operational tool for the investigation and design of accessible packaging. The purpose of this tool is to provide an objective assessment of the level of accessibility of packaging, thereby guiding the designer in the identification of solutions to enhance existing packaging, increase its level of accessibility and sustainability, and ensure its social responsibility.

1. Introduction

Our society is becoming increasingly complex and diversified, with individuals from various geographical origins, new first and second-generation citizens with their own cultures, and social groups differentiated by age or specific physical and cognitive abilities (Figure 1). Indeed, over recent years, Europe's demographic structure has undergone significant changes due to strong migration flows and an aging population (Eurostat data, 2023). As a result, the issue of

accessibility to products, services, and environments is becoming more prevalent, extending

beyond niches of users with specific needs to encompass society as a whole.

Figure 1. Dimensions of diversity. Credits: authors.

In our era of globalization, multiculturalism is an integral part of modern societies (Cerrina Feroni & Federico, 2017). The interconnections between diverse cultures influence many aspects of daily life, from cuisine to fashion, education to design.

Designing for a multicultural world is not only about inclusion but also about innovation and sustainability. This approach allows for the creation of products, services, and spaces that meet the needs and desires of a diverse population, promoting social cohesion and valuing cultural diversity.

Social sustainability, which considers people's well-being as fundamental, can be achieved through an inclusive design approach, involving values such as equity, safety, participation, integration, well-being, and quality of life. It is also an area of focus for companies, as neglecting these aspects can lead to commercial repercussions (Fain, 2018).

In this context, the present contribution aims to introduce a recently started research project focused on the accessibility of packaging—an omnipresent, mass-produced item that accompanies almost all our consumption activities, from purchase to use and disposal. Packaging's functional and communicative attributes make it a particularly intriguing subject of study: it is a powerful communication tool, capable of conveying meanings related to brand values and significantly influences purchase decisions and consumer perceptions.

The research aims to explore packaging accessibility, with a specific emphasis on cultural accessibility[1], which mainly pertains to cognitive and communicative design aspects. While the topic of accessibility in the packaging industry has seen significant theoretical and experimental discussion regarding its physical-sensory components - such as readability, manageability, ease of opening, and usability (Yoxal et al., 2019)— there remains a need for further exploration of solutions that make packaging cognitively inclusive for culturally diverse audiences.

[1] Cultural accessibility refers to the design and provision of products, services, and environments in a way that ensures they are inclusive and usable by people from diverse cultural backgrounds. The goal of cultural accessibility is to eliminate cultural barriers and promote inclusivity, making sure that cultural differences do not hinder people's ability to access, understand, and benefit from a product, service, or environment.

[2] The Ethical Packaging Charter is a project by Politecnico di Milano and Edizioni Dativo. It is a set of principles and guidelines aimed at promoting responsible and sustainable practices in the packaging industry, promoted by the Packaging Ethical Charter Foundation. It encompasses various aspects of packaging design, production, and lifecycle management, with a focus on minimizing environmental impact, ensuring social responsibility, and enhancing consumer safety and satisfaction. (Source: https://fondazionecartaeticapackaging.org/)

As emphasizes in the Ethical Packaging Charter[2], packaging has evolved into a mature and essential product, necessitating collaborative reflection among industry stakeholders to ensure its development aligns with consumer, user, environmental, and societal needs (Baule & Bucchetti, 2015). In this context, the communicative and cultural accessibility of packaging has become increasingly significant, highlighting the importance of design awareness in influencing user interaction and comprehension.

Packaging inherently must fulfil multiple requirements, often forcing designers, producers, and distributors to balance different functions. Its primary role is to protect and preserve its contents throughout the supply chain—from production to storage, transportation, display, purchase, and final consumer use. Additionally, packaging must facilitate product sales by ensuring easy identification and clear communication of contents. It is also meant to establish a physical-sensory and cultural connection with users, allowing for intuitive and straightforward interaction. Moreover, legal requirements, such as environmental labelling and specific needs of producers or distributors, must be met (Goodman-Dean et al., 2016).

Packaging design should account for the wide range of human perceptual and cognitive processes, gestures, languages, and cultural backgrounds (International Standard, 2011). Each of these aspects influences design choices regarding shape, material, operational mechanisms, opening and closing systems, quantity, size, and placement of key information, among others. Recognizing that not all design needs can be perfectly aligned, it falls to the designer to prioritize which aspects to emphasize based on the specific context.

Extensive research in psychology and consumer behavior underscores the significant role of culture in shaping cognition, perception, behavior, and decision-making (De Mooij & Hofstede, 2011; Ji & Yap, 2016). The subjective relationship between packaging and the user can be explored through personal values, which can be categorized into three main areas: internal values (such as self-actualization, self-respect, and fulfilment), external values (like respect, security, and belonging), and pleasure-oriented values (including excitement, enjoyment, and pleasure). These values drive consumer behavior and are shaped by cultural influences (Limon et al., 2009). According to congruence theory[3], consumers are more inclined to choose products and

[3] In psychology it is a cognitive consistency theory that focuses on the role of persuasive communications in

brands that align with their personal values. Consequently, packaging that reflects both the cultural and personal values of consumers is more effective in shaping their purchase intentions (Ploom et al., 2019).

To support user and environmentally-conscious packaging design, several tools have been developed over the years, in order to assess the performances (both quantitative and qualitative) of existing packaging, evaluate their compliance with quality standards, and highlight project opportunities. For this research, some tools developed in the context of other research experiences were analyzed, which allowed for critical reflection on the interpretive keys adopted and the ultimate goals of these instruments: from environmental and social sustainability (Badalucco, 2011; De Giorgi, 2013; Barbero & Tamborrini, 2018), to design implications in terms of physical and sensory accessibility on both a qualitative (Badalucco, 2011; De Giorgi, 2013; Rossi, 2019) and quantitative/performance level (Fain, 2018).

However, aspects concerning cultural accessibility in its communicative dimension appear to require further reflection (Van den Berg-Weitzel & Van de Laar, 2001) with specific reference to the design of information content to help users overcome socio-cultural barriers. These barriers are related, for instance, to cultural self-referentiality—such as the use of technical and specialized language (Gallavotti & Pistoi, 2007)—or the lack of adequate and/or shared languages, such as the limited use of information in English or other languages, or alternative languages like Braille, digital insights, etc. These aspects have design implications related to the expressiveness of packaging —through elements like colour, shape, typography, etc. — and how information is presented, either explicitly (by highlighting facts, images, and details) or implicitly (through symbolism and metaphors).

The central research question thus becomes: what specific tools and methodologies can be developed and applied to critically analyze and promote the effective design of culturally inclusive packaging?

This entails identifying strategies and tools that not only assess the cultural accessibility of packaging but also guide designers in creating packaging that respects and reflects diverse cultural perspectives and needs. The aim is to ensure that packaging is accessible and appealing to a broad spectrum of consumers from various cultural backgrounds, thereby enhancing user experience and fostering inclusivity.

2. Cultural accessibility and packaging: a methodological approach

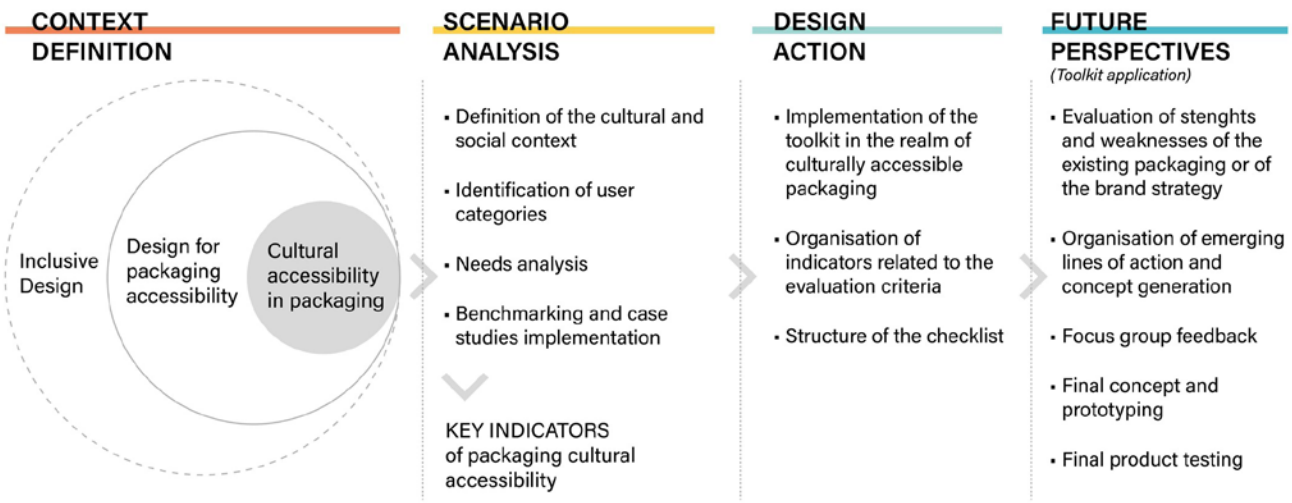
Designing the built environment, everyday objects, information, services, strategies, means necessarily having to take into account the variety of human beings, their different needs and capabilities in performing actions or achieving goals. A topic of social sustainability that looks at the component

of people's well-being as a fundamental fact, which can also be achieved through an inclusive approach.

Indeed, the central theme of inclusive design embraces various design approaches that aim to create products and services that are accessible to and usable by a wide range of people, regardless of their abilities or circumstances (Coleman, 1994). These approaches include, for example, design strategies that refer to the areas of Universal design (Mace, 1985), Design for All (EIDD - European Institute for Design and Disability, 2004) and Human Centred Design (ISO 9241-210:2010[4], point 2.7 - standard Ergonomics of human-system interaction).

The article proposes, through a comparative analysis of different attitudes and interpretations of cultural accessibility in packaging, an in-depth exploration and categorisation of the communicative-informative characteristics.

From a methodological perspective (Figure 2), the topic was initially approached through a literature review aimed at defining the design domain of Inclusive Design in packaging, which refers to the creation of packaging solutions that are accessible, usable, and appealing to the widest possible range of people, regardless of their age, ability, cultural background, or other characteristics (Waller et al., 2015). This activity allowed for the identification of the main categorizations and interpretations of cultural accessibility in packaging, which were useful for the



subsequent selection and analysis of case studies, which proved to be of interest in terms of

4 Definition of Human Centered Design available in "Ergonomics of human-system interaction - Part 210: Human-centred design for interactive systems", section 2.7.

inclusive solutions with respect to diverse user groups (gender identity, language proficiency, geographical origin, educational background, etc.).

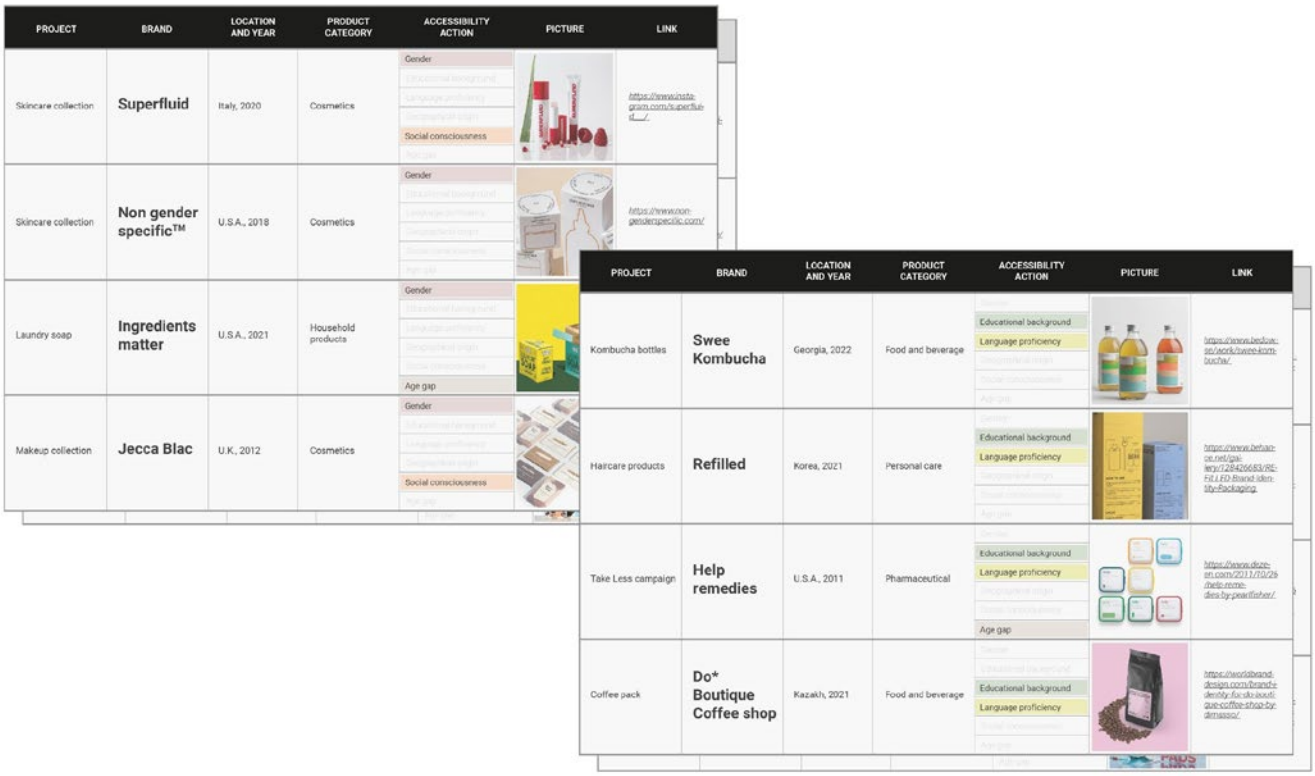


Figure 2. Methodological approach for the development of a cultural accessible packaging. Credits: authors.

A selection of 50 case studies of existing packaging (Figure 3), notable for their proposed cultural accessibility solutions, was conducted. These case studies span various product categories and were chosen based on the types of accessibility they address.

Figure 3. An extract of the case studies of cultural accessibility mapped and analysed. Credits: authors.

2.1 Gender

Gender neutrality in packaging – a topic extensively explored in recent studies - refers to designing and creating products that does not specifically target or appeal to any particular gender, aiming instead to be inclusive and appealing to all consumers regardless of their gender identity (Huang, 2023). This approach avoids using stereotypical colours, imagery, language, or iconic elements that are traditionally associated with a specific gender, focuses instead on neutral features that can appeal to a broader range of consumers (Dimaandal & Espineda, 2023).

From a gender inclusion perspective in packaging, it is evident that certain sectors, such as cosmetics and children's toys (Figure 4), have already made significant strides. These market areas have explored and implemented marketing and packaging design strategies that reflect greater sensitivity and inclusivity towards various genders. However, there are still sectors that could benefit from increased attention in this regard.
For instance, the household cleaning sector remains strongly rooted in gender stereotypes, often representing and targeting a predominantly female audience. This perpetuates the notion that domestic tasks are primarily a responsibility of women, overlooking the reality of a society where an increasing number of men share these duties. A change in packaging that reflects a more equitable and inclusive view could help break these patterns and promote a more modern and realistic image of household management.
Similarly, the alcoholic beverage sector tends to target a predominantly male audience, both through packaging design choices and advertising strategies. This trend not only excludes a significant portion of the female market but also reinforces limiting stereotypes that associate certain types of alcoholic drinks exclusively with men.
Promoting packaging that is gender-neutral or even celebrates consumer diversity could not only expand the market target but also contribute to a more balanced and inclusive representation of the consumers.

Figure 4. Some of the case studies collected in which design attentions related to gender accessibility can be identified. Credits: authors.

2.2 Educational background

From a design perspective it is essential to recognize that not all individuals have access to the same social and cultural resources. Therefore, communication must be straightforward and accessible to everyone: developing solutions that overcome socio-cultural barriers that often lead to feelings of cultural inadequacy is crucial.

Regarding the attention to the cultural background of target users, it is interesting to observe how packaging experimentation has made significant progress, particularly in the fields of personal care and pharmaceutical products (Figure 5). These areas have leveraged digital technologies and visual design techniques to facilitate access to detailed and comprehensible information about the usage and storage of products. For instance, QR codes and other interactive technologies allow consumers to access digital insights in various languages and formats, making information accessible to a culturally diverse audience. Additionally, visual simplifications, such as universal icons and intuitive illustrations, help overcome language barriers, ensuring that instructions are understood regardless of the users' cultural background.

Figure 5. Selected case studies in which some design attentions to people with different cultural backgrounds can be identified. Credits: authors.

2.3 Language proficiency

Linguistic accessibility in packaging is a topic of growing importance in the modern world, where globalization and cultural diversity have become the norm. Ensuring that product information is understandable to people from various linguistic backgrounds is crucial not only for enhancing the consumer experience but also for ensuring safety and compliance with international regulations, particularly in sensitive sectors such as food, pharmaceuticals, and cosmetics.

The use of images, symbols, and icons results in effective communication, particularly in contexts where language comprehension varies among users. These visual elements must be culturally relevant and easily recognizable to ensure that the intended message is universally understood. Incorporating digital and audio insights can further enhance comprehension; for instance, QR codes can link to multilingual websites or video descriptions, offering alternative ways to engage with textual content. Additionally, narration and verbal descriptions should be clear and engaging, ensuring that all users can access and understand the information being conveyed. This multi-faceted approach helps bridge language gaps and ensures effective communication across diverse audiences (Alley-Young, 2014).

One of the most innovative ways to enhance linguistic accessibility in packaging is through the use of digital technologies[5]. For instance, many companies are incorporating QR codes or digital insights into their packaging that redirect users to multilingual online content. This content can include video tutorials, detailed instructions, and nutritional or safety information.

Visual simplifications, such as the use of universal icons and intuitive illustrations, represent another effective approach to improving linguistic accessibility. These graphical elements can convey essential information without the need for text, overcoming language barriers (Figure 6).

Figure 6. Some of the case studies where particular attention is given to linguistic accessibility. Credits: authors.

2.4 Geographical origin

When developing packaging that considers the geographic origin of end users, it is essential to adopt an approach that acknowledges and respects diverse cultural traditions, preferences, and regional sensitivities. This can be achieved through in-depth market research that analyses the demographic and cultural variety of consumers in different territories (Berg-Weitzel & Laar, 2001), for instance, adapting the use of colours, symbols, and graphics to reflect local aesthetics and positive cultural associations (Figure 7).

Among the strategies that might be interesting to adopt, the use of foreign lettering can be advantageous if it aligns with the origin of the product, thus improving perceived quality, especially for familiar products. Positive evaluations are further amplified when there is congruency between the lettering and the product category, as consumers tend to favour

[5] It is important to remember that some functions may improve accessibility for certain types of users but not for others. In fact, digital accessibility certainly represents a great opportunity for a large part of consumers, but at the same time it can be a limitation for older users. Therefore, a good accessible packaging project should still take into account providing the same cultural content through the structuring of differentiated experiences.

familiar products with unconventional lettering (Hornikx et al, 2013). Additionally, colour interpretation by different cultures plays a crucial role in brand perception. An example is the use of the colour green. While it is universally linked to nature and life, its specific meanings can differ significantly based on the religious, historical, and cultural influences of each region. For instance, in countries with Islamic traditions, green is associated with religion, prosperity, and elegance. Conversely, in China, green can also carry negative connotations related to infidelity and shame.

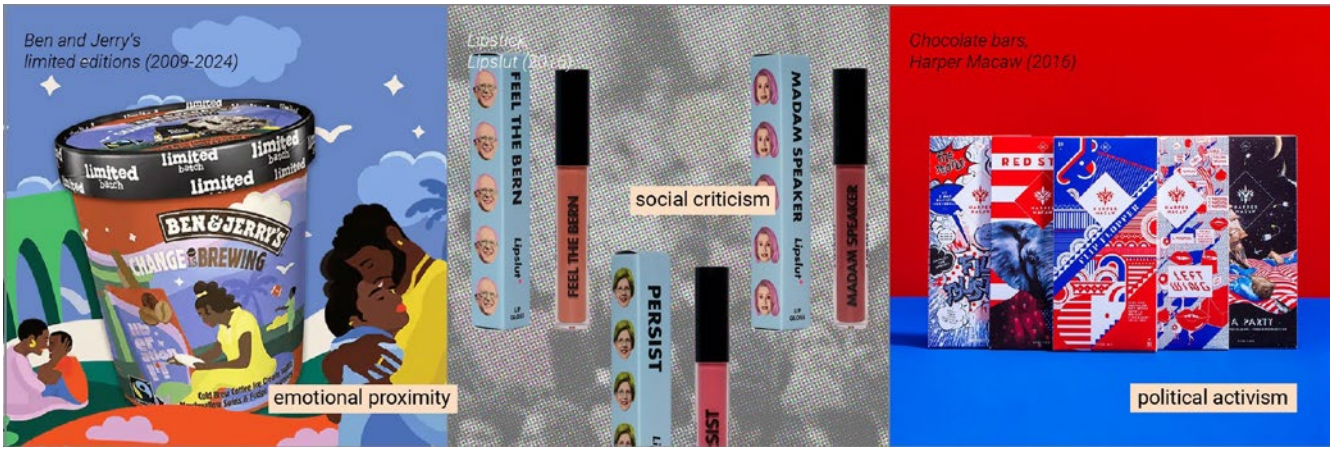
Effective packaging design should consider these cultural differences in colour preferences to avoid negative connotations and enhance appeal. Companies that skilfully utilize colour (as well as symbols and icons) in their packaging can significantly boost product appeal, increase profits, and achieve greater brand recognition, demonstrating that colours have different meanings across cultures and can profoundly affect product perception (Valdillez, 2012).

Figure 7. Some of the case studies in which attention is paid to cultural elements related to the different geographical origin of potential consumers. Credits: authors.

2.5 Social consciousness

Today's consumers are more informed, critical, and demanding, seeking trust, transparency, fairness, and social responsibility from companies. Marketers face the challenge of appealing to a generation that values immediacy, digital connectivity, and social consciousness. Large corporations are expected to contribute positively to society by addressing social and environmental issues, creating "shared value" and integrating ethical business practices and responsible investment, concerned with sustainable production and sourcing, and comprehensive environmental management (Kiygi-Calli, 2019).

Social activism in packaging (Figure 8) reflects a company's commitment to corporate social responsibility, demonstrating awareness of social and environmental concerns. This commitment not only enhances a brand's reputation and builds consumer trust but also aligns with growing consumer expectations for ethical and environmentally responsible practices. Sustainable and recyclable packaging helps reduce environmental impact, while inclusivity and diversity in design challenge stereotypes and promote equality. Brands that integrate these values into their packaging strategies often benefit from improved brand reputation, increased customer loyalty, attraction of new consumers, competitive advantage, and alignment with regulatory trends. Additionally, social activism in packaging can stimulate innovation, opening new business



opportunities and fostering a more inclusive and sustainable world.

Figure 8. Some of the case studies where an explicit brand position on issues of social consciousness is evident. Credits: authors.

2.6 Age gap

In packaging design, taking into account the differences in age of the users is crucial in order to respond to very different needs in terms of physical, perceptual and cultural abilities, thus reaching as wide a market as possible. For instance, according to some studies (Świda et al, 2018; Guido et al, 2020; Banerjee et al, 2022) certain packaging types and designs, like glass bottles, straightforward logos, and muted colours, are generally preferred by older consumers. Additionally, they give priority to details like the product's composition, producer name, and expiration date.

To cater to this demographic, packaging must address physical challenges such as reduced hand strength, compromised vision, and difficulties in reading small text. It is therefore useful to adapt design precautions related primarily to the physical accessibility of the product.

On the other hand, developing attractive culturally appropriate packaging can attract younger consumers to products traditionally targeted at older demographics (Figure 9). This strategy offers several advantages such as broadening the consumer base and changing the perception of the products. Fresh and modern packaging can significantly enhance a product's appeal, particularly to young consumers. Attractive designs, vibrant colours, and innovative graphics can capture the attention of a younger audience who may not have previously considered the product. Incorporating current trends such as interactive technologies - like QR codes and augmented reality - or popular themes can make the product more relevant and engaging for this demographic. Interactive packaging experiences, such as games, quizzes, or exclusive content accessible via QR codes, can stimulate interest and encourage engagement. Additionally, packaging that tells a story or aligns with social causes important to young people, such as environmental or social issues, can further increase its appeal. Formats are youth-responsive, like single servings or portable containers, and a renewed brand identity incorporating elements of pop culture or youthful influences, can build a stronger emotional connection and make the product more appealing.

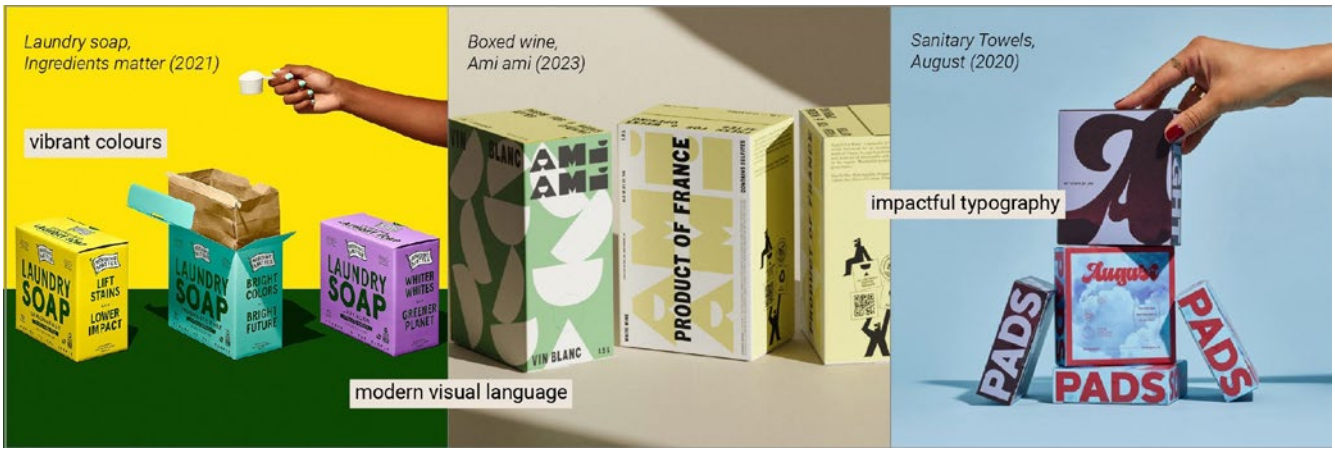


Figure 9. Some of the case studies in which specific design features open up the brand to new customer groups (with a focus on the age of the target audience). Credits: authors.

3. Future perspectives: implementation of an operational tool

Packaging transcends mere functionality; it acts as a visual storyteller, conveying emotions, values, and cultural narratives. Inclusive design principles form the cornerstone for creating packaging that appeals to a wide range of cultural backgrounds and identities. By incorporating diverse visual elements, designers can ensure that packaging speaks to a broad audience, fostering a sense of belonging and respect among consumers. This approach helps in building a positive brand image, as consumers are more likely to support brands that reflect their values and experiences.

Moreover, culturally sensitive packaging design can enhance the emotional connection between the product and the consumer. When consumers see themselves and their values reflected in a product's packaging, it creates a stronger emotional bond and can drive brand loyalty. This emotional connection is crucial for brands aiming to differentiate themselves in a competitive market.

The use of diverse cultural symbols and inclusive design elements also helps in breaking down stereotypes and promoting cultural understanding. For example, featuring a variety of skin tones and body types can challenge traditional beauty standards and promote a more inclusive notion of beauty. Similarly, using culturally significant symbols and colours can help in acknowledging and celebrating cultural heritage, thereby fostering a more inclusive society.

Incorporating these elements requires a deep understanding of the target market and a commitment to inclusivity. Brands must engage with cultural experts and diverse communities to ensure that their packaging design is not only inclusive but also respectful and authentic. This collaborative approach can lead to more innovative and culturally resonant packaging solutions.

The results of the analysis and mapping thus made it possible to critically assess the types of interventions that could contribute to a more culturally accessible packaging. Based on these reflections, the theoretical and methodological foundations were laid for the development of a tool capable of analysing the state of inclusivity of a packaging and monitoring its coherence in progress.

A brief description of the tool is therefore given below, which, in addition to the criteria of cultural accessibility, includes parameters of physical accessibility.

The development of the tool is therefore not the subject of the paper but a pre-existing element that can benefit from the outcomes of this new part of the research on cultural accessibility.

The tool consists of a detailed checklist organised by skill areas, each of which covers a different aspect of the physical or communicative accessibility of packaging. This tool has been designed to be used during specific action steps and with the involvement of different stakeholders, thus guaranteeing a systematic and collaborative approach to the process of evaluating and improving the product itself: this allows data and feedback to be gathered from different perspectives, ensuring that all skill areas are examined and improved in a coherent and integrated way.

The moment a company decides to take critical action regarding the accessibility (physical, sensory, communicative) of its packaging, the first step should be to interact with the designer expert in order to understand the scope and objectives of the project.: the specific products in question, current accessibility challenges and what the company hopes to achieve are discussed.

The next step should involve the designer gaining a deeper understanding of the products, the target market, and the social and cultural contexts of the area where the products will be sold. In a next phase, crucial in the methodological process, would be the organisation of dedicated focus groups with stakeholders, during which accessibility problems and points of specific design interest are noted. To guide this process, the designer can will use the checklist as an operational tool to support the critical analysis of specific aspects - examining both the physical, sensory, and cultural accessibility of the packaging - and to provide a general overview of the product, highlighting its strengths and identifying critical points, which can reveal new design opportunities. To go into more technical detail, this tool includes two specific devices: an evaluation form in the format of a checklist of criteria, useful as a pre-design tool (Badalucco, 2011), capable of returning the level of accessibility of the existing packaging analysed, and the indication of possible improvements related to the results of the analysis carried out. The purpose is to provide an objective assessment of packaging accessibility, guiding the designer in identifying solutions to enhance the packaging's accessibility, sustainability, and social responsibility, particularly concerning physical and cultural contexts.

The first form analyses physical accessibility characteristics, grouped into subcategories such as handling, opening, closing, and dispensing systems. It documents the presence or absence of these features and evaluates any complexities or difficulties in the physical interaction between the user and the packaging, considering factors like required force, number of movements needed, and the possibility of one-handed use, etc.

The second form considers the communicative accessibility characteristics divided into aspects of information, comprehension, identification, and cultural factors.

The forms (Figure 10) are graphically structured with four columns to enhance understanding and make completion more intuitive. The main column lists statements related to the characteristics being evaluated (e.g., "Cultural aspects"), offering specific references. To the left are the subcategory groupings, while the four evaluation parameters are to the right:

- "No" indicates the characteristic is not met for any user category.
- "In part" means the characteristic is met only for some user categories.
- "Yes" signifies the characteristic is met for most user categories, including people from various cultural and linguistic backgrounds, able-bodied individuals, individuals with physical limitations (e.g., motor disabilities, visual impairments, deafness, arthritis, colour blindness), individuals with cognitive limitations (e.g., neurobiological disorders, mild intellectual disabilities), and individuals with temporary

limitations (e.g., pregnant women, people with injured limbs).

· "N.A." (Not Applicable) applies if the characteristic cannot be evaluated for the specific type of packaging analysed.

The final column for notes is essential, as it allows for documenting observed criticalities, providing a useful basis for subsequent packaging improvement guidelines to be developed by the designer. The completion process can ideally be divided into two phases: after the initial analysis, which involves observing the packaging, filling out the various items, and writing notes, the number of ticks for each evaluation parameter is counted. This will highlight, using a "traffic light system", the subcategories that require more attention due to potential accessibility issues.

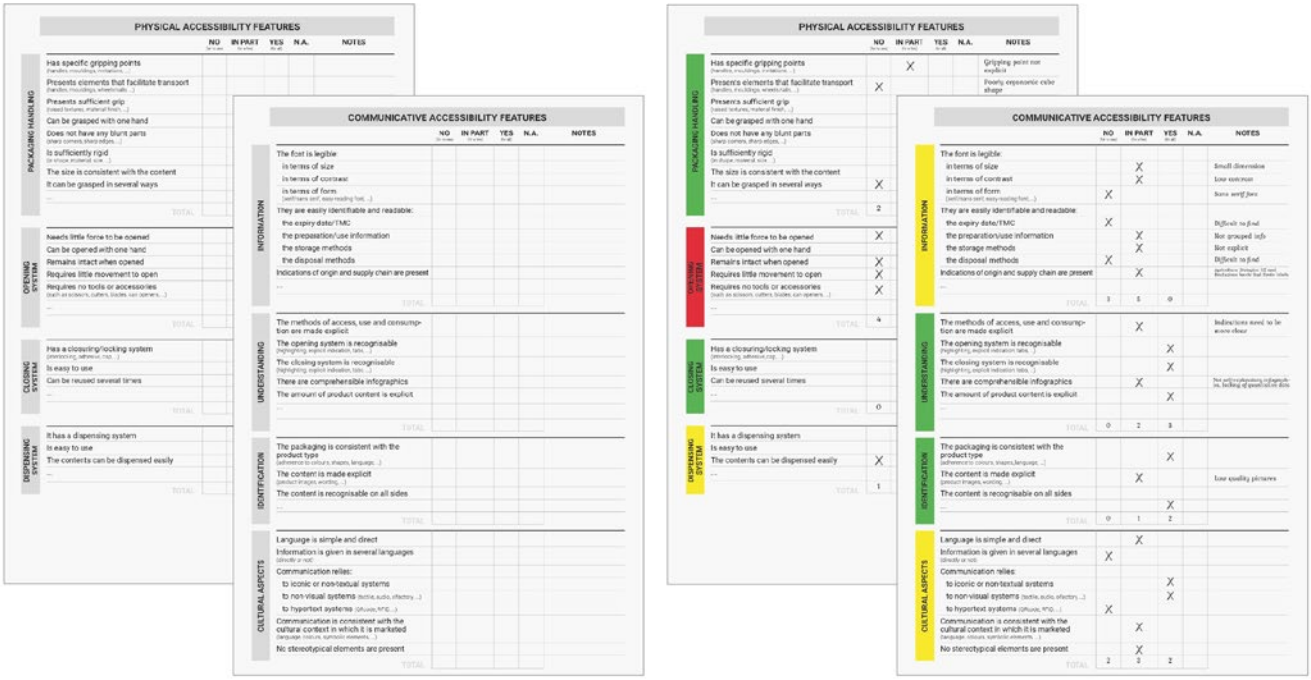


Figure 10. The structuring of the tool and an example of compilation. Credits: authors.

After this analytical session, the designer examines the results, extracting the critical issues related to the accessibility of the packaging under investigation and translating them into requirements for the re-design of the product. The designer then moves on to the creative phase, developing new design concepts that address the identified problems. These concepts are then discussed with stakeholders and technically developed until a design is achieved that best meets the needs expressed in the preliminary phase. These will be further tested through models, which are tested internally to ensure compliance with the required accessibility standards. After that, the company can develop prototypes based on the implementations proposed by the

designer. It would be essential to propose again at this stage a further heterogeneous focus group formed not only by the main stakeholders, but also by other subjects such as representatives from the company, cultural associations, accessibility experts, and other relevant entities that actively work on the topic of accessibility, in its different shades. The group members then evaluate the new packaging proposed by the designer - through the use of the checklist, which then takes on the function of a performance verification tool for the new product - providing valuable feedback on how well they meet cultural accessibility needs. Their insights should be carefully documented and analysed, leading to further refinements.

After incorporating the focus group's feedback, the designer finalizes the designs, and the company moves forward with production. But the process doesn't end there. Post-launch would be useful if the company and designer monitored the market response to ensure the new packaging effectively meets the cultural accessibility goals.

4. Conclusions

The explorations carried out lead in the first instance to the identification of two main project scenarios for increasing the cultural inclusiveness of packaging: (a) an approach according to which the packaging product can offer a differentiated experience to respond to different needs, even within the same object; (b) the definition of differentiated packaging, for instance different packaging solutions for the same sales content, thus able to adapt the performance provided to the specific cognitive needs of the user, through dedicated packaging.

In the context of the research, the implementation of the designed checklist is one of the main objectives, but it is not the only purpose of the work, that aims to enrich and expand the study and academic literature on a specific topic – that of cultural accessibility in packaging design - that, to date, has received a considerable lack of attention and feedback. This research theme follows the more central and debated strand of sustainable packaging design, which has been the main focus of study in recent decades, and from which it actually originates. In fact, accessibility is still a question of sustainability, where, however, the point of view varies from environmental to social.

The topic of packaging accessibility itself sees studies and insights, particularly into aspects of physical accessibility, less so into those of cultural accessibility, that, despite its relevance, has not been adequately explored in previous research. The aim is to contribute to a more comprehensive and detailed understanding of the topic of cultural accessibility in packaging design, providing new perspectives and information that can stimulate further academic studies and debates.

References

Alley-Young, G. (2014). Advertising to Illiterate People. Kingsborough Community College.

Badalucco, L. (2011). Il buon packaging. Imballaggi responsabili in carta, cartoncino e cartone. Edizioni Dativo. [Good packaging. Responsible packaging in paper and cardboard]

Barbero, S., & Tamborrini, P. M. (2018). Osservatorio Eco-Packaging (OEP): un mix di ricerca, didattica, progettazione e comunicazione. In S. Ferraris, & A. Vallicelli (eds). Microstorie di didattica del progetto. (pp. 389-399). Società Italiana di Design. [Eco-Packaging Observatory (OEP): a mix of research, education, design and communication]

Baule, G., & Bucchetti, V. (2015). Carta Etica del Packaging. Edizioni Dativo & Politecnico di Milano. [Ethical Packaging Charter]

Banerjee, N., Chatterjee, S., Bardhan, S., Mukherjee, S. (2022). Impact of Select Design Characteristics in Food Packaging on Consumer Behavior: A Study on Elderly Population in Kolkata. In Chakrabarti, D., Karmakar, S., Salve, U.R. (eds). Ergonomics for Design and Innovation. HWWE 2021. Lecture Notes in Networks and Systems, vol 391. Springer, Cham.

Berg-Weitzel, L., & Laar, G. (2001). Relation between culture and communication in packaging design. In The Journal of Brand Management. 8. 171-184.

Caputo, I., Bozzola, M., Oddone, M. & Volkova, A. (in press). Il packaging per l'utenza diversificata. Metodologie e strumenti per il design dell'accessibilità. In Design per la Diversità, SID Annual conference 2023. [Packaging for diversified users. Methodologies and tools for accessibility design]

Cerrina Feroni, G., Federico, V. (eds)(2017). Società multiculturali e percorsi di integrazione. Francia, Germania, Regno Unito ed Italia a confronto. Firenze University Press. [Multicultural societies and integration pathways.
France, Germany, the United Kingdom and Italy compared]

Coleman, R. (1994). The case for inclusive design – an overview. Proceedings of the 12th Triennial Congress of the International Ergonomics Association. Toronto: International Ergonomics Association.

De Giorgi, C. (eds)(2010). Packaging sostenibile? Metodo multicriteria di valutazione del packaging

alimentare. Poliedro - Pollenzo Index environmental and economics design. Umberto Allemandi & C. [Sustainable packaging? Multi-criteria method for evaluating food packaging. Poliedro - Pollenzo Index environmental and economics design]

De Mooij, M., & Hofstede, G. (2011). Cross-cultural consumer behavior: A review of research findings. In Journal of International Consumer Marketing, 23(3/4):181–92.

Dimaandal, R. J. H., & Espineda, M. N. (2023). Gender-Inclusive Children's Toy Package Design: An Alternative Approach to Gender-Neutral Design Based on Children's Perceptions. In Archives of Design Research, 36 (4), 141-161.

Eurostat. (2023). Demography of Europe – 2023 Edition. From https://ec.europa.eu/eurostat/web/interactivepublications/demography-2023

Fain, B. (2018). Food Packaging Design Accessibility Guidelines. Arthritis Australia – Accessible Design Division. From https://arthritisaustralia.com.au/wordpress/wp-content/uploads/2018/01/Food-Packaging-DesignAccessibility-Guidelines_Arthritis-Australia.pdf

Gallavotti, B., & Pistoi, S. (2007). La comunicazione istituzionale della scienza: come evitare la deriva autoreferenziale (oppure la sindrome di Rain Man?). Analysis, 4, 20-23. [The institutional communication of science: how to avoid the self-referential drift (or Rain Man syndrome?)]

Goodman-Dean, J., Waller, S. D., Bradley, M. J., Yoxall, A., Wiggins, D., & Clarkson, P. (2016). Designing Inclusive Packaging. In P. Burgess (eds). Integrating the packaging and product experience in food and beverages: A route map to consumer satisfaction. (pp.37-57).

Guido, G., Pichierri, M., Rizzo, C., Chieffi, V. & Moschis, G. (2021). Information processing by elderly consumers: a five-decade review. In Journal of Services Marketing, 35 (1), 14-28.

Hornikx, J., Van Meurs, F., & Hof, R. J. (2013). The Effectiveness of Foreign-Language Display in Advertising for Congruent versus Incongruent Products. In Journal of International Consumer Marketing, 25(3), 152–165.

Huang, R. (2023). Packaging Design of Objects from a Gendered Cultural Perspective. In Journal of Sociology and Ethnology, 5, 83-90.

International Standard (2011). ISO 11156:2011. Packaging – Accessible Design – General requirements. From https://www.iso.org/standard/50175.html

Ji, L.J., & Yap, S. (2016). Culture and cognition. In Current Opinion in Psychology, 8,105–111.

Kiygi-Calli, M. (2019). Corporate Social Responsibility in Packaging: Environmental and Social Issues. In Altinbasak-Farina, I., Burnaz, S. (eds). Ethics, Social Responsibility and Sustainability in Marketing. Accounting, Finance, Sustainability, Governance & Fraud: Theory and Application. Springer.

Limon, Y., Kahle, L. R., & Orth, U. R. (2009). Package Design as a Communications Vehicle in Cross-Cultural Values Shopping. In Journal of International Marketing, 17(1), 30-57.

Mace, R. (1985). Universal design: Barrier free environments for everyone. In Designers West, 33(1), 147-152.

Ploom, K., Pentus, K., Kuusik, A., & Varblane, U. (2019). The Effect of Culture on the Perception of Product Packaging: A Multimethod Cross-Cultural Study. In Journal of International Consumer Marketing, 32(3), 163– 177.

Rossi, E. (2018). A comprehensive tool for developing new human-centred and social inclusion-oriented design strategies and guidelines. In Theoretical Issues in Ergonomics Science, 20(4), 419-439.

Świda, J., Halagarda, M., & Popek, S. (2018). Perceptions of older consumers regarding food packaging as a prerequisite for its improvement: A case study of Polish market. In International Journal of Consumer Studies, 42, 358-366.

Valdillez, K. (2012). Color and brand design for multicultural packaging. California Polytechnic State University.

Van den Berg-Weitzel, L., & Van De Laar, G. L. M. (2001). Relation between culture and communication in packaging design. In Journal of Brand Management, 8(3), 171-184.

Waller, S. D., Bradley, M. D., Hosking, I., & Clarkson, J. (2015). Making the case for inclusive design. In Applied Ergonomics, 46, 297–303.

Yoxall, A., Gonzalez, V. H., Best, J., Rodriguez-Falcon, E., & Rowson, J. (2019). As you like it: Understanding the relationship between packing design and accessibility. In Packaging Technology and Science, 32(10), 496-507.

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RESEARCH ON THE EMOTIONAL VALUE OF TRADITIONAL RESIDENCES FROM THE PERSPECTIVE OF DAILY LIFE —— TAKE THE EXAMPLE OF THE EAGLE RIVER DIAOLOU GROUP

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ABSTRACT | In the context of the era of urban-rural integration in China, traditional residences have gradually faded from people's view, affecting their status in society. Influenced by urbanization and modern lifestyle, villagers' living needs have changed. They desire convenient living conditions and also hope to develop and renovate their homes to bring in income. Traditional residences face the dilemma of survival and development amid modernization. The urgent issue in the renewal of traditional residences is how to retain their architectural forms while continuing their spirit and culture, thereby preventing them from converging with urban architecture. This paper aims to explore the emotional value and modern significance of traditional residences from the perspective of daily life. The study will analyze aspects such as landscape protection, skill inheritance, cultural transmission, nostalgic memory and emotion, and adaptation to modern life. It seeks to understand how traditional residences can meet the residents' living needs while evoking their historical memory and emotional resonance through their unique spatial layout, architectural forms, and cultural symbols. It will explore the differences in emotional perceptions among different groups towards traditional residences and propose strategies for protecting and updating traditional residences during modernization, aiming to achieve their sustainable development and cultural inheritance.

KEYWORDS |URBAN-RURAL INTEGRATION; DAILY LIFE; TRADITIONAL RESIDENCES; EMOTIONAL VALUE

1. Introduction

Traditional residential houses are the physical carriers of regional culture and construction techniques, providing a daily function of place for local people to live in. Traditional residential buildings are closely linked to their surroundings, reflecting the influence of specific geographical and cultural features. As a result, traditional houses display unique characteristics in different regions and are often seen as a way of highlighting regional identity.

Under the impetus of rural urbanisation, traditional houses may face a number of problems in order to accommodate the needs of development. The uniformity of urban morphology has led to the homogenization of space, materials, and construction methods; the obstruction of cultural heritage has resulted in the gradual fading of local characteristics and historical memory. Traditional residential houses symbolize collective memory and nostalgia, but with the process of urbanization, the original village and community structures have been destroyed or rebuilt, causing residents to lose their emotional attachment and identification with their hometown, thereby exacerbating the disconnection of social rootedness. These challenges suggest the need to find sustainable development solutions while preserving traditional cultural and architectural features in order to promote social harmony and the continuity of cultural heritage.

2. Research on the emotional value of traditional houses: introduction of daily life perspective

In the context of China's fast economic development, rural architectural design has begun to adopt an orderly and symbolic approach similar to that of the city, making the architecture disconnected from the real life of village residents. With the change of time, the traditional concepts and lifestyles of villagers have changed, which has a great impact on 'daily life'.

Researching the emotional value of traditional residential houses from the perspective of daily life involves an in-depth exploration of the emotional connection and interaction between people and traditional living spaces. This connection is not only reflected in the comfort and practicality of the physical space, but also in the history, culture, customs and group memory carried by the houses. In the face of this problem, experts and scholars have beginning to think about how to start from the daily life, through the study of the regional characteristics of traditional houses and the living habits of local residents, so as to make the traditional houses and the people's 'daily life' more closely integrated, which is particularly important.

The perspective of daily life is a way to study and understand social phenomenon, which focuses on people's behaviours, habits, experiences and interactions in daily life. This perspective emphasises the details and micro-levels of life and explores how people construct and understand their world in daily life. Through observing and analysing daily activities, social interactions, family life and work scenarios, the researcher is able to gain a deeper understanding of the values, emotions and cultural identities of individuals and groups. The perspective of daily life focuses not only on macro-level social structures and institutions, but also on the specific practices and experiences of people in everyday situations, revealing how society and culture are concretised and manifested in everyday life.Henri Lefebvre is a French philosopher and social theorist known for his research on daily life, urban space and social production. The multiple origins and connotations of the concept of 'daily life' point to the fact that it not only distinguishes itself from the monotony of ordinary life, but also refers to the withdrawal and alienation of authenticity, which is characterised by repetition, triviality, and dullness, reflecting the reality of consumer and symbolic societies (Henri Lefebvre, 1964). In his definition of the basic connotation of 'daily life', Lefebvre also emphasises the repetitive, experiential and recurrent behavioural activities of 'daily life', and pays more attention to the real feelings of individuals and different groups of people towards the spatial place, focusing on the spatial The basic connotation of 'daily life' in reproduction (Gaoling, 2014). Domestic research on the theory of daily life started late, but with the attention and input of academics, this research field is gradually developing and maturing. Xiao Qunzhong's Ethics of Daily Life Behaviour highlights the importance of ethics in daily life through the ethical analysis of specific behaviours in daily life. Through in-depth theoretical expositions and rich case studies, Xiao Qunzhong demonstrates how to practice ethics in daily life to improve the morality of individuals and society. In the book, it is emphasised that ethics is not only a theoretical discussion but also a part of daily life (Xiao, 2018). He argues that ethics should focus on people's actual behaviour and moral choices in daily life, rather than just remaining at the abstract theoretical level.

In the habitat of traditional villages, there is a close connection between daily life and traditional residential houses. The shaping of architectural forms and the inheritance of regional culture in villages are of great significance, but there is not much research and practice on daily life perspectives and traditional residential houses. In the process of updating traditional residential areas, from the perspective of daily life, through the users of residential areas can better understand the specific realities and needs of the use of traditional residential areas, combined with regional characteristics, to carry out scientific and reasonable transformation and protection, not only to improve the quality of life of the residents, but also to effectively pass on and continue the traditional culture.

3.Research on the emotional value of traditional residential houses in Siwa village of the Qing Ethnic Group from the perspective of daily life

3.1 Overview of traditional residential houses

The Qiang

The Qiang are one of the oldest ethnic groups in Chinese history, mainly located in Aba Tibetan and Qiang Autonomous Prefecture and its surrounding areas in Sichuan Province. The history of the Qiang can be traced back to the 'Qiang people' in ancient literature, who were once a nomadic tribe active in the eastern part of the Tibetan Plateau and the western part of Sichuan. There are records of the Qiang people in such ancient texts as the Classic of Mountains and Seas and the Records of the Grand Historian, and these ancient Qiang people have a close historical connection with today's Qiang people. With the long historical process and the evolution of production activities, the Qiang people gradually formed a unique worldview and religious belief system.

The beliefs of the Qiang people are mainly based on multi-god worship, and the contents of deity worship are rich and diverse, covering nature gods, household gods, labour craft gods and village gods. Among them, the nature gods are the reverence and worship of nature, including the gods of mountains, water, wind and other natural forces; the family gods are the worship of ancestors and the prayers for family peace and the safety of future generations; the gods of labour and craftsmanship have symbols that are closely related to daily production and life, such as the gods responsible for the construction of houses, the gods in charge of stonemasonry and blacksmithing skills, which represent the Qiang people's respect for and belief in craftsmanship; while the village gods are worshiped through the village gods, which are the gods of the Qiang people. The village gods, on the other hand, exist in the form of 'sacred groves', protecting the safety and harmony of the entire village.

This belief system not only reflects the Qiang people's respect for their ancestors and the importance they attach to their families, but also expresses their worship of the power of nature and their concept of coexistence with nature. In Qiang culture, the ideas of honouring ancestors, praying for peace, and worshipping and harmonising with nature have taken deep root and become an inseparable part of their culture.

Heihu Qiang Village

Heihu Qiang Village is located in the mountains in the northwest of Mao County, Aba Tibetan and Qiang Autonomous Prefecture, Sichuan Province, China. Heihu Village is a well-preserved ancient Qiang village in Mao County. (Figure 1) The Eagle River Diaolou Group the most famous in Heihu Village, is located at the top of a half-mountain slope, with cliffs on both sides. (Figure 2) in the past, such a geographical location is conducive to resist foreign intrusion, play a collective defence role. Most of the watchtower clusters are located on the north-south trending ridge, with an altitude of 2,277 metres above sea level and a vertical distance of about 300 metres from the valley of the Heihu River, covering an area of about 15,000 square metres. The villagers' way of life is based on ploughing and herding. Although herding was once also an important economic pillar, due to policy adjustments, they now rely mainly on ploughing for their livelihood. Most of the villagers grow plum trees and corn, which have become their main economic sources. In such an ecological environment, agricultural activities not only sustain the livelihood of the village, but also protect the traditional way of life.

Figure 1 Heihu Qiang Village Architecture Complex

Figure 2 The Eagle River Diaolou Group

Traditional residential houses

The traditional residential houses of the Qiang Village are famous for their unique architectural style and structural design, which are not only adapted to the natural environment of the high mountain terrain, but also contain rich cultural connotations. The phrase 'living on the mountain and building a house of stone' describes the Qiang architectural form of choosing the site and using materials locally. Qiang residential houses are mainly built of stone and wood, reflecting the concept of harmonious coexistence with nature. These buildings are usually located on mountain slopes or ridges, built on the mountains, forming a patchwork of village patterns.

The original architectural texture of the Eagle River Diaolou Group is well-preserved, mainly constructed with stone as the material, demonstrating the traditional architectural style of the Qiang people, with the functions of earthquake-proof, wind-proof, fire-proof, and foreign enemy-proof. The traditional residential houses of the Qiang are composed of Zhuang houses, towers, watchtowers or boarding houses (Figure 3). Zhuang house is a common Qiang residential buildings, generally two to three floors, the ground floor for raising livestock and storage rooms, two or three floors for living space, the top floor is the 'photo floor', for the 'God' living place; towers are the main function of defence against foreign enemies, combined with

the function of the beacon, about 20-40 meters, in a trapezoidal shape, with the function of the beacon. 20-40 metres, in a trapezoidal shape. Distributed here a total of 12 stone masonry towers, so far, these towers in the basic intact existing 5; watchtower is a combination of Zhuang Fang and towers, has a strong defensive function at the same time can live; boarding house form and similar to the footstools, a layer of aerial raising livestock, the first floor is the living space. Zhuangfang, Diaolou, Diaofang structure for most of the stone and wood structure, the use of stone, yellow mud, wood and other materials to build.

Figure 3 Zhuangfang Diaolou Diaofang (from left to right)

In addition to the unique natural scenery and profound cultural traditions, Heihu Qiang Village is also facing a series of challenges and opportunities. With the acceleration of urbanisation and the penetration of modern lifestyles, the villagers' life needs are changing. They are not only eager to improve the convenience of their lives, such as obtaining more modern housing infrastructure and more convenient transport conditions, but also hope that the development and renovation of their houses can bring economic benefits and improve their living standards.

However, the village is located in a geographic location that is significantly different from that of the city. The complexity of the terrain and the remoteness of the location make the transport of building materials and construction more difficult. The introduction of modern facilities also needs to overcome the constraints of the natural environment, especially among the mountains and cliffs, making construction and renovation works challenging. In addition, although Heihu Heihu Qiang Village has the potential to develop tourism, the development of tourism faces uncertainty due to the village's remote location and the limited number of travellers. How to attract more tourists and improve the living conditions of the villagers while preserving the traditional culture and natural ecology has become an important issue for the development of Heihu Qiang Village.

3.2 The influence of village space on people's daily life in a daily perspective

In the daily life perspective, apart from the building itself, other spatial elements play a key role in creating the residents' emotions and sense of identity with the traditional village. By combining the five senses of perception (sight, hearing, smell, touch and taste) and the five elements of Kevin Lynch's Urban Imagery (paths, boundaries, zones, nodes and landmarks), these spaces profoundly affect the quality of life and cultural identity of the residents through their daily use and interaction.

Paths are the main access routes for residents' daily activities, and their design and layout directly affect the visual experience. Paths in traditional villages are often meandering, combining with the natural terrain to form a unique visual landscape (Figure 4). The design of the paths in Heihu Qiang Village follows the mountainous terrain, presenting a staggered landscape. Residents walking along these paths can appreciate the integration of traditional architecture and natural scenery, which enhances the visual identity of the village.

Figure 4 Roads in the Eagle River Diaolou Group

Boundaries play a role in dividing different areas in traditional villages. The stone walls commonly

found in Qiang villages are carefully stacked with local stones, which are not only sturdy and durable, but also have a good sound insulation effect. (Figure 5) These walls not only effectively separate different functional areas within the village, such as residential areas, farmland, places of worship, etc., but also form a natural sound barrier, effectively blocking the intrusion of outside noise. In a typical Qiang village such as the Eagle River Diaolou Group, the clever layout of the stone masonry walls keeps the living areas of the residents away from the hustle and bustle, and maintains tranquillity and peace, providing the villagers with a quality living environment.

Figure 5 a stone wall

Zone division in traditional villages not only clarifies the distribution of different functional areas, but also affects the olfactory experience of the inhabitants. Different areas, such as living areas, farmland areas and public activity areas, emit their own unique smells. The living area of the Eagle River Diaolou Group is filled with the warm texture of wood and the rising smoke of cooking, and these smells are a symbol of home, giving people a sense of warmth and tranquillity. The aroma of wood may stem from the natural properties of the building materials, while the cooking smoke is directly related to the villagers' food culture and daily life habits, and the farmland area is filled with the fresh scent of soil and plants, which constitute an important part of the residents' daily life.(Figure 6)

Figure 6 Smells emanating from different areas. For example, When the inhabitants cook, they still burn wood as their main source of fuel. As the smoke rises, the air is filled with the distinctive aroma of burning wood, and this odour, mixed with the warmth of the cooking smoke, emanates throughout the village, becoming an integral part of the daily

life of the village.

Nodes are the main places for socialising, trading and cultural activities of the village inhabitants, and the materials and design of these places have a significant impact on the tactile experience.

The nodes in Heihu qiang village, such as watchtowers and ritual platforms (Figure 7), each carry a different 'taste function'. The watchtower gives the building a 'spicy' level of protection and strengthens the safety of the building with its defensive nature; while the sacrificial platform symbolises the 'sweet' harmony and faith with its spiritual function, which maintains the emotional bond of the society. The two together constitute the core nodes of Qiang architecture, reflecting the complex relationship between material and spiritual, reality and faith. Therefore, the nodes of a building can be compared to the 'seasoning points' in cooking, and each node is like the seasoning in a dish, giving the building a unique 'taste'.

Figure 7 Diaolou (left) and Sacrificial platform (right)

Landmarks are buildings or objects in villages with distinctive features and identities, which can be experienced by linking the physical characteristics of landmarks with human

senses, especially the sense of touch that can directly perceive the material, texture and space

of the buildings. The Qiang Diaolou, as an important defence building of the Qiang village, is high and strong, usually made of stone, with a rough and heavy appearance (Figure 8). Touching the stone walls of the towers, people can feel the stone cold and hard, this tactile experience intuitively conveys the towers in the defence against invasion of foreign enemies in the role of defence. Tactile towers symbolise the towers in the village defence system in the core position, its towering form and solid materials together to convey a sense of strength and security, into the Qiang architecture of the 'tactile perception of the starting point'. People close to the towers, touch the roughness of the wall, as touching the deposition of time, stone erosion through the wind and rain left behind the texture, conveying a sense of history and the toughness of the old building. For the Qiang people, towers are not only fortifications, but also the wisdom of our ancestors and the witness of life, the sense of touch strengthens the link between history and culture.

Figure 8 Stone materials from different periods

3.3 Emotional value of traditional residential houses based on daily life

Traditional residential houses carry rich

emotional values in daily life, which are not only reflected on the material level, but also deeply affect the occupants on the spiritual and cultural levels.

The traditional residential houses of the Qiang people focus on the harmonious coexistence with nature in their location and construction. Most of the Qiang villages are built on high mountains or halfway up the hillside, and they are good at using the terrain to construct houses in a staggered and falling manner. This kind of layout is not only conducive to saving land and resources, but also helps to maintain ecological balance and reduce the impact of natural disasters. The Qiang inhabitants believe that traditional residential houses are an important link for them to live in harmony with nature, reflecting their reverence and love for the natural environment. Traditional residential houses are characterised by stone masonry buildings and quadrangle layouts, which are not only beautiful and sturdy, but also adapted to the local natural environment. The Qiang Diaolou, Walled Villages and residential houses all use local stone and clay, which ensures the stability of the buildings and also complements the surrounding natural environment. Protecting these features will preserve the historical appearance and unique charm of the village, enabling residents and visitors to experience the unique architectural culture of the Qiang.

Traditional Qiang architectural skills are the crystallisation of the wisdom of our ancestors, and passing on these skills is not only a continuation of the techniques, but also a sign of respect for our ancestors and culture. In the process of skills inheritance, the interaction between masters and disciples and the co-operation between family members are important ways of

emotional communication. The passing on of skills is in itself a transmission of culture and emotion that enhances cohesion within the group. In recent decades, however, traditional construction techniques may be gradually lost, and the younger generation prefers modern construction techniques to traditional ones. The research found that the people who mastered the traditional building skills in Chinese villages today are generally older, around 80 years old and above, and they are no longer able to build houses. This phenomenon may also lead to the loss of traditional building skills.

In order to realise the sustainable development of traditional Qiang residential houses, they need to be adapted to the needs of modern life on the basis of maintaining the traditional style and cultural connotations. At the same time, emphasis should be placed on the transmission of skills to avoid the loss of these skills.

3.4 Emotional perception of Qiang residential houses by different groups

There are significant differences in the emotional perception of Qiang residential houses among different groups. For local residents, traditional residential houses are the core of their lives, carrying rich emotional and cultural values. Foreign tourists feel the unique charm of traditional residential houses more from the perspective of appreciation and experience, and their cognition of traditional residential houses is more complicated.

Different groups have significant differences in their emotional perceptions of Qiang residential houses, and local residents have deep nostalgia for traditional residential houses. These buildings are not only their homes, but also the places where they live and grow up. The scene at the entrance of the village, the village paths, the traditional customs and activities, all these images carry the historical memories of the family and the community. Living in traditional residential houses for a long time has created a strong emotional bond between them and these buildings. Every detail in traditional residential houses records their life moments and family stories, and leaving these places will make them feel lost and nostalgic. The nostalgia of foreign tourists for traditional residential houses is mainly a romanticised and idealised emotion, and they hope to feel a way of life different from modern life through visiting and experiencing traditional residential houses. When visiting traditional residential houses, they are more interested in appreciating their unique aesthetics and cultural charms and experiencing a novel and unusual way of life. Traditional residential houses offer a unique travel experience for foreign travellers. Unlike modern hotels or flats, traditional residential houses provide travellers with the opportunity to experience first-hand the lifestyle and living environment of local people, and thus get closer to the local culture and life. Some travellers have emotional resonance when visiting traditional residential houses and are infected by their

simple and peaceful atmosphere. Such resonance may stem from admiration for traditional culture, nostalgia for history or a desire for a peaceful life.

3.5 Challenges facing the Qiang residential house in the context of modernisation

With the advancement of globalization and urbanization, traditional villages and residential houses are facing the risk of disappearance. Modern lifestyles and architectural styles are gradually permeating the Qiang areas, significantly impacting traditional Qiang residential houses. Additionally, many Qiang settlements are located in earthquake-prone regions, where natural disasters have severely damaged these residential houses (Yang, 2022). For example, the Wenchuan earthquake highlighted the limitations of traditional building materials; materials like adobe walls are prone to collapse during earthquakes, failing to provide adequate safety. Consequently, residents have chosen more cost-effective new building materials over traditional ones to adapt to modern life, sometimes resulting in the loss of the unique regional characteristics of traditional architecture.

In contemporary society, the phenomenon of residents converting their houses into homestays is increasingly common. The primary purposes include promoting local economic development, increasing residents' income, facilitating cultural exchange and heritage, and meeting diverse accommodation needs. As an emerging form of tourism accommodation, homestays not only attract tourists and boost local tourism and related industries but also provide a means for homeowners to increase their income, especially in areas rich in tourism resources, where the returns are more significant. The regional characteristics and cultural atmosphere of homestays offer an important window for showcasing and preserving local culture. Tourists can gain a deeper understanding of local history and lifestyles by staying in homestays, thereby promoting cultural exchange.

4. A discussion of the emotional value of traditional residential houses from the perspective of daily life

Qiang traditional dwellings hold significant emotional value in daily life, which is not only reflected in their practicality and defensiveness but also in their social, cultural, aesthetic, and spiritual symbolism. The preservation and inheritance of these traditional dwellings are of profound significance for maintaining the cultural identity and emotional belonging of the Qiang people.

By analyzing the emotional value of Qiang traditional dwellings for both local residents and outside tourists, we can comprehensively understand the multiple meanings of traditional architecture in modern society. In terms of common emotional value, both

local residents and outside tourists have deep emotional connections with Qiang traditional dwellings. For the former, this connection is more rooted in cultural heritage and practical living, while for the latter, it is derived from cultural experience and aesthetic enjoyment. Regarding differences in emotional value, local residents' emotional value is more focused on long-term living memories and cultural identity, with a strong desire to protect and inherit these traditional dwellings. In contrast, outside tourists' emotional value is more about temporary experience and appreciation, gaining spiritual satisfaction and cultural education through tourism. As for complementary roles, the economic benefits and social attention brought by outside tourists help local residents protect and inherit traditional dwellings. Meanwhile, the hospitality and cultural heritage of the residents enhance tourists' travel experiences and cultural understanding.

Through the emotional value analysis of these two groups, it is evident that Qiang traditional dwellings hold multiple meanings in modern society. They are not only cultural heritage but also a bridge connecting the past and the future, promoting cultural exchange and economic development.

Concluding

In the wave of globalisation and urbanisation, the traditional residential houses of Qiang Siwa Village are facing unprecedented challenges and opportunities. These ancient and simple residential houses are not only the space where the Qiang people have lived for generations, but also a deep carrier of emotion and culture. Built on the mountains and integrated into nature, they embody the wisdom of the Qiang people and the concept of harmonious coexistence, carry family memories and historical inheritance, and become an emotional link between the past and the present. From the perspective of daily life, it has an important and positive guiding effect on the protection and renewal of traditional villages, which can not only create better activity space and stimulate spatial vitality according to the needs of the villagers, but also better excavate the rural folklore and protect the regional vernacular culture. This paper summarises the current situation and problems of traditional residential houses at the present stage by understanding the daily behavioural activities of villagers through the research on Sihua Village. By analysing the different views and emotional analyses of local residents and foreign tourists in the Qiang residential houses, it explores the possibilities of the Qiang nationality in the modern society, triggers the designers' attention to the daily life of the rural residents, and is helpful to promote the inheritance and development of the Qiang culture and to maintain the ethnic diversity and ecological balance.

References

Lefebvre, H. (1946). The Critique of Everyday Life. (Vol. 1). Sheed & Ward.

Gao, L. (2014). 'On the Theory of Critique of Everyday Life'; Journal of Anhui Vocational College of Electronics & Information Technology, 13(4), pp. 103–105. DOI:10.3969/j.issn.1671802X.2014.04.033.

Xiao, Q. (2018). Ethics of daily behavior. Beijing: Renmin University of China Press(Contemporary Chinese Social Moral Theory and Practice Research Series). ISBN 978-7-300-26369-4

Certeau, M. de. et al. (2009). The Practice of Everyday Life 1: The Art of Practice. Nanjing: Nanjing University Press (Contemporary Academic Prism Translation Series: Situationist International Series).

Lynch, K. (1960). The Image of the City. MIT Press. [6] Gan, L. (2019). Research on the Reconstruction Strategy of Qiang Residential Building Culture Based on CAS Theory: A Case Study of Longxi Township, Wenchuan County, Sichuan Province. China National Exhibition, (10), 194–196.

Gan,L (2019). Research on the Cultural Reconstruction Strategy of Qiang Residential House Architecture Based on CAS Theory - Taking Longxi Township in Wenchuan County, Sichuan Province as an Example China Ethnic Expo, (10), 194-196. DOI:10.3969/j.issn.1007-4198.2019.10.098.

Yang, Y. et al. (2022). Investigation and Study on the Functional Status of Rebuilt Houses in Tangshan Area after the Earthquake Journal of Beijing Architecture University, 38(1), 45-57. DOI:10.19740/j.2096-9872.2022.01.06.

Yang, Z., & Tang, J. (2017). OLD HOUSE NEW LIFE -- ANALYSIS OF THE ARCHITECTURAL DESIGN OF RURAL B&B IN THE RECONSTRUCTION OF THE OLD HOUSE, (9), 158-160.DOI:10.3969/j.issn.1003-0069.2017.09.073.

Ji, F. (2000). Architecture of the Qiang People in China. Chengdu: Southwest Jiaotong University Press.ISBN:7-81057-414-0

YAN An (2020). Spatial Characteristics of Qiang Village Landscape in Mao County--Taking Heihu Qiang Village as an Example Green Science and Technology, (1), 65-67.DOI:10.3969/j.issn.16749944.2020.01.025.

Liu, Wei, & Zhou, Hao Ming (2022). Analysis of Construction Concept and Measures of the Heihu Village's Environment Adapted to Climate, (5), 28-32. ISSN:1000-7237

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“BLOCKCHAIN APPLIED TO SYSTEMIC DESIGN: ENSURING PROJECT AUTHENTICITY THROUGH QUANTITATIVE REPORT VERIFICATION”

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ABSTRACT | Systemic design encompasses a wide range of sectors and projects related to technology, people, and the environment. A common element is the production of detailed and analytical documents and reports on the design development carried out. However, at present, methods of verification and protection for systemic projects have not been identified, representing a lack of safeguarding for designers and all involved parties. The study conducted in Italy by the Polytechnic University of Turin addresses this lack of protection and focuses on the treatment of such reports from a quantitative data perspective, namely through their verification using blockchain technology. Blockchain was chosen over other verification methods because it is a decentralized and cost-free technology that can be adapted to various social contexts and conditions. Blockchain offers two main tools for verification: notarization and smart contracts. Notarization is a process that allows the document to be notarized and subsequently locked with all the information contained within it. In this context, notarization is used to increase designers' attention to the entered data because it cannot be overwritten. On the other hand, smart contracts are autonomous programs that execute contracts recorded on the blockchain. These contracts can be used to automate the verification of data contained in project reports. The combined use of notarization and smart contracts on the blockchain provides greater security for documents produced in the field of systemic design. This not only increases confidence in the validity of the documents, thereby avoiding cases of greenwashing and speculation, but also offers greater protection to designers. As a symbol of this verification, a Non-Fungible Token (NFT) is issued.

An NFT is a type of cryptographic token that represents a unique object. In this case, the NFT is inserted into a node of the blockchain to attest to the project's verification. This provides tangible and immutable proof of the verification that has taken place. The project has been implemented in three different contexts: wineries in southern Spain, a facility management company, and the post-university education sector. The verification process enables the protection of small local entities and the scaling of business processes, involving the local community and individuals. The application of blockchain technology in systemic design offers a new experimental method for decentralized verification and protection of projects and the data contained within them.

KEYWORDS | SYSTEMIC REPORTS, DATA VERIFICATION, PROTECTION SUSTINABILITY, NO GREENWASHING, BLOCKCHIAIN VERIFICATION, NOTARIZATION

1. Introduction to the Topic: Prelude to the Research Method

In the context of systemic design, an area that encompasses a wide range of sectors and projects, the generation of comprehensive documentation and textual reports detailing and analyzing the work carried out emerges as a common element. However, we face a significant challenge: the need to limit the production of documents that, while oriented towards sustainability, present inaccurate data, thus constituting a form of environmental deception. In this context, accurate data verification represents a crucial aspect. Although established control procedures already exist, such systems often adopt a centralized perspective. The real design challenge lies in implementing a decentralized and cost-effective approach to data verification, thus ensuring the integrity and reliability of information within the scope of systemic design (Ryan, 2014). The research methodology is based on the integration of blockchain into systemic design for validating sustainability reports. This approach merges the principles of systemic design with blockchain technology, combining the ability to delineate material flows aimed at reducing the ecological footprint with the blockchain's capacity to ensure data transparency and immunity to manipulation (Sevaldson, Jones, 2019). The research process follows an iterative approach, characterized by phases of research on current and past conditions, design, implementation, and repeated testing to refine the proposed solution. During development, blockchain has been integrated as a key tool for validation and assurance of data integrity. This integration involved the development of smart contracts, notarization, and NFTs that ensure the immutable recording of environmental, social, and economic information. The methodology also includes a phase of thorough testing and validation, where the design system is subjected to a series of simulated scenarios and real situations to assess its effectiveness, scalability, security, and adaptability to the needs of the business context and stakeholders. A fundamental element of the methodology has been the active participation of stakeholders, including representatives of companies, who have chosen to actively apply the project. This involvement has ensured a comprehensive analysis of the needs

and constraints of the operational context, contributing to ensuring the effectiveness and adaptability of the proposed solution.

1.2 The Most Well-Known Applications of Blockchain

The idea of applying blockchain to systemic design stems from the study of its applications carried out in recent years, starting from its inception in the financial world (Tapscott, & Tapscott, 2016). Blockchain technology, thanks to its versatility, has involved numerous sectors worldwide, addressing various issues. Among the many applications of blockchain, one of the most promising is its ability to improve data verification and traceability in a wide range of areas. Firstly, in the financial sector where its application originally emerged in 2008, as part of the Bitcoin whitepaper, written by an individual or group of individuals under the pseudonym Satoshi Nakamoto, blockchain has revolutionized the way economic transactions occur (Nakamoto, 2008). Cryptocurrencies like Bitcoin and Ethereum utilize blockchain technology to enable secure and transparent financial transactions, eliminating the need for traditional financial intermediaries (Wood, 2014). But it's not only in the financial world that blockchain has made its presence felt; in the logistics and supply chain management sector, companies worldwide are adopting blockchain to trace the origin and path of products along the entire distribution and supply chain. This not only ensures greater transparency but also helps prevent fraud and counterfeiting (Puthal, Malik, Mohanty, Kougianos, & Das, 2018). The use of blockchain technology for managing counterfeits in the world of art has gradually expanded, allowing a revolutionary change in both the creative industry and among collectors (Whitaker, 2019). In addition to the aforementioned sectors, blockchain has also found applications in digital identity management, copyright protection, and even in EU-funded electronic voting systems (Netservice, 2024). In all these contexts, blockchain offers an unprecedented level of security and reliability, enabling the creation of transparent and decentralized systems (Zyskind, Nathan, & Pentland, 2015).

1.3 Current Parameters for Verification Environmental Data in Reports

Starting from these examples of applications developed since 2008, the analysis delves into exploring the current verification criteria implemented on documents and reports focused on environmental development initiatives for businesses and organizations. In this context, practical scrutiny methods emerge, such as ISAE 3000, an international standard issued by the International Auditing and Assurance Standards Board (IAASB). This directive, originally conceived for assurance engagements not related to financial information, has recently been adopted as a reference for sustainability reporting examinations and assessments (Stern, 2020). This choice is due to its ability to provide a comprehensive view when analyzing the reliability and accuracy of non-

financial data communicated by companies. It should be noted, however, that ISAE 3000 is commonly employed by auditors who, due to their predominant expertise in financial matters, may not be as adept at scrutinizing sustainability-related data in detail. To outline specific parameters related to sustainability data, the Global Reporting Initiative (GRI) was established in 2007, an independent international entity that developed and promoted a reporting framework for sustainability (El Alfy, Weber, 2019). Founded in Amsterdam in 1997, GRI formulated the GRI Standards with the aim of facilitating clear, comprehensive, and reliable environmental, social, and economic reporting. These standards are structured into various categories, each dedicated to specific aspects of sustainability reporting. For example, the GRI Standards Series includes the main guidelines for preparing sustainability documents, covering topics such as governance, human rights, labor, environment, procurement, and anticorruption, among others. The GRI Taxonomy, on the other hand, defines a standardized structure for the presentation and analysis of sustainability data, facilitating comparability and analysis of reports (Thistlethwaite, Menzies, 2016). This series establishes a standardized framework for presenting and analyzing sustainability data, facilitating comparability and analysis of sustainability reports. These parameters represent guidelines for companies but not verifications for the data that are reported in the documents, but parameters to adhere to in the representation of quantitative data.

Another prominent method for controlling environmental data included in systemic reports is represented by audits conducted by centralized certifiers. In this context, ISO standards are widely used, recognized, and adopted globally, which establish specific parameters for various business areas. Analyzing the main cases dealing with environmental issues, there is ISO 14001, which not only defines the requirements for establishing an Environmental Management System (EMS) but also, through its provisions, requires the acquisition and monitoring of environmental data to assess organizational performance (Boiral , 2007). Similarly, ISO 14064 plays a crucial role in managing greenhouse gas emissions, providing detailed guidelines for the quantification, monitoring, and reporting of such emissions (Dunlop, Hawkins, Levick, Orozco, Vernoit, Wright, 2019). Its provisions provide a framework for external verification of information, ensuring compliance with established standards.
To accurately assess their environmental performance, companies can rely on ISO 14031, which offers specific guidelines for implementing internal environmental performance assessments. Finally, ISO 14020 focuses on environmental labeling and declarations, promoting transparency and reliability of environmental information reported on products and services.
However, it is worth noting that obtaining ISO certifications requires verification by a centralized entity and entails a fee for certification, which can be a limitation for small businesses and may encourage a decrease in attention to the presented

documents. It can therefore be summarized that the technologies involved in verifying environmental data often involve third-party users or certifying entities, which provide guidelines and support for checking such data or providing punctual verification. However, it has emerged that such processes are not uniform and decentralized or scalable on a global level. In response to these challenges, the proposal to adopt blockchain technology in this context also emerges. This approach aims to overcome the current limitations of the cases analyzed, providing a transparent and decentralized verification system for environmental data, thereby enhancing the reliability and consistency of reported information and promoting scalability in environmental data control.

2. Use of Blockchain and IT Systems for Data Verification

The blockchain, with its notarization capability and implementation of smart contracts, emerges as a revolutionary solution for verifying environmental data reported in systemic reports. This innovative approach is based on a computer system that transforms documents into code and transactions that become part of the enormous chain of blocks continuously mined by miners, hence blockchain (Tapscott, Tapscott, 2016). At the core of blockchain operation lies the cryptographic hashing algorithm, which transforms data into a unique fixed-length cryptographic hash. This process is irreversible, meaning that it is not possible to trace back to the original data from the generated hash. This ensures the integrity and security of the data recorded on the blockchain (Kalendzhian, 2021).

Furthermore, blockchain utilizes a distributed consensus system to validate and accept new transaction blocks in the chain. This process involves a network of nodes or participants working together to verify the authenticity of transactions and reach a consensus on their inclusion in the blockchain. This ensures that all network nodes agree on the current state of the blockchain and prevents any attempt at manipulation by a single malicious actor (William, 2016).

Notarization represents one of the main advantages of blockchain for verifying environmental data, considering the officialization of a document and thus all the information contained therein. A crucial aspect of blockchain is the concept of "verification digest" or "block hash." This is a unique value generated for each blockchain block using the cryptographic hashing algorithm. The verification digest is calculated taking into account all the data contained in the block, including transaction data and the hash of the previous block. This ensures that even the slightest modification to the block data would generate a completely different hash, immediately revealing any attempted manipulation. With blockchain, it is possible to securely and permanently record environmental information, such as greenhouse gas emissions, natural resource consumption, and environmental impacts of industrial activities, which is what the project

aims to do in the tested application fields. This information is stored in cryptographically protected blocks, which serves as undeniable proof of their authenticity and origin, recorded down to the day, hour, minute, and second.

While notarization commits data providers and involved to declare the truth as a public act, smart contracts, on the other hand, are self-executing computer programs that allow the automation and automatic execution of specific actions once certain conditions written in JavaScript code are met (Buterin, 2021), (Buterin, 2013). These smart contracts can be used to automate a range of processes related to environmental data management, such as verifying greenhouse gas emissions concerning time and size, monitoring energy consumption based on usage, and distributing environmental credits as in a specific case of application analyzed below (Bellassen, Leguet, 2007).

After obtaining data verification through blockchain technology or through notarization or smart contracts, the option to incorporate the verified digest into an NFT (Non-Fungible Token) image represents a next step in the project; to ensure the authenticity and integrity of certified data, the NFT offers an additional level of security and authenticity, making the certification symbol visually distinctive and easily recognisable, a logo. Using an NFT image as a certification symbol offers several practical advantages. First, NFTs are unique and immutable digital objects, registered on a blockchain, making them extremely secure and resistant to counterfeiting, as it is not possible to generate a copy of the issued certification. Incorporating the verified digest into an NFT image thus creates a digital seal confirming the authenticity of certified data and prevents manipulation or falsification (Mullings, 2022). Secondly, the NFT image can be easily shared and viewed on various digital platforms, making the symbol usable in different contexts. This helps promote transparency and trust in certified data, as companies and other stakeholders can easily verify the authenticity of the certification symbol through the blockchain. Furthermore, using an NFT image as a certification symbol adds an element of prestige and exclusivity to the certification itself. This confers a sense of importance and recognition to certified data while being generatable at low cost and therefore accessible to all economic strata.

This can encourage greater adoption of blockchain technology by companies, as they see the tangible benefits it can offer in terms of security and usability (Taylor, 2022). Thanks to the transparency and immutability of blockchain, recorded environmental information can be easily verified by any stakeholder, and personnel can verify what is stated, ensuring greater trust and transparency in the environmental reporting process. For example, years later, it is possible to review a past document and check for inconsistencies compared to subsequently published data, thus avoiding instances of greenwashing.

Undoubtedly, the use of blockchain technology for verifying environmental data offers several distinct advantages over

traditional approaches adopted by the Global Reporting Initiative (GRI), ISO standards, and ISAE 3000, which are just some of the existing verification methods but represent the chosen comparison panel in the initial analysis as the most widespread.

Therefore, thanks to the transparency and easy accessibility of data guaranteed by the public and transparent nature of blockchain (Antonopoulos, 2022). Another key feature of blockchain is data security against current privacy concerns, although potential attempts at malicious manipulation are not to be excluded (Antonopoulos, & Wood, 2019). Finally, the use of blockchain can contribute to reducing the costs associated with managing and validating environmental data, which represent an annual expenditure for companies or entities. By eliminating the need for intermediaries and streaming verification processes, this technology can help reduce both actual and overall operating costs of organizations. In comparison, the Global Reporting Initiative (GRI) provides free guidelines but requires subsequent levels to be paid for, ISO standards, and ISAE 3000 are subject to annual review by releasing companies and chartered accountants; therefore, continuous expenditure is required to keep up with market demands and public and private tenders. Blockchain, with its decentralized, immutable, and transparent nature, overcomes these limitations by providing an advanced technological solution for environmental data verification (Maupin, 2017).

2.1 Project Application Cases

The project research has yielded significant results in applications, demonstrating the effectiveness of blockchain technology in the realm of corporate environmental management in various domains. Through the use of practical simulations, a clear positive impact on environmental practices and data transparency has emerged. The project was successfully applied at the Antigua Real Fabrica de Hojalata, a highly sustainable winery located in Juzcar, southern Spain, in the province of Malaga. Here, smart contracts were utilized to verify the company's CO2 emissions related to the transportation of annually produced wine bottles and calculate the CO2 absorption of vineyards over the course of a year. This innovative approach allowed the company to accurately and reliably assess its environmental impact and identify opportunities to improve its sustainability practices. Additionally, the project addressed the challenge of wastewater discharged into the nearby Genal River, situated adjacent to the winery. Through the notarization process, an official verification of the actions undertaken by the company since 2023 to reduce the impact of wastewater on the surrounding environment, pursuing the 6th and 12th development goals, it will be possible to compare the project's progress in the coming years and avoid retroactive changes to feign fallacious improvements. This notation has provided an additional level of transparency and authenticity to the company's sustainability

actions, providing a solid foundation for its reputation and credibility in the industry. As the subject of the master's thesis project, the case study has also shown the potential scalability to all wineries in the area (Schilling & Liboni, 2023). It is important to note that Antigua Real Fabrica de Hojalata was the first company involved in this in-depth analysis, holding the verification digest of its actions. However, it was chosen not to include this digest in an NFT as a public symbol, as it was the initial experimentation phase. The verification of the proposed project's functionality was then applied to Reber S.r.l., based in Turin, which benefited from notarization verification for environmental data present in the 2023 sustainability report and in the development report prepared according to systemic flow analysis covering the company's emissions for the same year and aiming for a reduction by 2030.

This approach allowed the company to ensure the integrity and authenticity of information regarding water consumption, CO2 emissions, waste impact, and harmful particles to water, as a waste producer REA (Reber, 2023); in this case as well, the company's commitment can be monitored by comparing data annually. This provided an additional level of security and reliability, eliminating the risk of manipulation or alteration of environmental data being provided, published, and verified in public digital act. Additionally, the use of blockchain made the verification process more efficient and accurate; although the company holds ISO 14001 and the certificate provided by EcoVadis, it chose this verification method to attest to public documents (Reber, 2024). As recognition of passing the verification, Reber S.r.l. received an NFT (Non-Fungible Token) as a symbol of successful certification. This NFT contains the digest representing a cryptographic imprint of the verified data, confirming the authenticity and integrity of the information uploaded in today's public documents. This certification further strengthened the company's reputation and credibility in the facility management sector. The project application has expanded to the world of post-university training; the adoption of blockchain technology by SIAT (Italian Society of Technical Analysis) represents a significant example of the growing adoption of this technology in business operations. SIAT recognized the potential of blockchain to enhance the integrity and reliability of its processes by implementing a notarization system to verify CO2 emissions from company events and for issuing exam certifications. Notarization via blockchain allows SIAT to register and store immutable and verifiable records of every CO2 emission linked to company events, such as seminars, conferences, and workshops during the second half of 2024; the project is currently in development. This will ensure that each event is traceable and that related data cannot be retroactively altered. For each event, SIAT will record details such as date, time, location, and presented content with the respective CO2 calculation and the products chosen for compensation, carbon credits, but will also implement increasingly sustainable resource usage methods. This information will then be "notarized" on the

blockchain, creating a permanent record that can be easily verified by third parties involved in the events. This process increases confidence in the services offered by SIAT, as participants and stakeholders can be certain of the authenticity and accuracy of the information. In addition to notarizing emissions from company events, SIAT will use blockchain by 2025 for issuing certifications for exams. After passing an exam, the candidate's details and results are notarized on the blockchain. This provides tangible and indisputable evidence of acquired skills, facilitating the recognition of qualifications by employers and other institutions and reducing the production of paper documentation.
The analysis of environmental data and its verification represent a crucial component for organizations aiming to demonstrate their concrete commitment to sustainability without perpetrating greenwashing. In this scenario, blockchain has proven to be an innovative solution that can bridge these possibilities. As demonstrated by the case studies of Antigua Real Fabrica de Hojalata, Reber S.r.l., and SIAT Società Italiana di Analysis Tecnica, the application of blockchain has allowed for accurate and indisputable verification of environmental data. This has led to increased confidence in the reported information and facilitated the recognition of sustainability initiatives by companies.

2.2 Evaluation of the Results Obtained and the Critical Issues

It is essential to approach the chosen design process with a critical eye, recognizing not only the benefits that have been widely reported but also the challenges and limitations inherent in this technology. The technological complexity of blockchain represents one of the main barriers to adoption, due to the low level of understanding. This complexity can be daunting for organizations that do not have the necessary resources to invest in training and technological and computer updates. Furthermore, scalability issues arise when transaction volume increases, potentially leading to delays and higher costs that could compromise system efficiency. The lack of interoperability between different blockchains, some dedicated to economic transactions and others to verify transactions like Cardano, may limit data sharing and the effectiveness of the technology on a larger scale.

Additionally, the energy consumption of some blockchain implementations, especially those based on Proof of Work, may conflict with environmental sustainability goals. Some blockchains are transitioning from high-energy consensus mechanisms, such as Proof of Work (PoW), to more efficient protocols like Proof of Stake (PoS) or variants thereof, which require significantly less energy to operate (Schilling & Liboni, 2023). Another critical aspect is the quality of data entered into the blockchain. While the technology ensures the integrity of data once registered, it cannot guarantee the possibility of duplication. This means that errors or repetitions in the initial data will be perpetuated in the system. Furthermore, the need for transparency must be balanced with compliance with data privacy regulations, creating tension between information

accessibility and protection of personal information (Kulhari, 2018). The challenges do not stop at the technology itself. Adoption and acceptance of blockchain can be slowed down by distrust of new technologies or confusion in considering Bitcoin and blockchain as the same tool. It is therefore crucial for organizations to work to promote understanding and the benefits of blockchain to overcome resistance to change. Additionally, organizations must navigate an uncertain regulatory environment in Italian legislation, which can pose legal and operational risks. Despite these challenges, blockchain, analyzed since the late 1990s, has the potential to become a revolutionary tool in the field of environmental reporting (Szabo, 1997). Organizations adopting this technology position themselves as leaders in the field of sustainability, ready to respond to the growing demands for accountability and traceability from stakeholders, consumers, and financial entities. To fully harness the potential of blockchain, a critical and aware approach is needed that takes into account its limitations and actively works to mitigate associated risks.

3. Conclusions and Future Challenges

In the context of promoting environmental sustainability through blockchain technological innovation, the project aims to establish itself as a reference point for future sustainable practices. Looking ahead, a series of evolutions capable of revolutionizing how we address environmental and social challenges are outlined below.

The future prospects of blockchain will project towards a horizon of significant transformations that could revolutionize not only how we interact with data but also how we approach sustainability and technological innovation. The widespread implementation of blockchain, thanks to the work of miners who will further develop it from financial and computer science perspectives, will allow its application in key sectors such as manufacturing, sustainable agriculture, and ecological construction, where the need for transparency and traceability will increasingly become urgent to demonstrate. This expansion could lead to a reduction in environmental impact and an increase in operational efficiency.

The advent of Artificial Intelligence (AI) and the Internet of Things (IoT) will enrich the project with advanced analytical capabilities and more sophisticated data collection (European Investment Bank, 2021). AI can offer predictive insights based on data collected through blockchain, while IoT can provide real-time environmental monitoring, enhancing responsiveness and measurement accuracy. This synergy between technologies could lead to smarter resource management and a greater understanding of implemented environmental dynamics, allowing for realistic long-term predictions. The involvement of local communities will be crucial for the project's success. Through active participation in data collection and evaluation, communities can gain greater environmental awareness and become active protagonists in promoting sustainability. This bottom-up approach

could stimulate behavioral change and greater collective responsibility towards the environment (European Investment Bank, 2021). The standardization of blockchain protocols for sustainability and international collaboration will be necessary steps to ensure consistency and effectiveness of data verification practices on a global scale, in addition to the production of specific laws and regulations. This could facilitate the adoption of public policies and regulations that promote transparency and accountability in the sustainability sector; many steps forward have already been taken in 2024 with Bitcoin operating on blockchain computing.

Moreover, the provision of economic incentives and tokenization can play a crucial role in encouraging the adoption of sustainable practices. Sustainability-linked tokens can be used to reward companies and communities that contribute to generating reliable data and adopt environmentally respectful behaviors. This rewards system could stimulate broader commitment to sustainability and innovation. Education and public awareness of the importance of sustainability and environmental data verification will be essential for the project's progress. Awareness campaigns and educational programs can be implemented to engage the public and promote a cultural shift towards more sustainable behaviors.

Interdisciplinary collaborations with fields such as sociology, behavioral economics, and environmental psychology can provide a deeper understanding of the human factors influencing sustainability-related decisions. This integration of knowledge can lead to more effective solutions and more targeted engagement strategies. Finally, by promoting transparency and accountability, blockchain can become a key tool in encouraging the adoption of evidence-based practices and guiding policy decisions towards a more sustainable future. In conclusion, blockchain is emerging as a key technology for the future, with the potential to radically transform our approach to sustainability, innovation, and social responsibility. As we approach this future, it will be crucial to continue exploring and developing its applications to maximize benefits for society and the environment.

References

Amr Alfy, Olaf Weber. (Feb. 1, 2019). An Overview of Reporting Frameworks. From: Corporate Sustainability Reporting: The Case of the Banking Industry, Centre for International Governance Innovation.

Andreas M. Antonopoulos. (2022). Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications.

Andreas M. Antonopoulos and Gavin Wood. (2019). Mastering Ethereum: Building Smart Contracts and DApps.

Bellassen, V., Leguet, B. (2007). The emergence of voluntary carbon offsetting. Technical Report 11, autosaisine. 2007, 36 p.

Buterin, V. (2013). Ethereum White Paper: A Next-Generation Smart Contract & Decentralized Application Platform. Available at: https://ethereum.org/whitepaper/

Buterin, V. (2021). Formal Verification of Smart Contracts. Ethereum Foundation. Available at: https://ethereum.org/greeter/

Dunlop, S., Hawkins, J, Levick, K., Orozco, D., Vernoit, I. E., Wright, K., (2019). GREENHOUSE GAS ACCOUNTING AND REDUCTION From: BANKING ON ASIA: ALIGNMENT WITH THE PARIS AGREEMENT AT SIX DEVELOPMENT FINANCE INSTITUTIONS IN ASIA, E3G.

European Investment Bank, (Jun. 1, 2021). Appendix B.: AI and blockchain applications across sectors. From: Artificial intelligence, blockchain and the future of Europe: How disruptive technologies create opportunities for a green and digital economy.

European Investment Bank, (2021). The AI and blockchain landscape. From: Artificial intelligence, blockchain and the future of Europe: How disruptive technologies create opportunities for a green and digital economy.

Kalendzhian, S. (2021). How Technology is Changing the Nature of Work and Altering the Practice of Law. From: Technology, Innovation and Access to Justice: Dialogues on the Future of Law, Edinburgh University Press.

Kulhari, S. (2018). Data Protection, Privacy and Identity: A Complex Triad. In Building-Blocks of a Data Protection Revolution: The Uneasy Case for Blockchain Technology to Secure Privacy and Identity, Nomos Verlagsgesellschaft mbH.

Maupin J. (2017). Blockchains and the G20: Building an Inclusive, Transparent and Accountable Digital Economy.

Mullings, S. (2022). Beyond Exotification. From: Jamaica Making: The Theresa Roberts Art Collection, Liverpool University Press.

Nakamoto, S. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System. Available at: https://bitcoin.org/bitcoin.pdf

Netservice, (2024). CRYPTO-VOTING Il sistema di e-voting basato su tecnologia Blockchain. Avaiable: https://www.netservice.eu/research-and-development/crypto-voting

Olivier Boiral. (Jan. - Feb., 2007). Corporate Greening through ISO 14001: A Rational Myth? Avaiable: Organization Science, Vol. 18, No. 1.
Puthal, D., Malik, N., Mohanty, S. P., Kougianos, E., & Das, G. (2018). Everything you wanted to know about the blockchain. IEEE Consumer Electronics Magazine, 7(4), 6-14 DOI:10.1109/MCE.2018.2800506.

Reber, (Marzo 2024). Ecovadis. Avaiable: https://www.reber.it/news/rinnovo-certificazione-sicurezza-emantenimento-della-certificazione-ambiente/

Reber, (Ottobre 2023). Il bilancio di sostenibilità Reber è nella blockchain. Avaiable: https://www.reber.it/news/block/

Ryan, A. (2014). A Framework for Systemic Design. FORMakademisk. 7. Research Journal of Design and Education.

Sevaldson, B., Jones, P. (2019). An interdiscipline emerges: Pathways to systemic design, She Ji: The Journal of Design, Economics, and Innovation. DOI: 10.1016/j.sheji.2019.06.001.

Shilling, A. F., Liboni, M. (2023). La blockchain al servizio del design sistemico: come una tecnologia può trasformare le validazioni dei report sistemici nelle aziende vinicole Spagnole. Rel. Pier Paolo Peruccio, Giuseppe Pedone, Francesco Bruschi. Politecnico di Torino, Corso di laurea magistrale in Design Sistemico (pp. 150-166).

Shilling, A. F., Liboni, M. (2023). La blockchain al servizio del design sistemico: come una tecnologia può trasformare le validazioni dei report sistemici nelle aziende vinicole Spagnole. Rel. Pier Paolo Peruccio, Giuseppe Pedone, Francesco Bruschi. Politecnico di Torino, Corso di laurea magistrale in Design Sistemico (pp. 250-262).

Stern, J. (Nov.1, 2020). Measuring Methane Emissions: methodologies and data sources. In Methane Emissions from Natural Gas and LNG. Imports: an increasingly urgent issue for the future of gas in Europe, Oxford Institute for Energy Studies.

Szabo, N. (1997). Formalizing and Securing Relationships on Public Networks. First Monday, 2(9). Available at: https://firstmonday.org/article/view/548/469.

Alex Tapscott, Don Tapscott. (2016). Blockchain revolution: How the technology behind bitcoin is changing money, business, and the world. Foreign Aff., 95, 6.

Taylor, T. (2022). Recommendations for Further Reading. From: The Journal of Economic Perspectives, Vol. 36, No. 1, DOI: 10.1257/jep.36.1.193.

Jason Thistlethwaite, Melissa Menzies. (Jan. 1, 2016). ASSESSING THE GOVERNANCE PRACTICES OF SUSTAINABILITY REPORTING. C. Hurst & Company.

N. Surname, N. Surname (LEAVE BLANK) [STYLE: _P/RoD RUNNING HEAD Even]
Whitaker A. (2019) Art and Blockchain: A Primer, History, and Taxonomy of Blockchain Use Cases in the Arts. Artivate, Vol. 8, No. 2, DOI: 10.18278/artivate.8.2.1.

Jacob William (2016). Smart Contracts: The Essential Guide to Blockchain Smart Contracts for Developers and Blockchain Enthusiasts.

Wood, G. (2014). Ethereum: A Secure Decentralized Generalized Transaction Ledger. Available at: https://ethereum.org/pdfs/EthereumYellowPaper.pdf.

Zyskind, G., Nathan, O., & Pentland, A. (2015). Decentralizing privacy: Using blockchain to protect personal data. In Security and privacy workshops (SPW), 2015 IEEE, DOI: 10.1109/SPW.2015.29.

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UNTOLD STORIES: THE GRAPHIC DESIGN OF MARIA KEIL AND CRISTINA REIS DURING THE PORTUGUESE DICTATORSHIP AND THE PATH TOWARDS INCLUSIVENESS

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ABSTRACT | The history of Portuguese graphic design is intertwined with the history of the country that, between 1933 and 1974, lived under a harsh dictatorship called Estado Novo (New State). The stories of women working in the design field, then male-dominated, are even more constrained by the Portuguese social context of that period, marked by gender inequality and lack of inclusiveness. The purpose of this paper is to unveil the role of Maria Keil and Cristina Reis, who, despite difficult conditions, contributed to the development of the design practice in Portugal before and after its official establishment in the 1960s. Literature review, documentary research, and content analysis reveal how their work is still fairly unknown to the public, even inside graphic design classrooms. The research also shows how the lack of women's visibility in graphic design is more accentuated in Portugal due to its sociocultural context under the regime, which also censored some of their works. Uncovering their heritage in today's Portuguese graphic design allows us to walk in the direction of more inclusive graphic design history and practice.

KEYWORDS | INCLUSIVE GRAPHIC DESIGN, WOMEN DESIGNERS, PORTUGUESE DESIGN, MARIA KEIL, CRISTINA REIS

1. Introduction

The lack of visibility of women in Portuguese Graphic Design during the Military Dictatorship and Estado Novo regime (1926-1974) stems from several social, political, and cultural factors. Portugal had one of the longest dictatorships in Europe, spanning a total of 48 years, with some scars still noticeable today. Led by António de Oliveira Salazar (1889-1970) from 1933 to 1968, the authoritarian regime ended with his successor, Marcello Caetano (1906-1980). During that period, the state persecuted all forms of thought that diverged from the official discourse (Fragoso, 2010). Only the Carnation Revolution of April 25th, 1974 – which celebrated its 50th anniversary in 2024 – effectively managed to end it.

The regime invariably shaped the sociocultural conditions of a country that, even before the coup d'état of 1926, was already behind other European and North American countries. In the words of Barbosa (2015, p.2), it "further contaminated the political and economic situation that it had inherited by cultivating a backward-looking philosophy of 'being Portuguese', which led to further stagnation and cultural decline". During the 1960s, while places such as the United States and the United Kingdom were experimenting with countercultural forms of graphic design against the dominant culture and the establishment, Portugal was still undermined by propaganda. As Souto (2018) reminds us, the history of Portuguese design itself seems to have been conditioned by the dictatorship, with the late start of industry and education.

This study aims to unveil the contributions of Maria Keil (1914-2012) and Cristina Reis (1945) to graphic design during and after Estado Novo and to analyze their little presence in the records of Portuguese design history. Buckley stated that, although women have been involved with design in a variety of ways, "a survey of the literature of design history, theory, and practice would lead one to believe otherwise" (1986, p.3). Authors such as Scotford (1991), Thomson (1994), Clegg & Mayfield (1999), Skyes (2017), and Guida (2020) agree with this perspective.

Rawsthorn (2018) also acknowledges the privileged position of white men. For Franchini and Garda (2016), this lack of knowledge goes beyond the public, being shared by students, academics, and professionals. The reasons for such a situation include an array of social contexts, gender stereotypes, education, work environment, and recruitment processes (Trauth, Quesenberry, & Huang, 2006; Yue, 2018).

Women contemporary of Keil and Reis were especially subjected to discrimination and difficulties. Guida (2020, p. 607) considers that for them, working was an "almost heroic result, if the profession had to be accompanied by conventional social and cultural roles: being a wife, being a mother, taking care of the family home, looking after the offspring". This reality seems accentuated in the Portuguese context, whose prolonged regime made it even harder for women to access education and the job market, confining them in their social role of dedicated wives and mothers. This chronic dysfunction, according to Meer (2012), has led to women being less encouraged to consider their lives and work as worthy of historical attention. It was in this complex framework that Maria Keil and Cristina Reis lived and worked.

2. Method

This study proposes an analysis of the work of Maria Keil and Cristina Reis, while also discussing their traces and heritage in Portuguese design history. The choice of the two designers as case studies derives from the fact that Keil was the first woman to work in an advertising studio in Portugal and that Reis was one of the first two Portuguese women with a degree in graphic design – meaning they both had pioneering roles in the field. Having two people from different generations (one born in 1914 and the other in 1945) provides an ampler look into the role of women in the history of Portuguese design and its parallel with the evolution of the profession – even before its official establishment in the country.

Thomson (1994, p.30) tells us that "to understand the positions women found in the graphic design profession, we must turn to documentary sources that provide a broader picture of the profession and its history". Accordingly, the first step of this research is the literature review on the Portuguese sociocultural, political, and economic context during the regime, with an emphasis on the life and stereotypical roles of women; the growth and establishment of graphic design in Portugal; the work of Maria Keil and Cristina Reis; the overall lack of visibility and representation of women in design history, with the Portuguese case. This approach provided a detailed view of the intricate relations between the topics.

Then, documentary research is followed, focusing on materials of the period, such as newspaper articles, laws and decrees, videos, and interviews, to grant a deeper understanding of all mentioned circumstances. This phase includes an immersion into the work of both designers,

to comprehend their practices: how they worked, who they worked for, what they did, and the possible constraints. Then, a search and analysis of Design History programs in Portuguese universities was carried out. Finally, the exploratory analysis aims at understanding the invisibility of women designers in Portuguese design history, not only to gasp this lack of representation and inaccurate perceptions about their roles but also to discuss possible answers.

3. The (slow) progression of graphic design in Portugal

Graphic design in Portugal had a slow rise and progress compared to other European and American countries, where it developed earlier and more quickly. For Thomson (1994, p.28), "the concept of graphic design and the professional graphic designer evolved in the United States during the second half of the 19th century". In Portugal, this situation does not occur or does not find similar terms. According to Barbosa (2011), texts on the history of Portuguese design appeared late and sporadically, a likely consequence of the little importance attributed to this field in Portugal during the 20th century.

First, as mentioned by Almeida (2009), the absence of an industrial revolution in Portugal contributed to an apparent lack of need to reformulate the design process associated with industrial production and, consequently, did not allow any thoughts on design whatsoever. This difficulty in affirming the design practice has naturally impacted how its story is written, interpreted, and told. At the same time, and perhaps due to its recent rise and development in historical terms, graphic design is sometimes regarded as something "supplementary or additional to other projects" (Walker, 2017, p.1). Thus, the history of this field, as well as that of its agents, deepens and becomes even more complex.

The delay felt in Portugal regarding design also resulted from education itself, still tied to 19thcentury academism, stubbornly focused on the division between major and minor arts, with painting and sculpture in the front row. In this sense, it was up to the ateliers to find ways to mitigate the gap between artistic practice and knowledge (Almeida, 2009). Mantas (2012) states that there was a lack of graphic consciousness and, therefore, the average quality of the work was low – from an artistic point of view, project development, and printing process. In 1934, António Ferro (1895-1956) lamented the crisis of the graphic arts in Portugal, pointing out the absence of a professional graphic school as a symptom of a worrying cultural weakness (Ferro, 1934). Other authors of the time, including Adolfo de Mendonça and Luiz Moita, drew attention to the need for Portugal to invest in the development of graphic arts through education and the regulation of the sector (Mantas, 2012).

Within a stagnant country, practically closed to external inputs, the development of graphic design in Portugal finally got out of the impasse with the arrival of Swiss artist Fred Kradolfer (1903-1968) in 1924 (Fragoso, 2012).

Kradolfer, who had studied at the School of Applied Arts in Zurich, brought a new sense of modernity, with which Portuguese artists had not had previous contact. Still, the public was yet to get familiar with this field. According to Barbosa (2015), it is through architecture that design acquired some value in the Portuguese lexicon: the magazine Arquitectura (1952) is the first place where we can find the use of the word 'designers' – although combining industrial and graphic design. That is why, as Manaças (2005) reminds us, it was only from the 1960s onwards that people began to talk about design in Portugal. The 1965 International Exhibition of Industrial Design was responsible for the official recognition of the term 'design' by including it in the title and catalogs (Souto, 2017). Still, these words "were only applied in contexts referring to the professional activity in the 1970s, usually beneath a signature" (Barbosa, 2015, p.10). According to Almeida (2014), by the 1970s, the design praxis was still unaltered and under the control of its main agents.

Formal design education in Portugal also came late and rather slowly. For a long time, the Fine Arts schools insisted on not recognizing the importance of this area. Some professors opposed the inclusion of design in their programs because they argued that the institutions would suffer, with painting and sculpture losing prestige (Rafael 2006; Almeida, 2009). As a result, the first higher education course in design was implemented only in 1969, with the founding of the Institute of Art and Decoration (IADE) in Lisbon – today the oldest design faculty in the country. The first design courses in public institutions appeared in 1974, after the revolution (Barbosa et al. 2015). Later, it was the reform of those public courses at the Fine Arts schools of Porto and Lisbon, between 1975-78, that finally validated design as an autonomous discipline (Santos, 2001).

In terms of showcasing, it is worth noting the Graphic Arts Exhibition, held by the National Society of Fine Arts (SNBA) in 1941 – an early attempt to legitimize graphic design in Portugal. The exhibition's presentation text highlighted the proximity of graphic arts with fine arts, as an effort to bring design into the artistic sphere. However, the first major design exhibitions were the Portuguese Design Exhibitions that took place in 1971 and 1973, proposing an overview of the panorama of this field and the professionals of the period (Almeida, 2015). Those exhibitions ended up being a provocation to the context of design in Portugal, revealing the public and state ignorance regarding this subject (Pinheiro & Franqueira, 2022). From the catalog of both exhibitions, one can easily spot another problem in the history of Portuguese graphic design: a clear predominance of industrial design. The latter was already more developed and studied, and as the initial agents worked in both areas, there was an imbalance in its favor. That is why today it is easier to find references in industrial design and, oftentimes, when seeing the word 'design', it is not related to graphic production.

The Portuguese Design Association (APD), founded in 1976, is the first representative

of the profession in the country. However, the professional activity of 'designer' was only incorporated into the personal income tax code (IRS) in 2007 and recognized and published in the Portuguese Classification of Professions in 2011 (Pinheiro & Franqueira, 2022). Clearly, as stated by Agapito et al. (2015), design is still defining itself and seeking its position in Portuguese society, through its expansion and progression.

4. The condition of women during the regime

The recent and complex history of graphic design in Portugal is not the only factor contributing to the invisibility of women designers. If that were the case, then the stories of male designers would also be hidden in the corners of the slow and somewhat confusing process of affirmation of this field. In part, the explanation for this persistent invisibility lies in the condition of Portuguese women during the regime, resulting from the sociocultural conjuncture of the country.

Article 5 of the 1933 Constitution stated that citizens were equal before the law, "except for women, the differences resulting from their nature and the wellbeing of the family" (PT Const. 1933, art. 5). Even before the consecration of this discriminatory discourse, the 1930 censuses already considered women as less important citizens, including them in the category of "family members assisting their respective heads" (Cova & Pinto, 1997). The 1940 census maintained that view, adjusting the designation to "domestic" (Cova & Pinto, 1997). The expression "head of the family", intended for men, remained until 1981 (Casimiro, 2003). Decree-law 23:048 of September 1933 stated that the work of women and minors, outside the home, would be regulated by special provisions by the requirements of morality, physical defense, motherhood, education, and social good (Decreto-Lei nº 23:048, 1933). The 1968 Civil Code defined men as the leader of the family and responsible for all decisions regarding all family members (Hargreaves, 2020). Once again, we can see that women had fewer rights than men, as Sousa highlights (2019). However, to obtain a broader perspective on the condition of Portuguese women during the dictatorship, we must also look at the country's social, political, cultural, and economic context.

In 1970, close to the end of the regime, only 47% of Portuguese houses had running water, 58% had access to sewage, and electricity was present in only 63% (Almeida, 2009). At the beginning of this decade, 32% of the population worked in the primary sector, and 30% did not have proper homes, with around 21.000 families living in slums in the Lisbon area (50 anos 25 de abril, 2024). Additionally, education rates remained low throughout the period (Almeida, 2009). In 1960, the illiteracy rate was still 33.1%, much higher than in other southern European countries like Spain (14%) or Italy (8,3%). For Melo & Benavente (1978) and Cavaco (2018), illiteracy rates were persistently high, in a strategy of programmed obscurantism, with only slight improvements

due to international pressure. Access to universities was, of course, restricted, with a rate of just 5% also in 1960 (Almeida, 2009). The main victims of those rates were the women, whose access to education until the 1960s was even more limited (Adão, 2012; Sousa, 2019). The obligation for girls to attend at least four years of schooling was only legislated at the dawn of that decade (Mantas, 2012). From this point on, we can finally observe what Sousa (2019) calls the "feminization" of education, especially in secondary education. This phenomenon demonstrates a slow but growing awareness of the importance of education – something that worried the state, which did not want women to deviate from their natural destiny (Sousa, 2019).

The 48 years of dictatorship were marked by the crushing of fundamental civil and political liberties, with committees and censorship acting in all social areas (Samara & Rosas, 2021). Political parties and expressions of discontent were banned. Topics such as war, racism, and even family relationships were subject to censorship (Mantas, 2012). There was greater oppression against women who, for example, could not leave the country, open bank accounts, or even take contraceptives without their husband's consent (Pinto et al., 2014). Also, they could not vote, and some professions, such as judge, diplomat, military, or police officer were offlimits (Pinto et al., 2014). For the regime, female work was fatal to the birth rate, disrupting the home and promoting demoralization (Vaquinhas, 2011). Those who were able to work earned, on average, half the salary paid to men (Pinto et al., 2014). The salary gap was legislated, with the promulgation of decree-law 32:749 of April 15, 1943, which determined that salaries should meet the 'normal needs' of the worker, in harmony with age, sex, professional category, and local living conditions (Melo, 2017). Divorce was illegal for church marriages until 1975, and the penal code provided mitigating circumstances for men who killed women for adultery (RTP, 2014). Women were expected to be obedient to their husbands and dedicated to the home (Pimentel, 2012). Ultimately, the guardianship exercised by husbands created a form of dependence that nullified the legal capacity of women (Cardoso, 2023). The press also participated in the stereotypical social construction of women (Marques et al., 2019).

Stereotyping a certain group is characteristic of propaganda speeches, contributing to the perpetuation of discrimination (Van Dijk, 1995). Still, according to Samara and Rosas (2021), women did not stop participating and trying to have an active role in society. The case studies of this research, Maria Keil and Cristina Reis, reflect this fight well.

5. The design of Maria Keil and Cristina Reis

Although both Maria Keil and Cristina Reis have worked as graphic designers during the Portuguese regime, they are from different generations and have thus experienced different work practices and sociocultural constraints. Those experiences seem to have invariably shaped their career paths and design praxis. Maria Keil, the older of the two, is from the second generation of Portuguese Modernists (Fragoso, 2012; Souto, 2018) – before the establishment of graphic design as a profession or study area in Portugal, and before the word 'design' came around in the country. Like many artists of the time, she worked within several artistic areas, including painting, tile design, illustration, and graphic design – the latter known at the time as 'graphic art', 'graphic arrangement', or 'decoration'. When asked about her position within the artistic context, she defined herself as a "blue-collar worker of the arts" (Leitão, 2005). Keil was the first woman in Portugal to have worked in an advertising studio: the ETP - Estúdio Técnico de Publicidade, founded by José Rocha (1907-1982) in 1936, alongside artists such as Fred Kradolfer (Souto, 2018). In her design career, she also experimented with editorial design, poster design, illustration, and postage stamps.

The separation of 'high' and 'low' arts, rooted in the Portuguese artistic context of the time, brought discrimination and prejudice to those working within the 'minor' fields. Keil suffered prejudice while working as a 'graphic artist' because people did not consider such activity proper or worthy for painters, due to being commercial based (Cotrim, 2004). She had started the Painting course at the Fine Arts School of Lisbon, later dropping it when she got married to fellow student and architect Francisco Keil do Amaral (1910-1975). About her time at the Fine Arts School, Keil referred to how little she learned there, due to its chronic stagnation, and how much she learned outside (Mantas, 2012). With a different design view, the American magazine Arts and Industry included her in the 1939 article Pioneers for Publicity, about Portuguese graphic design (Mantas, 2012).

In the 1930s and 1940s, she, along with most artists of that period, worked for the state, despite being opposed to the regime. Several projects were made for Secretariado da Propaganda Nacional (SPN)/Secretariado Nacional de Informação (SNI), while António Ferro was in charge (Quintas, 2014). This apparent oxymoron results from a symbiosis between the state and the anti-regime artists: one side needed the money to live and the other needed artists with quality work. However, from 1949 onwards, the volume of state orders diminished considerably, after Ferro was removed from office due to incompatibilities with Salazar.

The inclusion of Keil in the 1942 Graphic Arts Exhibition was the first public recognition of the quality of her design (Mantas, 2012). Still, although acclaimed from the beginning,

one cannot but notice the adjectives usually employed when talking about women's achievements. At the time, the work of women was usually described with words such as 'gracious', 'delicate', 'sentimental', 'sensible', 'enchanting', 'lyric', or 'feminine' (Hargreaves, 2020). Adriano de Gusmão (1908-1993), described Keil's work as a "nice effort, where one can notice some interesting details, in drawing and color, even betraying her feminine nature" (1947, p.23). We can observe something similar in what Roberto Nobre (1903-1969) wrote in 1957, stating that "one of the aspects that makes the work of Maria Keil unique is the richness and variety of her art, indeed rare in a woman" (1957, p.117). Mariac Dimbla (n.d.), another woman, avoids the use of stereotypical adjectives, focusing instead on the harmony achieved between tradition and modernity. Dimbla's article was written for a magazine called Modas e Bordados (Fashions and Embroidery), subtly revealing the impossibility of escaping stereotypical images of women.

Additionally, most comments, according to Mantas (2012), are made about painting (even though Keil did not consider herself a painter), confirming once again the superiority of this area in the Portuguese context.

In a very conservative country, Maria Keil defended the women's cause, having joined the Women's Democratic Movement (MDM), the Democratic Unity Movement (MUD), and the National Council for Portuguese Women (CNMP) (Mantas, 2012). Along with her husband, she worked for the anti-regime publication Seara Nova (1921-). In 1947, some works exhibited at the SNBA, including Keil's Regresso à Terra, were apprehended by the state (Mantas, 2012). She was arrested in 1953 by the political police (PIDE) for getting Maria Lamas (1893-1983) – a Portuguese anti-regime writer and feminist activist – at the airport. About her opposition to the regime, Keil said that they all did what they could because the important thing was to participate somehow (Cruz, 2002). She described herself and her inner circle as "a few but all anti-regime" (Leitão, 2005). In 1969, she designed the poster "Por um Portugal Livre e Melhor" (For a Better and Free Portugal), for the Electoral Commission of Democratic Unity (CEUD). She also designed the poster for the exhibition Women Writers of the World, held at the SNBA and organized by CNMP. In 1980, Keil received the rank of Commander of the Military Order of Santiago de Espada, in recognition of her work.

Figure 1. Works of Maria Keil. From left to right: Pompadour advertisement (c. 1940), Vignette for Seara Nova (1941), Page from agricultural production campaign (1946), For a Free and Better Portugal Poster (1969). Source: Biblioteca Nacional de Portugal.

Cristina Reis was born in Lisbon in 1945. In the 31 years between the birth of the two designers, the role of women in Portuguese society remained almost stagnant. Still, Reis had the opportunity to study graphic design at the Ravensbourne College of Art and Design in London, being one of the first women in Portugal with a higher education in the field. Before going abroad, she undertook the Basic Design Course at the studio of Daciano da Costa (1930-2005), due to the absence of such courses in universities. Daciano da Costa, prevented from teaching in the Fine Arts school by the regime, decided to create this course on his own premises (Fragoso, 2010). For Reis, this was a pioneering experience that only a few lucky people had the opportunity to participate in (Reis, 2014). While there, she had access to a problem-solving education, learning about the Bauhaus and the Ulm School (Souto & Brízio, 2014).

Her studies in London, funded by a scholarship from Calouste Gulbenkian Foundation, were also influenced by the condition of women in that period, who even in other European countries were not on par with men. The field she intended to study in England was, in fact, cinema, having abandoned it in favor of design when she realized that as a woman, she would not have been able to go beyond becoming a 'script girl' (Lisboa, 2020).

Back in Portugal in 1970, together with fellow designer Alda Rosa (1936), Reis organized the 1st Exhibition in Portuguese Design (1a Exposição de Design Português) and designed the graphic identity and catalog. She repeated the experience in the same role for the second exhibition in 1973. In 1974, she opened the cooperative DEZ with affirmed designer, architect, and artist Sena da Silva (1926-2001) - an indicator of her prominent

role in the Portuguese Design context. Censorship reached the work of Cristina Reis when the book O Mundo é a Nossa Casa, by Júlio Moreira (1929-2014), for which she worked with Margarida D'Orey, was seized and destroyed, as it was considered subversive (Lisboa, 2020; Barata,2023). The book, which appeals to an innovative environmental consciousness and change toward more sustainable futures, is now part of the national reading plan for schools.

From 1975 on, Reis starts working with Teatro Cornucópia, bringing graphic design into the theatrical sphere. Most of the work she did for this theatre company is now part of the collection of MUDE – Museum of Design and Fashion in Lisbon – donated when the theatre closed in 2016. Between 1979 and 1981, she went abroad again, this time to the Schaubühne Am Halleschen Ufer in Berlin, further experimenting with the crossing of design and theatre. Later, she became the director of Cornucópia, alongside Luís Miguel Cintra (1949). She also collaborated with Teatro Nacional D. Maria II, Teatro São Luiz, and Culturgest, among others. In 1994, the Portuguese Association of Design (APD) organized a series of exhibitions under the title Design & Designers, including Cristina Reis. She won the Career Award from the Portuguese Design Center in 2000 and the Gulbenkian Arts Award in 2010. For Coutinho (2020), even though Cristina Reis has been honored several times with awards and other recognitions, her work has not been properly studied, analyzed, and disclosed in a cohesive way. For Costa (2019), although women were working as graphic designers, there was no discursive practice on the subject. Still, as Duarte & Martins (2021) point out, she is and will be a reference for women designers to question their own practice.

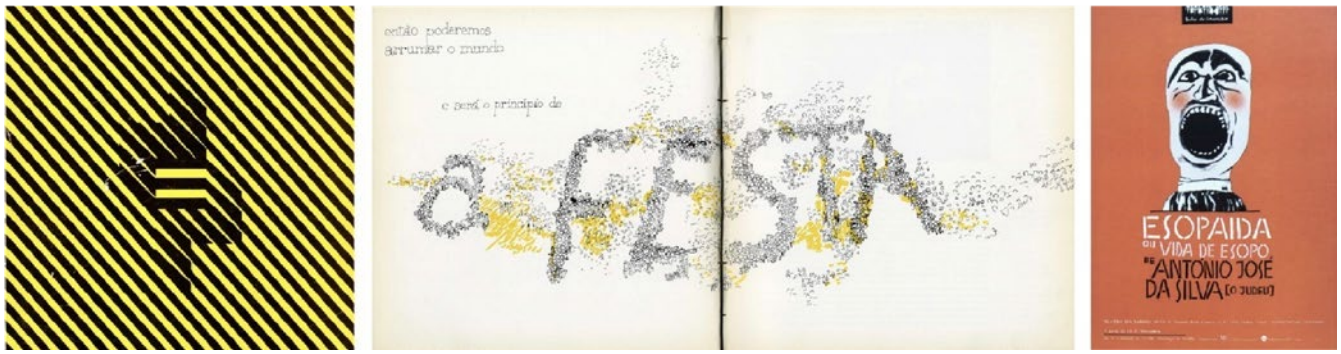

Figure 2. Works of Cristina Reis. From left to right: Cover for 2ª Exposição do Design Português (1973), interior from O Mundo é a nossa Casa (1973), poster for Cornucópia Theather (2004). Source: FCG/Biblioteca Nacional de Portugal.

6. (Lack of) Visibility

Despite their prominent roles in the development of graphic design in Portugal, Maria Keil and Cristina Reis remain fairly unknown to the public. This situation seems to reflect the chronic lack of inclusiveness in design publications and university curricula. A simple search on Portuguese design leads us to male names such as Daciano da Costa, Victor Palla, Sena da Silva, Sebastião Rodrigues, or António Garcia. According to Moura (2018), in the chronologies of the evolution of design in Portugal, with the intention of understanding each era and identifying its main actors, we only see the names of male designers. The same happens with the history of design ateliers, where there is a deficit of female representation (Moura, 2018).

The First Exhibition of Portuguese Design (1971) provides us with a major hint at this reality. Looking at the catalog, one can see that of all the fifty participating designers, only ten were women. Also, the first texts on Portuguese design (1974) – included in A Arte em Portugal no séc. XX by José Augusto França (1922-2021) – follow this trend. As a sign of possible upcoming change, Cristina Reis was recently included in Coleção D - Design by Jorge Silva (1958), published in September 2023 – a collection that up to that point was made only of male designers. Still, apart from this exception, references to women tend to be sporadic and usually synthetic, acknowledging their presence, but avoiding further discussion (Mantas, 2012). It is only natural that international publications follow this scenario. For instance, Novin's A History of Graphic Design (n.d.), in the chapter The Portuguese School of Graphic Design, does not include women. Bigger publications, such as The History of Graphic Design, by Müller (2022), favor Portuguese male designers. This seems to be in line with the perspective of Falcão (2015), for whom history was created by those who were able to work and remain working for an extended timeframe. Considering the Portuguese sociocultural context during this patronizing regime, it is no wonder that women faced more difficulties career-wise.

As Barbosa (2011) discloses, the research on the beginnings of design in Portugal, as well as some book collections, reveal a tendency to favor industrial design. This situation further compromises the visibility of women who worked at the time in the field of graphic design. Such a reality stands out even more by looking at design history programs included in graphic design bachelor's from different Portuguese Universities. For this purpose, we looked into IADE (Universidade Europeia), Faculdade de Belas-Artes da Universidade de Lisboa, Faculdade de Belas-Artes da Universidade do Porto, Universidade de Aveiro, Universidade de Coimbra, Universidade do Algarve, Politécnico de Leiria, ESAD Porto, Politécnico de Castelo Branco, Politécnico de Coimbra, Escola Superior Artística do Porto, and Universidade Lusófona. At the moment, there aren't specific programs on Portuguese graphic design

history, although there are on industrial design history, such as at Faculdade de Belas-Artes da Universidade de Lisboa. Despite all these bachelor's including Design History in their study plans, only IADE and Universidade de Aveiro have specific programs in Portuguese Design History. The analysis of the syllabus of both programs reveals a combination of Industrial and Graphic Design, without references to women in the descriptions provided to the students. Such reality makes us believe that there are no women worthy of mention, or that they did not provide enough quality or consistency to be studied. One can argue, as Costa (2019) states, that the absence of discourse on the work of Portuguese women designers at the time, also contributed to their later invisibility in historical studies. For Meer (2012), this is because women are considered less productive than men, meaning that the surrounding circumstances, namely oppressive sociocultural situations, are ignored. That is why Buckley (1986) states that this invisibility is also a consequence of historiographic methods.

Additionally, "the few women who make it into the literature of design are accounted for within the framework of patriarchy", defined as "designers or users of feminine products", or "under the name of husband, lover, father, or brother" (Buckley, 1986, p.3). We can observe a similar situation in both cases. Maria Keil often credited her husband and his guidance as the reason why she was able to work as an artist – that is especially true for women of her generation, with the few other women artists being also married to established male artists. In the case of Cristina Reis, one can rapidly associate her with the time she spent in the studio of Daciano da Costa or the work with Sena da Silva for DEZ. We must also take into consideration that the opportunity to work within this field during such a hard period is due to Maria Keil marrying into an artistic family and Cristina Reis being born into one.

Mantas (2012) points out the existence of a double prejudice: being a woman and having dedicated herself to areas that were then considered minor, such as graphic design. That is the case for both women whose stories were told here, especially Keil. The fact that these stories are still not properly told perpetuates an array of misrepresentations, misunderstandings, and undervaluation, making it difficult for teachers and students to find sources that reveal a more complete picture of Portuguese graphic design, thus creating a vicious cycle. Students, when faced with exercises in which they must choose designers from a list, might opt for those they already know better or can find more information about. Educators play an important role in the search for not-so-well-known designers, including women designers.

7. Conclusions: The path towards inclusiveness

The history of Portuguese design focuses on those who seem to have been the most fruitful figures, had the most work opportunities during the dictatorship period, and, in parallel, suffered fewer impositions from the state. The results show that women such as Maria Keil and Cristina Reis, who had fewer rights and, consequently, less visibility in society, are granted smaller places in texts, classrooms, and, ultimately, in history. It is necessary, to achieve any meaningful change, to deconstruct the discourses of design history, making them more inclusive.

The analysis suggests that the state of graphic design history in Portugal is deeply related to the tumultuous and complex past of the country, in which the profession struggled to grow and to get established as a respected field – separated from the pressure of fine arts and from the strength of fast developing industrial design. Together with the image of women during the regime, this factor heavily plays a role in the relevance of female designers, who faced a double prejudice. However, despite these limitations, we can observe that both designers took part in different but defining moments for Portuguese design.

In the first case, Keil's work unveils the role of Modernism in a country that, at the time, was everything but modern. The fact that she was the first woman working inside an advertising studio in Portugal goes against the bias of the period, in which women could only dedicate themselves to 'feminine' activities such as embroidery, jewelry, or painting – namely still life and portraits of children or other women – leaving the more serious subjects to men. Her role in modernizing graphic design in Portugal emerges through her synthetic and stylized style – innovative in that period and place.

The second case reveals that Reis, although three decades younger, suffered equally from the oppression of the regime, which still saw women as less important citizens. However, as one of the first Portuguese citizens with a higher education in graphic design, she took part in the organization of the first two design exhibitions in Portugal and worked with major brands and institutions of the period. She is also the symbol of a design transition towards a more democratic reality, finally embracing the field of graphic design. Moreover, her experiments with topics such as sustainability and ecology in the early 1970s put her at the vanguard of design discourse in Portugal.

In conclusion, the first step towards equity in design history involves contextualizing the realities in which women lived to understand how their surroundings shaped their career paths, in opposition to their male counterparts. In the Portuguese case, the following step is to include these women in design history programs, with more than simple mentions, promoting reflections and analysis about their design processes and outcome materials. It is worth noting that the

Portuguese context must also deal with the remnants of the historical supremacy of fine arts over design and industrial design over graphic design.

Although we have come far with women's rights over time, there is still plenty of work to do, including in the field of design. Today, women are still not granted the same visibility or opportunities. Just a few years ago, the 2019 AIGA Census revealed that 61% of designers were women, but only around 29% were creative directors (Design Census 2019; Larsen, 2021). The battles we now face to tell the stories of women designers are just another symptom of a deep need for change.

The bottom line of this exploration is that a more inclusive design history can contribute to a more inclusive design practice, which in turn can produce more equity and fairness in future design histories – a positive circular dynamic. It is, therefore, crucial to change design programs to make them more inclusive from the start. Encouraging students to learn inclusively is fundamental to creating future healthier practices and promoting positive change in graphic design.

References

Adão, A. (2012). A Educação nos artigos de jornal durante o Estado Novo (1945-1969): Um repertório cronológico, temático e onomástico. Instituto de Educação da Universidade de Lisboa. http://hdl.handle.net/10451/6382 [Education in newspaper articles during the Estado Novo (1945-1969): A chronological, thematic and onomastic repertoire.]

Agapito, D.; Almeida, H.; Fernandes, M.; Sílvia, C.; & A. Lacerda (2015). O perfil do designer e o papel do design nas empresas em Portugal. Sílabas & Desafios. https://sapientia.ualg.pt/handle/10400.1/7854 [The designer's profile and the role of design in companies in Portugal.]

Almeida, V. (2009). O Design em Portugal, um Tempo e um Modo. A institucionalização do Design Português entre 1959 e 1974. [Doctoral Thesis, Universidade de Lisboa, Faculdade de BelasArtes]. Repositório da Universidade de Lisboa. http://hdl.handle.net/10451/2485 [Design in Portugal, a Time and a Mode. The institutionalization of Portuguese Design between 1959 and 1974.]

Almeida, V. (2014). Design em Portugal: Da Democratização à Popularização. In E. T. Vilar (coord.), Design et al. (pp.187-206). Publicações D.Quixote. [Design in Portugal: From Democratization to Popularization.]

Almeida, V. (2015). Agora o Design. In J. Bártolo (coord.) Design Português 1960/1979 (vol. 4, pp.31-58). Verso da História. [Portuguese Design 1960/1979]

Barbosa, H. (2011). Uma história do design do cartaz português do século XVII ao século XX. [Doctoral Thesis, Universidade de Aveiro]. RIA Repositório Institucional. http://hdl.handle.net/10773/4706 [A history of Portuguese poster design from the 17th to the 20th century.]

Barbosa, H., Calvera, A. & Branco, V. (2011). The Design of Portuguese Political Poster: Two Politics, two discourses. FHD–Fundación Historia del Diseño and DHS-Design History Society, Annual Conference proceedings, (pp. 1-12).

Barbosa, H. (2015). Contradictions of the Estado Novo in the Modernisation of Portugal: Design and Designers int the 1940's and 50's. The Radical Designist, (4), Article 3. http://unidcom.iade.pt/radicaldesignist/wp-content/uploads/2016/01/DesignPolicies_HBarbosa.pdf

Barbosa, H., Calvera, A. & Branco, V. (2015). 40 Years of Design in Portugal created by designer. Precedentes: Genealogia da Museulogia do Design na Universidade de Aveiro, 1, 62-71.

Barata, A. (2023, October 17). O mundo é a nossa casa. Biblioteca de Arte Gulbenkian. https://gulbenkian.pt/biblioteca-arte/read-watch-listen/o-mundo-e-a-nossa-casa/ [The world is our home]

Buckley, C. (1986). Made in patriarchy: Toward a feminist analysis of women and design. Design Issues, 3(2), 3-14. https://doi.org/10.2307/1511480

Cardoso, A. R. (2023). O trabalho feminino e os seus condicionalismo durante o Estado Novo (19331974). [Master Thesis, Faculdade de Letras da Universidade de Coimbra]. Repositório Científico da UC. https://hdl.handle.net/10316/108443 [Female work and its conditions during the Estado Novo (1933-1974).]

Casimiro, F. (2003). Os conceitos de Família e Núcleo Familiar nos Recenseamentos da População em Portugal. Revista de Estudos Demográficos, 33, 7-26. [The concepts of Family and Family Nucleus in Population Censuses in Portugal.]

Cavaco, C. (2018). Analfabetismo em Portugal - Os dados estatísticos, as políticas públicas e os analfabetos. Revista Internacional de Educação de Jovens e Adultos, 1(2),17-31. http://hdl.handle.net/10451/46780 [Illiteracy in Portugal - Statistical data, public policies and the illiterate.]

Clegg, S., & Mayfield, W. (1999). Gendered by Design: How Women's Place in Design Is Still Defined by Gender. Design Issues, 15(3), 3–16. https://doi.org/10.2307/1511881

Constituição de 11 de Abril de 1933. https://www.parlamento.pt/Parlamento/Documents/CRP1933.pdf [Constitution of April 11, 1933.]

Costa, J. B. (2019). Os discursos do design gráfico na sua emergência em Portugal (1960-2000). [Doctoral Thesis, Faculdade de Belas-Artes da Universidade do Porto]. Repositório Aberto da Universidade do Porto. https://hdl.handle.net/10216/124620 [The discourses of graphic design in its emergence in Portugal (1960-2000).]

Cotrim, P. (2004, August 28). Maria Keil. A linha e o traço. Actual, p. 18. [Maria Keil. The line and the trace]

Coutinho, B. (2020). Cristina Reis (Lisboa,1945). Artigos MUDE. https://www.mude.pt/artigos/cristina-reis-lisboa-1945_3.html

Cova, A. & Pinto, A. C. (1997). Salazarismo e as mulheres - uma abordagem comparativa. Penélope: revista de história e ciências sociais, 17, 71-94. [Salazarism and women - a comparative approach.]

Cruz, V. (2002, November 9). Maria Keil: O mundo é deslumbrante mas não é bonito. Revista, pp. 66-69. [Maria Keil: The world is stunning but it is not beautiful.]

Decreto-lei nº 23:048 de 23 de Setembro de 1933. Diário Governo. https://www.dgert.gov.pt/wpcontent/uploads/2019/05/DL-23-set-1933-estatuto-do-trabalho-nacional.pdf [Decree-Law No. 23:048 of September 23, 1933.]

Design Census 2019 (2019). AIGA 4th Annual Census. https://data.world/design-census/designcensus-2019

Dimbla, M. (1955, June 29). Maria Keil: arte moderna dentro do tradicionalismo. Modas e Bordados, 35(2264), p. 7. [Maria Keil: modern art within traditionalism.]

Duarte, I. & Martins O. (2021, August 19). Cristina Reis. Errata. https://joanaemariana.pt/CristinaReis-Errata

Falcão, G. A. M. (2015). Criação livre e criação dedicada. [Doctoral Thesis, Universidade de Lisboa, Faculdade de Arquitetura]. Repositório da Universidade de Lisboa. http://hdl.handle.net/10400.5/12591 [Free breeding and dedicated breeding.]

Ferro, A. (1934, June 30). Espírito. Revista de Cultura/Bandarra: Semanário Literário, anteprimeiro número, pp. 1-4. [Spirit.]

Fragoso, A. (2010). Formas e Expressões da Comunicação Visual em Portugal. [Doctoral Thesis, Faculdade de Arquitetura da Universidade Técnica de Lisboa]. https://www.repository.utl.pt/bitstream/10400.5/1440/1/tese_doutoramento_ margarida_fragoso.pdf [Forms and Expressions of Visual Communication in Portugal.]

Fragoso, M. A. P. (2012). Design gráfico em Portugal: formas e expressões da cultura visual do século XX. Livros Horizonte. [Graphic design in Portugal: forms and expressions of 20th century visual culture.]

Franchini, C. & Garda, E. (2016). About MoMoWo - Women's Creativity since the Modern Movement (1918-2018). In A. M. F. García, C. Franchini, E. Garda & H. SeraŽin (Eds.), MoMoWo 100 works in 100 years. European women in architecture and design 1918-2018 (pp.6-7). France Stele Institute of Art History ZRC SAZU. DOI:10.3986/9789610501060

Guida, F. E. (2020). Women in Italian Graphic Design History: A contribution to Re-Write History in a More Inclusive Way. In Vukić F. & I. Kostešić (Eds.), Lessons To Learn? Past Design Experiences and Contemporary Design Practices. Proceedings of the ICDHS 12th International Conference on Design History and Design Studies. UPI2M Books.

Gusmão, A. (1947, June). Das Belas Artes. Impressões críticas. O Salão da Primavera. A 2.a Exposição Geral das Artes Plásticas. Artes & Colecções, 1(1), p.23. [Of Fine Arts. Critical impressions. The Spring Hall. The 2nd General Exhibition of Plastic Arts.]

Hargreaves, M. (2020, December). Breve história das mulheres artistas, condicionalismo e percursos alternativos, em Portugal e fora. FLUP Biblioteca Digital. https://ler.letras.up.pt/uploads/ficheiros/18321.pdf [Brief history of women artists, constraints and alternative paths, in Portugal and abroad.]

Larsen, J. (2021). Finding Female Recognition: A Career Comparison of Female and Male Graphic Designers. [Honors Thesis, Providence Campus]. Scholars Archive JWU. https://scholarsarchive.jwu.edu/student_scholarship/45/

Leitão, P. (2005). Maria Keil conversa com Pedro Leitão: "fui uma operária das artes", Bdjornal, (4), 11-13. [Maria Keil talks to Pedro Leitão: "I was a blue-collar worker of the arts"]

Lisboa, A. L. (2020). As mulheres no design gráfico em Portugal. Preservação da memória coletiva de Alda Rosa e Cristina Reis. [Master Thesis, Faculdade de Belas-Artes da Universidade do Porto]. Repositório Aberto da Universidade do Porto. https://hdl.handle.net/10216/130888 [Women in graphic design in Portugal. Preservation of the collective memory of Alda Rosa and Cristina Reis.]

Manaças, V. (2005). Percursos do Design em Portugal. [Doctoral Thesis, Universidade de Lisboa, Faculdade de Belas-Artes]. Repositório da Universidade de Lisboa. http://hdl.handle.net/10451/27715 [Design Paths in Portugal.]

Mantas, H. (2012). Maria Keil, "uma operária das artes" (1914-2012). Arte Portuguesa do século XX. [Doctoral Thesis, Universidade de Coimbra, Faculdade de Letras]. Repositório Científico da

UC. https://hdl.handle.net/10316/24453 [Maria Keil, "a blue-collar worker of the arts" (1914-2012). Portuguese art of the 20th century.]

Marques, A.; Duarte, I.; Pinto, A.; & Pinho C. (2019). A construção da identidade da mulher em revistas do estado novo. ex æquo, 39, 71-88. doi: https://doi.org/10.22355/exaequo.2019.39.05 [The construction of women's identity in magazines in the state of Novo.]

Meer, J. (2012). He, she, it… Women and the problems of gender in the history of graphic design - Introduction to the short biographies. In G. Breuer & J. Meer (Eds.), Women in Graphic Design 1880–2012, (pp. 383-392). jovis Verlag.

Melo, H. P. (2017). Os Direitos das Mulheres no Estado Novo- a segunda grande guerra. Edições Almedina. [Women's Rights in the Estado Novo - the second world war.]

Melo, A. & Benavente, A. (1978). Educação Popular em Portugal (1974-1976). Livros Horizonte. [Popular Education in Portugal (1974-1976).]

Ministério das Finanças (2001). Artigo 151. Classificação das Actividades. Diário da República 193 SÉRIE I-B: 5390 a 539.
https://info.portaldasfinancas.gov.pt/pt/informacao_fiscal/codigos_tributarios/irs/Pages/irs155.aspx [Article 151. Classification of Activities. Official Gazette of the Union 193 SERIES I-B: 5,390 to 539.]

Moura, M. (2018). O Design que o Design não vê. Orfeu Negro. [The Design that Design does not see.]

Nobre, R. (1957). A pintora Maria Keil. Lusíada: Revista Ilustrada de Cultura, 3(10), 117-126. [The painter Maria Keil.]

Pimentel, I. (2012). Irene Pimentel faz um retrato da mulher no Estado Novo. RTP Ensina. https://ensina.rtp.pt/artigo/irene-pimentel-faz-um-retrato-da-mulher-no-estado-novo/ [Irene Pimentel paints a portrait of women in the Estado Novo.]

Pinheiro G. & Franqueira T. (2022). Seis décadas de design em Portugal: a sua afirmação, institucionalização e valorização. Ergotrip Design, 6. https://doi.org/10.34624/etd.v0i6.32780 [Six decades of design in Portugal: its affirmation, institutionalization and valorization.]

Quintas, A. (2014). Grafismo e ilustração em Portugal nos anos 40. [Doctoral Thesis, Universidade Nova de Lisboa, Faculdade de Ciências Sociais e Humanas]. Repositório Universidade Nova. http://hdl.handle.net/10362/17018 [Graphics and illustration in Portugal in the 40s.]

Rafael, S. (2006). Sociodinâmica da emergência de um curso superior: O estudo de caso do curso de Design de Comunicação da Escola Superior de Belas-Artes. [Master Thesis, ISCTE, Lisboa]. [Sociodynamics of the emergence of a higher education course: The case study of the Communication Design course at the Escola Superior de Belas Artes.]

Rawsthorn, A. (2018). Design as an Attitude. JRP|Editions.

Pinto, A., Araújo D. & Tomás S. (2014). Desigualdades entre os homens e as mulheres antes do 25 de Abril. RTP Ensina. https://ensina.rtp.pt/artigo/o-ideal-feminino-do-estado-novo/ [Inequalities between men and women before the 25th of April.]

Samara. M. A. & & Rosas L. (2021, July 23). As mulheres na resistência à ditadura do Estado Novo. Setenta e Quatro. https://setentaequatro.pt/ensaio/mulheres-na-resistencia-ditadura-doestado-novo [Women in resistance to the dictatorship of the Estado Novo.]

Santos, R. A. (2001). Daciano da Costa e os Percursos do Design Português 1950-2000. In J. P. Martins (coord.), Daciano da Costa, Designer (pp. 63-77). Fundação Calouste Gulbenkian, Serviços de Belas-Artes. [Daciano da Costa and the Paths of Portuguese Design 1950-2000.]

Scotford L. M. (1991). Is there a Canon of Graphic Design History? AIGA Journal of Graphic Design, (2), 3-5.

Skyes, R. (2017, March 11). Where are the Women? Gender Disparities in Graphic Design History. Design History Society. https://www.designhistorysociety.org/blog/view/feature-whereare-the-women-gender-disparities-in-graphic-design-history

Sousa, I. (2019). Educação Feminina no Estado Novo (1938-1948): impacto na imprensa periódica [Master Thesis, Universidade do Porto, Faculdade de Letras]. Repositório Aberto da Universidade do Porto. https://hdl.handle.net/10216/122635 [Female Education in the Estado Novo (1938-1948): repercussions in the periodical press.]

Souto, M. H., & Brízio, F. (eds.). (2014). Dos caminhos do design em Portugal: à conversa com Cristina Reis e Eduardo Afonso Dias. Territórios do design em Portugal. Revista de Letras e Culturas Lusófonas, (23), 9-15. [From the paths of design in Portugal: to a conversation with

Cristina Reis and Eduardo Afonso Dias. Design territories in Portugal.]

Souto, M. H. (2017). Ensaio para um arquivo: o tempo e a palavra. Design em Portugal (1960-1974). CML/MUDE. [Essay for an archive: time and the word. Design in Portugal (1960-1974).]

Souto, M. H. (2018). Craftswomen and Designers in Portugal: Improbable Paths. In C. Franchini & E. Garda (Eds.), MoMoWo: Women's Creativity since the Modern Movement: an European Cultural Heritage (pp.218-224). Politecnico di Torino. DOI:10.3986/9789610501060

Souto, M.H., Brízio, F. (co-eds.). (2014). Dos caminhos do design em Portugal: à conversa com Cristina Reis e Eduardo Afonso Dias. Territórios do design em Portugal. Revista de Letras e Culturas Lusófonas, (23), 9-15. [From the paths of design in Portugal: to a conversation with Cristina Reis and Eduardo Afonso Dias. Design territories in Portugal.]

Thomson, E. M. (1994). Alms for oblivion: the history of women in early American graphic design. Design Issues, 10(2), 27-48. https://doi.org/10.2307/1511627

Trauth, E.M, Quesenberry J.L. and Huang H. (2006). Cross-cultural influences on women in the IT workforce. Proceedings of the Acm Sigmis Cpr Conference on Computer Personnel Research, (pp. 1219). Association for Computing Machinery. https://doi.org/10.1145/1125170.112517

Van Dijk, T. (1995). Discourses Semantics and Ideology. Discourse & society 6(2), 243-289. doi:http://doi.org/10.1177/0957926595006002006

Vaquinhas, I. (2011). A família, essa «pátria em miniatura». In I. Vaquinhas (coord.) & J. Mattoso (dir.), História da Vida Privada em Portugal - A Época Contemporânea (pp. 118-151). Círculo de Leitores. [The family, that "homeland in miniature".]

Walker, S. (2017). Research in graphic design. The Design Journal, 20(5), 549-559. doi: https://doi.org/10.1080/14606925.2017.1347416

Yue, Z. (2018). Gender Impact on Female Graphic Designers' Career Satisfaction. International Journal of Humanities Social Sciences and Education (IJHSSE) 5(10), 49-56. http://dx.doi.org/10.20431/2349-0381.0510006

50 anos 25 de abril, (2024). Portugal Social 1968-1974. 50 anos 25 de abril. https://50anos25abril.pt/historia/unidos-venceremos/portugal-social-1968-1974/ [Portugal Social 1968-1974.]

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CULTURAL DIMENSIONS IN DESIGN: RESEARCH ON THE SHIFTS OF INTERACTIVE RELATIONS

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ABSTRACT | Design, as an important creative activity in the process of human survival and development, is essentially a cultural creation activity of humanity. On the one hand, the power of culture deeply influences design, and design trend expresses and reflects the dynamic culture. On the other hand, design is also involved in the construction process of culture through multiple methods, becoming the main driving force for promoting cultural innovation. With the continuous development of people's awareness and understanding of culture, the interaction between design and culture has also changed simultaneously. The investigation of the relations between design and culture aims to fundamentally reveal the motivations, purposes, and principles of human design activities. In this paper, we discuss the changes of relation types between culture and design when they interact and interplay. According to the degree to which culture plays a central role in the design process, the scope of intervention, and the ways of participation, relation types can be divided into culture-oriented design, culturedriven design, and culture-as-tool design. The research discusses the differences among three relation types through summarizing their features and methods respectively, and highlights their influences on design practice, so as to assist designers to create more meaningful, diverse, innovative, and inclusive designs in an interconnected global context.

KEYWORDS | CULTURAL INTEGRATION, DESIGN PROCESS, DIVERSITY, SUSTAINABILITY, RELATION

1. Introduction

For decades, culture has been a crucial and essential topic of debate in various research fields. Tylor (1871), widely credited with providing the first formal definition of culture, holds culture as a "complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society". Williams (1976) states culture is one of the most complicated words that can be divided into three types of meanings: a particular way of human life, works and practices of art and intelligence, and signifying or symbolic systems. UNESCO (2001) defines culture as "the set of distinctive spiritual, material, intellectual and emotional features of society or a social group, that encompasses, not only art and literature but lifestyles, ways of living together, value systems, traditions and beliefs".

Globalization has made culture the most important asset to work with (Lee, 2004), and various fields emphasize the significant role of culture. The characteristic of contemporary society can be described as a "society of design" (Zhou, 2013), and design, as the product of human practice, is positioned as a cultural phenomenon (Sparke, 2013). The relations between design and culture are dynamic and bidirectional, and the modifications in the former's evolution both reflect and determine the developments in the latter (Röse, 2004; Moalosi et al., 2005). Design can be seen as the integration, transformation, and manifestation of tangible and intangible codes through various encoding methods, and all design processes should proceed under a counderstanding cultural context, so that designers, users and other participants can communicate, interact and empathize with each other through design practice.

The intertwined and ambiguous relations between design and culture are the subjects of continuous investigation by numerous design scholars, and they have explored the interaction between design and culture from an interdisciplinary perspective, believing that the two constantly evolve through mutual influence and jointly shape the material and spiritual world of humanity. However, these studies emphasize more how the

design process can better apply, protect, or promote culture by practice, and there is limited research on the changing relation types between design and culture, there is not much literature available for reference. We will analyze the core role, intervention scope, and participation methods of culture in the design process based on people's continuous understanding of the mutual influence and interaction between design and culture in design practice and suggest three types of relations between design and culture: culture-oriented design, culture-driven design and culture-as-tool design. In the next three sections, we will attempt to describe their content, features, and methods respectively, and differentiate them subsequently. The contribution concludes with a summary of the previously discussed points.

2. Collisions between cultural levels and design characteristics

Cultural issues are complicated and multi-faceted, scholars attempt to develop multiple levels or layers of culture to understand its complexity and the different dimensions it encompasses. Malinowski (1944) indicates that there are three cardinal constituents of cultural reality, physical basis and equipment of artifacts as material elements, norms, customs, traditions, and rules as institutional elements, ideas and values, interests and beliefs, and magic or religion as spiritual elements. Schein (1985) offers three levels of culture containing artifacts, espoused values and shared tacit assumptions. By combining Schein's theory with ideas drawn from symbolicinterpretive perspectives, Hatch (1993) raises a model called cultural dynamics and symbols are introduced as a new element into the levels of culture, the components of this cultural model are assumptions, values, artifacts, and symbols.

In the field of design, there is also a constant stream of thinking about cultural levels, and related research has been widely approved over the years. The cultural elements we use in design have no direct correlation with spiritual contents, it is we who give meanings to these elements, for example, the meaning of color is culturally mediated (Raskin, 1999). He (1992) divides "cultural space" into three structural levels like an inverted pyramid: the external, tangible and visible "outer level"; the behavioral "middle level" including human behavior rites, and regulations in the form of words and language; and the intangible "inner level" involving the manifestation of human ideologies. Leong (2003) develops a matrix model to replace He's pyramid (1992), consisting of material/design and style, behavior, institutions and customs, philosophy or ideology in each quadrant. Summing up the theories above, Lin (2006) states culture can be classified into physical or material layer which include daily related objects and tools, social or behavioral layer which include human-related rituals and customs, and spiritual or ideal layer which include emotion reflected art and religion. The consideration of the interactive relations between design and culture begins with linking cultural levels with their corresponding design characteristics.

3. Culture-oriented design

With the increase in global trade, communication, and migration, cultural integration and injection will inevitably become an essential force for design innovation. Concerned with design competitiveness in global markets, designers should demonstrate more responsibility for their designs when considering the impact of their designs, not only by meeting the demands of customers but also by preserving cultural variety and values. Globalization creates a more interconnected and multicultural world, design first needs to face two urgent problems: on the one hand, globalization leads to cultural homogeneity by denying or ignoring cultural identity, or abstracting cultural identity into universal identity, and in the process destroys cultural diversity and heterogeneity (Moalosi et al., 2007; Yao & Lu, 2016); on the other hand, it is necessary for global design to adapt to different local cultures, designers should know how to disrupt or support the local cultural system of society (Popovic, 2002). Culture-oriented design emerges in response to the proper time and conditions when it comes to culture-related basic issues.

3. 1 Design for culture: Crafting creative solutions with cultural significance

Culture-oriented design aims not only to embed unique cultural features into the design outcomes that assist in enhancing its added value, strengthening its identity attributes, and attracting a wider range of consumers, but also to create relevant, acceptable and significant designs to provide products, services, and environments that resonate with the cultural context of the target audiences. Culture-oriented products are employed as the basis for competitive advantage or product differentiation, as they can be used to mark the boundaries between groups, and create and divide differences or commonalities between figurations of people (Farr, 1966; Featherstone, 1995). Röse and Züblke (2001) propose that culture-oriented design is a design that integrates the cultural characteristics of product users, namely internationalized products with "cultural modules" and localized products that adopt specific cultural needs. Cultural features are regarded as unique characteristics that can be incorporated into the design to enhance its identity in the global market and to improve the individual consumer experience (Heskett, 2005).

Enhancing diversity and adding extra value to design, which are necessary for the improvement of design performance and experience, are the most significant features of culture-oriented design (Hsu et al., 2011). The key issue to injecting culture into design depends on the choice of cultural elements, such as functional, aesthetic and symbolic attributes (Leong, 2003; Lee, 2004). By drawing inspiration from certain cultures, designers integrate or transit cultural elements and insights into the design process, not only enhances the aesthetic and emotional appeal of the design but

also increases its relevance and usability in specific cultural contexts, helping to enrich the variation of the design, differentiate designs in the highly homogenized global market, add unique selling points that attract a broader audience to bring about the development of new market opportunities and cultural revitalization (Shin et al., 2015).

Another crucial feature of culture-oriented design is the user-centered idea that arises from the inevitable process of acculturation (Lee, 2004). Cultural experience affects user's response to design and customer's interpretation of visual artifacts, and an acculturated design method is needed to correct and control potential biases and mistakes caused by differences in cultural contexts and perspectives (Kostelnick, 1995; Dervin, 1999). As user's preferences for product forms are much driven by non-physical cultural factors, the employment of user-centered design concepts is required to connect design to a specific socio-cultural context (Bloch, 1995; Rosenman & Gero, 1998). Culture-oriented design creates stronger bonds with users, it can not only reflect users' identity, but also provide more insights on creating new designs that are effective and efficient, play a role in the intuitive use of designs, and meet the users' needs and expectations (Razzaghi & Ramirez, 2005; Prameswari et al., 2017). To align the design with the customers' background, designers naturally seamlessly integrate relevant cultural elements into the design, ensuring that the designed product, service, or environment resonates deeply with the customers, thereby improving their overall experience and satisfaction.

3.2 Culture-oriented design methods

Culture-oriented design produces products, services or experiences, and scenes or environments that are understandable, acceptable, and resonant to users through acknowledging and incorporating cultural plurality. Many scholars and designers have proposed various methods and theories of culture-oriented design, among which the most representative and frequently used are Moalosi and Lin.

Moalosi and others (Moalosi et al., 2005; Moalosi et al., 2007; Moalosi et al., 2008) define a culture-oriented design which states culture can be integrated into product design by assessing users' needs and activities, combining technological advancements or evaluating existing designs, and the process is developed into three interrelated phases. The first phase involves identifying the sources of socio-cultural factors that contain user needs in the user domain and their categorization, which is composed of social practice factors, emotional factors, material factors and technology/design factors. The second phase is about the integration of cultural factors and design features in the designer domain in which designers can discover the attributes of designs through different social interaction modes, and socio-cultural factors thus can be transformed into characteristics of functional, meaningful, knowledge, intermediary, gender, and aesthetics features, so that design expression matches the acceptance characteristics of user culture. The last phase focuses on creating novel design ideas that

align with the needs of users and design ideas that have a distinct and recognizable product image in the product domain, embedded with narrative abstract features of product that improve the product acceptance, construct differentiated lifestyle modes, and express personal identities for users. Moalosi's culture-oriented design method provides a culturally innovative structure of design, which adds value to design, meets user's true needs, and offers meaningful experiences.

Lin (2007) proposes a framework for correspondence between cultural layers and design features, and suggests three design features that correspond to the cultural levels mentioned earlier (spiritual/ideal level, social/behavioral level, and physical/material level) respectively when cultural objects are incorporated into cultural design: the inner level of reflective design with storytelling, affection and cultural meaning; the mid level of behavioral design with function, operation, usability, safety; the outer level of visceral design with colors, pattern, form, texture, decoration, lines and other appearance elements. Lin and others (Lin, 2006; Lin, 2007; Lin et al., 2007; Hsu, 2011) assume that the culture-oriented design model consists of three sections: conceptual model, research method, and design process. The focus of conceptual model is how to extract cultural features from cultural objects, followed by transforming these features into design models to design cultural outputs. There are three phases of research method: identification phase that extracts cultural features from original cultural objects, translation phase that transfers the extracted cultural features to design information and elements, and implementation phase that eventually designs the cultural outputs. Four steps are used in design process to design the cultural outcomes by using scenario and storytelling: investigation that sets a scenario to fit the three cultural levels; interaction that tells a story to describe user's needs and the features of outcomes; development that writes a script to confirm why consumers need the outcomes and how to design the outcomes to meet their needs; implementation that design the outcomes through creating, evaluating and modifying. Lin provides designers with the specified procedures for integrating culture into design for cultureoriented design patterns.

According to the investigation of theoretical research, Moalosi and Lin's culture-oriented design methods can complement each other and be widely recognized by design scholars. The approaches that inject culture into design practice in the design field, such as cultural product design, cultural creative design and culture-inspired design, can all be classified as cultureoriented design essentially because design is regarded as their core. In general, culture-oriented design involves a process of identifying and extracting cultural characteristics, transforming them into design elements, and then applying the transformed design elements appropriately in the design, which results in promoting the richness and diversity of design categories and achieving common understanding with users to arouse users' interests of culture, as well as generate economic value.

4. Culture-driven design

With the mass production of design and the spread of mass consumption, problems such as resource waste, environmental challenges, social inequality, and cultural erosion have emerged one after another. Intentions of modernism are making the world a better place through design (Julier, 1990), contemporary designers must be aware of their social and cultural responsibilities and carry out creative, sustainable, responsible, ethical, and cross-cultural design production. Papanek (1971) observes that the large-scale design in developing countries by outsiders has never worked. Similarly, Krippendorff (2005) states design strategies that go against the ecological wisdom of a culture are likely to fail. In other words, problems such as cultural barriers, cultural insensitivity and cultural inadaptability will inevitably arise without a deep understanding of the local culture. From these perspectives, culture-oriented design that serves commercial purposes cannot achieve fundamental transformation in the lives of the cultural groups to which people belong or meet their real cultural sensitivity needs, resulting in the emergence of culture-driven design.

4.1 Design with culture: Collaborative innovation in culture-centered practice

Culture-centered practice is a fundamental aspect of culture-driven design. By understanding and respecting cultural contexts, engaging local cultural communities, and integrating multiple stakeholders to support local actors and embed cultural narratives, designers can create designs that resonate deeply with users, thereby promoting cultural protection, preservation and continuation. The role of designers has changed, their ultimate goal is defining solutions instead of product production, and they should consider new actors and stakeholders in the design system, including service providers, local organizations, institutions and associations, as well as individuals (Morelli, 2007; Sangiorgi, 2011). Designers' creative skills can be utilized to help develop an inspiring, long-lasting, repairable, and worth-repairing cultural innovation, but it must be based on local capabilities, as only solutions developed in the local environment can meet cultural appropriateness, effectively promote local cultural relations and community flourishing, and environmental impacts can be recognized and alleviated (Walker, 2018).

Cultural sensitivity should be concerned, Lee and Sayed (2008) develop three principles of culturally sensitive design that may be used to understand the cultural other and are associated with innovative culture-centered design methods. The first principle states that local characterization of the past and future requires an understanding of cultural locales within the context of history and future aspirations rather than current "exotic snapshots" (Berk, 2013). The second principle emphasizes localization of global process, which asks for understanding globalization as a local response to modernity, rather than

a local Westernization. The third principle is a reflexive gaze which involves strong involvement, sympathy, and empathy from designers in the design process. In the era of globalization, designers must be aware that a "cultural design solution of goodwill" that has not undergone comprehensive understanding, research, communication, and coordination could seem insensitive and sometimes even rude to local users (Sun, 2012).

In contemporary society, the challenge of cultural sustainability is critically connected to culturedriven design, which is considered another significant feature. Sustainable development solutions at the cultural level are the most comprehensive, by understanding the cultural context, social and cultural results with long-term cultural durability can be designed (Manzini, 1994). As Loach et al. (2017) mention, culture is described as the fourth pillar of sustainable development, situated alongside social, economic, and environmental concerns, thus requiring more strategic approaches to encourage cultural vitality and manage cultural heritage.

Sustainability requires the integration of ethical and spiritual considerations, a sense of responsibility towards culture and environment, and the fulfillment of practical requirements throughout the entire design process, and is expressed as a deeper beauty that transcends surface and style (Walker, 2014).

4.2 Culture-driven design methods

Through studying and analyzing the research of numerous design institutions and scholars, we summarize related methods of culture-driven design. The culture-driven design method takes culture-centered design as the main framework, and some steps come from communitycentered design, co-design, sustainable design, transformation design, cross-cultural design, and so on. The culture-driven design method is divided into two main parts: predesign phase and design phase.

The predesign phase is composed of the background setup stage, presupposition awareness stage, and access stage, during which preliminary design research and planning are required. The background set-up stage includes collecting secondary sources to propose basic design problems and address the challenge of cultural competence, which requires: cultural awareness that realizes the bias towards other cultures may arise based on one's own culture; cultural skills about learning and applying specific cultural expertise; cultural encounters that involve a process encourage cross-cultural interaction; cultural desire about individual's motivation for interacting with other cultures; cultural knowledge in terms of seeking and acquiring a solid learning foundation about other cultures (Berk, 2013; Garran & Rozas, 2013). The presupposition awareness stage deals with the risk of cultural imposition in culture-driven design (Berk, 2013), designers must be vigilant against cognitive biases to avoid various forms of assumptions,

stereotypes, or prejudices toward other cultures. Furthermore, creating a design team with plural cultural backgrounds can bring multiple perspectives to reduce the barriers brought by cultural imposition (Page et al., 2016). The access stage is an intermediate stage between predesign phase and design phase, its primary targets include building organizational and personal networks, and differing cultural roles and norms as well (Berk, 2013). This transition stage provides access to another culture during the design phase, helping to bridge cultural divides and foster respect for diversity, and emphasizes inclusivity by allowing users from various cultural backgrounds to engage with the design while ensuring acceptance and support within the cultural context (Dutta, 2020).

The design phase involves actual design work and consists of four parts: cultural immersion stage, reflective integration stage, co-design and implementation stage, and evaluation stage. The cultural immersion stage is the process of deeply engaging and participating in a culture different from one's own (Berk, 2013), which maintains cultural sensitivity to both relation construction with other cultures and the otherness factors. Role negotiation is demanded to establish equal, honest, and open relationships among designers, users, and other participants. Additionally, complex cultural issues need to be mediated through different perspectives, and the design process creates a neutral space (Burns et al., 2006).

The reflective integration stage involves communicating and interacting with other stakeholders about different forms of design insights and initial design ideas through reflection and integration (Berk, 2013). The brief should be defined and redefied at this stage, the UK Design Council suggests designers conduct this operation at the beginning (Burns et al., 2006), we believe that in this cross-cultural context, however, it will be better for designers to deal with after a deep understanding, communication, and experience of the local culture. Furthermore, design proposals should be localized and achieve users' sensitive goals of comprehensive system contexts (Perkins, 2008), which entail conveying insights and knowledge to other participants with varying cultural competencies and obtaining their feedback and recognition.

The co-design and implementation stage contains direct and indirect involvement. Co-design means that cross-cultural and interdisciplinary actors participate, interact, and even directly provide creativity, in other words, their roles get mixed up and play important roles together in knowledge acquisition, idea generation and concept development (Sander, 2006; Sander & Stappers, 2008), which concerns a process of empowering local people (Meroni, 2008; CostanzaChoc; 2020). Moreover, designers' awareness of cultural sensitivity is a significant factor in preventing assumptions that may cause misunderstanding, offense, or harm to certain cultural groups (Van Boeijen & Zijlstra, 2020). In terms of design implementation,

cultural sustainability should be prioritized in culture-driven design to ensure co-created, long-term, and desirable outcomes. Various overlapping elements such as tradition, contextual factors, shared beliefs, values, and meanings, and specialized knowledge valued by local communities, are incorporated into culturally significant designs that consider practical, social, personal, and economic issues, forming the "quadruple bottom line of sustainability" (Walker, 2011; 2014; 2018).

The evaluation stage includes evaluation, modification, and distribution. Given the complexity and evolving nature of culture, periodic follow-ups, revisions, and evaluations guarantee that the design evolves in harmony with local cultural shifts, maintaining its flexibility, effectiveness and long-term relevance. Continuous attention and care toward the design scheme reflects designer's responsibility, ensuring that culturally tailored solutions truly achieve sustainability. Distribution is another criterion for assessing cultural design solutions by estimating their replicability across different cultures and promoting scalability to broaden the designs' reach and impact, allowing sustainable cultural design to be effectively delivered to a wider audience (Manzini, 2015). The evaluation stage is a long-term process that always connects with predesign phase to form a cycle of design patterns.

Rooted in a profound understanding of long-term concepts and the significance of culture, a sustainable, inclusive, interdisciplinary, and cooperative culture-driven design approach has emerged. The focus of design evolves from "objects" (such as appearance and experience) toward "ways of thinking and doing" (such as thinking patterns and design systems) (Cagan & Vogel, 2012; Manzini, 2016). The core of culture-driven design is culture, offering a new solution when traditional design or technological innovation fails to manage complicated social and cultural problems. The shift from culture-oriented to culture-driven approach marks a transition from consumerist, user-centered commercial design to sustainable, culture-centered social design. Papanek (1971) advocates that responsible designers should design for human "needs" rather than "wants" or artificially created wants, culture-driven design, likewise, is precisely built on cultural expressions that come from genuine origin and resonate with the audience.

5. Culture-as-tool design

The development trends of globalization, internetization, and digitalization gradually make the world a more interconnected whole. The breakthrough development of intelligent and digital technology has accelerated the arrival of the Singularity, and the technological wave marked by artificial intelligence (AI) has brought profound changes to the role of culture. It is obvious that we are living in a transitional period that embodied cultural instability. On the one hand, these changes help to expand the global dissemination of local cultures and enhance cultural plurality. Nevertheless, on the other hand, local culture may be invaded by powerful foreign cultures,

resulting in the loss of local culture, namely cultural displacement and erosion. These cultural issues are not only related to culture itself, but also closely connected with non-cultural realities such as ideology, power, identity, and economy. Culture-as-tool design aims to maximize the social and economic benefits of cultural activities and policies in the context of digital transformation, making culture a key instrument in responding to national strategies and achieving a better future.

5.1 Design through culture: The instrumentalization wave in the AI era

The various aspects of modernization promote the diversified development of culture, but yet exacerbate the tension and conflicts between cultures. Culture-as-tool design highlights the instrumentality of culture, referring to using culture as a means or instrument for attaining goals in non-cultural areas. Culture can only be entered when members of a group reach a common understanding of it and master its equipment and content (Du Guy, 1997; SpencerOatey, 2000). Culture is more like a "toolkit" or repertoire, as Hannerz (1969) put it, from which actors choose different segments to construct their lines of action. Swedler (1986) compares modern pluralistic society to a collection of cultural "toolkits", and culture influences actions by shaping a series of habits, skills, and styles, from which people construct action strategies. Culture-as-tool design emerges as a strategic approach, which takes culture not merely as a passive expression of human creativity and identity but as an active strategy of controlling and managing cultural repertoires that can be shaped and utilized to serve a wider range of needs.

The focus of culture-as-tool design is to embed intelligent and digital technologies, especially AI technologies, to support the construction of physical and virtual cultural platforms, thereby promoting sustainable and innovative development of culture. The Boundless Creativity Report (UK Government, 2021) points out that the accelerated shift of cultural content towards digital presentation modes after the pandemic has provided opportunities to reach new global audiences as well as new hyper-local audiences. This extended reach not only brings financial benefits by promoting online cultural consumption but also expands cultural influence through taking advantage of these new digital audiences to promote their rich cultural content internationally during periods of restricted physical participation. Due to the rise of AI, cognification becomes the main cultural trend of digital transformation, and the intelligent cognified environment mediates human interaction and even participates in interaction (Levin & Mamlok, 2021). Algorithms and big data as paradigmatic innovations can not only drive scientific progress, but also shape social values and norms (Lazzeretti, 2023).

Policy integration is one of the prominent features of culture-as-tool design. The focus on culture has shifted from direct use value to more instrumentalized versions of policy worth, instrumentalization regards cultural policy as the means to acquire non-

cultural results, but cultural content provides meaning for it (Hadley & Gray, 2017). France 2030 includes concern about cultural and creative content as one of the societal objectives (French Governmental Information Department, 2024), and a call for projects aimed at developing immersive technologies for the future to ensure France's cultural sovereignty has been launched (France Ministry of Culture, 2024). In recent years, the impact of globalization has made the trend towards the instrumentalization of cultural policies increasingly apparent (Gray, 2007). The policy integration in culture-as-tool design prevents treating culture in isolation, but combines cultural initiatives with economic, social, and political agendas, ensuring collaboration with more departments, disciplines, and stakeholders to implement cultural policies (Drew et al., 2021).

Economic focus is another important feature, emphasizing the role of culture as a catalyst for economic development. This approach recognizes the enormous potential of culture in driving economic growth and development in the process of digitalization, and fully exploits the economic value of cultural products and services by promoting innovative transformation in manufacturing, information and communication, and retail industries. Culture-as-tool design encourages participation and promotion in cultural tourism design, enriching innovative content and cultural activities of cultural heritage (Sheldon, 2020), thereby attracting more consumers to achieve the dual effect of expanding cultural dissemination and creating economic value. Besides, cultural projects that combine culture with broader consumption and strategies can help create employment opportunities, generate multiplicate economic benefits, and accelerate local development. Culture-as-tool design highlights the important role of culture in promoting economic prosperity, enhancing overall social well-being, and improving national strength.

5.2 Culture-as-tool design methods

Culture-as-tool design refers to the foresight strategic use of cultural repertoires to produce practical outcomes, respond to digital transformation and social changes, and promote the achievement of specific political and economic objectives. Design approaches that involve cultural actions such as strategy design, policy design, transition design, digital, virtual and immersive design, and AI-generated design can be regarded as culture-as-tool design in this case, and we divide its process into planning phase, design phase, and delivery and evaluation phase.

The planning phase requires participation and research of various actors to lay a solid foundation for subsequent design practice. Cross-sector dialogue is the first stage that brings together all designers, users, experts, cultural-related sectors, technical sectors and other stakeholders to define design issues jointly through communication and negotiation and develop insight in this process to turn intuition and observation into visions or action plans (Bason, 2014; Van Buuren et al, 2023). New forms of alliances should be

set up at this stage, and designers should identify the position of their design and themselves within the group. The second stage is intent and vision setting, and it aims to build a shared understanding of a broader vision through the integration of cultural policies and consumption goals in digital age. Scenario construction can help intent and vision transform into a plausible hypothesis by producing structure and motivation (Meroni, 2008). This stage describes the desired outcomes from multiple perspectives of actors and provides a conceptual sketch of the whole design process, and even can serve as a framework for evaluating and designing moves (Irwin et al., 2022). Discovery and placement, the third stage, includes various forms of research exploration and investigation through gathering cultural information and resources that help the design team generate ideas, and gain insights into users, organizations, markets, relevant policies, and other sectors. Additionally, user issues should be considered related to their utilization and interaction in design, as well as manufacturer issues, concerning influences of production technology, tools, materials, and broader industry analysis on design (Carlopio, 2010). To make design meaningful, culture-as-tool design requires designers to have a wealth of knowledge and insight into the relevant content system and the workings of specific departments involved (Walker et al., 2001).

The design phase involves the practice process of culture-as-tool design. Firstly, the development stage puts the research from planning phase into real design practice. It requires the creative ideation of numerous design proposals that respond to the vision of cultural intervention. Moreover, the prototype of the design outcome, selected from previous ideations, should be produced with appropriate intelligent and digital technical support to represent and concretize the design concept. The second stage, calibration and standardization, is the key section of whole culture-as-tool design, which demands that we own and master the cultural repertoire to ensure effective understanding and engagement within a shared cultural context (Milkie, et al., 2014), thus preventing the occurrence of "cultural lag". Technology is not a good traveler unless it is culturally calibrated (Kaplan, 2004), and this perspective also applies to design. Culture is recognized as both constraining and empowering, through calibration and localized standardization, culture can serve as a catalyst for local entry into the global market and a defensive tool for resisting foreign ideological invasion in the wave of global cultural turbulence. Hence, culture-as-tool design could ensure the unity of guidance and directions for cultural actions in the rise of generative AI and help establish a consistent and firm cultural identity externally. Lastly, implementation stage illustrates the ultimate production of design outcome. It involves cooperation among designers, end users, external experts, interest groups, and other stakeholders, leading to envisioning and approaching the desirable outcome together (Irwin et al., 2022). Culture-as-tool design supports cultural policies through the alignment of

cultural repertoires, creates multimodal and crossmodal human-AI generative, interconnective, integrative, and collaborative cultural content and application scenarios, and promotes innovative cultural production to drive consumption, thereby stimulating the flourishing of politics and the economy.

The delivery and evaluation phase involves putting the design outcomes into use and evaluating them afterward, as well as making revisions as needed. Design outcomes are delivered to a wider range of users, and the key point of this phase is that while users are using or participating, the design outcome is also iterating simultaneously. Von Hippel (2005) uses the term "democratization of innovation" to refer to the increasing tendency of users of products and services to innovate on their own, as for many users, it will be easier to obtain what they want by designing for themselves. As digital society is characterized by its dynamic nature and the ability of people to be both consumers and content creators (Levin & Mamlok, 2021), the design outcome is like an adaptive system, which is open and interactive, and able to organize or reorganize itself based on changes that occur (Meroni, 2008; Sudjic, 2024). Generally, cultureas-tool design is an automatically iterating system in this phase, as it involves the participation and interaction of many new users, whose actions will help to continuously expand the content of the design results. Nevertheless, the design team still needs to regularly evaluate the design results and intervene and adjust them as necessary to ensure that the design outcomes constantly meet the needs and preferences of cultural policies and consumption in the overall direction.

The emergence of culture-as-tool design is to serve cultural policies and cultural consumption in the digital age, in response to the turbulent social landscape brought about by technologies such as AI in the contemporary world. This design treats culture not merely as an end in itself but as a means to drive economic development, promote social cohesion, and enhance political stability. It integrates cultural initiatives with a wider policy agenda through cross-sector collaboration and interdisciplinary strategies, ensuring that cultural activities can bring tangible benefits such as creating employment opportunities, supporting local development, promoting economic growth, and fostering cultural identity. This approach balances the instrumental and intrinsic values of culture, helping people establish a common understanding of cultural vision through the interaction between the two, responds to the constantly changing needs of digital transformation, and maximizes the social impact of cultural investment and initiatives.

6. Discussion

Design is taken as a culturally specific practice

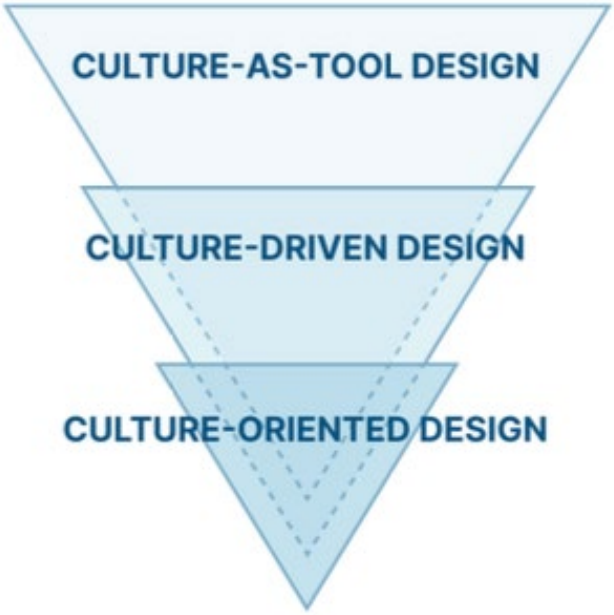
that is driven almost entirely by strategies of differentiation (Julier, 2000). According to the analysis above, the relation between design and culture can be divided into design for culture, design with culture, and design through culture, corresponding to culture-oriented design, culture-driven design, and culture-as-tool design respectively. By summarizing three relation types between design and culture, a classification with multiple parameters is provided to demonstrate their differences (Table 1). These three design approaches do not conflict with each other and sometimes appear together in design practice because there is an inclusive relation among them (Figure 1): culture-oriented design is included in culture-driven design, while the latter is included in culture-as-tool design.

Figure 1. The inclusive relation among three design approaches.

7. Conclusion and future work

Table 1. Classification of three relation types between design and culture.

	Culture-oriented design	Culture-driven design	Culture-as-tool design
Relation	Design for culture	Design with culture	Design through culture
Design participation	Translate and transform	Collaborate and empower	Integrate and manage
Role of designer	Leader	Promoter	Coordinator
Culture intervention	Added value	Resonated expression	Shared cultural repertoire
Design subjects	Designer	Designer, user, and stakeholder	Designer, public, industry expert, cultural sector, technical sector, and stakeholder
Keywords	Diversified, acculturated, and user-centered	Sustainable, collaborated, and culture-centered	Instrumentalized, co-created, and strategic
Design aim	User needs; diversity of design; commercialization	Real cultural needs; social responsibility; cultural diversity	Digital transformation; social change; social and economic good
Design theories	Product design; service design; user experience design; etc.	Participatory design; co-design; transformation design; etc.	Strategy design; policy design; transition design; AI-generated design; etc.



When exploring the types of interactive relations between design and culture that constantly change, we classify them into culture-oriented design, culture-driven design, and culture-as-tool design. We found that these three design approaches have changed people's understanding of cultural content and exploration of design practices deepened. Each approach has different backgrounds, features and aims, but all provide unique design perspectives for the diverse, innovative, and sustainable development of culture. A deep understanding of the integration of culture and design is crucial for addressing contemporary globalization challenges, as it can help designers, industry experts, and more participants create meaningful, inclusive, and transformative design outcomes in the context of cultural turbulence.

The relation between design and culture is an eternal and dynamic research topic, and with the development and changes in society, research in this field will continue to deepen and expand, attracting scholars, experts, and designers to further collaborate to explore and address the challenges and opportunities at the intersection of the two through interdisciplinary research and practice. This research mainly examines the changes in the interactive relations between design and culture through the analysis and summary of design theories related to culture, which limits the scope of the findings to a conceptual level, without extensive empirical validation through practical examples. In the future, we will explore various design practices and case studies, as well as conduct specific analyses and thorough discussions based on particular cultural contexts to further explain and supplement the research content.

References

Bason, C. (2014). Design for policy. Surrey:

Gower Publishing Limited.
https://doi.org/10.4324/9781315576640

Berk, G. G. (2013). A framework for designing in cross-cultural contexts: Culture-centered design process [Unpublished doctoral dissertation]. University of Minnesota.
https://hdl.handle.net/11299/155725

Bloch, P. H. (1995). Seeking the ideal form: Product design and consumer response. Journal of Marketing, 59 (3), 16-29. https://doi.org/10.1177/002224299505900302

Burns, C., Cottam, H., Vanstone, C., & Winhall, J. (2006). Red paper 02: Transformation design. London: Design Council. Retrieved June 15, 2024, from https://www.designcouncil.org.uk/fileadmin/uploads/dc/Documents/red-paper-transformationdesign.pdf

Cagan, J. M., & Vogel, C. M. (2012). Creating breakthrough products: Revealing the secrets that drive global innovation. New Jersey: FT Press. https://doi.org/10.1184/R1/5788092

Carlopio, J. (2010). Strategy by design: A process of strategy innovation. New York: Palgrave Macmillan. https://doi.org/10.1057/9780230105263

Costanza-Chock, S. (2020). Design justice: Community-led practices to build the worlds we need. Cambridge: MIT Press. https://doi.org/10.7551/mitpress/12255.001.0001

Dervin, B. (1999). Chaos, order and sense-making: A proposed theory for information design. In R. E. Jacobson (Ed.), Information design (pp. 35-57). Cambridge: MIT Press.

Drew, C., Robinson, C., & Winhall, J. (2021). Systems-shifting design report. London: Design Council. Retrieved June 15, 2024, from https://www.designcouncil.org.uk/fileadmin/uploads/dc/Documents/Systemic%2520Design%25 20Report.pdf

Du Gay, P. (1997). Doing cultural studies: The story of the Sony walkman. London: SAGE.

Dutta, M. (2020). Communication, culture and social change: Meaning, co-option and resistance. Palgrave Macmillan. https://doi.org/10.1007/978-3-030-26470-3

Farr, M. (1966). Design management. London: Hodder & Stoughton.
Featherstone, M. (1995). Undoing culture: Globalization, postmodernism and identity. London: SAGE Publications.

French Governmental Information Department. (2024, May 7). France 2030. https://www.info.gouv.fr/grand-dossier/france-2030

French Ministry of Culture. (2024, January 30). France 2030: Launch of a call for projects to ensure our cultural sovereignty in immersive environments and metaverse. https://www.culture.gouv.fr/en/press/press-releases/France-2030-launch-of-a-call-for-projectsto-ensure-our-cultural-sovereignty-in-immersive-environments-and-metaverse

Garran, A. M., & Rozas, L. W. (2013). Cultural competence revisited. Journal of Ethnic & Cultural Diversity in Social Work, 22(2), 97–111. https://doi.org/10.1080/15313204.2013.785337

Gray, C. (2007). Commodification and instrumentality in cultural policy. International journal of cultural policy, 13(2), 203-215. https://doi.org/10.1080/10286630701342899

Hadley, S., & Gray, C. (2017). Hyperinstrumentalism and cultural policy: Means to an end or an end to meaning?. Cultural Trends, 26(2), 95-106. https://doi.org/10.1080/09548963.2017.1323836

Hannerz, U. (1969). Soulside: Inquiries into ghetto culture and community. New York: Columbia University Press.

Hatch, M. J. (1993). The dynamics of organizational culture. Academy of management review, 18(4), 657-693. https://doi.org/10.5465/amr.1993.9402210154

He, X. (1992). The worship of Chinese gods of nature. Shanghai: Sanlian Bookstore.

Heskett J. (2005). Design: A very short introduction. New York: Oxford University Press. https://doi.org/10.1093/actrade/9780192854469.001.0001

Hsu, C. H., Lin, C. L., & Lin, R. T. (2011). A Study of Framework and Process Development for Cultural Product Design. In P. Rau (Ed.), Internationalization, design and global development. IDGD 2011. Lecture Notes in Computer Science, vol 6775 (pp. 55-64). Springer-Verlag Berlin Heidelberg. https://doi.org/10.1007/978-3-642-21660-2_7

Irwin, T., Tonkinwise, C., & Kossoff, G. (2022). Transition design: An educational framework for advancing the study and design of sustainable transitions. Cuadernos del Centro de Estudios en Diseño y Comunicación, 105, 31-72. http://dx.doi.org/10.18682/cdc.vi105.4188

Julier, G. (1990). Radical modernism in contemporary Spanish design. In P. Greenhalgh (Ed.), Modernism in Design (pp. 204-225). London: Reaktion Books.

Julier, G. (2000). The culture of design. London: SAGE Publications.

Kaplan, M. (2004). Introduction: Adding a cultural dimension to human factors. In M. Kaplan (Ed.), Cultural ergonomics. Amsterdam: Elsevier. https://doi.org/10.1016/S1479-3601(03)04016-5

Kostelnick, C. (1995). Cultural adaptation and information design: Two contrasting views. IEEE transactions on professional communication, 38(4), 182-196. https://doi.org/10.1109/47.475590

Krippendorff, K. (2005). The semantic turn: A new foundation for design. Boca Raton: CRC Press. https://doi.org/10.4324/9780203299951

Lazzeretti, L. (2023). What is the role of culture facing the digital revolution challenge? Some reflections for a research agenda. In L. Lazzeretti, S. Oliva, N. Innocenti, & F. Capone (Eds.), Rethinking culture and creativity in the digital transformation (pp. 10–30). London: Routledge. https://doi.org/10.4324/9781003332374-2

Lee, J.J. & Sayed, S. (2008). Culturally sensitive design. In T. Keinonen (Ed.), Design connectionsKnowledge, value and involvement through design (pp. 54-63). Finland: UIAH Press.

Lee, K. P. (2004). Design methods for cross-cultural collaborative design project. In J. Redmond, D. Durling, & A. de Bono (Eds.), Futureground - DRS International Conference 2004. https://dl.designresearchsociety.org/drs-conference-papers/drs2004/researchpapers/128

Leong, B. D., & Clark, H. (2003). Culture-based knowledge towards new design thinking and practice: A dialogue. Design Issues, 19(3), 48-58. https://doi.org/10.1162/074793603768290838

Levin, I., & Mamlok, D. (2021). Culture and society in the digital age. Information, 12(2), 68. https://doi.org/10.3390/info12020068

Lin, R. T. (2006). 訴說故事,營造情境--文化創意設計的情境故事 [Scenario and story-telling approach in cross cultural design]. 藝術欣賞, 2(5), 4-10.

Lin, R. T. (2007). Transforming Taiwan aboriginal cultural features into modern product design: A case study of a cross-cultural product design model. International Journal of Design, 1(2), 4553.
Lin, R., Sun, M. X., Chang, Y. P., Chan, Y. C., Hsieh, Y. C., & Huang, Y. C. (2007). Designing "culture" into modern product: A case study of cultural product design. In N. Aykin (Ed.), 2nd International

Conference on Usability and Internationalization, UI-HCII 2007 (pp. 146-153). Springer. https://doi.org/10.1007/978-3-540-73287-7_19

Loach, K., Rowley, J., & Griffiths, J. (2017). Cultural sustainability as a strategy for the survival of museums and libraries. International journal of cultural policy, 23(2), 186-198. https://doi.org/10.1080/10286632.2016.1184657

Malinowski, B. (1944). A scientific theory of culture, and other essays. University of North Carolina Press.

Manzini, E. (1994). Design, environment and social quality: From "existenzminimum" to "quality maximum". Design Issues, 10(1), 37-43. https://doi.org/10.2307/1511653

Manzini, E. (2015). Social innovation and design: Enabling, replicating and synergizing. In P. Stebbing, & U. Tischner (Eds.), Changing paradigms: Designing for a sustainable future (pp. 328–337). Cumulus Think Tank.

Manzini, E. (2016). Design culture and dialogic design. Design Issues, 32(1), 52-59. https://doi.org/10.1162/desi_a_00364

Meroni, A. (2008). Strategic design: Where are we now? Reflection around the foundations of a recent discipline. Strategic Design Research Journal, 1(1), 31–38. https://doi.org/10.4013/sdrj.20081.05

Milkie, M. A., & Denny, K. E. (2014). Changes in the cultural model of father involvement: Descriptions of benefits to fathers, children, and mothers in parents' magazine, 1926-2006. Journal of Family Issues, 35(2), 223-253. https://doi.org/10.1177/0192513x12462566

Moalosi, R., Popovic, V., & Hickling-Hudson, A. (2007). Culture-orientated product design. In S. Poggenpohl (Ed.), IASDR07 Proceedings: Emerging Trends in Design Research (pp. 1-19). The Hong Kong Polytechnic University.

Moalosi, R., Popovic, V., & Hickling-Hudson, A. (2008). Culture-orientated product design. International Journal of Technology and Design Education, 20(2), 175–190. https://doi.org/10.1007/s10798-008-9069-1

Moalosi, R., Popovic, V., Hudson, A., & Kumar, K. L. (2005). Integration of culture within Botswana product design. Proceedings 2005 International Design Congress.

Morelli, N. (2007). Social innovation and new industrial contexts: Can designers "industrialize" socially responsible solutions?. Design Issues, 23(4): 4-21.

https://doi.org/10.1162/desi.2007.23.4.3

Page, G. G., Wise, R. M., Lindenfeld, L., Moug, P., Hodgson, A., Wyborn, C., & Fazey, I. (2016). Codesigning transformation research: Lessons learned from research on deliberate practices for transformation. Current Opinion in Environmental Sustainability, 20, 86-92. https://doi.org/10.1016/j.cosust.2016.09.001

Papanek, V. (1971). Design for the real world: Human ecology and social change. New York: Pantheon Books.

Perkins, R. (2008). Challenges and questions concerning "culturally-sensitive design". TechTrends. 52(6), 19-21. https://doi.org/10.1007/s11528-008-0212-3

Popovic, V. (2002). Activity and designing pleasurable interaction with everyday artifacts. In W. S. Green, & P. W. Jordan (Eds.), Pleasure with products: Beyond usability (pp. 367-376). London: CRC Press. https://doi.org/10.1201/9780203302279.ch29

Prameswari, I., Hibino, H., & Koyama, S. (2017). The role of cultural schema in developing culture-based product design. Journal of the Science of Design, 1(1), 57-66. https://doi.org/10.11247/jsd.1.1_1_57

Raskin, J. (1999). Presenting information. In R. E. Jacobson (Ed.), Information design (pp. 341-348). Cambridge: MIT Press.

Razzaghi, M., & Ramirez Jr, M. (2005). The influence of the designers' own culture on the design aspects of products. In EAD06 International Conference of the European Academy of Design. Hochschule für Künste Bremen. https://doi.org/10.26190/unsworks/454

Röse, K. (2004). The development of culture-orientated human-machine system: Specification, analysis and integration of relevant intercultural variables. In M. Kaplan (Ed.), Cultural ergonomics (Advances in human performance and cognitive engineering research, Vol. 4) (pp. 61-103). Leeds: Emerald Group Publishing Limited. https://doi.org/10.1016/S14793601(03)04003-7

Röse, K., & Züblke, D. (2001). Culture-oriented design: Developers' knowledge gaps in this area. IFAC Proceedings Volumes, 34(16), 11-16. https://doi.org/10.1016/S1474-6670(17)41494-7

Rosenman, M. A., & Gero, J. S. (1998). Purpose and function in design: From the socio-cultural to the techno-physical. Design Studies, 19(2), 161-186. https://doi.org/10.1016/

s0142694x(97)00033-1

Sanders, E. B. N. (2006). Design research in 2006. Design research quarterly, 1(1), 1-8.

Sanders, E. B. N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. Codesign, 4(1), 5-18. https://doi.org/10.1080/15710880701875068

Sangiorgi, D. (2011). Transformative services and transformation design. International Journal of Design, 5(2), 29-40.

Schein, E.H. (1985). The corporate culture survival guide: Sense and nonsense about culture change. San Francisco: Jossey-Bass.

Sheldon, P. J. (2020). Designing tourism experiences for inner transformation. Annals of Tourism Research, 83, 102935. https://doi.org/10.1016/j.annals.2020.102935

Shin, M. J., Cassidy, T., & Moore, E. M. (2015). Design reinvention for culturally influenced textile products: Focused on traditional Korean bojagi textiles. Fashion Practice, 7(2), 175-198. https://doi.org/10.1080/17569370.2015.1045354

Sparke, P. (2013). An introduction to design and culture: 1900 to the present (3rd ed.). London: Routledge. https://doi.org/10.4324/9780203129999

Spencer-Oatey, H. (2000). Culturally speaking: Managing rapport through talk across cultures. London: Continuum.

Sudjic, D. (2024). Flourishing in the world. In N. Dunn, L. Cruickshank, & G. Coupe (Eds.), Flourish by design (pp. 123-127). London: Routledge. https://doi.org/10.4324/9781003399568-27

Sun, H. (2012). Cross-cultural technology design: Creating culture-sensitive technology for local users. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199744763.001.0001

Swidler, A. (1986). Culture in action: Symbols and strategies. American sociological review, 273286. https://doi.org/10.2307/2095521

Tylor, E. B. (1871). Primitive culture: Researches into the development of mythology, philosophy, religion, art, and custom. London: John Murray.

UK Government. (2021, July 23). Boundless Creativity Report. https://www.gov.uk/government/publications/boundless-creativity-report/boundless-creativityreport

UNESCO (2001). UNESCO universal declaration on cultural diversity. Paris: UNESCO. Retrieved June 7, 2024, from http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CLT/pdf/5_Cultural_Diversity_EN.pdf

Van Boeijen, A. G. C., & Zijlstra, I. S. J. (2020). Culture sensitive design: A guide to culture in practice. Amsterdam: BIS Publishers.

Van Buuren, A., Lewis, J. M., Peters, B. G., & Voorberg, W. (2023). Improving public policy and administration: Exploring the potential of design. In A. Van Buuren, J. M. Lewis, & B.G. Peters, Policy-making as designing (pp. 1-17). Bristol: Policy Press. https://doi.org/10.56687/9781447365952-003

Von Hippel, E. (2005). Democratizing innovation. Cambridge: MIT Press. https://doi.org/10.7551/mitpress/2333.001.0001

Walker, S. (2011). The spirit of design: Objects, environment and meaning. Oxford: Earthscan. https://doi.org/10.4324/9781849776769

Walker, S. (2014). Designing sustainability: Making radical changes in a material world. London: Routledge. https://doi.org/10.4324/9781315797328

Walker, S. (2018). Culturally significant artifacts and their relationship to tradition and sustainability. In S. Walker, M. Evans, T. Cassidy, J. Jung, & A. T. Holroyd (Eds.), Design roots: Culturally significant designs, products, and practices (pp. 39-50). Bloomsbury Publishing. https://doi.org/10.5040/9781474241823.ch-005

Walker, W. E., Adnan Rahman, S., & Cave, J. (2001). Adaptive policies, policy analysis, and policymaking. European Journal of Operational Research, 128(2), 282–289. https://doi.org/10.1016/S0377-2217(00)00071-0

Williams, R. (1976). Keywords: A vocabulary of culture and society. New York: Oxford University Press.

Yao, W., & Lu, G. (2016). Approaching a Chinese cultural transferring design model through analysis of culturally oriented design and its context. In P. Rau (Ed.), Cross-Cultural Design: 8th International Conference. Lecture Notes in Computer Science (pp. 389–396). Springer International Publishing Switzerland. https://doi.org/10.1007/978-3-319-40093-8_39

Zhou, X. (2013). 当代设计观念的哲学反思 [Contemporary design concept of philosophical reflection]. 装饰, 6, 59-61. https://link.oversea.cnki.net/doi/10.16272/j.cnki.cn11-1392/j.2013.06.040

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NAVIGATING CHALLENGES IN PARTICIPATORY DESIGN: EXPLORING HANDOVER TOOLS WHEN DESIGNING FOR PEOPLE WITH DEMENTIA.

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ABSTRACT | The rising number of people worldwide living with dementia necessitates designers' involvement in addressing their needs. Participatory design is a practice that advocates involving people with dementia (PwD) in the design process to ensure their voices are heard and their needs and wishes are reflected in the designed outcomes. However, challenges such as emotional strain on PwD and designers, limited time and resources, and organisational efforts hinder participation. This paper explores "handover tools" as a means to transfer dementia-related insights to designers when direct involvement of PwD is not feasible. The paper first describes and defines "handover tools". Secondly, handover tools were selected and categorised. Third, a total of 45 handover tools were discussed during one-on-one interviews with professional designers. The data gathered during these interviews were clustered resulting in five overarching needs that designers expressed for implementing handover tools in the design process. This paper reports on these five needs and situates them within different design contexts and existing literature. This research underscores the potential of handover tools in design practice, contributing to the accessibility of designing for PwD.

KEYWORDS | DEMENTIA DESIGN, HANDOVER TOOLS, EMPATHY IN DESIGN, DESIGN PROCESS, DESIGNER NEEDS

1. Introduction

More than 55 million people worldwide are living with dementia (PwD) (WHO, 2023), a neurodegenerative condition causing progressive cognitive, psychiatric and physical changes, frequently accompanied by stigmatisation and social isolation (Cerejeira et al., 2012). Given the ageing population and the absence of a cure, the number of PwD will continue to rise. Designers can be part of those who respond to this growing need. To design for people whose lived experience differs from that of the designer, active participation by individuals representing that group is required (Pullin, 2009). Recent years witnessed a shift towards participatory design, involving PwD in the design process (Novek & Wilkinson, 2022; Liddle et al. 2022). Participation leads to more inclusive products that foster expressions of personhood and social engagement, supporting a positive transition from the medicalised understanding of dementia towards a more holistic understanding of the condition (Wilkinson, 2002; Hodge et al. 2023). Participation not only leads to products that prioritise the wishes and needs of PwD but also enriches designers' understanding of how to design inclusively (Kowe et al., 2022).

Despite the benefits, participatory design poses significant challenges for grounded implementation in design practice due to the nature of dementia (Hellstrom et al., 2007; Vink et al. 2016). Emotional strain and stress can arise for both participants and designers, negatively influencing the project (e.g. designers lacking empathy and adaptability towards participants' abilities or getting emotionally overwhelmed) (Kowe et al., 2022; Suijkerbuijk et al., 2022). Although Hendriks (2019) states that it is essential for designers to fully immerse themselves in the lives of PwD to build a designer-participant connection, these connections require time and demand effort from the designer, while time and resources are often limited in design projects (Smeenk, 2019). Moreover, the organisational efforts to involve PwD in the design process (e.g. recruitment, ethical approvals, adapting design methods) can present challenges, especially for designers lacking an understanding of the reality of working with PwD (Vink et al. 2016).

While participatory design should always be prioritised, there is a need to explore alternative approaches in cases where the involvement of PwD in the design process is not feasible. This paper explores 'handover tools' to facilitate the focused transfer of an understanding of PwD as unique individuals, based on interactions with PwD, in the early exploratory stages of the design process. Through a scoping review, handover tools were selected and categorised according to Pratte et al.'s framework (2021). A total of 45 handover tools responding to the framework were discussed during twelve, one-on-one, semi-structured interviews with professional designers. The interviews acted as open spaces for exploring the ability of handover tools to transfer dementia insights and their suitability in design practice. The interview transcripts were analysed to identify common themes, resulting in five overarching needs that designers expressed for using handover tools in the design process. This paper reports on these five needs and situates them within different design contexts and existing literature. To conclude, several challenges and considerations regarding these needs are addressed.

This paper contributes to a growing understanding of the use of handover tools. By addressing the challenges of participatory design and investigating alternative approaches from the designers' perspective, the research aims to stimulate accessibility for PwD-oriented design practices.

2. Method

Designers are interviewed to grasp opinions, needs and preferences regarding the use of handover tools when the involvement of PwD in the design process is not feasible. To guide these interviews, 45 handover tools were selected through a dual approach: a literature review to refine the definition of 'handover tools' and a scoping review to select the 45 tools.

2.1 A literature review: defining handover tools

A rapid literature review was conducted into the terminology used to describe tools to transfer dementia insights and participants' experiences. The pragmatic choice for a rapid literature review was made based on its ability to produce information in a timely manner (Khangura et al. 2021). Google Scholar and snowball sampling (i.e. forward and backwards citations) were used to identify papers reporting on approaches, methods, tools and artefacts to transfer dementia insights and participants' experiences to other designers. Included sources evaluated, compared, or described an approach, method, tool or artefact to transfer information about PwD. Studies on participants other than PwD were excluded, since designing for PwD requires a specific sensitivity to be reflected in the tool (Branco et al. 2015). In total 21 papers reporting on transferring dementia insights were included in the review and three categories of tools were identified:

1. Participatory design tools facilitate the participation of PwD in the design process and enable direct contact between the

designer and PwD (Lazar et al., 2017; Brankaert et al., 2019; Foley et al. 2019). These tools are even more relevant when designing for PwD, where collaboration with those with the condition often requires additional effort due to cognitive impairments, communication restrictions, and behavioural changes.

2. Awareness tools to support dementia awareness and understanding for PwD, often by altering stigmatised and stereotyped views that live within the general population (Lee, Tsang & Hendriks, 2017; Kouprie & Sleeswijk-Visser, 2009).

3. Empathy tools evoke empathy for PwD, often by taking on the PwD's perspective and thereby experiencing aspects of dementia (Lindsay et al. 2012; Hattink et al., 2015).

However, these three categories do not correspond with the aim of this research.

1. Participatory design tools require the presence of PwD, whereas this research seeks alternatives when including PwD in the design process is not feasible.

2. Awareness tools aim at creating a public understanding for PwD, while this research looks into tools creating a 'designers' understanding of PwD.

3. Empathy tools partially correspond with this research, however, empathy tools often focus on the physical experiences of impairments rather than the broader cognitive, mental, or social consequences of conditions like dementia. This research advocates for the transfer of empathy as a broader understanding of, being aware of, and being sensitive to the feelings, thoughts, and experiences of PwD (Lee, Tsang & Hendriks, 2017; Smeenk et al., 2017). So instead of referring to the transfer of empathy as an emotional response, handover tools transfer an empathic understanding for PwD, aiming to convey an emotional understanding and informed comprehension of what PwD go through.

Based on the rapid literature review, the term 'handover tool' will be used, referring to tools transferring an empathic understanding for PwD to designers when the involvement of PwD is not feasible. 'Handover' corresponds to the process of transferring insights and experiences and originates from the 'Empathic Handover Approach' that enables experienced designers to hand over dementia insights to design team members (Smeenk et al., 2017).

2.2 A scoping review: categorising and selecting handover tools

To access the scope of available handover tools, literature and other design-related media were searched, using keywords like 'empathy tool' and 'information transfer'. These handover tools were categorised according to Pratte et al.'s descriptive framework (2021). This framework was chosen since it focuses on tools designed to create an empathic response similar to handover tools. The framework

describes tools according to the different audiences; designers, caregivers and the public, and along three dimensions;

1. First, the amount of agency the tool allows during the experience. Limiting agency can help users to feel the frustrations and challenges of PwD (Pratte et al. 2021). For example, documentaries like 'Wei. Zorgen voor pap' (Lenssen, 2019) restricts viewers' narrative agency to elicit the desired emotional effect. Similarly, the 'Into D'mentia simulation cabin' (Hattink et al., 2015) strategically limits the user's interaction agency with objects in the cabin, to simulate challenges of PwD. On the other hand, providing more agency with the tool can allow the user to gain a deeper understanding through exploration as an active participant. 'Through the D'mentia Lens' is an ecourse and VR simulation for users to engage with at their convenience (Wijma et al. 2018).

2. The second dimension is the perspective of the tool. For example, the VR experience a 'Walk Through Dementia' provides users with a first-person perspective to experience what PwD go through (Hicks et al., 2023). 'The Visit' uses a second-person perspective, inviting viewers to interact with Viv, a realistic and responsive virtual character with dementia (Papadopoulos et al., 2021). An example of a tool using the third-person perspective is 'dementiadiaries.org' (Innovations in Dementia, 2024). A blog on which PwD share real and raw accounts of life with dementia for others to read and observe (Skog et al. 2000).

3. The third dimension refers to the augmentation or limiting of mobility, perception, psyche and tangible elements (Pratte et al. 2021). An example of a handover tool to experience mobility limitations is the 'AGNES Age Suit' for wearers to experience physical sensations of an elderly person (Lavallière et al., 2017). Perceptual limitations and augmentations affect senses like hearing, vision, speech, smell, and touch. For example, the 'Alzheimer's Eye Challenge' is a mixed reality game for users to complete tasks while experiencing visual impairments (Kroma & Lachman, 2018). Physiological sensations involve biosignals such as breathing and heart rate. The Breeze Pendant measures and transmits breathing patterns for the users breathing to match, creating a shared reaction (Frey & Cauchard, 2018). Tangible handover tools influence sensations through physicality. For example, 'The Demented Objects' let users experience symptoms of dementia (Lee, Tsang & Hendriks, 2017). The 'Ok Dementia Jacket' is one of the Demented Objects leaving wearers to feel frustrated and desperate for it is impossible to close in a normal manner (Lee, 2019).

Handover tools were categorised along one or more of the three dimensions to select tools representing the framework. A total of 45 handover tools were included in the final selection for the expert interviews, detailed in the next section.

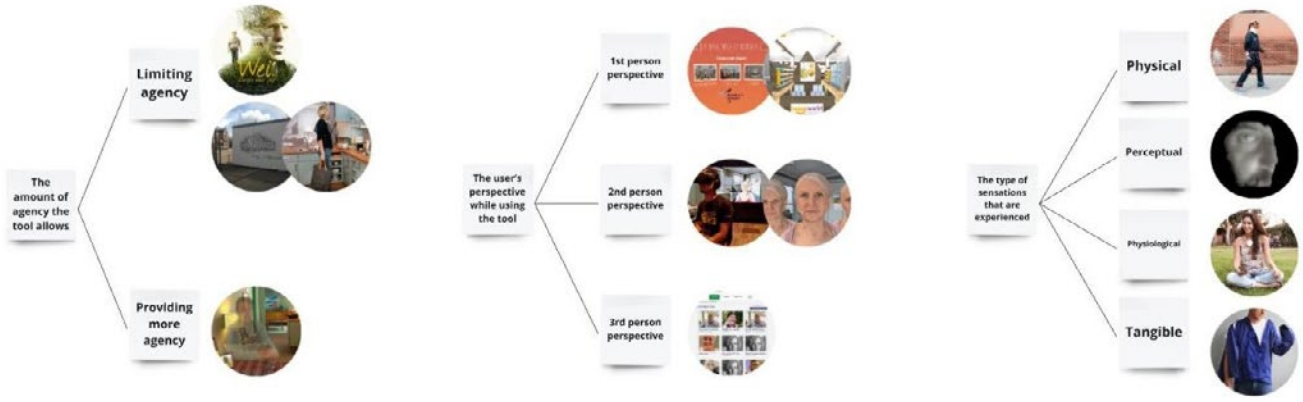

Figure 1. Referenced tools categorised according to Pratte et al.'s descriptive framework (Lenaerts, 2024)

2.3 Material Speculations: Expert interviews to reflect on handover tools

Semi-structured, one-on-one interview sessions were held with twelve professional designers to gain designers' perspectives on handover tools. Designers were recruited via the authors' network using direct communication and chain referral sampling. The interviewees included an equal mix of independent designers and those working in small design studios or large agencies, spanning industry and education, with both junior and senior profiles. Their experience with dementia ranged from extensive to limited or none.

Each session began with a three-minute introduction video, followed by a semi-structured interview. The goal was to capture the designer's expert opinion on using handover tools in design practice. A physical quadrant scheme was used to visually guide the conversation and capture the designer's output. Designers were asked to place the 45 handover tools along two axes of the quadrant while stating their perspectives on the strengths and weaknesses of each tool. The vertical axe represented the tool's potential to transfer dementia insights and experiences for designers to foster an empathic understanding for PwD. The horizontal axe indicated the tool's applicability in design practice, considering time and budget constraints, technology limitations, artistic decisions and designers' personal preferences.

The three-hour interview sessions provided time and space to explore handover tools and optimise recall from the designer's perspective. Three questions guided the interviews for designers to reflect on their practice, their views on participant involvement and tools to represent participants, and their preferences regarding the 45 handover tools. Recognising designers' struggle to articulate tacit knowledge, the first author posed open-ended questions like, "What insights do you need in your

design process?" and "What tools would support your way of working?" intended to uncover designers' attitudes and values and to elicit unexpected insights. All twelve interviews were recorded with permission and transcribed in full.

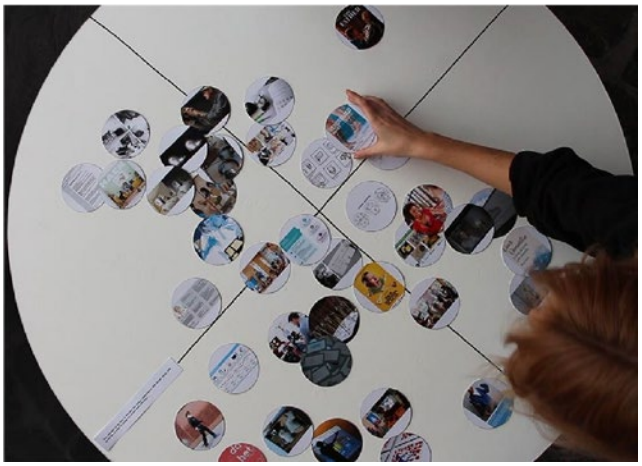

Figure 2. Designer placing a handover tool on the physical quadrant scheme (Lenaerts, 2023)

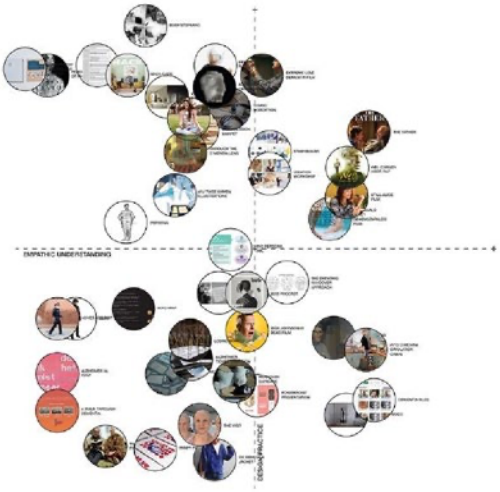

Figure 3. Final quadrant scheme of one designer (Lenaerts, 2023)

2.4 Clustering findings: Identifying designers' handover needs

The interview transcripts were analysed to gain a deeper understanding of the twelve interviews. The first author identified quotations and statements regarding the effectiveness, ease of use, satisfaction, and acceptability of handover tools. These were organised into themes using a Miroboard. Together with the co-authors of this paper (i.e. senior designer-researchers with over 10 years of experience in design involving PwD), these themes were discussed, identifying five key needs for using handover tools in design practice: (1) the need to capture the true experience of PwD, (2) the need to bridge the gap between designers and PwD, (3) the need to transfer both an emotional and cognitive understanding, (4) the need for reflection to enhance an understanding of dementia, and (5) the need to address designers' specific needs and contexts.

Figure 4. Organising themes and identifying five needs in Miro

3. Findings

The following section reports on the five identified needs and, when possible, situates them within different design contexts and existing literature.

3.1 Capturing the True Experience of PwD: Involvement and Transparency

During the interviews, designers expressed concerns about the authenticity of handover tools. For the acceptance of these tools, designers emphasised the need for them to be grounded in real and true experiences of PwD and be transparent on their origins. Designers showed a strong preference for tools that are perceived as genuine and free from bias. For instance, one designer expressed appreciation for a testimonial video on 'dementiadiaries.org' (Innovations in Dementia, 2024), noting, "You're not there, but you have the first person narrative, so you know that is not made up, you hear a real person telling a story of their life."

Although authenticity and representativeness are highly valued, the spectrum of dementia is broad. Each PwD is unique, with distinct thoughts, emotions, wishes and needs (Kitwood, 1997). Additionally, 'dementia' is an umbrella term and given the wide variety of types, each individual is affected differently. As the disease progresses, PwD may experience cognitive changes (e.g.

memory deterioration, language difficulties, disorientation in time and space), psychiatric changes (e.g. personality changes, depression, hallucinations) and physical changes (e.g. impaired movement, eyesight, hearing) (APA, 2000; Lobo et al., 2000). Moreover, each PwD exists within a unique social context. The network of formal and informal caregivers surrounding the PwD plays a crucial role in understanding the individual PwD, particularly, since the diagnosis is frequently accompanied by social isolation (Cerejeira et al., 2012).

During the interview, one designer stated, "If I've learned anything, it's that every PwD is different." Handover tools must encompass the uniqueness of PwD, which can be achieved by involving PwD in the development of these tools. For example, the use of personas is often criticised for representing stereotyped versions of PwD, so in the research by Jais et al. (2016), PwD and other stakeholders were actively involved in the development of personas to avoid such stereotypes.

However, some tools capture only single aspects of dementia. For example, the 'Alzheimer's Eye Challenge' risks stereotyping PwD as universally experiencing visual challenges (Kroma & Lachman, 2018; Hodge et al., 2023). Additionally, literature refers to the risk of giving minimal utterances too much importance (Lindsay et al. 2012; Hendriks et al., 2014). During the interviews, one designer shared the story of her grandfather who stole objects when residing in a care home. She stated, "You can assign meaning to these stolen objects, but it is dangerous as a designer to attach too much importance to them." Presenting a single aspect of the disease must be properly framed to avoid narrowing designers' perspectives on PwD.

Designers expressed an overall need for transparency regarding the origins of handover tools. For example, the VR experience 'The Visit' is accompanied by a website and academic paper detailing how the main character, Viv, was developed from verbatim interviews with five women with dementia (Papadopoulos et al. 2021). Such transparency on the tool's origins and development often increases designers' trust in the handover tool.

3.2 Bridging the Gap Between Designers and PwD: The Handover Facilitator

For Handover tools to authentically represent the experiences of real PwD, someone has to engage directly with PwD gathering insights into their complex and multifaceted experiences. In 'the Empathic Handover approach', a designated member of the design team 'harvests' dementia-related insights through personal interactions with PwD to afterwards 'hand over' these insights to the other members of the design team (Smeenk et al., 2017). One designer was experienced with 'the Empathic Handover approach' and valued having "an expert there" during the handover activities.

Designers often face challenges fully understanding the handover process and grasping dementia-related insights. In a study

by Hodge et al. (2023), designers working with 'dementiainspiration packs' sometimes struggled to understand the material. In these cases, they could seek assistance from experienced facilitators.

Thus, a second need for effective handover tools is the involvement of a facilitator who engages directly with PwD, translates these insights into handover tools, provides guidance when designers encounter difficulties during the handover process, and represents PwD throughout the design process. The role of the 'handover facilitator' is crucial in bridging the gap between designers and PwD and facilitating the handover process.

3.3 The empathising process: an emotional and cognitive understanding

The notion of empathy in design has been extensively examined and recognised as a way for designers to internalise participant requirements (Sustar & Mattelmäki, 2017; Koskinen et al., 2003; Lindsay et al., 2012). During the interviews, designers expressed a clear need for handover tools to transfer an empathic understanding for PwD, encompassing both an emotional response towards PwD and an informed comprehension of dementia. To address this need, it is essential to explore the principles of empathy that can be integrated into handover tools.

Empathy in design encompasses two facets; affective and cognitive empathy (Hattink et al., 2015). Affective empathy involves the ability to emotionally resonate with another's feelings, often facilitated by identifying perceived similarities between the designer and the PwD, such as gender, race, or personal experiences (Hunt, 2019). The 'Through the D'mentia Lens' VR simulation enhances affective empathy by aligning the user's gender to that of the virtual character with dementia. Another example is 'the ideation workshop', where designers recall their personal experiences to compare them with those of PwD, to deepen their understanding of PwD's experiences (Sleeswijk Visser & Kouprie, 2008).

Cognitive empathy, on the other hand, involves understanding another's perspective and emotional state by imagining oneself in their situation. For example, when trying to close the 'Ok Dementia Jacket', users can experience the frustration and desperation of being unable to close it normally, simulating PwD's struggles when performing simple daily tasks (Lee, 2019). According to Plumm and Terrance (2009), affective empathy can facilitate cognitive empathy, when individuals share similarities with PwD, they are more likely to imagine themselves in their circumstances. Therefore, handover tools should integrate cognitive and affective aspects to convey an empathic understanding of PwD.

Furthermore, empathy is not a state but a dynamic, evolving process (Sleeswijk Visser & Koupri, 2008). Designers expressed the need for a general understanding of dementia before using certain handover tools. For example, the film 'The Father' (Zeller, 2020)

was referred to as hard to follow and fully grasp without prior knowledge of dementia. This need aligns with the four phases of empathy of Kouprie and Sleeswijk-Visser (2009): discovery, immersion, connection, and detachment. Going through these four phases builds an empathic understanding for PwD. A designer envisioned that "at different points in the design process, different handover tools will help you." In the 'ideation workshop', designers go through these four phases, using specific handover tools in each phase and building upon the previous one (Visser & Kouprie, 2008). Moreover, literature states that a person's empathic abilities can grow and develop (Sleeswijk Visser & Koupri, 2008; Sustar & Mattelmäki, 2017). Thus, handover tools should facilitate an 'empathising process', progressively building the designers' empathic understanding of dementia.

3.4 Enhancing Dementia Understanding through Reflection

Reflection is a critical component of the design process (Carlson & Dobson, 2020; Turner, 2021). Designers expressed the need to organise thoughts, gain an individual understanding of dementia, and develop a shared understanding of dementia within the design team.

When utilising handover tools, designers must navigate layers of information, from objective data to subjective insights. Individual research and reflection provide insight into dementia. However, group interactions bring unique benefits, enabling the processing of complex information collaboratively (Turner, 2021). During the interviews, one designer expressed the value of both individual and shared moments of reflection, "I do see benefits in executing parts of the design process in group, but at certain moments, I think researching things on your own still has a lot of value."

Engaging in reflection and discussion, whether individually or within a group, helps designers critically assess and synthesise information (Carlson & Dobson, 2020). This need for reflection is also highlighted in empathic design, where guided discussions enhance the understanding of participants' experiences (Alzayed et al., 2021). For example, when using 'the Demented Objects,' some take on the role of the PwD while others respond to the PwD's behaviour. Afterwards, a guided discussion between those performing and those observing allows for a deeper analysis of the experiences, fostering a more empathic understanding of dementia (Lee, Tsang & Hendriks, 2017).

3.5 Tools for designers: Specific Needs and contexts

One designer identified two phases when designing for PwD, "one in which you get an understanding of dementia and one in which you gain insights as a designer".

The interviews revealed that 'design-specific insights' can be gained through a wide variety of information capturing unique and true aspects of dementia, for example photographs,

drawings, handwriting, recordings, quotes, personal objects, and artefacts made by PwD. These thick descriptions are perceived as informational and inspirational for designers to gain insights into PwD's preferences, abilities, way of interacting, movement and intonation. A designer noted after viewing a short video on 'dementiadiaries.org', "I also see the chair the man is sitting on, tiles and lighting. Those things are super important for me to know."

The interviews and literature indicates that designers prefer highly visual tools (Lee, 2008; McGinley & Dong, 2011). In the research of Jais et al. (2016), more visual methods of presenting personas were explored. One designer stated a preference for highly visual tools, since they often use minimal text, stating, "I don't want to read."

Designers also expressed a preference for tangible handover tools. One designer described tangible tools as providing "a physical connection, even if you haven't been in contact." Additionally, tangibility can enhance memory by linking information to physical objects (Hornecker & Buur, 2019). For example, Foley et al. (2020) developed 'Life Story Boxes' including physical objects representing different aspects of PwD's lives. One designer emphasised the value of exploration and attention regarding tangible tools, noting that picking up a physical cone representing bowling, provides a different level of engagement, compared to reading the word 'bowling'.

Furthermore, handover tools must align with the design project and its desired outcomes to be effective and relevant. Most handover tools will be used in the early, exploratory stages of the design process where efficiency is crucial. One designer mentioned his preference for easy-toaccess, online tools, like dementia blogs (e.g. dementiadiaries.org), since "a designer's job is 90% behind a computer." In comparison, the 'Empathic Handover approach' (Smeenk et al., 2017) was seen as time-consuming and challenging to organise. Designers were also hesitant towards VR tools (e.g. The Visit, a Walk Through Dementia and Through the D'mentia Lens), describing them as "cumbersome" and "distracting" due to the equipment itself getting in the way of the experience.

Additionally, the diversity of design projects shows the need for handover tools to be adaptable, providing designers agency to freely use and reshape them as needed (Hodge et al., 2023). One designer stated, "Suppose I have to design a cup holder, then I'll watch the parts of a documentary when PwD are eating or preparing food".

Moreover, diverse design contexts necessitate flexible handover tools. In educational settings, for example, tools should accommodate designers' emotional needs, as student designers are more prone to become emotionally overwhelmed (Baldner & McGinley, 2014; Guillemin & Gillam, 2015). In professional contexts, projects are often constrained by time and resources, requiring intuitive and easy-to-use tools (Lee, 2008;

McGinley & Dong, 2011). Tools like 'personas' have the advantage of being commonly accepted in design practice (Jais et al., 2016). In contrast, designers were hesitant to use the Empathic Handover Approach (Smeenk et al. 2017), since roleplay was perceived as unprofessional.

Moreover, handover tools corresponding to a design studio's or agency's identity are more likely to be implemented. Aesthetic and interesting-looking handover tools can motivate initial use. As one designer noted, "If it were just a dry text about the person [PwD], we [design studio] would be much less inclined to engage with it than something designed in a cool way." This preference was echoed by others, mentioning the importance of aesthetic tools during meetings with clients and other stakeholders, reflecting the designer.

4. Discussion

Challenges and considerations concerning the five needs will be discussed and situated within existing literature. A sixth consideration was added concerning the lack of direct engagement with PwD.

4.1 Challenges considering the True Experience of PwD

Basing handover tools on true experiences of PwD can cause challenges in grasping a PwD's true experiences and selecting which insights to hand over.

First, the interaction itself can be 'untrue'. A designer noted, "PwD can overperform because they feel observed and want to show that they're doing great." Additionally, due to dementia, PwD can bend the truth, overestimate their capacities or deny having difficulties (Hendriks et al., 2014). As well as caregivers having a hard time accepting the diagnosis and over- or underestimating the PwD (Hendriks et al., 2014). On the other hand, due to the progression of dementia, preferences and abilities of PwD can change, highlighting the importance of taking many perspectives into account. For example, one designer shared an experience where family members of the PwD stated he never spoke about the war, however, when interacting with the designer he kept referring to the war.

Another designer referred to "aspects you don't want to talk about like the undesirable sexual behaviour", further raising the question of which insights have to be transferred.

4.2 Facilitating the Handover: Multiple Facilitators and Skill Requirements

Some designers expressed that they would take on the role of handover facilitator, considering their commitment to the project, willingness to interact with participants, personal experience or interest. A designer will interact with PwD from a design perspective. This knowledge and understanding of the design process is seen by designers as beneficial and "makes it possible to take more concrete steps more

quickly". One designer expressed her trust in handover tools made by colleagues, "If a colleague has created a persona, I can use that. I don't necessarily have to do it myself". Additionally, Littlechild et al. (2015) indicate that designers view data collected by other designers not as superior or inferior but as 'merely different' from their own data. In practice, designers often divide the work, as a designer mentioned, "sometimes only one person [of the design team] goes [to the participants] and then we follow the [design] process with his experiences". Choosing a handover facilitator from the design team can be beneficial in comparison to someone external, because of their understanding of the team structure and atmosphere to tailor tools to the context and way of working (Zingoni, 2019). However, very few designers who are working in the high stress design field have the time or inclination to take on this role (Kowe et al., 2022). Can the participation with PwD be executed by others, unburdening the designer?

First, PwD can choose to share and capture their experiences through handover tools, for example the dementia blog 'dementiadiaries.org' (Skog et al. 2000; Innovations in Dementia, 2024). Second, in design practice, often the client takes on a similar role. A designer stated, "It is the responsibility of the client to qualitatively explain something." Another designer mentioned that in their social design studio, they make use of personas provided by clients, for example "hospitals have a fixed set of personas". She also commented how she finds it useful to create handover tools together with the client, "because they often have the knowledge and can provide those background stories." A third group to consider are formal and informal caregivers. Caregivers often spend the most time with PwD, especially when involved in the primary care of the PwD. A designer-educator explained how her students only involve caregivers in the design process, since the lack of ethical approval to work with PwD. Lastly, more research regarding dementia is being conducted by other experts (e.g. psychologists, sociologists, anthropologists) (Lee, 2007). Dementia experts often have years of experience on the topic of dementia, which can provide designers with valuable insights during the design process (Hodge et al. 2023).

However, designers agreed that the handover facilitator needs certain skills to successfully support the design process. PwD, caregivers and other experts often lack a design perspective. A designer noted, "Somebody working in healthcare has a completely different perspective. They often don't understand what we do or how we work."

4.3 Aspects of the Empathising Process: Time and Personal Ability

During the empathising process, time is needed to reflect and internalise an empathic understanding. For example, Sleeswijk Visser & Kouprie (2008) highlight how sufficient time is a key element of the 'ideation workshop'.

Another aspect to consider regarding the empathising process is a designer's ability

to empathise. Literature refers to designers' intuitive ability to identify others' thoughts, feelings, motivations, emotions, values, priorities, preferences, and inner conflicts (Fulton Suri, 2003). As one designer stated, "Agencies just end up in a completely new context each time they enter a competition, so they're used to that". Another designer, highlighted an empathic increase due to years of experience as a designer, stating, "If you're a designer for a few years, you can empathise enough with what that [dementia] is going to be like."

Literature agrees that a person's empathy level is hard to measure, however, it is proven that an empathic understanding can grow and further develop, requiring the ability and willingness of the designer (Battarbee et al., 2003; Alzayed et al.; 2021). Handover tools have to take into account differing empathic levels of designers and the time needed to grow empathy levels.

4.4 Factors Influencing Reflection

The handover facilitator can support designers through dialogue and discussion, fostering designers to actively question and reflect on themselves and the design project in relation to PwD. This aligns with the concept of social constructivism, which posits that design emerges through conversation and interaction (Bucciarelli, 1994; Fleming, 1996; Luck & McDonnell, 2006). For example, 'the ideation workshop' emphasizes reflecting on the insights and experiences gathered through the handover tool, rather than simply receiving processed data (Sleeswijk-visser & Kouprie, 2008). One designer shared this perspective stating, "Engaging in the research and putting together a persona yourself, will do more than just receiving a persona."

Moreover, handover tools often necessitate a debriefing moment to ask for questions and clarification from the facilitator and to contextualise experiences (Sustar & Mattelmäki, 2017). A designer expressed how a debriefing session after the 'Through the D'mentia Lens VR experience' (Wijma et al. 2018) positively contributed to her understanding of dementia.

Multiple factors can influence the designer's reflective process, for example, the lack of time or a safe space for reflection. Additionally, trust is needed from the design team towards the handover facilitator. One designer stated, "To make a tool work, a necessary condition is to create an environment where your team or designer has that trust, which the handover facilitator transfers." However, this trust is hard to guarantee and depends largely on designers personalities, team atmosphere, and group dynamic.

4.5 Designing for Diversity: Designer Needs and Contexts

Designers should not be considered as a homogeneous group. Designers have different ways of working. For example, one designer "would just find it super interesting to see a ton of examples of what has already been

made", yet another designer preferred not to see other examples "to not get influenced by other designs and stay original".

Furthermore, each designer has personal preferences regarding tools that often outweigh other criteria. One designer stated on the 'Ok Dementia jacket' (Lee, 2019) "I think it has the potential to provide a lot of insight, but I myself would never use it." Especially experienced designers expressed clear personal preferences towards certain handover tools, corresponding to their way of working. A designer shared her preference for the Bob podcast on dementia (Audiocollectief Schik, 2017), "I just like to listen to podcasts and I find it a very good way to take in stories."

Moreover, designers come from diverse cultural backgrounds, which can result in varying values and perspectives on dementia, as well as differences in work settings and access to technologies (Peter et al., 2020). While one approach is to make handover tools more abstract and adaptable to be applicable in different cultures and settings, Peter et al. (2020) suggest tools to be more "consciously culturally tailored" requiring stakeholder involvement in their creation and customisation.

4.6 Facing actual reality: motivating for Direct Engagement

During the interviews, experienced designers acknowledged the necessity of tools to transfer dementia insights when the involvement of PwD in the design process is not feasible. However, they consistently emphasised the importance of direct engagement with PwD, providing designers with unique insights that are difficult to capture through other means. As one designer noted, "The things I learned while talking to PwD and observing them isn't something you can correctly grasp with only a handover tool." This sentiment was echoed by another designer, stating, "You see more, you can look around, you can touch, that works better than seeing someone else's perspective." Additionally, literature confirms that designers prefer to gather their own data (McGinley & Dong, 2011).

However, designers with limited to no experience with PwD revealed that handover tools sparked their interest in designing for PwD. They viewed handover tools as valuable for introducing and preparing designers to interact with PwD.

Conclusion

This paper explored the critical role of handover tools in bridging the gap between designers and PwD when direct engagement is not feasible. Handover tools carry out the process of transferring dementia-related insights and experiences to designers, fostering an empathic understanding for PwD. Through interview sessions with professional designers, this study has identified five overarching needs for effective handover tools: (1) the need for participant involvement and tool transparency to capture the true experience of PwD, (2) the need for a handover facilitator with dementia expertise to bridge the gap between designers and PwD, (3) the need to transfer both an emotional and cognitive understanding through an empathising process, (4) the need for individual and group reflection to enhance an understanding of dementia, and (5) the need to address designers' specific needs and contexts.

While emphasising the importance of aligning handover tools with these five needs, the paper also addresses several challenges considering their development and implementation. The complexity of dementia and the diversity of design contexts show the need for further research into the adaptability of handover tools since there is no one-size-fits-all solution.

This paper highlights the value of handover tools as actionable formats for capturing and conveying dementia insights and experiences. By defining the needs for their development and addressing the challenges of their implementation from the designers' perspective, it aims to contribute to a growing understanding of the use of handover tools in design practice, thereby contributing to the accessibility of designing for PwD.

References

Alzayed, M. A., McComb, C., Menold, J., Huff, J., & Miller, S. R. (2021). Are you feeling me? An exploration of empathy development in engineering design education. Journal of Mechanical Design, 143(11), 112301. https://doi.org/10.1115/1.4048624

American Psychiatric Association. (2000). Diagnostic and statistical manual of mental disorders (4th ed., text rev.). American Psychiatric Association.

Audiocollectief Schik. (Host). (2017). Bob [Audio podcast]. VPRO Dorst. https://www.vpro.nl/dorst/producties/bob.html.

Baldner, C., & McGinley, J. J. (2014). Correlational and exploratory factor analysed (EFA) of commonly used empathy questionnaires: New insights. Motivation and Emotion, 38(5), 727-744. https://doi.org/10.1007/s11031-014-9417-2

Battarbee, K., & Mattelmaki, T. (2003). Meaningful product relationships. Design and Emotion, 1, 337-344. Boca Raton, FL, USA: CRC Press.

Branco, R. M., Quental, J., & Ribeiro, Ó. (2015). Getting Closer, Empathising and Understanding: Setting the Stage for a Codesign Project with People with Dementia. Interaction Design and Architecture(s) Journal, 26, 114-131.

Brankaert, R., Kenning, G., Welsh, D., Foley, S., Hodge, J., & Unbehaun, D. (2019). Intersections in HCI, Design and Dementia: Inclusivity in Participatory Approaches. Proceedings of the Designing Interactive Systems Conference. 357–360. https://doi.org/10.1145/3301019.3319997

Bucciarelli, L. L. (1994). Designing engineers. MIT Press.

Carlson, J. D., & Dobson, T. (2020). Fostering Empathy through an Inclusive Pedagogy for Career Creatives. International Journal of Art & Design Education, 39(2), 430-444. https://doi.org/10.1111/jade.12289

Cerejeira, J., Lagarto, L., & Mukaetova-Ladinska, E. B. (2012). Behavioral and psychological symptoms of dementia. Frontiers in Neurology,, 3(73), 1-21. https://doi.org/10.3389/fneur.2012.00073

Coulson, N. S., & Shaw, R. L. (2013). Nurturing health-related online support groups: Exploring the experiences of patient moderators. Computers in Human Behavior, 29(4), 1695-1701. https://doi.org/10.1016/j.chb.2013.02.003

Cross, N. (2000). Engineering design methods: Strategies for product design (3rd ed.). Wiley.

Fleming, D. (1996). Design talk: Constructing the object in studio conversations. Design Issues, 12(2), 41-66. https://doi.org/10.2307/1511850

Foley, A., Pantidi, N., &, McCarthy, J. (2019). Care and design: An ethnography of mutual recognition in the context of advanced dementia. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems. 610, 1-15. https://doi.org/10.1145/3290605.3300840

Foley, S., Pantidi, N., & McCarthy, J. (2020). Student Engagement in Sensitive. Design Contexts: A Case Study in Dementia Care. CHI. https://doi.org/10.1145/3313831.3376161

Frey, R. M., & Cauchard, J. R. (2018). Remote Biofeedback Sharing, Opportunities and Challenges. In Proceedings of the ACM International Joint Conference and 2018 International Symposium on Pervasive and Ubiquitous Computing and Wearable Computers. 730-733. https://doi.org/10.1145/3267305.3267701

Fulton Suri, J. (2003). Empathic design: Informed and inspired by other people's experience. In I. Koskinen, K. Battarbee, & T. Mattelmäki (Eds.), Empathic design: User experience in product design (pp. 51-58). IT Press.

Gove, D., Small, N., Downs, M., & Vernooij-Dassen, M. (2017). General practitioners' perceptions of the stigma of dementia and the role of reciprocity. Dementia, 16(7), 948-964. https://doi.org/10.1177/1471301215625657

Guillemin, M., & Gillam, L. (2015). Ethics, reflexivity, and "ethically important moments" in research. Qualitative Inquiry, 10(2), 261-280. https://doi.org/10.1177/1077800403262360

Hattink, B. J., Meiland, F. J. M., Campman, C.A.M., Rietsema, J., Sitskoorn, M., & Dröes, R. (2015). Zelf dementie ervaren: Ontwikkeling en evaluatie van de Into D'mentia simulator. Tijdschrift voor Gerontologie en Geriatrie, 46, 262-281. https://doi.org/10.1007/s12439-015-0130-8

Hellstrom, I., Nolan, M., Nordenfelt, L., & Lundh, U. (2007). Ethical and methodological issues in interviewing persons with dementia. Nursing Ethics, 14(5), 608-619. https://doi.org/10.1177/0969733007080206

Hendriks, N. (2019). The involvement of people with dementia in the design process. Leuven: KU Leuven..

Hendriks, N., Huybrechts, L., Wilkinson, A., & Slegers, K. (2014). Valuing implicit decision-making in participatory design: A relational approach. CoDesign, 10(1), 1-14. https://doi.org/10.1145/2662155.2662196

Hicks, B., Konovalova, I., Myers, K., Falconer, L., & Board, M. (2023). Taking 'A walk through dementia': exploring care home practitioners' experiences of using a virtual reality tool to support dementia awareness. Ageing & Society, 43(5), 1042-1067. https://doi.org/10.1017/S0144686X21000994

Hodge, J., Foley, S., Lambton-Howard, D., Booi, L., Montague, K., Coulter, S., Kirk, D., & Morrissey, K. (2023). Exploring Participants' Representations and Shifting Sensitivities in a Hackathon for Dementia. ACM Trans. Comput.-Hum. Interact. 30(3), 1-35. https://doi.org/10.1145/3571814
Hornecker, E., & Buur, J. (2019). Getting a grip on tangible interaction: A framework on physical space and social interaction. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. 437-446. https://doi.org/10.1145/1124772.1124838

Hunt, M. E. (2019). Shifting Abortion Attitudes using an Empathy-based Media Intervention: A Randomized Controlled Study. Ph.D. Dissertation. University of Arkansas, Fayetteville, AR, USA.

Innovations in Dementia. (2024). Dementia Diaries. The National Lottery Community Fund. Retrieved July 10, 2024, from https://dementiadiaries.org/.

Jais, C., Hignett, S., Allen, R., & Hogervorst, E. (2016). Developing personas for use in the design of dementia care environments. Presented at the Healthcare and Society: New Challenges, New Opportunities. International Conference on Healthcare Systems Ergonomics and Patient Safety (HEPS 2016). https://hdl.handle.net/2134/21982

Kitwood, T. (1997). Dementia reconsidered: The person comes first. Open University Press.

Khangura, S., Konnyu, K., Cushman, R., Grimshaw, J. M., & Moher, D. (2012). Evidence summaries: the evolution of a rapid review approach. Syst Rev. 1-10. https://doi.org/10.1186/2046-4053-1-10

Koskinen, I., Battarbee, K., & Mattelmeaki, T. (2003). Empathic design. IT press.

Kowe, A., Panjaitan, H., Klein, O. A., Boccardi, M., Roes, M., Teupen, S., & Teipel, S. (2022). The impact of participatory dementia research on researchers: A systematic review. Dementia, 21(3), 1012–1031. https://doi.org/10.1177/14713012211067020

Kouprie, M., & Visser, F. S. (2009). A framework for empathy in design: stepping into and out of the user's life. Journal of Engineering Design, 20(5), 437-448. https://doi.org/10.1080/09544820902875033

Kroma, A., & Lachman, R. (2018). Alzheimer's Eyes Challenge: The Gamification of Empathy Machines. Proceedings of the 2018 Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts. 329-336. https://doi.org/10.1145/3270316.3270320

Lavallière, M., D'Ambrosio, L., Gennis, A., Burstein, A., Godfrey, K. M., Waerstad, H., ... & Coughlin, J. F. (2017). Walking a mile in another's shoes: The impact of wearing an age suit. Gerontology & geriatrics education, 38(2), 171-187. https://doi.org/10.1080/02701960.2015.1079706

Lazar, A., Edasis, C., and Piper, A. M. (2017). A critical lens on dementia and design in HCI. In Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems. 2175–2188.

Lazar, A., & Dixon, E. E. (2019). Safe enough to share: Setting the dementia agenda online. In Proceedings of the ACM on Human-Computer Interaction. 3 (85), 1–23. https://doi.org/10.1145/3359187

Lee, Y. (2008). Design participation tactics: the challenges and new roles for designers in the codesign process. Co-design, 4(1), 31-50. https://doi.org/10.1080/15710880701875613

Lee, Y. (2019). Ok Dementia Jackets. Retrieved August 3, 2024, from https://www.yankilee.com/okdementiajackets

Lee, Y. C., Tsang, A. S. Y., &, Hendriks, N., (2017). Open dementia project: Empathic tools between magic and everyday life. Proceedings Cumulus Hong Kong, 199-205.

Lenssen, R. (Director). (2019). Wei. Zorgen voor pap [Film]. Ruud Lenssen Documentaries.

Liddle, J., Worthy, P., Frost, D., Taylor, E., & Taylor, D. (2022). Partnering with people living with dementia and care partners in technology research and design: Reflections and recommendations. Australian Occupational Therapy Journal, 69(6), 723-741. https://doi.org/10.1111/1440-1630.12843

Lindsay, S., Brittain, K., Jackson, D., Ladha, C., Ladha, K., & Olivier, P. (2012). Empathy, participatory design and people with dementia. Proceedings of the SIGCHI conference on Human factors in computing systems, 521-530. https://doi.org/10.1145/2207676.2207749

Littlechild, R., Tanner, D., & Hall, K. (2015). Co-research with older people: perspectives on impact. Qualitative Social Work, 14(1), 18-35. https://doi.org/10.1177/1473325014556791

Lobo, A., Launer, L.J., Fratiglioni, L., Andersen, K., Di Carlo, A., Breteler, M.M.B., et al. (2000) "Prevalence of dementia and major subtypes in Europe: a collaborative study of population based Cohorts." In Neurology 54(11), S4–S9.

Luck, R. (2007). Learning to talk to users in participatory design situations. Elsevier Design Studies, 28, 217-242. https://doi.org/10.1016/j.destud.2007.02.002

Luck, R., & McDonnell, J. (2006). Architect and user interaction: the spoken representation of form and functional meaning in early design conversations. Design Studies, 27(2), 141-166. https://doi.org/10.1016/j.destud.2005.09.001

McGinley, C., & Dong, H. (2011). Designing with information and empathy: Delivering human information to designers. The Design Journal, 14(2), 187-206. https://doi.org/10.2752/175630611X12984592780005

Mylonopoulou, V., Weilenmann, A., Torgersson, O., & Jungselius, B. (2020). Searching for empathy: a swedish study on designing for seniors. Proceedings of the 11th Nordic Conference on Human-Computer Interaction: Shaping Experiences, Shaping Society,1-10. https://doi.org/10.1145/3419249.3420125

Niederdeppe, J., Bu, Q. L., Borah, P., Kindig, D. A., & Robert, S. A. (2008). Message design strategies to raise public awareness of social determinants of health and population health disparities. The Milbank Quarterly 86, 3 (2008), 481–513. https://doi.org/10.1111/j.14680009.2008.00530.x

Novek, S., & Wilkinson, H. (2019). Safe and inclusive research practices for qualitative research involving people with dementia: A review of key issues and strategies. Dementia, 18(3), 10421059. https://doi.org/10.1177/1471301217701274

Papadopoulos, C., Kenning, G., Bennett, J., Kuchelmeister, V., Ginnivan, N., Neidorf, M. (2021). 'A visit with Viv: Empathising with a digital human character embodying the lived experiences of dementia', Dementia: The International Journal of Social Research and Practice, 20(7), 24622477. https://doi.org/10.1177/1471301221998888

Peters, D., Loke, L., & Ahmadpour, N. (2020). Toolkits, cards and games – A review of analogue tools for collaborative ideation. CoDesign, 17(4), 410-434. https://doi.org/10.1080/15710882.2020.1715444

Plumm, K. M., & Terrance, C. A. (2009). Battered Women Who Kill: The Impact of Expert Testimony and Empathy Induction in the Courtroom. Violence Against Women 15, 2, 186–205. https://doi.org/10.1177/1077801208329145

Pratte, S., Tang, A., &, Oehlberg, L. (2021). Evoking Empathy: A Framework for Describing Empathy Tools. TEI, Association for Computing Machinery, New York, NY, USA, Article 25, 15 pages. https://doi.org/10.1145/3430524.3440644

Pullin, G. (2009). Design meets disability. MIT Press.

Ritchie, J., Lewis, J., Nicholls, C. M., & Ormston, R. (2003). Qualitative research practice (Vol. 757). London: sage.

Schön, D. A. (1983). The reflective practitioner: How professionals think in action. Basic Books.

Skog, K., Grafström, M., Negussie, B., & Winblad, B. 2000. The patient as 'teacher': Learning in the care of elderly persons with dementia. Nurse Education Today 20, 4, 288–297. https://doi.org/10.1054/nedt.1999.0388

Slegers, K., Duysburgh, P., Hendriks, N., & van Rijn, H. (2013). Participatory design for persons with cognitive or sensory impairments. The 14th International Conference on Human-Computer Interaction (INTERACT), IV, 781). Springer.

Smeenk, W. (2019). Navigating empathy: empathic formation in co-design.

Smeenk, W., Sturm, J., & Eggen, B. (2017). Empathic handover: How would you feel? Handing over dementia experiences and feelings in empathic co-design. CoDesign, 1-16. https://doi.org/10.1080/15710882.2017.1301960

Smeenk, W., Sturm, J., Terken, J., & Eggen, B. (2018). A systematic validation of the Empathic Handover approach guided by five factors that foster empathy in design. CoDesign, 1-21. https://doi.org/10.1080/15710882.2018.1484490

Smith, C.E., Nevarez, E., & Zhu, H. (2020). Disseminating research news in HCI: Perceived hazards, how-to's, and opportunities for innovation. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems. 1–13. https://doi.org/10.1145/3313831.3376744

Suijkerbuijk, S., Thoolen, M., Nap, H. H., Minkman, M., IJsselsteijn, W., Brankaert, R., & de Kort, Y.

(2022). Adaptivity in Research Practice with People Living with Dementia: A Designer's Reflection. Proceedings of Dementia Lab conference, 3. https://doi.org/10.1007/978-3-031-14466-0_2

Sustar, H., & Mattelmäki, T. (2017). Whole in one: designing for empathy in complex systems. Proceedings of Nordes, 7(1).

Turner, H. (2021). Effective critique through affective peer engagement. Journal of Interior Design, 46(3), 29-45. https://doi.org/10.1111/joid.12195

Vink, J., Wetter-Edman, K., Edvardsson, B., Tronvoll, B. (2016). Understanding the Influence of the Co-Design Process on Well-Being. Proceedings of Service Design and Innovation conference, 390-402

Visser, F. S., & Kouprie, M. (2008). Stimulating empathy in ideation workshops. Proceedings of PDC, 174-177.

Wijma, E. M., Veerbeek, M. A., Prins, M., Pot, A. M., & Willemse, B. M. (2018). A virtual reality intervention to improve the understanding and empathy for people with dementia in informal caregivers: results of a pilot study. Aging & mental health, 22(9), 1121-1129. https://doi.org/10.1080/13607863.2017.1348470

Wilkinson, H. (2002). Including people with dementia in research: Methods and motivations. In H. Wilkinson (Ed.), The perspectives of people with dementia: Research methods and motivations (pp. 9–24). London: Jessica Kingsley Publishers.

World Health Organisation. (2023, March 15). Dementia. World Health Organisation. Retrieved August 1, 2024, from https://www.who.int/news-room/fact-sheets/detail/dementia.

Zeller, F. (Director). (2020). The Father [Film]. Les Films du Cru.

Zingoni, M. (2019). Beyond aesthetics, empathy first. The Design Journal, 22(3), 351-370. https://doi.org/10.1080/14606925.2019.1592808

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TIME FOR (S)HEROES TO ENHANCE CIRCULAR FASHION AND COSTUME, ART INSTALLATIONS, DEVISING FOR DESIGN, STATE-OF-THE-ART TECHNOLOGY, INCLUSION AND DIVERSITY

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ABSTRACT | Time for (s)heroes is a capacity-building project for young fashion and costume designers and artists together with local youngsters engaged through drama activities, impacting sustainability, green shift, inclusion, and diversity. This paper addresses the cross-fertilization of theatre theories, drama pedagogies, and the design world via a pedagogical and operational model producing art installations and digital and tangible fashion and costume for (S)hero characterization. It applies reflective drama methods to engage local young people to voice what they think about being role models for inclusion, diversity, sustainability, and the green transition.

The interconnectedness of fashion and costume design with art installations is explored in the digital and tangible representations of (S)heroes. The study is relevant to art and design forms with characters, such as performing arts, theatre, metaverse with avatars, and digital games. Impact is pursued on both designers in sustainable material usage, reduction of left-over materials and circular approach, as well as manufacturers together with policymakers in reference to processes.

KEYWORDS | DIGITAL DESIGN, FASHION AND COSTUME, ART INSTALLATIONS, THEATRE, INTERDISCIPLINARITY

1. Introduction

Please Time for (S)heroes is an international research, design, and innovation (RDI) collaboration between a consortium of six organizations from five countries Finland, Estonia, Latvia, Germany, and Spain funded by the European Union Creative Europe with a duration of 48 months and a total budget of 1,425M€. Time for (S)heroes addresses sustainability, co-design, and lifelong learning in state-of-the-art technology for digital and material fashion and costume design and art installation with digital elements. Capacity building is also provided in terms of business mindset and entrepreneurial skills.

Time for (S)heroes is based on locally devised but globally relevant (S)hero stories by reinterpreting hero narratives critically in the framework of sustainable design, inclusion, and diversity. The focus is on every day, sometimes mundane realities; ethical leadership for gradual social change and the values, commitment, strength, and transformation it requires.

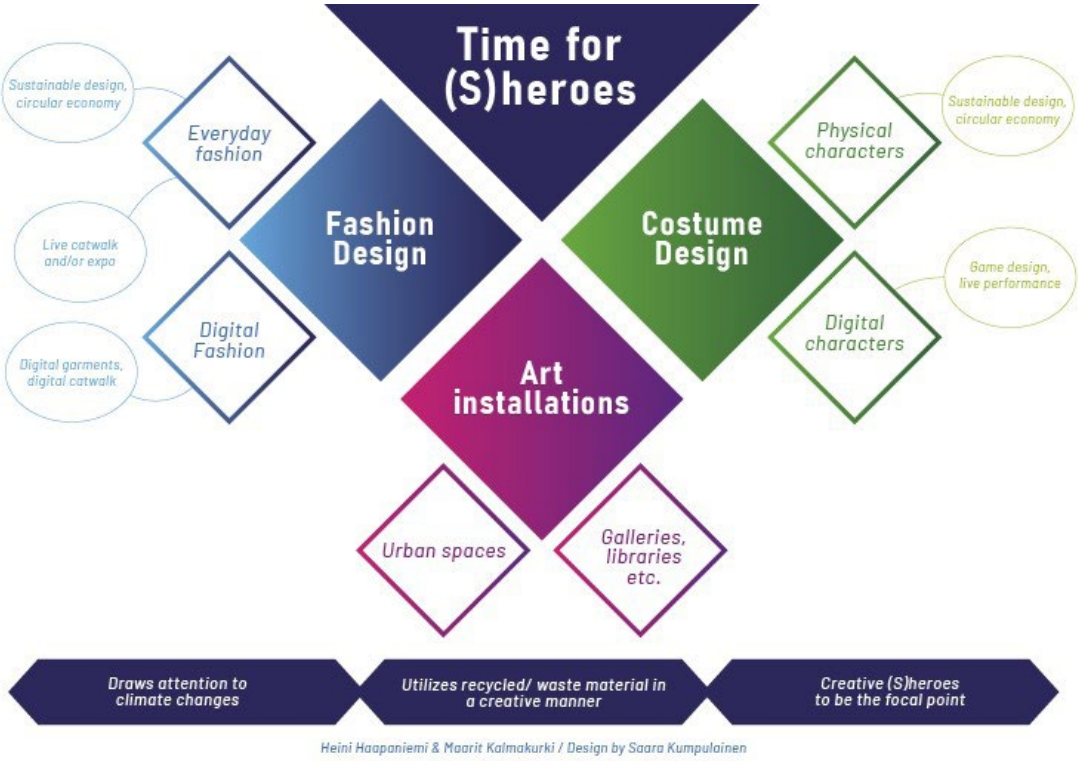

Figure 1. Interconnectedness of character-related art and design forms by Haapaniemi and Kalmakurki, visualisation by graphic designer Kumpulainen.

The first phase of the (S)hero rethought is conducted via devising and drama methods in local schools. The gathered narratives are about to inspire and inform the iterative design processes. Engaging youngsters in critical discourse is fueled via drama methods: the spotlight is given to collectively formulating positive future scenarios and alleviating climate change anxiety by co-creating fictive characters called (S)heroes. Through integrity and everyday action, young people are empowered to become every day (S)heroes within their social group. Engagement and dialogue between young people and designers empower them both by focusing on sustainable and ethical design, everyday choices, and validating values and identity through action.

A collective mindscape is created by offering impactful co-design experiences in four categories via design briefs:

1. CIRCULAR ECONOMY—DESIGNS AND ART INSTALLATIONS:

   Reusing materials, converting discarded items into products, and giving them a new life.

2. (S)HERO REVISITED:

   The local patriarchal hero myth is reimagined and turned into artworks and design products, inviting deconstruction, investigation, and awareness of the antiquated process of creating legends and heroes.

3. FASHION AND COSTUME - THE REIMAGINED (S)HERO:

   Directing attention to fashion and costume, allowing digital and physical artifacts and characters to be created.

4. HERO ARCHETYPE TRANSFORMED:

   Reconstructing the new (S)hero and deploying it in digital and tangible forms in the performing arts.

The nature of design inquiry is experiential and iterative and benefits from relative creative freedom. Yet, it will be constrained and predisposed to the selected genre, form, purpose, modality, and material dedicated to the product (Ledin, Machin, 2020).

The visualisations below demonstrate the steps of the design process. The diamond visualisation illustrates from top to bottom the five main phases and demonstrate what is the required input on the left to the expected outcomes on the right. The ribbon visualisation gives each step equal emphasis and celebrates diversity in color and form.

Figures 2. and 3. Design of the timeline in two different formats by Haapaniemi and Kalmakurki with visualisations by graphic designer Kumpulainen.

Fashion and costume designers are regarded as the (S)heroes of the day for leading the green shift, advancing sustainability, reducing material waste, and spreading best practices for circular, sustainable design. Aligned with lifelong learning, competences are built in various capacity-building modules, from state-of-the-art technology to circular design and entrepreneurial skills. Digital tools mentorships are provided to co-design holograms, characters in physical space, installation art with digital elements, animations, soundscapes, visuals, and interactive content in visceral design ethos to elicit wanted emotions from audiences (Kamil, Abidin, 2013).

Broader social participation is facilitated through exhibitions in urban spaces, galleries, libraries, theatres, and performing arts centers to advance both a sense of belonging and mediate versatile identities in a digital era (Moujan, 2020).

2. Pedagogical and operational model to advance knowledge transfer between four co-design inquiries

University pedagogy functions traditionally at the limits of disciplines. Yet, interdisciplinary crossfertilization offers an opportunity for knowledge construction, knowledge transfer, and activities that are beneficial both for learning and future working life (Tavin, Tervo, Löytönen, 2018). Each new initiative requires that the prevalent understanding of especially art and design is problematized and transformed by other disciplines to enable completely new areas of inquiry and practice to emerge in between the disciplines, also referred to as radical creativity (Tavin, Tervo, Löytönen, 2018; Björklund et al., 2022).

The transdisciplinary pedagogical and operational model with "parallel inquiry cycles" and "performative inquiry for character-related design," acknowledges that drama inquiry can inform design processes (Haapaniemi, Leinonen, 2023). The model connects state-of-the-technology, participatory design and ethnography with practice-based, art-based, and performative inquiry fostering shared reflection, creativity and co-design for artists, designers, engineers, and youngsters to enhance collaborative learning, sustainability, and inclusion (Haapaniemi, Leinonen, 2023; Wagner et al. 2021; Leavy 2020; Travis 2020; Fels 2015; Blomberg, Karasti 2012; Fels, Belliveau 2008). The model is applied and adjusted to meet the needs of the four design briefs in time for (S)heroes.

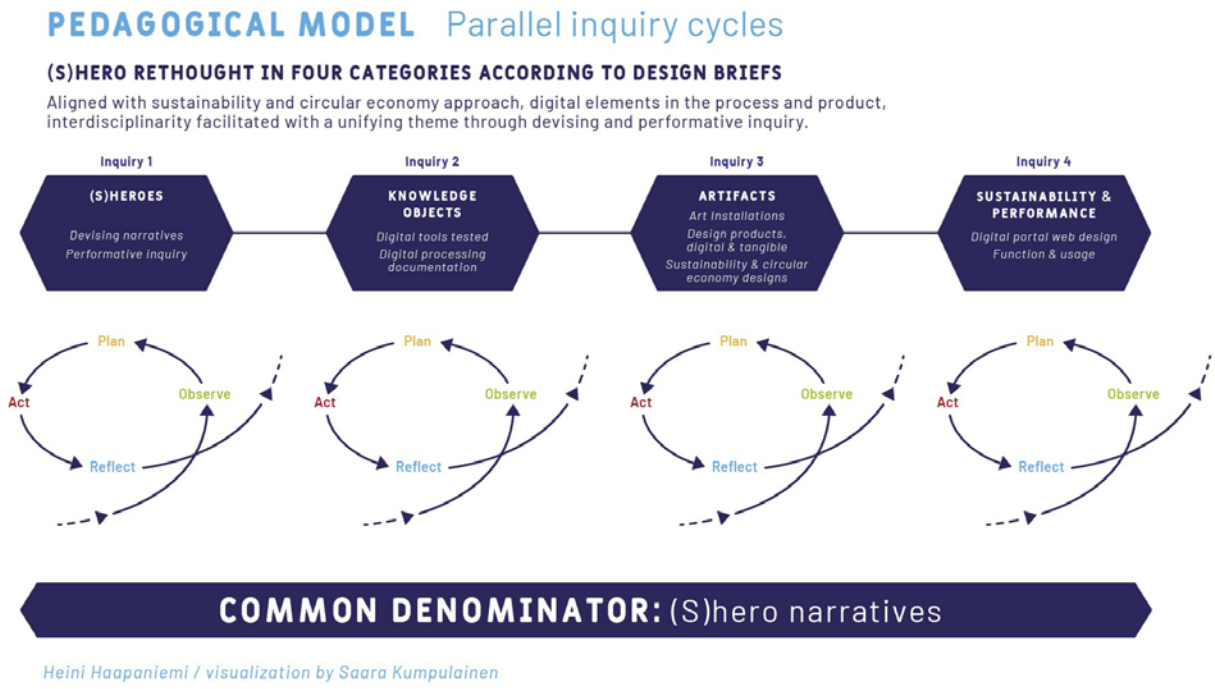

Figure 4. Time for (S)heroes pedagogical and operational model with parallel co-design inquiries by Haapaniemi, graphic design and visualisation by graphic designer Kumpulainen.

The pattern of Observe–Plan–Act–Reflect is an iterative cycle format in the model (Heron, Reason, 2002; Khaner, Linds, 2015; Haapaniemi, Leinonen, 2023). The more time and competency are invested in the iterative cycle format, the more detailed and refined the product and outcome are. Lingering in shared reflection has a crucial role as it enables informed decision-making (Schön, 2017; Dalsgaard, Halskov, 2012). Knowledge transfer between the four inquiries in the model can become successful only with the reciprocity of sharing based on trust that leads to action (Ståhle, 2004). In the parallel co-design inquiries, various optional solutions are reflected, assessed, negotiated, and tested, which equips the participants to solve unanticipated, interdisciplinary design challenges also in the future and feed information to the other parallel inquiries when shared reflection between the four inquiries takes place (Marton, Trigwell, 2000; Tyler 2021; Muukkonen, Kajamaa, 2024).

The model distinguishes two types of knowledge vessels, namely knowledge objects, which are abstractions that condense knowledge, and knowledge artifacts, which are concrete art and design items in both digital and tangible formats (Bereiter, Scardamalia, 2003; Merrill, 2000; Niedderer, 2013; Schatzki, Knorr-Cetina, Von Savigny, 2001; Khazraee, Gasson, 2015; Cetina, 2016). Advancing and articulating knowledge objects is facilitated by the co-designing community's collective efforts and resources (Schatzki, Knorr-Cetina, Savigny 2001; Bereiter, 2002; Bereiter, Scardamalia, 2003; Hakkarainen, Palonen, Paavola, Lehtinen, 2004). Knowledge objects evolve over time, are constantly in progress, incomplete, and in their nature open-ended (Knorr-Cetina, 2001; Cetina, 2016). Since knowledge objects are always in the process of being materially defined, they "continually acquire new properties and change the ones they have" thus generating questions (Knorr-Cetina, 2001, 181). They can be used at any stage to analyze the current stage of the progress of an inquiry (Merrill, 2000). Similarly, from a narrative point of view in negotiating shared meaning and value within the codesign process, an epistemic object embeds a story that enlists the support of others within the same inquiry and results in some form of collaborative understanding through either accepting or disputing the shared narrative (Khazraee, Gasson, 2015, 140; Haapaniemi, Leinonen, 2023).

Transformative (S)heroes with ecological touch equip the digital and tangible knowledge objects with associations, meanings, and cultural codes. Knowledge objects include a variety of digital contents and abstractions: the design drivers for each design brief realization, concept maps, (S) hero character personality trait lists, early prototypes, modifications and reports, visual learning diaries, and sketches done individually and produced as more time and competency is allocated to the iterative co-design process. Design artifacts refer to both digital and tangible costumes and fashion; recycled objects and material given new functions and meanings as part of the art installations with integrated thematic elements.

3. Knowledge construction through art and design

Depending on the purpose for which knowledge is produced, whether it is systemic knowledge enhancing understanding; target knowledge providing sustainable direction; or transformation knowledge, the methodology for research may be different (Hadorn, 2008). Vision is important for the (S)hero and transformation knowledge guides visions (Ibid.). Bruner distinguishes two different ways of knowing: paradigmatic and narrative knowing; the former refers to scientific, logical, and tested knowledge, while the latter aims at meaning-making and understanding others and one's own stories (Bruner, 2017). Narrative analysis of the hero trope refers to a qualitative method used to understand what kinds of stories are told including various media and modalities such as drama, texts, media texts, images, or environments, which are understood as narratives or narrative-like structures (Bruner, 2017; Flick, 2013). In the pedagogical model, the narratives are the very source that are examined through performative inquiry, process drama, devising and four parallel research design inquiries.

Art-Based Research (ABR) is "rich, complex, often unpredictable, and mostly unspeakable, leading researchers to areas of knowledge that have not yet been classified and restricted by words and logic (Kallio-Tavin et al., 2017, 103). Additionally, in design, procedural knowledge is largely experiential and tacit and is not usually made explicit. Thus, while creative practice may well be linked to the generation of new knowledge, art, design, and research appear to have "a number of opposing tendencies concerning the format and communication of this knowledge, which must be resolved in order to conduct satisfactory creative research" (Niedderer, 2013, 3). Kallio-Tavin et al. (2017) claim there prevails a challenge of articulating and analyzing the element of aesthetics representation in art with the notion "artistic, visual, multisensorial, and practice- based knowledge are difficult to articulate, especially in terms of what sort of knowledge they formulate or introduce to research" (Kallio-Tavin et al., 2017, 103).

Research in art and design problematizes the practices of art, design, and research, their relationships, and their respective processes and products (Niedderer, 2013). According to Niedderer this problem is three-fold: ontological, considering which questions could or should be asked in art and design research that are appropriate and worthwhile; epistemological, considering which perspectives or approaches could or should be incorporated into the inquiry; and methodological in considering how any inquiry could or should be undertaken from the point of pragmatic conduct (Biggs 2002, 2004; Niedderer 2009; 2013).

4. Amplified existence, the meaningful—meaningless spectrum of art, and liminality as a fruitful transitory place

Youth participating in art and design practices for rethinking the (S)hero are offered an amplified existence. According to Gilbert, art, design, and creativity refer to broader awareness, awakening for openings, and living a life driven more strongly by curiosity than fear (Gilbert, 2016, 9). When starting the adventure, the critical voice that tells participating is self-indulgent or preposterous needs to be ignored (Gilbert, 2016, 11). Embracing freedom in foolery replaces the feelings of extreme selfconsciousness, the need to control and know where the process leads, to enjoy shared self-discovery and awareness of the ways of inquiry and meaning-making for reciprocity, dialogue, and amplified existence (Gilbert, 2016, 11-12). Collaborative creativity is connected to the embodied body-mind-soul connection, which cannot be accessed in any other manner (Snowber, 2012; 2022).

The central paradox of any art form denotes it is meaningless. However, art is also deeply meaningful for individuals, communities, and ecosystems as artists possess the capacity to participate in the meaning structure formation (Gilbert, 2016, 134.). The paradox invites one to be comfortably inhabited with a balance of one's own creative expression being the most important in the whole world and simultaneously, it must not matter at all or might be ridiculous, e.g., sometimes a leap from one end of the paradoxical spectrum to the other extreme in a matter of minutes is a lifeline for artists, designers, and creatives (Ibid.).

Intellectual curiosity combined with artistic endeavor may lead to liminal, transitory learning and processes that are simultaneously fruitful and chaotic. Liminal space refers to a transformative state in which there is a reformulation of the participants' meaning frame and an accompanying shift in ontology or subjectivity (Land, Rattray, & Vivian, 2014). The liminal state can also refer to the inbetweenness of disciplines, modalities, and art forms. Liminality functions invite the participant to encounter something new, consisting of integrating the acquired knowledge and experience into the already existing knowledge schemas (Land, Rattray, Vivian, 2014; Morrison, 2008; Meyer, Land,2003).
According to Land et al., the liminal space entails a discursive shift, e.g., the acquisition and use of new forms of written and spoken discourse and internalizing these (Land, Rattray, Vivian, 2014).

Dewie and Herbard speak about the in-between space as consisting of struggle, uncertainty, and doubt - a place of frustration, discomfort, and possible negativity (Howard p. 141 as cited in Hatt, 2022). In this liminal space, from a pedagogical perspective, the participants begin to "learn how to learn," and their knowledge schemas start to change (Mayer, 2008). Learning, by its very nature,

means beginning from a place of not knowing, similar to starting a process of art that has enabling constraints such as material, media, or form (Fogarty, 2022, 65). This is particularly true in co-design and interdisciplinary contexts. The reflective collaborative lingering in the liminal stage, the edge of chaos and structure, needs to be scaffolded and supported to enable growth (Morrison, 2008). Yet, the stage of multiple directions, opportunities, and windows of possibility, which can appear chaotic, provides the needed creative challenge toward informed decision-making and meaningful change (Ibid.).

5. Installation art reducing climate anxiety

Voicing shared values provides a platform for dialogue in the realization of art installations and design artifacts as well as in the process of drama structure (Thompson, 2022; Gervais, 2006; Schwartz, 1994). Meaningful action and participation in installation art constitute a meaningful experience (Tian, 2023; Nelson et al., 2010). Time for (S)heroes asks whether co-designing installation art and digital characters based on the values and actions of (S)heroes is meaningful and why. What kind of actions meet the criteria for (S)heroism, e.g., is taking part in protesting in a large demonstration, which is at its core a value-based act, an act of (S)heroism? In terms of the environment, true climate work might be planting seedlings in a forest. Still, the role of the artistdesigner in the communities they live is not only aesthetic pleasure or entertainment but also connecting with the community, providing tools for critical thinking, exploring, and envisioning a better future.

Art can offer solace for climate anxiety when it promotes values, content, and even spirituality, which can soothe the viewer in the complexities of climate change and motivate positive everyday decisions and actions. Regarding the emotional impact of artistic expression – art can evoke emotions, spark introspection, and create a deep sense of connection to the earth and ecosystems. By fostering this emotional connection, art can motivate individuals to take meaningful action against climate change in their everyday choices. Art can also be a powerful vessel to explore narratives of healing and recovery in the evolving climate conversation.

Climate change is one of the wicked problems our societies face. Among young people, climate anxiety often manifests as sadness, fear, general anxiety, and anger (Thompson, 2021; Hickman, 2021). This emotional spectrum can also include feelings of powerlessness, frustration, and uncertainty (Ibid.). The overall climate issue is so broad and significant that it is nearly impossible for an individual, especially a young person, to fully comprehend it, as young people are still learning to understand large-scale issues, multilayered challenges, and how to manage their emotions related to them (Cefai et al., 2021; Thompson, 2021; Hickman, 2021). Nevertheless, climate anxiety can provide fuel and transform into a resource for change.

This is a positive outcome scenario for climate anxiety, and it resonates with action and hope for both today and the future. Climate anxiety can be replaced by dreams, visions, hope, and practical actions at the level of everyday life and within one's spheres of influence. Individual consumption decisions and recycling practices become important in everyday life, allowing individuals to become role models in larger recycling and consumption trends.

Alleviating anxiety through emphasis on listening skills, active dialogue, and collaboration helps young people understand that they are not alone with their feelings and are not responsible for the world's events either—yet, cultivating the ability to collaborate, even when dealing with wicked problems, can lead to successful solutions (McCune et al., 2023; McCune et al., 2024; Cefai et al., 2021).

6. Applied theatre: drama pedagogy and interpreting new (S) hero narratives

Drama methods are suitable tools to evoke focused inquiry and collaborative creativity across disciplines in higher education. Drama methods have gained popularity both in phenomena-based learning and in communication and language learning in secondary education but are still relatively little explored in interdisciplinary co-design or transdisciplinary design initiatives beyond Academia (Dunn 2016; Bowell, Heap 2012; Schneider, Crumpler, Rogers 2006; Cawthon, Dawson, Ihorn, 2011). Drama and bodily expression have been utilized in participatory and user-centered design for collaborative generation and exploration of design ideas to help designers achieve greater empathy and user understanding in the given context (Brandt, Grunnet, 2000).

The transition from expression to experience through drama evokes collective creativity. The link between intellectual understanding and the body can promote embodied learning through communicating with and through the body which is crucially important in dramatic exploration (Thompson, 2022; Fells, 2018; Brauer, 2002; Neelands, 2000). Drama, which has a kinesthetic, action orientation, provides a strong social context for learning and motivates students' desire to communicate about the characters, their relations, values, and actions (Haapaniemi, Leinonen, 2023; Winston, Stinson, 2011; Norman, 2002).

Experimenting with the fictive (S)hero characters and what constitutes their values are focal in process drama and devising workshops with youngsters (Gervais, 2006; Schwartz, 1994). Aristotle (384 – 322 BCE) divides the character types into three categories according to their status: superior to the audience, inferior, and at the same level – all of which influence how the audience reacts to them (Aristotle, 2006). Temperament dictates whether the character is easily irritated, optimistic, talkative, open-minded, reserved, introverted, extrovert, elegant, arrogant, or well-mannered. The constitution of the character is revealed by action and

moral choices (Ibid.). The co-designed characters are stored in value maps with character traits, and their interrelatedness is explained to contribute as rich source material for designers (Bruner, 2017; Flick, 2013; Gervais, 2006).

The drama method is built on shared reflection within the scenario – similar to the role of reflection in design iteration – including a collective stepping out of it, providing a special feature of simultaneous observation and action, research, and exploration of the fictive world to create understanding, negotiate meaning as well as experience empathy towards the fictive characters or end users in design (Haapaniemi, Leinonen, 2023; Schön, 2017; O'Toole, 2003, Owens, Barber, 2001; Neelands, 2000; Jackson, 1993). Lingering in shared reflection is an integral part of both drama pedagogy and enables informed decision-making for a group of designers in an interdisciplinary co-design context (Bowell, Heap, 2013; Schneider et al., 2006; Schön, 2017; Cavagnaro, 2023; Noel, 2023). Drama worlds are potential spaces for growth as they enable critical reflection within participatory and sociocultural learning (Piazzoli, 2018). This provides tools for prospective designers to become reflective practitioners before, during, and after each iterative design loop (Schön, 2017).

6.1 Devising to transform the hero trope

Devised theatre offers a site for productive critical pedagogies as it enables integrating polyphonic voices with a result much greater than writing a script by oneself (Perry, 2011; Oddey, 2013).

Devising empowers the participants to choose and influence the perspectives that gain attention (Oddey, 2013). Devised narratives ensure meaning is communicated as the process challenges every group member to confront the theme and engage with it individually at different levels, as well as develop a sense of group cooperation, affiliation, and unity at the same time (Ibid.).

Devising is based on a passion and desire to say something, a need to question or make sense of a theme, cultural phenomenon, or other starting point that encourages the group to investigate further. Devising begins with the interaction between the members of a group and the starting point or stimulus chosen. Possible barriers at the individual and group levels need to be tackled. The group absorbs the source material and responds to it, and the drama pedagogue generates a method of working appropriate to the initial aims of the project. The devising process challenges every group member to confront the work, engage with it individually at different levels, and develop a sense of group cooperation, affiliation, and unity simultaneously. All groups are different as personalities change the group dynamics and impetus of the work. Thus, ultimately, devising is about the group discovering a relationship between itself and the theme it engages with (Oddey, 2013).

In a meaningful continuum, the process becomes the product: script, narrative, characterization map, or dramaturgical item.

6.2 Process drama informing design

Process drama is a genre of applied theatre in which the participants, together with the facilitator, engage in the co-construction of a fictive world. As an improvised dramatic form, it encourages the negotiation of meaning through the process of experience and reflection. A drama pedagogue is a facilitator from within a role within the same fictive world with the purpose of engaging rather than entertaining (Dunn, Stinson 2011). Cecily O'Neill, the founder of process drama, refers to the form as a thematic exploration with no intention of creating a performance for the audience, instead facilitating the shared exploration and reflection (Taylor, Warner, 2006; O'Neill, 1995). Drama pedagogue participates in the action from within a role with attention to status - lower, same, or higher and thus becomes an "active participant in the unfolding of events" and the social networks within the fictive world (Kao and O'Neill 1998: 26 as cited in Piazzoli, 2018). The facilitator is a coequal performing team member capable of analyzing power structures within the created scenarios and between the characters (Haapaniemi, Leinonen, 2023; Thompson, 2022).
Process drama inquiry easily integrates other art forms as pre-text, a starting point. Different art forms, such as visual arts, images, and photography, as well as poems, textual reference, or sound, can be used as stimuli for process drama (O'Neill 1995). In the (S)heroes process drama workshops with young people, an initial stimulus launches the dramatic world, the shared fiction, based on visual and perceptual modes of thinking and relates to opening access to skills participants already have but that are simply waiting to be released (Edwards, 2012, 7).

Rose explores the relationship between the performative approach, visual research methods, and contemporary visual culture, characterized by convergence (Rose, 2014). She suggests that images tend to be deployed as communicational tools rather than representational texts to produce sociological knowledge in the wider social field (Ibid.). Thus, visual prompts, e.g., visual pre-texts, supplement the kinesthetic, embodied drama process well. Visuals open access by conscious volition to the visual, perceptual mode of thinking to experience a focus in awareness and seeing things in a different way (Edwards, 2012, 89). The modes of knowing, whether rational or artistic, can be integrated into the process of drama scenarios. Bringing in visual prompts to process drama advances information processing, as the ways of knowing through art, in this case, visual art, bring information to the rationale (Edwards, 2012, 38).

After launching the pre-text, the process drama structure can be divided into three phases: the initiation phase, where

participants create their roles and become immersed in the dramatic situation; the experiential phase, where participants explore the dramatic world through several strategies, or 'conventions'; and a reflective phase, where participants reflect on the learning, making their own meanings explicit (O'Toole, Dunn, 2002).

Process drama consists of several scenarios that are not interconnected in a linear, chronological sequence but follow a non-linear narrative. It plays with spatial and temporal dimensions to explore a theme within the realm of human emotions and behavior (Piazzoli, 2012, 28).

6.3 (S)hero qualities, values, and behavior informing

What makes a hero a (S)hero is originality, but not always. A (S)hero does not follow the mainstream in situations where heroic qualities are needed, yet they do not oppose norms or resort to anarchy at the expense of credibility. A (S)hero dares to see things differently, a quality that artists and designers treasure. (S)hero turns attention from oneself to others with a positive impact through sharing. (S)heroism is considered from the perspective of integrity, resilience, and consistency. Thus, it is a deeper quality in a person, anchored in the ability to live with integrity according to (S)heroic values as part of a community (Gervais, 2006; Schwartz, 1994). (S)heroes live in a mental atmosphere that entails small gestures of attention to others. The (S)hero succeeds only through trusting relationships and interacting with others. This collaboration encouraged through co-design, breaks the prevailing traditional myth of loneliness in the concept of heroism. Heroism in one area, such as leadership or political power, can turn against itself if one does not align with ethical and responsible behavior, adjust, and regulate their actions. War zones, difficult circumstances, survival, and managing in everyday life are typically regarded as the traditional hero quests. Also, overcoming a serious illness or that of a close family member is often seen as heroism because mental commitment to well-being and recovery is regarded as crucial—the attitude of not giving up. This type of heroism and capability is linked to selfsufficiency and even a desperate rise – a hero for surviving and sustaining. Similarly, sports champions center their energies around winning over other contestants and accomplishing one achievement after another.

The focus in (S)heroes is on recasting the heroes – the transformation of the hero archetype and providing more variety to the interpretations of (S)heroes of today and the future (Pearson, 1989). The visionary transformation and reframing of the hero trope takes place through design and characterization both in everyday life (fashion design), in live performance (costume design), and in urban spaces (installation art). Campbell distilled the hero's journey into three main steps, namely Separation, Initiation, and Return, when analyzing the great classic stories (Campbell, 2008). The

universal pattern includes a hero who receives a call and - after reflection - leaves his known world. Within this quest, the suffering on a physical and psychological level leads to solutions for dangers that threaten communities to which the transformed (S) heroes return. Transformational (S)heroes are driven by ideals, while transactional heroes prefer instrumental action and seek pragmatic solutions. Both types keep the dream alive that collective happiness can be achieved. Because they possess admirable qualities, audiences want to emulate them. The new (S)hero is archetypal and universal, yet simultaneously has a thousand faces, celebrating incompleteness, vulnerabilities, and flaws as crucial for renewal, being humane, and regarding them even as success factors.

The need to mirror oneself in (S)heroes is strong, but the role and face of the contemporary hero have become thoroughly problematic. Thus, exploring which faces or personae the (S)hero must put on to appeal to the present and future generations is important. To what extent can a critical approach to the concepts of (S)hero and (S) hero's journey inspire students through drama methods and co-designing to reflect and create and shape the future by providing an alternative view to the existing norms and forms? A balanced approach is nurtured: all are encouraged to be strong, proactive, accomplished, and determined. Many academics are rather critical of the hero because of his prototypical manliness or as an exponent of a meritocratic worldview.

7. Characterization and costumes for sustainability with integrated theories

Costume and fashion relate to the character as outfits, garments, accessories, and other symbolic emblems express the value sets of their bearers (Dean, 2016). Costume design conveys a strong message in performing arts—not only in theatre but also regarding artists as performing idols and young people interested in cosplay or live-action roleplay (Ibid.).

Costumes are powerful in visually portraying a character's personality and fictional histories in live performance and digital media, such as computer animation (Kalmakurki, 2021). Character trades influence their attire, and how they are dressed and depicted in visual format. Performance and staging of a play create an illusion that is often more real or penetrating than reality. A vision the director wishes to convey to the audience becomes elevated existence, the director's interpretation of the version of some investigated theme, topic, or truth brought forth by the playwright (Cunningham, 2019, 10). Set and costume design are part of this overall artistic vision. Costume design involves a process of thinking about human character and representation using garment(s) as its main visual, but not sole, means (Ibid.). Pantouvaki argues designing costume is often thought of as 'in service' to performance-making, as either a direct response to the director's vision or a creative team's interpretation of a text or theme (2020). However, in (S)heroes, the costume itself

is a product of an artistic-research-design inquiry. Contemporary thinking in costume practice expands beyond storytelling and embraces substantial characteristics of life within diverse social frames (Pantouvaki, 2020). It involves understanding and accepting others' personalities, practicing empathy and observation, and improving interpersonal and intercultural communication (Ibid.). In this line of thought (S)heroes fashion and costume design processes invite us to think with and through costume by proposing costume as a tool for analysis, negotiation, communication, experimentation, and expression of ideas and behaviors (Ibid).

Aligned with the European Green Deal and EU Strategy for Sustainable and Circular Textiles (S)heroes foster digital and green transition in fashion and design industries in Europe by reducing material and textile waste through digital design, recycling, and circular economy. The fashion industry accounts for 10% of CO2 emissions and 25% of chemical emissions and is second only to agriculture as a consumer of water (Cheng, Charter, 2023). It is also largely in its infancy in terms of sustainability and circularity policy development despite being considered one of the most polluting industries, with 1.92 million tons of textile waste produced yearly. Fast fashion is increasingly coming under the policy spotlight. It has been specifically highlighted in the EU Strategy for Sustainable and Circular Textiles with a stated goal of taking fast fashion out of fashion. However, previous research shows that companies in fashion, clothing, and textiles (FCT) are at a basic level of awareness in relation to product circularity (PC). In addition, the research by Cheng and Charter highlights that most PC tools are designed for advanced users and are not product-specific, thus requiring adaptations to meet industry needs (Cheng, Charter, 2023).

In (S)heroes, interdisciplinary co-design teams aim to investigate sustainable and ecological methods with a practice-led methodology approach (see Groth, 2016; Mäkelä, 2007) to design fashion collections and costumes for live performance to allow the engagement with physical materials to lead the design process and undecided product outcomes. Sustainable methods consider both sustainable materials, circular economy, and zero waste design. One of the concepts for the (s)herowear is ecological materialism and innovative ideas which also focus on the ways how materials are recycled in the future.

Sustainable design is investigated via a unique and artistic "upcycling" process and via digital garment making process. Using the long tradition in the field of costume to recycle clothing from one production to another through designers' adjustments will benefit both fields. On the other hand, digital garment making has expanded in the fashion industry to reduce the need for garment sample making, strengthening sustainable industry practice. However, digital tools are still slowly emerging in costume design practice and can therefore learn from the fashion field. Participants experiment with clothing made from leftover industry materials, with zero waste, creating recycled

items, and explore the possibilities of digital garment making to create costume and fashion design. Working with digital tools has a strong ecological impact, supporting sustainable garment creation by minimizing fabric waste. In practice, this is visible through testing garments' fit, design style, colors, and prints digitally prior to making them with physical fabrics. We propose that this method can also be useful for costume making in live performance. In addition, digital costume making proposes new ways of presenting costumes and characters on stage entirely digitally in a live event, which promotes sustainability, as the costumes are not physically made. Hence, another concept for (S)heroes is to expand digital design from its traditional use and create digital characters with costume, art installations and fashion and present them in public spaces interacting with physical people or actors.

8. Conclusions

The (S)heroes promote the green transition, ethical leadership, sustainability, and inclusion by inviting polyphonic voices to speak and participate in the project. Ethical leadership and integrity are grounded in well-defined values that empower (S)heroes to act with dignity (Schwartz, 1994). In this line of thought, even small actions that encourage each other to proliferate and multiply into a movement of hope for the future.

(S)heroes to become ethical future leaders requires equipping them with tools and anchoring them in hope and resiliency. Discernment, even in the smallest action and in decision-making, is a capability that requires not only knowledge but fostering, cherishing, rehearsing, and being applied prior to it is a built-in quality. Shortly, if (S)heroes' actions are not responsible, their future activity will not be successful. Nowadays, success in entrepreneurial terms means ethical dimensions, responsibility, sustainability, integrity, and the establishment and nurturing of trusting relationships.

The pedagogical model suggests that embodied learning, drama methods, and reflection play an integral role in the four design research inquiries (Haapaniemi, Leinonen, 2023). The model uses a vigorous synthesis of approaches in an interdisciplinary manner, which means integrating knowledge and methods from different disciplines to address common denominators and themes – such as the (S)heroes – in beneficial. The model can be applied to structuring interdisciplinary case studies, design challenges, and advance higher education curriculum development, especially with a central role of characters.

Interdisciplinarity in the model brings technological advancement, sociology, social science, design, and art together, referring to a combination of knowledge construction methods to find synergy, creative solutions, and new perspectives. Interdisciplinarity relates to more than one branch of knowledge involving two or more academic, scientific, or artistic disciplines. Interdisciplinarity creates

socially-robust knowledge with stakeholders, in this case young people, by building on established methods to produce reliable knowledge and goes even beyond that generate new connections with societal impact (Nowotny et al., 2003; Caniglia et al. 2017).

In applying the model, higher education institution with its stakeholders, takes part in the shared construction of knowledge and cognitive processes. To accomplish cutting-edge innovations, higher education institutes need to resort to transdisciplinary approaches (Hadorn, 2008). The greatest challenges globally can only be resolved by working together in a collaborative, interdisciplinary manner. Technology and research-based innovations play an important role in solving joint global challenges, so-called wicked problems, such as climate change, healthcare, clean energy, and other wicked systemic challenges (McCune et al., 2023; 2024).

Participating in new types of initiatives and consortiums that focus on the relationships between interdependent parts is crucial. A more resilient future is enabled by collaboration based on different ways of knowledge construction, empathy to understand and accept differences, and focus on otherness and togetherness (Vita, 2023, 180). Co-designing requires flexibility, adaptability, and access to resources that support diverse perspective integration as successful outcomes of an innovation process consider interdisciplinary approaches with a shared vision from the start (Ibid.). Wicked problems have similarities with systems thinking and complex systems, which can be changed through interactions within the ecosystem, e.g., instead of trying to change mindsets, the entire context needs to be rethought and changed (McCune et al., 2023; 2024; Ståhle, 2004; Luhmann, 1995). Considering multiple ways of knowing and collaborating in acting with responsibility is crucial both for society and the planet (Vita, 2023).

Successful design processes require constant reflection with oneself, other co-designers, as well as the materials and methods employed to lead to informed decision-making (Stickdorn et al., 2018; Schön, 2017; Dalsgaard, Halskov, 2012). Decision-making is enhanced by testing the prototypes at each stage with authentic audiences. Communication and reflection on the process development stage, challenges, setbacks, and successes need to be well articulated at regular intervals (Ståhle, 2004). Dialogue includes testing, reflecting, questioning, and discussing whether the product and its features are relevant from the end user perspective when added value is sought in the spheres of technological innovation, aesthetics, and usability.

Testing the suitability of drama methods to design initiatives provides important knowledge as drama inquiry integrates imagination, perception, spatial skills, creativity, intuition, inventiveness, embodied presence, and communication skills. The values being promoted through drama pedagogy include openness, empathy, and engagement, simultaneously competences

enhanced include reflection, metacognitive and communication skills, as well as creativity and teamwork skills (Haapaniemi, Leinonen, 2023). Further consideration for research includes testing and validating the applicability of the model in curriculum development in HEI through evidence gathered and coded according to Grounded Theory principles (Thornberg, Charmaz, 2013; Compton, Barrett, 2016).

References

Aristotle. (2006). Poetics. ReadHowYouWant. Com.

Björklund, T., Eriksson, V., Feng, X., Klenner, N., Kuukka, A., & van der Marel, F. (2022). Towards Radical Creativity.

Brandt, E., & Grunnet, C. (2000, November). Evoking the future: Drama and props in user centered design. In Proceedings of Participatory Design Conference (PDC 2000) (11-20). New York: ACM Press.

Brauer, G. (2002). Body and Language: Intercultural Learning Through Drama. Greenwood Publishing Group.

Bruner, J. (2017). A study of thinking. Routledge.

Campbell, J. (2008). The hero with a thousand faces (Vol. 17). New World Library.

Cawthon, S. W., Dawson, K., & Ihorn, S. (2011). Activating student engagement through drama-based instruction. Journal for Learning through the Arts, 7(1), n1.

Cefai et al. (2021). A systemic, whole-school approach to mental health and well-being in schools in the EU.

Compton, M., & Barrett, S. (2016). A Brush with Research: Teaching Grounded Theory in the Art and Design Classroom. Universal Journal of Educational Research, 4(2), 335-348. DOI: 10.13189/ujer.2016.040204

Cheng, I., & Charter, M. (2023). A pathway towards future sustainable fashion in 2023. In Accelerating Sustainability in Fashion, Clothing and Textiles, 363-376. Routledge. DOI: 10.4324/9781003272878-36

Cunningham, R. (2019). The magic garment: Principles of costume design. Waveland Press.

Dalsgaard, P., & Halskov, K. (2012, June). Reflective design documentation. In Proceedings of the designing interactive systems conference, 428-437. DOI: 10.1145/2317956.2318020

Dean, S. E. (2016). Where is the body in the costume design process? Studies in Costume & Performance, 1: 1, p. 99–101.

Dunn, J. (2016). Demystifying process drama: Exploring the why, what, and how. Nj, 40(2), 127-140. http://dx.doi.org/10.1080/14452294.2016.1276738

Edwards, B. (2012). Drawing on the Right Side of the Brain: The Definitive. Penguin.

Fels, L. (2015). Performative Inquiry: Reflection as a Scholarly Pedagogical Act. In Warren Linds & Elinor Vettraino (Eds.). Playing in a house of mirrors: Applied theatre as reflective pedagogical practice. Rotterdam, The Netherlands: Sense.

Fels, L., & Belliveau, G. (2008). Exploring Curriculum: Performative Inquiry, Role Drama & Learning, Vancouver, B.C.: Pacific Educational Press. ISBN 978-1-895766-84-4.

Flick, U., Ed., (2013). The SAGE handbook of qualitative data analysis. Sage.

Gervais, M. (2006). Exploring Moral Values with Young Adolescents through Process Drama. International Journal of Education & the Arts, 7(2), 1-34.

Gilbert, E., (2016). Big Magic – Creative Living Beyond Fear. Riverhead Books.

Groth, C. (2016). The role of sensory experiences and emotions in craft practice. In Peter Lloyd, & Erik Bohemia (Eds.). Proceedings of DRS 2016: Design + Research + Society - Future-Focused Thinking, 7, 28952910.

Haapaniemi, H., & Leinonen, T. (2023). Towards a Pedagogical Model Applying Commedia dell'Arte and Art Workshops in Higher Education Design Studies. Open Education Studies, 5(1), 20220199. DOI: 10.1515/edu-2022-0199

Hadorn, G.H. et al. (2008). The Emergence of Transdisciplinarity as a Form of Research. In Hadorn, G.H., et al. Handbook of Transdisciplinary Research. Springer, Dordrecht. https://doi.org/10.1007/9781-4020-6699-3_2

Hickman, C., Marks, E., Pihkala, P., Clayton, S., Lewandowski, R. E., Mayall, E. E., ... & Van Susteren, L. (2021). Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey. The Lancet Planetary Health, 5(12), e863-e873.

Kallio-Tavin, M., Suominen, S., & Hernández-Hernández, F., (2017). Art Based Research Traditions and Orientations in Europe: Perspectives from Finland and Spain, in Handbook of Arts-Based Research, Leavy, P. (Ed.), Guilford Publications.

Kalmakurki, M. (2021). Digital character costume design in computer-animated feature films. Doctoral thesis. Aalto Arts Books.

Kamil, M. J. M., & Abidin, S. Z. (2013). Unconscious human behavior at visceral level of emotional design. Procedia-Social and Behavioral Sciences, 105, 149-161.

Khaner, T., & Linds, W. (2015). Playing in entangled spaces: Exploring ethical know-how through embodied inquiry. Playing in a house of mirrors: Applied Theatre as reflective practice, 127-150.

Luhmann, N. (1995). Social systems. Stanford, CA: Stanford University Press.

McCune, V., Scoles, J., Boyd, S., Cross, A., Higgins, P., & Tauritz, R. (2024). Academic identities and teaching wicked problems: how to 'shoot a fog' in a complex landscape. Higher Education Research & Development, 43(1), 166-179.

McCune, V., Tauritz, R., Boyd, S., Cross, A., Higgins, P., & Scoles, J. (2023). Teaching wicked problems in higher education: Ways of thinking and practising. Teaching in Higher Education, 28(7), 1518-1533.

Moujan, C. (2020). More than Urban. Mediated Identities in the Futures of Place: Emerging Practices and Spatial Cultures, 233-247. DOI: 10.1007/978-3-030-06237-8_13
Neelands, J. (2000). In the hands of living people. Drama research, 1(1), 47-59.

Mäkelä, M. (2007). Knowing Through Making: The Role of the Artefact in Practice-led Research. Know Techn Pol 20, 157–163. https://doi.org/10.1007/s12130-007-9028-2

Nelson, R., Lavender, A., Bay-Cheng, S., & Kattenbelt, C. (2010). Mapping intermediality in performance. Amsterdam University Press.

Niedderer, K. (2013). Explorative materiality and knowledge. The role of creative exploration and artefacts in design research. FORMakademisk, 6(2). DOI: 10.7577/formakademisk.651

Norman, R. (2002). Power as pedagogy: The potent possibilities in drama education. English Quarterly Canada, 34(1/2).
O'Neill, C. (1995), Drama Worlds -a Framework for Process Drama. Portsmouth: Heinemann.

O'Toole, J. (2003). The process of drama: Negotiating art and meaning. Routledge.

O'Toole, J., & Dunn, J. (2002). Pretending to learn: Helping children learn through drama.

Owens, A., & Barber, K. (2001). Mapping Drama. Carel Press.

Pantouvaki, S., (2020). Costume Thinking as a Strategy for Critical Thinking. Paper presentation at Critical Costume 2020 Conference (online). Available at: https://costumeagency.com/project/sofiapantouvaki/ [Accessed 15.10.2020]

Pearson, C. S. (1989). The hero within: Six archetypes we live by. HarperOne.

Perry, M. (2011). Theatre and knowing: Considering the pedagogical spaces in devised theatre. Youth Theatre Journal, 25(1), 63-74.

Piazzoli, E. (2018). Embodying language in action: The artistry of process drama in second language education. Springer.

Piazzoli, E. (2012). Engage or entertain? The nature of teacher/participant collaboration in process drama for additional language teaching. Scenario: A Journal of Performative Teaching, Learning, Research, (2), 28-46.

Rose, G. (2014). On the relation between 'visual research methods' and contemporary visual culture. The sociological review, 62(1), 24-46.

Schwartz, S. H. (1994). Are there universal aspects in the structure and contents of human values? Journal of Social Issues, 50, 19–45.

Schneider, J. J., Crumpler, T. P., & Rogers, T. (2006). Process drama and multiple literacies. Portsmouth, NH.

Schön, D. A. (2017). The reflective practitioner: How professionals think in action. Routledge.

Snowber, C.N. (2022). Dance, place and poetics: Site-specific performance as a portal to knowing. Springer/Palgrave Macmillan, ISBN: 978-3-031-09715-7

Snowber, C. (2012). Dance as a way of knowing. New Directions for Adult and Continuing Education, 2012(134), 53-60. DOI: 10.1002/ace.20017

Stickdorn, M., Hormess, M. E., Lawrence, A., & Schneider, J. (2018). This is service design doing: applying service design thinking in the real world. " O'Reilly Media, Inc.".

Ståhle, P. (2004). Itseuudistumisen dynamiikka – systeemiajattelu kehitysprosessien ymmärtämisen perustana. In Näkymätön näkyväksi: Avauksia kehitysprosessien näkymättömän dynamiikan tutkimukseen. Publisher: Tampere University Press. Available from: ResearchGate [accessed May 27, 2024]. [THE DYNAMICS OF SELF-RENEWAL – SYSTEMS THINKING AS THE BASIS FOR UNDERSTANDING DEVELOPMENTAL PROCESSES. IN MAKING THE INVISIBLE VISIBLE: OPENINGS FOR THE STUDY OF THE INVISIBLE DYNAMICS OF DEVELOPMENTAL PROCESSES.]

Taylor, P., & Warner, C., (Eds.), (2006). Structure and Spontaneity: The Process Drama of Cecily O'Neill.

London: Trentham Books.

Thompson, A. R. (2022). The anatomy of drama. Univ of California Press.

Thompson, T. (2021). Young people's climate anxiety revealed in landmark survey. Nature, 597(7878), 605-605. DOI: 10.1038/d41586-021-02582-8

Thornberg, R., & Charmaz K., (2013) Grounded Theory and Theoretical Coding, In The SAGE Handbook of Qualitative Data Analysis, Flick, U. (ed.), SAGE Publications Ltd

Tian, J. (2023, July). On the Application and Influence of Interactive Installation in Urban Public Art. In International Conference on Human-Computer Interaction (250-258). Cham: Springer Nature Switzerland. DOI: 10.1007/978-3-031-34609-5_18

Vita (2023) A dialogue about experiences of collaboration in design practice, The Design Journal, 26:1, 173-183, DOI: 10.1080/14606925.2022.2144551

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DATA SONIFICATION AND THE POWER OF AUDIO: BREAKING BOUNDARIES OF INFORMATION DESIGN WITH CREATIVITY, ACCESSIBILITY, AND INNOVATION

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ABSTRACT | Data sonification, the practice of representing data through sound, has great potential to (1) expand the way we engage with information and experience learning, (2) offer a more inclusive avenue for design projects, and (3) break the boundaries of traditional design through innovative expression. This speculative paper explores the potential for data sonification to advance and transform the field of design through several avenues, with particular focus on shifting information consumption modalities and expectations, improving accessibility in design, and the design-oriented nature of sonification processes. The realms of design and data sonification are each powerful in their own right, yet there is ample room and need for these practices to support and influence each other. In fact, this synergy is needed for both fields to advance. This paper first acknowledges existing research around design-conscious data sonification, and explores the limitations of visual traditions in design.. It then discusses the powerful link between data sonification and design, exploring sonification as a design problem to be solved. It then presents two categorical arguments for why data sonification can help expand the world of design. The first is that data sonification shifts expectations and boundaries of design by propelling designers out of their comfort zone and introducing audiences to an unfamiliar format that is emotionally stirring. The second is that sonification is an excellent solution for inclusivity and accessibility limitations, welcoming individuals who might be excluded by purely visual modalities. This paper concludes by recommending practical starting points for designers, addressing next steps for the community, discussing existing challenges (user experience and technological limitations), and encouraging creators to engage with this unique method.

KEYWORDS | DATA SONIFICATION, INFORMATION DESIGN, AUDIO, FUTURE OF DESIGN, DATA VISUALIZATION, MULTIMODAL, DATA CONSUMPTION, DATA, AUDIO-DRIVEN DESIGN, EDUCATIONAL STORYTELLING, DATA-DRIVEN ART

1. Introduction

In the space of information design and data representation, there is heavy reliance on visual elements to convey an idea or message. Culturally, we are quite attached to this modality — but what would it be like to integrate audio as a more widely-used format for information design? There is broad familiarity with charts and graphs as a means of communicating data, whether that be in journalism, the classroom, or research. While visuals are powerful, they have certain limitations in that they are often presented in static format, are overused or misused, and lack a certain emotionality. Furthermore, they are exclusive to the sense of sight. Data sonification, the practice of using sound to communicate data, is a method that activates the under-appreciated sense of hearing and is beneficial to information design in at least two significant ways. First, expressing data in the form of audio makes data accessible to people who are visually impaired or blind. There is a heavy reliance on visualization as a tool for tasks like data analysis and developing educational content, but by integrating sonification into these realms, data can be consumed without reliance on sight. Second, data sonification is beneficial for engagement, sparking curiosity, and stirring emotion within someone. A sound composition may have the power to activate a poignant reaction more than a static data visualization can.

There is a great opportunity for designers of multiple disciplines to use information-driven audio to shift their own practices, strengthen the impact on their audiences, and ultimately expand the field of design as a whole. The field of information design is well-explored, and marked by strong theories around concepts like visual aesthetics, harmony, hierarchy, information structure, and so on (Pettersson, 2014). These principles are generally vision-oriented, and there seems to be less focus on design theory around sound. Designers could transform their work by embracing this lesser-explored modality. This speculative paper argues for the need to integrate data sonification into the world of design, as part of a movement towards more inclusive and intriguing methods for communicating information, educational storytelling, exploratory research, and beyond.

The subsequent sections of this paper will proceed as follows. Section 2 acknowledges previous research done to examine the relationship between design perspectives and data sonification. Section 3 reviews traditional forms of design through brief historical acknowledgment of heavily visual media in information design, addressing its benefits and limitations. Section 4 introduces the concept of data sonification, framing data sonification as a design problem and discussing examples of design-conscious sonification. Section 5 presents the argument that data sonification can shift expectations for audiences and designers by sparking curiosity around the unfamiliar, stirring emotional response, and invoking underexplored creative methods. Section 6 presents the argument that data sonification helps contribute to improved design inclusivity by providing an accessible medium for people who are visually impaired or blind. Both Sections 5 and 6 argue that these respective benefits of design-oriented sonification can ultimately break boundaries of informative design and expand the field as a whole. Finally, Section 7 presents practical recommendations for designers to start implementing sonification, addresses current challenges to integrating the practice broadly, and calls for further research in the future.

2. Previous Work

The Sonification Handbook (2011) contains a chapter by Barrass and Vickers called, "Sonification Design and Aesthetics," which expounds on the evolving relationship between design principles and data sonification theory, and the varying perspectives about appropriate design goals for sonification. Not long before the book's publication, the community of sonification began to witness a call for awareness around aesthetics in creating sonification compositions, with greater receptiveness to the idea that "the field is currently focused on applications and techniques, and there is a need to consider users, environments and contextual issues more in the future" (p. 151). Additionally, there have been more calls for interdisciplinary contributions to the field of data sonification, noting "a false dichotomy predicated upon the assumption that art and science are somehow incompatible bedfellows," when in reality they are incredibly supportive to one another as innovative dominions (p. 158). This early research shows interest in pushing sonification practices beyond niche research and into a broader, more relatable context.

The realm of Human Computer Interaction (HCI) has also demonstrated significant cross-section between data sonification and design. Sonification falls under the umbrella of auditory display, which arises consistently in the design of devices and technologies that we use on a daily basis. It is important for devices to emit well-designed sound in communicating with the intended user, whether that be in systems such as cars, phones, computers, voice assistant devices, or any other interactive technology. In an early overall assessment of the field,

"Sonification Report: Status of the Field and Research Agenda," authors Kramer et al. address applications of sonification from a design lens and propose a research agenda for how these applications could be built out into the future (ICAD Proceedings, 1997; updated 2010). They emphasize that problem-driven projects would be an optimal application of sonification, and state that a "design challenge" would be particularly useful for unveiling the "unpublicized efforts" of sonification designers (22-23). But there are also gaps in the design theory of sonification, and more research is needed to establish a solid theoretical foundation. So while we see gradual concessions over the years that data sonification and design need each other, the implementation has been slow to manifest, and it is well past time that the sonification welcomes design and that designers embrace sonification as a practice.

In more recent years, we have seen various explorations of the intersection between data sonification and design. Jordan Wirfs-Brock discusses the value of integrating multiple sensory expressions like sound, taste, and touch into the process of brainstorming about the potential expression of data (Wirfs-Brock et al., 2022). Through "sketching across the senses," including the translation of information into sound, various design-focused practitioners can generate iterations of unique data translations which can aid them in their development processes. This reflects the strong link between auditory display and human computer interaction, through the mechanism of interaction design processes and methods. In further research uniting interaction design and sonification, Wirfs-Brock examines "narrative sonifications" – the process of presenting data sonification to audiences with the aid of narrative and providing steps for "training the listeners ears," thereby crafting the design of the final sonification presentation to be most impactful and meaningful for audiences (Wirfs-Brock et al., 2021). This narrative approach can be particularly useful for information designers to ensure that their intended audiences genuinely understand the intended message. Sara Lenzi, Paolo Ciuccarelli, and contributing founders of The Data Sonification Archive (https://sonification.design/) have investigated the relationship between design and sonification, including the implementation of intentional design when it comes to the communication of social issues in journalism (Lenzi, Ciuccarelli, 2020). They have also developed a framework for implementing a design-driven approach to data sonification with the "Data Sonification Canvas" (2024). They call for the active application of design research methodologies to improve "an iterative process which would lead from ideation through prototyping to production of sonification as a real-world application," and propel sonification in a direction where it could be widely embraced and implemented societally (Lenzi, Ciuccarelli, 2020). With greater fusion between the practices of sonification and design, we are sure to experience mutually interesting developments in both fields.

3. Traditions in Design, Prioritizing the Visual Mode

3.1 Visual Emphasis in Information Design

Practitioners of information design may be well aware of the typical focus on the visual modality by their peers and in the field more broadly. Even the curriculum at Northeastern University, which maintains an impressive and unique informational design program, consists of much required coursework that is firmly centered around design as a visual modality, such as "Visual Cognition," "Visualization Technologies," and "Visual Communication for Information Design" (Northeastern University Academic Catalog 2024-2025). The title of the graduate program, "Information Design and Data Visualization," indeed demonstrates the anchored focal point on visualization in the study and practice of design. Early on in their careers, information designers are reliably exposed to the theories of Edward R. Tufte, statistician and professor best known for his books such as The Visual Display of Quantitative Information (1983) and Envisioning Information (1990) (© by Edward R. Tufte). While perhaps antiquated and rigid in some ways, his work still shares some groundbreaking concepts, like the idea of "escaping flatland," integrating depth, and eliminating superfluities in visual representations of information (Envisioning Information, p. 13). In an article about global information design, Paul Kahn presents historical frameworks of information design, all of which are specifically defined under an umbrella of visual communication; while Kahn calls for an expansion of the practice, audio is not mentioned ("Global Information Design, Part 1: A New Framework for Understanding Data Visualization" 2019). Even in fields submerged in the act of communicating information, such as data-driven journalism, "visual design plays a major role in data stories and in multimodal artifacts in general" (Weber et al, 2018).

3.2 Benefits and Limitations of the Purely Visual Mode

The purpose of examining traditional design tendencies is not to dismiss or downplay the value of visualization in design, but rather to point out the lack of focus on other sensory modalities like auditory perception. Of course, the visual modality is incredibly powerful and visual design is brimming with an array of beneficial qualities. Visual information design has the power to be highly specific and detailed, and effectively communicate ideas. It is also non-temporal; the eye can navigate nonlinearly around an image, unconstrained by a start and end time. Yet it has a long history of challenges and gradual adaptation with evolving technology, expanding from the highly scientific to the more artistic and experimental. Sonification theorists can benefit from this history – they can "learn from the visualization community's mistakes and embrace cross-disciplinary interactions from the outset, including those with cognitive scientists and artists" (Kramer et al., 2010). This calls for a synergy between data sonification

and design practice, and an opportunity for both fields to grow and improve.

Adhering to the purely visual has its limitations, and faces potential pitfalls in applications such as data visualization. Common problems include disproportionately scaling the data, unclear labeling, missing context, and oversimplification, leading to "false representations of the data and incorrect conclusions" (Webber et al., 2019). But researchers are beginning to explore the potential of multimodal information representation more often. It is possible that integrating additional sensory formats in information design can spur a more memorable and engaging experience. In a study by Saktheeswaran et al. measuring the impact of integrating multisensory interaction in visual network exploration, researchers found that interaction design involving speech, touch, and audio was preferred by participants (Saktheeswaran et al., 2020). Reasons for this included "freedom of expression" in task performance, being more direct and natural, as well as the modalities being quite "complementary" in nature. Additionally, user experience (UX) designers are beginning to think about how to integrate multiple senses in design to enhance informational experiences; historically, designers have approached design as exclusively unimodal, which does not reflect our actual multisensory day-to-day experience (Content Science Review, 2022). Changing attitudes towards information design invite the opportunity for data sonification to be implemented among these practitioners.

4. The Vital Link Between Design and Data Sonification

4.1 A Conceptual Overview: What is Data Sonification?

Data sonification is the practice of representing data through sound. It falls under a broader category of auditory display, which examines "how the human auditory system can be used as the primary interface channel for communicating and transmitting information" (The Sonification Handbook, 2011: p. 1). Within this domain, sonification is specifically the "technique of rendering sound in response to data and interactions." While the use of non-speech sounds (software instruments, etc.) to convey data is more widely practiced, speech and the voice are also valid mechanisms to present a sonification. The most common approach to data sonification is called "parameter mapping," which is the process of associating data or information with auditory parameters such as pitch, volume, timbre, tempo, etc. Parameter mapping is the form of sonification to which this paper is primarily referring. While some of these definitions have become more established over time, the field of data sonification is ever-evolving, and practitioners have debated about more granular details of best practices and principles. A tangible design theory for data sonification remains in development, and further undertakings of design-oriented sonification would help to clarify and expand current efforts.

4.2 Approaching Data Sonification as a Design Problem

Data sonification is, by its very nature, a design problem. The goal of a data sonification creator is to convey information contained within a data set through clear and (possibly) aesthetically-pleasant sound composition. This creator, in effect a designer of information and sound, will consider factors such as targeted audience, presentation format, and chosen narrative in crafting a composition. If the aim of an information designer is to communicate information so that it is easy to understand and memorable, it can then be said that sonification developers are information designers, tackling that very problem through sound. Indeed, sonification requires design: Grond and Berger present a framework for the design process of parameter mapping sonification which involves the "data domain" (data features such as events, polarity, and dimensions) and the "perceptual domain" (sound synthesis aspects such as frequency, gain, time, brightness, harmony, texture) (The Sonification Handbook, 2011: p. 366). Iterating between these domains, the sonification designer adjusts the mapping function which takes features from the data domain and produces sonic output. This design process is characterized by "listening, tuning, and thinking," in which the designer makes creative adjustments for an optimized outcome.

There is information design embedded in our daily sonic environment. Design considerations live within the notifications from our smartphones that indicate a message arrival, in the sirens that whir down city streets communicating emergency, in the bell tower that tolls with the passing of each hour. But sonic applications of design are not widely discussed in the field of design, as visual solutions take the main stage. The historically expected applications of information design solutions are "infographics," "wayfinding systems," "data visualizations" or even intangible products like "strategies" or "stories," (Sheila Pontis, Northeastern University) and it is rare to find audio as a cited design solution. A perspective shift is needed to expand upon existing instances of information display; with additional creativity and analysis, designers who experiment with audio may find it to be a particularly viable and communicative medium.

4.3 The Impact of Design-Conscious Sonification Development

Sonification projects generated with a design-oriented mentality have potential to touch listeners in a more impactful way than outcomes of systematic approaches. If an information designer truly considers the clarity, emotional tone, and aesthetic of the audio narrative, choices made in development are likely to resonate with audiences hearing the final product. Recent research has been done by Sara Lenzi and Paolo Ciuccarelli to explore the value of a design-driven approach to sonification, emphasizing "intentionality" and deliberate decision-making to produce meaningful narratives (2020). They question the extent to which sonification practitioners

are aware of the communicative potential their work may have, and whether they carefully consider the effect of their design choices. Lenzi and Ciuccarelli encourage this thoughtful awareness, stating that "intentionality has been considered an indicator of a 'designerly' approach that can position sonification as a meaning-making medium of its own," rather than only for scientific purposes (2). They explore a series of case studies to demonstrate this, specifically in the field of data journalism. One example they explore is a 2013 collaborative project called Egypt Building Collapses, by the Tactical Technology Collective, the Shadow Ministry of Housing and the Egyptian Initiative for Personal Rights. Due to poor public policy and construction regulation, Egyptian urban areas have experienced a number of building collapses, leading to numerous casualties and families left homeless. The web-based project powerfully combines visual animation with sound, tracking the number of building collapses, the outcome of the collapse, and the reason for the collapse (https://egyptbuildingcollapses.org/). With each building that falls, one can hear a destructive, mechanical, crumbling sound effect, representing each unfortunate occurrence, the sound compounding with higher rates. This project exemplifies highly intentional design because it takes an issue of social injustice and makes it viscerally present for the listener; the use of destructive sound samples causes the listener to "associate the sound directly with its source" (3). Rather than opt to make this sonification benign, neutral, or even pleasant, the creators purposefully design a jarring, emotional piece which calls for policy change.

Intentionally-designed sonification compositions reflect a keen awareness around social context and intended audience. An information designer may often encounter the challenge of presenting a particularly sensitive social issue, or solemn material, such as death rates, crime patterns, or human rights violations. Designers have the responsibility to both clearly articulate the content and remain conscious of the listener. Another example of intentional sonification design around a sensitive topic is a project called "London Under the Microscope," by D'Efilippo, Ray, and Geere (https://vimeo.com/571217327). Representing Covid-19 cases and deaths in London spanning one year, the piece pulses ominously, gradually building in intensity as the death toll increases. At first, the listener can hear individual instances of Covid-19 deaths, but as the numbers increase the sonification culminates into droning layers, powerfully symbolizing the pandemic's magnitude. The designers' subtle yet powerful choices for this sonification both memorialize lives lost and inform listeners of the data. The effect of intentional design is that the listener deeply connects with the material. Rather than being tasked with the work of drawing meaning from the audio, designers can embed contextual cues, metaphors, and creative indicators into their work to communicate a meaningful message.

5. Breaking Boundaries with Sonification: Expectations, Innovation, and Creativity

5.1 Shifting Audience Expectations through Novelty and Emotional Impact

Data sonification is a relatively new method of representing information, with limited acknowledgement among research communities and the public. While this has generally been noted as a downside to the method of sonification (Barrass an Vickers, 2011), it may be worth considering an alternate perspective. The fact that sonification is not yet well known could potentially be beneficial to information designers, as its novelty offers a format that may be unexpected and intriguing for audiences. Well-designed sonification tends to be bespoke, as data-driven narratives are highly context-dependent, and systematic approaches do not always work well with audio synthesis. Designers have the opportunity to bask in the dearth of sonification design norms, gifted with a blank slate in this emerging field. Examples of excessively codified information design techniques, such as graphical visualizations or "scrollytelling" projects, have seen broad application across numerous platforms, and users have become well-familiar with (if not jaded by) these presentation methods. Sonification, on the other hand, still remains protected from the threat of systematization, and its uniqueness may prompt engaged and curious listening.

Initial impressions of data sonification may cast it as a dry, scientific method lacking enjoyment, but that is where designers may play a role in transforming this assumption. Innovative creators can leverage design and aesthetic to direct the presentation of sonified data towards "an audience with expectations of a functional and aesthetically satisfying experience" (Barrass an Vickers, 2011, 2011: p. 165). Recent public-facing sonification projects have cropped up frequently in the field of astronomy, largely from the part of NASA. The organization has created a series of sonifications mapping digital imagery data from the James Webb Space Telescope to layered, ethereal sounds. Users can thus "hear the stars," absorbing soundscapes which are "designed to be captivating to anyone who tunes in" (NASA: Webb Sonifications, 2024). The reach of NASA is wide, and compositions like these are contributing to a shift in audience awareness and interest in sonification, exemplifying artfully-designed sonic arrangements which are calming and enjoyable. However, these sonifications are problematic in ways, because they can mislead listeners to believe that stars are actually emitting sound, or that sound is possible in space, which it is not. The infrared light observed by the Webb telescope is the data that is eventually mapped to sound, but that may not be clear to the listener. Perhaps an ideal equilibrium between data clarity and auditory aesthetic is achievable, allowing audiences to have both a pleasant experience and walk away having learned something new.

Beyond novelty, the variable of emotion may contribute greatly to shifting audience expectations in information design. The relationship between sound and emotion warrants significant acknowledgement within any discussion on design and data sonification. Duncan Geere, information designer and creator of the Loud Numbers Podcast (in partnership with Miriam Quick), makes a compelling argument for the capacity of audio to drive emotional response in ways that pure visuals may not ("Telling Stories With Data & Music," 2020). As a case study, he references a sonification piece memorializing individuals killed in the 2016 Orlando Pulse nightclub (Reveal from The Center for Investigative Reporting, 2016). This piece sonifies the life spans of the victims who lost their lives with cycling bell tones that end in unison, the suddenness creating a powerful effect. He states: "This would make a boring visualization — merely the lifespans of some people. But it makes a powerful sonification. Because the sound is experienced through time, you're lulled into a sense of security by the calming repeated rhythms, then comes the shock of all those lives ending at the same time." One can imagine numerous applications for which a simple data visualization simply doesn't have much sentimental punch, where a sonic rendering might do better. Geere explains how an emotional effect can be especially leveraged when a designer takes advantage of the meaning we associate with sound. For example, a designer might use literal sound effects to indicate events occurring, such as a thunder clap or a building collapsing, or use solemn musical tone to indicate data that is perhaps tragic or unfortunate. It has been shown that audio, particularly when it contains characteristics of musicality, has the ability to affect the emotional state of an individual (Bhatti et al., 2016). With design-driven elements, a sonification can convey a message that may last longer in a listener's mind due to the emotional resonance it causes. There are endless ways to embed meaning and association into a data sonification track, and this is something designers should consider with listeners in mind.

5.2 Expanding the Designer's Mindset through Innovative Sonification

As mentioned, data sonification creation is truly a design-oriented process. While designers may feel hesitant to experiment with data-driven audio, they may also find that their training in solution-focused strategy, user experience, iterative testing, and observation will aid them greatly when trying out sonification. With well-established theory and literature on visual design, individuals with this background may feel attached to the visual mode, but also well-armed to try something new to grow their practice. So if visual design theory is well established, what of sonification design theory? As discussed in Section 4, sonification design theory is still in flux, and its goals are still being debated and pondered. Some practitioners state that the goal should could be to convey the overall shape or trend of a data set through

sound composition that equally reflects this informational contour (Campo, 2007), others consider the goal of engaging with listeners in an interactive way, encouraging them to explore the data themselves (Walker and Nees, The Sonification Handbook, 2011: p. 20), and still others offer up the goal of simply catalyzing curiosity about the informational content. But ultimately the hope is to convey a message in a clear and interesting manner. There are innumerable avenues for accomplishing this through audio, and this is where the designer's intuition, expertise, and creativity come in handy.

How can designers begin to open their minds to sonification? There are some existing design frameworks available to aspiring sonification developers. For example, Campo offers a systematic design space map for sonification by defining three axes which need to be identified: x, the number of data points; y, the number of data dimensions; and z, the number of sonic parameters (Campo, 2007). Another tool for sonification design is the Data Sonification Canvas, developed by Lenzi and Ciuccarelli (2024), which defines a set of building blocks to tackle a data sonification composition. This canvas consists of of four primary areas to be identified: (1) Use Case – who are the users and what is the goal; (2) Mapping Choices – the mapping of data to sound; (3) Sonification Approach – does the presentation lean more analytical or narrative; and (4) Listening Experience – how will users listen to the sonification (Lenzi & Ciuccarelli, 2024). Designers may also look to the field of Human Computer Interaction (HCI) for reference, which is deeply immersed in product design processes and has employed sound techniques for innovation. "Sonic sketching" in interaction design offers an alternative to visual brainstorming; designers can use their own voices to convey the nature of data and capture their ideas in sound (Explorations in Sonic Interaction Designs, Rocchesso, 2011). These frameworks provide useful thought processes for approaching data sonification without being so defined as to risk rigidity. Furthermore, they may change and evolve as more designers from multiple disciplines contribute to the data sonification lexicon. Designers can use these schemas to begin thinking about data sonification and develop a new mindset about the possibilities of information communication.

5.3 Unifying Sonification and Design to Break Boundaries and Mutually Advance

The field of data sonification is undergoing a shift towards greater receptivity of design theory, producing an apt juncture for traditionally-trained designers to enter the community. The historically niche and academia-focused field of sonification is broadening to include more design-conscious output, and this change is necessary for a transition towards a more "widely adopted medium" (Lenzi et al., 2020). In the Open Sonifications manifesto, authors Wirfs-Brock, Perera, and Geere call for the expansion of sonification as a creative, exploratory practice, breaking beyond the conventions which have become rigid in dominant sonification

communities (2024). They point out that the conventional goal of sonification has been to provide "analytical insight," and call for an expansion of goals beyond this tradition. These goals include: (1) transform our views and assumptions about the world, (2) engage us in activism, and (3) understand data through self-expression (p. 4). This alternative offering to sonification design is groundbreaking because it dispels the barriers of previous conceptions about the practice, and initiates a perfect moment for designers, artists, and storytellers to embrace sonification as an open, creative form of expression. From the perspective of designers, the use of sonification presents an opportunity for exploration, creativity, and innovation that should not be limited by rigid convention or protocol. The planted seeds of shifting sonification practices are sure to flourish into an unexpected and diverse garden of design outcomes in the near future.

A possible avenue for building a bridge between information design and the unfamiliar realm of data sonification is by combining it with visual methods. Audiences may find comfort in the experiential grounding of an image or physical artifact, bringing their preexisting acquaintance with visual navigation to the experience. With this familiar framework, one may then be inclined to lean further into the piece, absorbing its sonic quality as well. Furthermore, "audio-visual congruent presentation" of information may be particularly impactful on cognitive processing and eliciting emotional response (Pan et al., 2019). While this approach may be tempting to a seasoned visual editor, it runs the risk of limiting a designer's willingness to branch away from techniques familiar to them. Designers should question whether they are truly employing their own creativity and expanding their own concept of information design methodologies.

The synergy between data sonification and design perspective is absolutely essential. Design can benefit from data sonification as a compelling tool of information communication, and data sonification can benefit from design through intentional aesthetic craft. Information designers wield the power to impact audiences with their craft, and this has social and cultural weight. Furthermore, there is an unbreakable link that exists between design and innovation, and the language inherent to design naturally pushes industries forward (Hernandez et al., 2018). Designers seek product solutions with curiosity, implementing new approaches consistently; as such, design-driven output can produce interesting new forms of communication and data representation. Channeling this curiosity towards data sonification can expand the designer's toolbox of iterative, performative, and exploratory design methods. From a user experience perspective, there is great benefit as well – experiencing information through multiple modalities can actually be beneficial for memory retention and an association of distinctiveness (Matusz et al., 2017). Additionally, just as changing one's typical routine can activate the brain in a helpful way, consuming information through

diversified modalities that include audio could ultimately be a more colorful and fulfilling way to experience the world. If designers choose to leverage the power of audio, wielding it with great intention and thoughtfulness, their creative output can certainly help to fortify the synergy of sonification and design.

6. Inclusivity and Accessibility Solutions with Sonification

6.1 The Problem of Exclusivity in Traditional Design

Most often, products are designed with good intent, educational resources are crafted with high hopes, and research projects are shared with enthusiasm – yet almost just as often, these manifestations of design processes are ultimately made without keeping a wide enough range of potential audiences in mind. Conventionally, designers have viewed accessible design as a separate, isolated process for a specific slice of the population. Designers may often fall into intuitive tunnel vision of creating for able-bodied users without fully considering different capabilities across user groups. In discussing a practical approach to inclusive design, Keates et al. point out that even when designers create accessibility-focused products, they focus on disabilities – but for better inclusivity, "principal concern for a designer should be physical capabilities, irrespective of cause" (Keates et al., 2000).

The problem of exclusivity is further exacerbated by evolving technologies, for example when changing user interfaces generate new challenges to users that could get missed in the design phase. In this environment of ever-changing technology, designers might need to further research the subtleties of features and devices that become paired with their product. It could be that designers are creating for the user rather than with the user; exclusivity often arises from a non-participatory process, rather than "a design process where the end user contributes to the development and life cycle of the product or system, through his/her perspectives and needs" (Moreira da Silva, F. 2023). A positive aspect of changing technologies is that more avenues of accessibility are introduced, as we are given access to higher quality screens, speakers, automation mechanisms, materials, communication devices, and beyond. However, with a broader range of possibilities comes the challenge of finding an optimized solution in a potentially overwhelming design space.

As information design outcomes are so often visual, it could be the case that creators are building projects with the assumption that consumers of this information are endowed with sight, or simply presume that solutions for individuals outside of the sighted population are not an option. Where visual representation of information may be exclusive, data sonification can offer a helping hand.

6.2 Sonification for Improved Inclusivity in Design

Data sonification as an accessibility solution can act either as a replacement to visual design or an augmentation of visual design. Approaching the integration of sonification as an augmentation of design may have successful effects for more inclusive solutions, as it considers the extension of design features to welcome in an additional swath of users in addition to pre-existing users. With the lens of design augmentation rather than replacement, and sonification in mind, the powerful combination of audio and visual components should be considered. Auditory graphs, which simultaneously contain both a data visualization component and an accompanying sonic representation of the data, provide an apt example. Imagine a digitally embedded time-series line graph with a call-to-action component that initiates a sonification composition reflecting the same temporal trend. In a 2010 study comparing sighted and non-sighted user interaction with auditory graphs, Walker et al. found that both groups of study participants were able to effectively derive understanding of the data, sharing many preferences in graph design, with certain exceptions across the groups (Walker et. al 2010). This offers another reminder to include users of varying abilities in the design process.

Another example of potential sonification solutions arises in the challenging case of geographical navigation aids and digital cartography design: "Google Maps and ESRI products are the standard mapping solutions for governments, schools, and other institutions (Cal fire, 2019), and they are completely visual," with highly-limited and expensive auditory alternatives (Biggs, 2019). Biggs discusses a series of studies testing audio-based and tactile map navigation solutions, finding that there is potential to develop truly inclusive "nonvisual navigation experiences," by combining a "turn by turn navigation solution with a detailed cross-sensory map" (Biggs, 2019). Bigg's subsequent work features Audiom, "an auditory and text-based dynamic web-based digital map, [which] can be embedded into almost any application or website" (https://www.audiom.net/). Data sonification is applied here as the user navigates the auditory map with keyboard arrows, receiving sonic feedback about geographical placement, directionality, and proximal entities.

Sonification can also be used in the context of science and education to provide accessible, audio-based tools for researchers or students who may not be able to rely on sight to conduct their work. Take the example of the Accessible Oceans project, from the Woods Hole Oceanographic Institution. Senior scientist Amy Bower and a collaborative team of researchers are exploring the ways in which auditory perception and data sonification can be harnessed to improve accessibility in science education and research. In creating several prototypes combining auditory display, sonification, narration, and music,

a goal of their efforts is to "enhance the perception and understanding of ocean data for visitors to museums, aquariums and science centers, including those who are blind or have low vision" (Accessible Oceans, WHOI, 2024). Designing user experiences to include sound is vital to transforming educational environments for improved inclusivity, and data sonification is being used here to achieve that needed change.

Whether one considers inclusivity solutions through the lens of sonification as a replacement for the purely-visual design or an extension of it, the auditory representation of data can transform the outcome of design in a multitude of contexts. Multi-sensory sonification solutions are highly inclusive and ideal in many contexts, as we find with the mentioned examples of audio-visual graphs, multimodal geographical maps, and sonified oceanographic data. But there are also plenty of possible applications for sonification to be used in radio, podcasts, and voice-assistive technology, which can be purely auditory. The goal is to reduce exclusivity in how we design, communicate, and share information. Data sonification achieves this beautifully by including users who are visually impaired or blind.

7. Practical Starting Points, Challenges to Integration, and Future Work

7.1 How Designers Can Get Started with Data Sonification

For designers and communicators interested in getting started with data sonification, it's best to start simply. It's helpful to pick a topic that is of personal interest to the designer, and start with a data set that contains just two columns for the x- and y-axis. Due to the fact that the act of listening is inherently temporal, with a beginning and ending (unless an application allows for user interaction and/or navigation), time-based data often works quite well for intuitive sonic output. Thus x will be mapped temporally, and y will be sonified based on the creator's choices for sound synthesis. However, this is in no way a rule; data can be derived from textual documents, geographical patterns, or other sources that are not linked to time. A designer will also want to think about the characteristics of their sound synthesis; perhaps the sounds implemented will relate directly to the data narrative through metaphor, or perhaps the numbers are mapped to pitch or volume to show a trend. The sonification may be temporally condensed or stretched out over time. It may be calming, or jarring, or musical, or neutral. It may also be helpful for designers to refer to the existing sonification design schemas mentioned in Section 5.2, such as The Data Sonification Canvas, which provides a conceptual framework for solving a sonification design problem.

There are a handful of easy-to-use web tools which allow a user to upload a data set, and adjust parameters to automatically sonify their data. Some of these include TwoTone.io (https://twotone-midiout-beta.netlify.app/), Highcharts Sonification Studio (https://sonification.highcharts.com/#/app), and DataSonifyer (https://studio.datasonifyer.de/en). There are also tools which do require some code but which offer abundant documentation, such as Sonic Pi (https://sonic-pi.net/), Supercollider (https://supercollider.github.io/), Highcharts (https://www.highcharts.com/), and Tone.js (https://tonejs.github.io/). If one is already comfortable using digital audio workstations (DAWs) and audio editors, such as Logic Pro X, Adobe Audition, Audacity, or GarageBand, sonification can be done manually in these editors, or by using a MIDI-generating tool such as csv-to-midi (https://csv-to-midi.evanking.io/) and importing the MIDI file into a DAW.

However, one myth that should be dispelled up front is the idea that "sonification requires computer skills" or even a traditional data set – in actuality, there are plenty of analog and manual techniques for creating sonification projects. In the Open Sonifications manifesto, authors Wirfs-Brock, Perera, and Geere offer up a sonification that only requires one's physical hand and voice: place your hand in front of you, and assign a base note to your thumb that you can sing or hum aloud; then, according to the heights of your other fingers, extrapolate the higher pitched notes; sing each finger in succession and hear how it sounds (2024). Their method highlights the progressive idea that "anything can be a dataset," allowing the sonifier to have a sense of "agency" and empowerment (p. 8).

Finding inspiration by browsing sonification examples also has substantial merit; by gaining more exposure to the work of other sonification designers, it becomes easier to wrap one's mind around what is possible to sonify, and even spark new project ideas. An exceptionally useful resource is the Data Sonification Archive (https://sonification.design/), which currently lists 452 sonification project examples across multiple disciplines. For more artistic applications, one can also explore the Sonification Art blog (https://sonificationart.wordpress.com/). Scouring the internet is also encouraged, as there will always be new examples emerging.

Another helpful step to take in familiarizing oneself with sonification is by connecting with existing communities of practitioners. If more information designers engage with these interdisciplinary communities of scientists, coders, artists, journalists, and beyond, the culture around sonification methodology will inevitably expand and improve. Some currently active communities include the Decibels Community (https://decibels.community/), a Discord-based group sharing ideas and tips about sonification; the International Community for Auditory Display (https://icad.org/), a well-established organization with ample conference proceedings to explore; and the Sonification World Chat (https://sonificationworldchat.org/). The Decibels Community in particular

has also published documentation about how to get started with data sonification. In a domain where paths are not always defined, these groups of sonification enthusiasts provide a welcoming anchor.

7.2 Current Challenges and Limitations Regarding User Experience and Technology

A primary challenge regarding sonification and user experience is that audiences may desire comfort and familiarity when it comes to information consumption. Social media scrolling has become a highly-familiar method of engaging with content, and users may not always have the patience or interest to listen through a data sonification. Many users also consume informative content in public, not necessarily wearing headphones or earbuds, and keeping their phone on silent. In this mode, they might miss a sonification entirely. This also highlights the attachment to the visual modality – most social media platforms are highly focused on visual presentation, which would require the combination of audio and visual components for sonifications to be shared on these platforms. What would make audiences more interested in and comfortable with listening to sonified data? It may come back to the hands of the designer to make the content fun, interesting, and even surprising in order to engage the user. Additionally, as social network platforms continue to evolve, there may be more opportunities for audio-focused content. The domain of podcasting also presents a promising opportunity for sonification to become more familiar for audiences, as more and more people listen to news, interviews, stories, and more in podcast form.

Another challenge for the sonification community is the transition out of the highly academic, analytical approach that dominates sonification practices at this juncture. Many sonification projects have been made by and for listeners within academia, and this excludes a wider population of artists, researchers, and communicators from other disciplines who could make great contributions to the field. The language around sonification needs to evolve, so that it can become more relatable to a wider audience. It could be helpful to develop more analogies to help people understand what sonification is, and adjust the definitions of sonification to be more welcoming to a wider range of creators.

Another challenge to the sonification creator is the transition from tool output to final presentation. For example, tools such as TwoTone.io, DataSonifyer and Sonic Pi require that the designer record or export an audio file, but then it is up to the designer to integrate this file into their final project. This adds another layer to the process which requires more effort and creativity. Creators who are comfortable with audio editing may easily weave an audio file into a podcast or sound art piece, but there are limited options when it comes to deciding how to embed audio into a webpage, for example. Audio-visual tools such as the Highcharts Sonification Studio allow for video export,

but lack the feature of embeddable code for chart integration into a webpage, requiring the user to find a workaround. The full Highcharts library allows users to embed audio charts directly into a webpage and endlessly customize dimensions and visuals, but this requires knowledge of front-end web development, which designers may not necessarily have in their skillset.

Another challenge for user experience is related to the quality of audio that is emitted from technological devices. It is common to listen to audio through phone or laptop speakers, but these may not always capture the subtleties of a sonification composition. Headphones are ideal in order to notice adjustments in audio parameters such as stereo image movement, variations in tone and texture, and so on. Designers may feel constrained around sound synthesis choices if they expect their targeted audiences' method of content consumption to have subpar audio quality. As the caliber of speakers, headphones, and earbuds continue to improve, this may be less of an issue in the future.

Additional tool development is needed to make sonification easier to integrate with a wide range of digital platforms. The existing web applications have limited features for exporting projects, and this presents a significant obstacle for accessibility and platform integration. Tools need to be relatively easy to use, while still maintaining customizable features for creating a unique sonification. Tools need improved integration features so that designers can more easily embed their projects into web pages and social media platforms. Designers may also need to try a variety of methods that do not depend on web applications. For example, they could include their own acoustic recordings, define their own parameter mapping functions, and/or use digital audio workstations to edit sound manually. In this respect, the current limitations can be considered beneficial, incentivizing creators to use more creative methods for data-driven audio.

7.3 Future Work and Applications of Multimodal Design

Data sonification practitioners and researchers are exploring what the future could sound like, and how data sonification may arise in our world of emerging technologies which are ultimately intertwined with design practice. For example, Jordan Wirfs-Brock points to voice assistant technology as a pertinent application for data sonification, exploring the prospect of voice assistant devices help you to sonify one's emotional states, log them over time, and reflect back to cultivate a deeper understanding a data set derived from personal experience (Wirfs-Brock, 2021). Wirfs-Brock's research also explores design prospects for voice assistant technologies to interpret personal music streaming behavior through data-as-sound, revealing possible personal informatics insights and new design solutions (Wirfs-Brock, 2020). Another future application of data sonification in the realm of design could be

in the context of educational art museum experiences. Through implementations of augmented reality, researchers Dam et al. have examined the effects of sonification as a supplement to the visual art experience; generating an algorithm-created sonification to accompany a series of paintings from the genres of Abstract, Impressionist, Realist, and Renaissance (Dam et al., 2024). They found that the experience produced the most positive user feedback, improving sentimental reaction and increasing engagement. A particularly promising future (and present) application of sonification is in the realm of data journalism, which has already witnessed an array of impactful sonification examples in publications, podcasts, and radio shows. In publication form, consider "Nine Rounds a Second: How the Las Vegas Gunman Outfitted a Rifle to Fire Faster" from The New York Times (https://nyti.ms/3D8Ie4A). This data sonification shows the speed of the 2017 Las Vegas shooter's outfitted weapon, as compared with a fully automatic weapon . In podcasting, consider "The Natural Lottery: Betting on climate change at the end of the Earth," from Loud Numbers: A data sonification podcast (Geere and Quick, 2021: https://www.loudnumbers.net/). This data sonification takes foreboding climate data and turns it into a techno track. And in radio, consider "What sound does a volatile stock market make?" from Marketplace (Wirfs-Brock, Ryssdal, and Fam, 2020: https://www.marketplace.org/2020/03/31/the-sounds-of-a-volatile-stock-market/). This piece is a 12-second sonification of the stock market from Jan. 2, 2020 to March 27, 2020, where each second represents a week of trading. These examples demonstrate how effective sonification can be for a method of data-driven storytelling.

Further research and discussion is needed to understand how design and data sonification can mesh further, with particular need to study the impact of design-oriented data sonification on listeners. As the small field of data sonification expands, and designers continue contributing to this field, there will be more diverse and expansive access to a range of sonification projects whose success can be studied. Designers should explore the relationship that their intended audience have with audio as a format for information consumption and communication, keeping it in mind as they explore the realm of data-driven audio. This paper addresses a selection of previous research endeavors investigating the link between design and sonification, and calls for these research efforts to continue. It addresses the excessive reliance on visual modalities in the field of design, which has created a rigid attachment to this format. It calls for a shift away from the purely-visual, pointing out the power of design-conscious audio arrangement to stir audience emotion and idea retention, encouraging designers to apply their expertise to the method of sonification. It argues that data sonification has the power to shift audience expectations, expand the designer's mindset, and break boundaries in the realm of design through innovative practices. It addresses the benefit of sonification for accessibility and inclusivity, and the capacity

for this method to break down existing barriers of exclusivity in design. Finally, this paper offers practical starting points for designers to start creating sonifications, including theory, tools, and community; it also addresses distinct challenges of sonification and speculates about future work in the field. Data sonification is an emerging method that requires design-conscious thought, creativity, and experimentation. As shown in previous work, it has the power to resonate with audiences and to convey profound meaning. Information designers are sure to benefit from using this unique method, and in doing so can expand the field of design as a whole.

References

Pettersson, R. (2014). Information Design Theories. Journal of Visual Literacy, 33(1), 1–96. https://doi.org/10.1080/23796529.2014.11674713

Hermann, Thomas & Hunt, Andy & Neuhoff, John. (2011). The Sonification Handbook.

Kramer, Gregory; Walker, Bruce; Bonebright, Terri; Cook, Perry; Flowers, John H.; Miner, Nadine; and Neuhoff, John, "Sonification Report: Status of the Field and Research Agenda" (2010). Faculty Publications, Department of Psychology. 444. https://digitalcommons.unl.edu/psychfacpub/444

Jordan Wirfs-Brock, Maxene Graze, Laura Devendorf, Audrey Desjardins, Visda Goudarzi, Mikhaila Friske, and Brian C Keegan. 2022. Sketching Across the Senses: Exploring Sensory Translation as a Generative Practice for Designing Data Representations. In Extended Abstracts of the 2022 CHI Conference on Human Factors in Computing Systems (CHI EA '22). Association for Computing Machinery, New York, NY, USA, Article 92, 1–7. https://doi.org/10.1145/3491101.3503712

Jordan Wirfs-Brock, Alli Fam, Laura Devendorf, and Brian Keegan. 2021. Examining Narrative Sonification: Using First-Person Retrospection Methods to Translate Radio Production to Interaction Design. ACM Trans. Comput.-Hum. Interact. 28, 6, Article 41 (December 2021), 34 pages. https://doi.org/10.1145/3461762

Lenzi S., Ciuccarelli P., Liu H., Hua Y. 2020. Data Sonification Archive. http://www.sonification.design.

Lenzi, S., & Ciuccarelli, P. (2020). Intentionality and design in the data sonification of social issues. Big Data & Society, 7(2). https://doi.org/10.1177/2053951720944603

Lenzi, Sara & Terenghi, Ginevra & Moreno, Aitor. (2020). A design-driven sonification process for supporting expert users in real-time anomaly detection: Towards applied guidelines. 7. 163994. doi: 10.4108/eai.13-7-2018.163994

College of Arts, Media and Design < Northeastern University Academic Catalog. (2024). Northeastern University Academic Catalog. Retrieved July, 2024, from https://catalog.northeastern.edu/graduate/arts-media-design/

Edward R. Tufte. 1986. The visual display of quantitative information. Graphics Press, USA.

Edward R. Tufte. (1990). Envisioning information. Graphics Press, USA.

Kahn, Paul. (2019, September 13). "Global Information Design, Part 1: A New Framework for Understanding Data Visualization." Nightingale: Journal of the Data Visualization Society. https://nightingaledvs.com/global-information-design-a-new-framework-for-understanding-data-visualization/

Weber, Wibke & Engebretsen, Martin & Kennedy, Helen. (2018). Data stories. Rethinking journalistic storytelling in the context of data journalism. Studies in Communication Sciences. 18. 191-206. 10.24434/j.scoms.2018.01.013.

Webber, K.L. & Morn, J. (2019). Limitations in data analytics: Considerations related to ethics, security, and possible misrepresentation in data reports and visualizations. IHE Research Projects Series, 2019-003. Retrieved from: https://ihe.uga.edu/sites/default/files/inline-files/Webber_2019003_paper_0.pdf.

A. Saktheeswaran, A. Srinivasan and J. Stasko, "Touch? Speech? or Touch and Speech? Data Sonification and the Power of Audio:Breaking Boundaries of Information Design with Creativity, Accessibility, and Innovation Investigating Multimodal Interaction for Visual Network Exploration and Analysis," in IEEE Transactions on Visualization and Computer Graphics, vol. 26, no. 6, pp. 2168-2179, 1 June 2020, doi: 10.1109/TVCG.2020.2970512.

Content Science Review. (2022, August 1). "Multimodal Design and UX: A Q&A with Designing Across Senses." Content Science Review. Retrieved July, 2024, from https://review.content-science.com/multimodal-design-and-ux-a-qa-with-designing-across-sens es/

Pontis, Sheila. "Defining information design" (2015, March 9). Sheila Pontis. Retrieved August 1, 2024, from https://sheilapontis.com/2015/02/11/defining-information-design/.

Briones MA (2018). Egypt Building Collapses. https://alterna tive-narratives-vis-archive.com/case_studies/egypt-build ing-collapses.html/. Retrieved August 4, 2024 from https://egyptbuildingcollapses.org/.

Valentina D'Efilippo, Arpad Ray, and Duncan Geere. "London Under the Microscope." (November 2021). Commissioned by The Museum of London. https://vimeo.com/571217327.
NASA. (2024, February 28). "Listen to the Universe: New NASA Sonifications and Documentary." https://www.nasa.gov/missions/chandra/listen-to-the-universe-new-nasa-sonifications-and-doc umentary/.

The National Aeronautics and Space Administration (NASA). "Webb Sonifications: Explore Webb's images and data - through sound." Retrieved July, 2024, from https://science.nasa.gov/mission/webb/sonifications/

Geere, Duncan. (2020, December 8). "Telling Stories With Data & Music: Exploring a new approach to sonification" Nightingale: Journal of the Data Visualization Society. https://medium.com/nightingale/telling-stories-with-data-music-f60ac0b5f1be

Briggs, Jim. (2016, June 18). "A sonic memorial to the victims at Orlando's Pulse nightclub." Reveal at The Center for Investigative Reporting. https://revealnews.org/blog/a-sonic-memorial-to-the-victims-at-orlandos-pulse-nightclub/

Adnan Mehmood Bhatti, Muhammad Majid, Syed Muhammad Anwar, Bilal Khan. "Human emotion recognition and analysis in response to audio music using brain signals." Computers in Human Behavior, Volume 65, 2016. Pages 267-275. ISSN 0747-5632, https://doi.org/10.1016/j.chb.2016.08.029.

Ricardo J. Hernández, Rachel Cooper, Bruce Tether, Emma Murphy. "Design, the Language of Innovation: A Review of the Design Studies Literature." She Ji: The Journal of Design, Economics, and Innovation, Volume 4, Issue 3, 2018. https://doi.org/10.1016/j.sheji.2018.06.001.

Pawel J. Matusz, Mark T. Wallace, Micah M. Murray. A multisensory perspective on object memory. Neuropsychologia, Volume 105. 2017. Pages 243-252. ISSN 0028-3932. https://doi.org/10.1016/j.neuropsychologia.2017.04.008.

Moreira da Silva, F. (2023). Inclusive Design is Much More Than the Opposite of Exclusive Design. In: Martins, N., Brandão, D., Paiva, F. (eds) Perspectives on Design and Digital Communication III. Springer Series in Design and Innovation, vol 24. Springer, Cham. https://doi.org/10.1007/978-3-031-06809-6_10

Simeon Keates, P. John Clarkson, Lee-Anne Harrison, and Peter Robinson. 2000. Towards a practical inclusive design approach. In Proceedings on the 2000 conference on Universal Usability (CUU '00). Association for Computing Machinery, New York, NY, USA, 45–52. https://doi.org/10.1145/355460.355471

Walker, B. N. and Mauney, L. M. 2010. Universal design of auditory graphs: A comparison of sonification mappings for visually impaired and sighted listeners. In Proceedings on the 2000 conference on Universal Usability (CUU '00). Association for Computing Machinery, New York, NY, USA, 45–52. https://doi.org/10.1145/355460.355471

Biggs, Brandon. 2019. Designing Accessible Nonvisual Maps. Submitted to OCAD University in partial fulfillment of the requirements for the degree of Master of Design in Inclusive Design (2019, 14 May). https://openresearch.ocadu.ca/id/eprint/2606

Audiom. https://www.audiom.net/

Accessible Oceans. 2024. Woods Hole Oceanographic Institution. "Accessible Oceans" research project, funded by the National Science Foundation (NSF 2115751). https://accessibleoceans.whoi.edu/

Jordan Wirfs-Brock, Sarah Mennicken, and Jennifer Thom. 2020. Giving Voice to Silent Data: Designing with Personal Music Listening History. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (CHI '20). Association for Computing Machinery, New York, NY, USA, 1–11. https://doi.org/10.1145/3313831.3376493

Abhraneil Dam, YeaJi Lee, Arsh Siddiqui, Wallace Santos Lages, Myounghoon Jeon, Audio augmented reality using sonification to enhance visual art experiences: Lessons learned, International Journal of Human-Computer Studies, Volume 191. 2024. 103329, ISSN 1071-5819. https://doi.org/10.1016/j.ijhcs.2024.103329.

Lenzi, S., Terenghi, G., & Moreno-Fernandez-de-Leceta, A. (2020). A design-driven sonification process for supporting expert users in real-time anomaly detection: Towards applied guidelines. EAI Endorsed Transactions on Creative Technologies, 7(23), e4. https://doi.org/10.4108/eai.13-7-2018.163994.

Jordan Wirfs-Brock, Jamie Perera, and Duncan Geere. 2024. Open Sonifications: A Manifesto for Many Ecologies of Data and Sound. In Proceedings of the 2024 ACM Designing Interactive Systems Conference (DIS '24). Association for Computing Machinery, New York, NY, USA, 2660–2674. https://doi.org/10.1145/3643834.3660757.

Lenzi, S., & Ciuccarelli, P. (2020). Intentionality and design in the data sonification of social issues. Big Data & Society, 7(2). https://doi.org/10.1177/2053951720944603.

De Campo, Alberto. 2007. Toward a Data Sonification Design Space Map. Proceedings of the 13th International Conference on Auditory Display, Montreal, Canada, June 26 - 29, 2007. https://www.icad.org/Proceedings/2007/deCampo2007.pdf.

Lenzi, S., and Ciuccarelli, P. (2024) Designing tools for designers: The Data Sonification Canvas, in Gray, C., Ciliotta Chehade, E., Hekkert, P., Forlano, L., Ciuccarelli, P., Lloyd, P. (eds.), DRS2024: Boston, 23–28 June, Boston, USA. https://doi.org/10.21606/drs.2024.730.

International Community For Auditory Display. https://icad.org/.

Decibels Community. https://decibels.community/.

Jordan Wirfs-Brock. 2021. Learning to Listen to Data: Voice Interaction, Sonification, and Narrative. In Companion Publication of the 2021 ACM Designing Interactive Systems Conference (DIS '21 Companion). Association for Computing Machinery, New York, NY, USA, 7–10. https://doi.org/10.1145/3468002.3468231.

Barrass, Stephen & Vickers, Paul. (2011). Sonification Design and Aesthetics. In book: The Sonification Handbook (pp.145-172)Publisher: Logos VerlagEditors: Hermann, Thomas and Hunt, Andrew D. and Neuhoff, John.

Larry Buchanan, Jon Huang, and Adam Pearce. (2017, October 5). "Nine Rounds a Second: How the Las Vegas Gunman Outfitted a Rifle to Fire Faster." The New York Times.
Data Sonification and the Power of Audio:
Breaking Boundaries of Information Design with Creativity, Accessibility, and Innovation
https://nyti.ms/3D8Ie4A.

Duncan Geere and Miriam Quick. (2021, June 5). "The Natural Lottery: Betting on climate change at the end of the Earth." Loud Numbers: A data sonification podcast. Season 1, Episode 1. https://www.loudnumbers.net/.

Jordan Wirfs-Brock, Kai Ryssdal, and Alli Fam. (2020, March 31). "What sound does a volatile stock market make?" Marketplace. https://www.marketplace.org/2020/03/31/the-sounds-of-a-volatile-stock-market/.

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“PLACES TO LEARN — CULTURAL HERITAGE ENRICHMENT MODEL (CHEM) FOR TRANSFORMATION AND INNOVATION THROUGH ART AND DESIGN”

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ABSTRACT | Places to Learn - Cultural Heritage Enrichment Model (CHEM) is a conceptualisation, a practical design tool to enrich the cultural heritage features and narratives of selected places through art direction, digital and tangible design, and Culture and Creative Industries (CCI) involvement. In addition, CHEM offers a solution towards better-functioning places that are aligned with the regenerative, e.g., ecological approach in design; vibrant places filled with design and art that are citizen and user friendly.

CHEM consists of four parallel digital and tangible design-research inquiries, based on culture-led innovation methods: first, to identify and analyse cultural heritage and shared values as constitutive elements of the vision of the place, and second to understand, interact, co-design and transform with a process of culture-led regeneration.

CHEM is replicable, transferrable and scalable to different contexts and cultures on small, medium and grand scales. It enables sustainable growth with CCIs and invites investment and tourism in the revitalisation of cultural parks, urban spaces and other sites of interest characterised as Places to Learn (P2L), enabling them to flourish.

KEYWORDS | PARTICIPATORY DESIGN, CREATIVE INDUSTRIES, SUSTAINABILITY, DIGITAL NARRATIVES, COMMUNITY ART, CULTURAL HERITAGE, TRANSDISCIPLINARITY

1. Introduction

CHEM design-research inquiries focus on unique regional cultural heritage narratives and items, converting them into digital and tangible design artefacts, which engage both the local citizens and entire ecosystem of CCI. CHEM enhances the attractiveness of heritage sites, urban districts and other Places to Learn (P2L) to visitors and investors. It also increases the sense of belonging and social inclusion among local citizens; furthermore, it integrates P2L into local ecosystems as vibrant places for cultural activity, learning, socialising, exercising and spending time with others through culture-led regeneration (Della Spina, Giorno, Galati Casmiro, 2019). These places become vibrant places to enjoy and to experience the four realms: namely, adding aspects of aesthetics, entertainment, education and, to a certain extent, art, as an imaginary escapism value to the places in a balanced and appealing manner (Pine, Gilmore, 2011). Each of the four specific design-research inquiries in CHEM produce tangible and digital artefacts, such as murals, active design elements, public art, installation art spiced with digital elements, digital narratives and characters in physical space, mixed reality production, cultural heritage routes with augmented and mixed reality elements and other innovative outputs that have a state-of-the-art quality.

When the art and design direction provided by CHEM is applied to its full potential, various actors and stakeholders benefit from the mutual flourishing of P2L. In many places and settings, CCI possess a tremendous unused potential in their capacity to offer meaningful contents for each place, regardless of the places' socioeconomical status (Della Spina, Giorno, Galati Casmiro, 2019). Cultural institutions, together with associations, cooperatives and design universities, can enhance the originality of places by advancing enriched cultural heritage that is visible on urban sites, inside art institutions and museums, as well as in outreach programmes and site-specific projects by museums and other cultural institutions (Stylianou-Lambert, Boukas, Christodoulou-Yerali, 2014).

By Places to Learn (P2L), CHEM refers to any public places that can manifest the cultural heritage lineage and legacy, e.g., libraries, shopping centres, parks and any heritage sites of interest. By adding public art, regenerative approach and active design to P2L, new forms of art intervention and functional design products with artistic touch emerge, such as drinking water fountains and electrical cabinets with decorations, any informative boards that can be enriched by artistic designs' visualisations, icons and symbols. Building facades invite art in the form of murals or digital art, especially in the dark months of the year; public parks and marketplaces can become playgrounds for young designers, performing artists and visual artists through collaborations and open competitions.

2. CHEM model transmitting cultural meaning, increasing attractiveness and strengthening the sense of belonging

The four lines of inquiries are based on the latest knowledge, and they enable achieving the expected outcomes within the timeframe of four years (48 months). The purpose is to engage local communities and citizens, especially youth – representatives of the limitless generation, who live and work in the mixed hybrid online-offline setting, through invitation to participate in community arts, drama-based pedagogical and service design workshop. This engagement aims to produce, devise and gather data that inform the four innovative design-research inquiries (sub-objectives, cultural-led innovation, models).

Design-research inquiries refer to complex design processes that are grounded in transdisciplinary research and culture-led innovation:

1. Active design elements in urban spaces aligned with regenerative design principles.
2. Cultural modular design inquiry realised with circular materials in urban spaces.
3. Re-imagining the past through digital storytelling (VR, AR, MR).
4. Installation art with digital elements (digital & physical interact).

CHEM integrates the three core principles of the New European Bauhaus (NEB), sustainability, inclusion and aesthetics, into the design-research inquiries. NEB is an EU policy and funding initiative launched by the European Commission in 2021. It fosters sustainable solutions for transforming the built environment and lifestyles under the green transition (European Union, 2021).

CHEM structure is based on a pedagogical model which consists of several interlinked inquiry processes and ways of knowing, in which the participants co-design by processing information and data to generate artefacts, knowledge objects and design products in both digital and tangible format (Haapaniemi, Leinonen, 2023). In the original model, all the inquiry types, the art-based, design-based, drama-based and technology-augmented inquiry processes, together contribute to the collaborative knowledge construction,

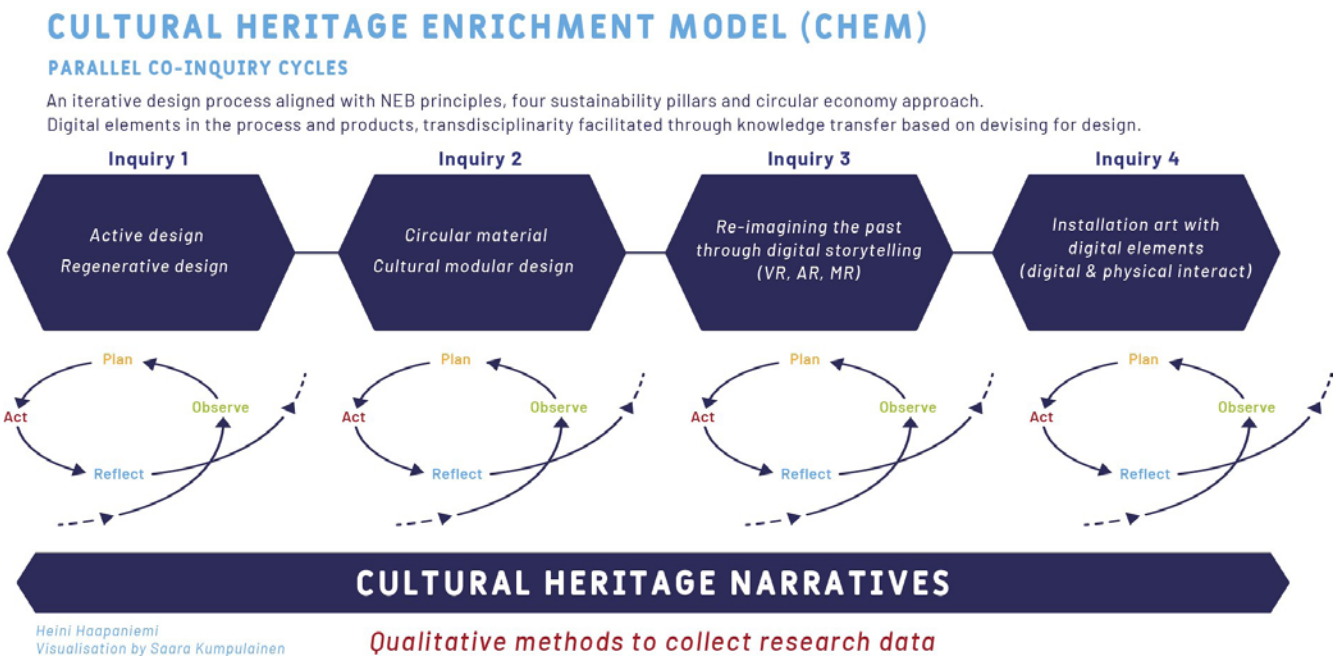

Figure 1. CHEM Parallel Inquiries, preliminary model modified from Haapaniemi and Leinonen (2023).

similar to the definition of progressive inquiry, "a pedagogical model for structuring and supporting a group of learners in a deepening questionexplanation process", peculiar to academic research groups (Haapaniemi, Leinonen, 2023; Hakkarainen, 2009). The separate, yet parallel and simultaneous, inquiries have dynamic influence on each other, yet they are four distinguished ways of constructing knowledge and co-designing: first, acquiring and processing knowledge and second, co-designing in a participatory and interdisciplinary manner (Haapaniemi, Leinonen, 2023). CHEM employs collaborative, participatory and art-based methodologies to inform design. Utilising a non-linear and iterative approach to address complex design challenges enables reflective practice in three dimensions of reflection-inaction: first, prior to designing; second, while designing; and third, after the design action, before the next loop begins (Haapaniemi, Leinonen, 2023; Schön, 2017).

Recurring iterations are characteristic of design processes. As explained in Author's model, each single co-inquiry cycle has, in reference to Heron and Reason, a pattern of Observe–Plan–Act–Reflect (Heron, Reason, 2002, p. 167 as cited in Khaner, Linds, 2015, p. 134), which has also been utilised as the bases of CHEM. Planning artistic and design direction entails thorough research on issues identified in the Observe phase and choosing the best methods to elicit more knowledge on the challenge or task at hand. Without first observing, studying the context and defining the problem, the shift to planning is not possible. Establishing criteria and considering enabling constraints are part of the Planning phase, which steers the Action phase.
The Action phase is based on a selected approach aligned with the methodology, which then leads to reflection on the process and its outcomes. Reflection can contain a comparison of alternative solutions and lead to another loop or stage with more complexity

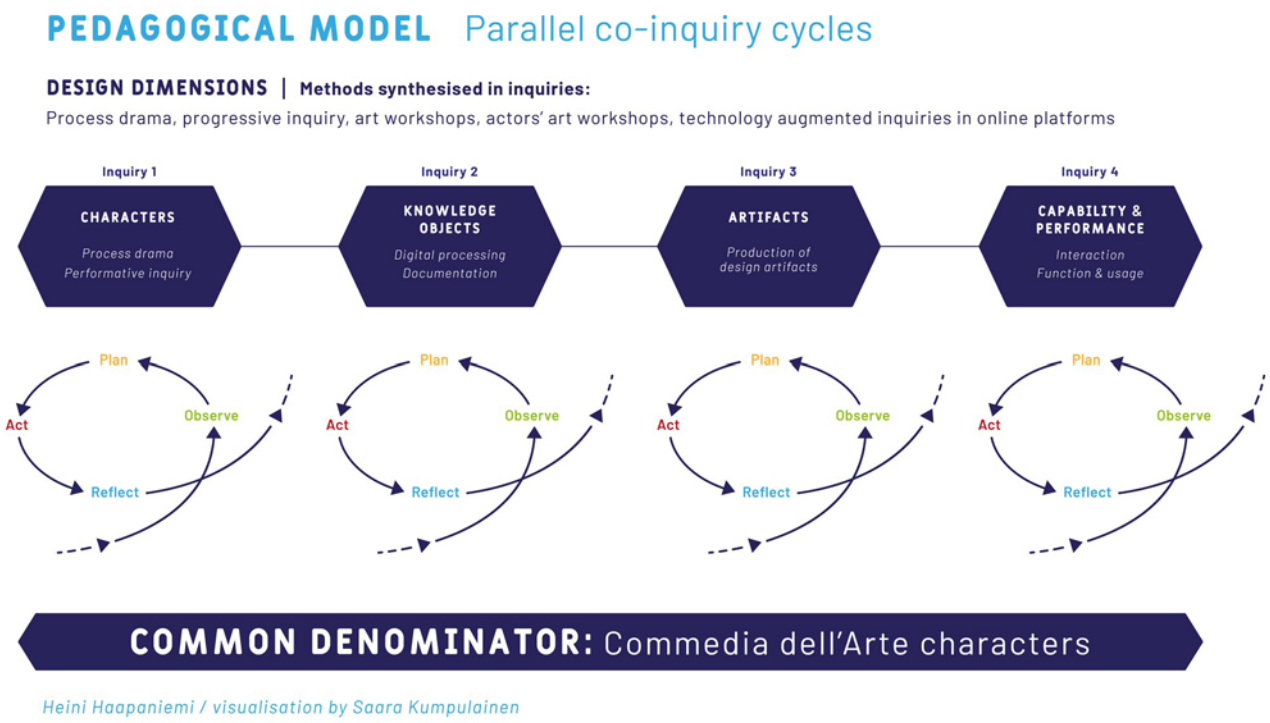

Figure 2. The Pedagogical model: Parallel co-inquiry cycles with four distinctive inquiry types and the common denominator Commedia dell'Arte characters as described in Haapaniemi and Leinonen (2023).

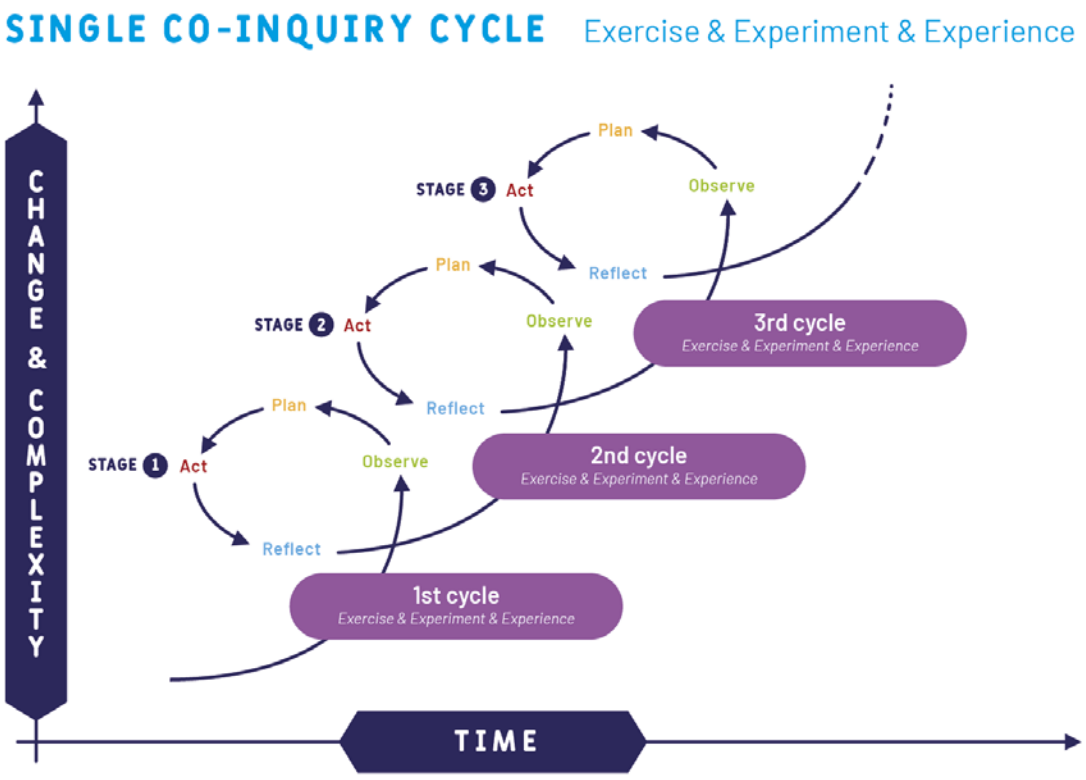

Figure 3. The iterative nature of a single co-design inquiry as visualised in Haapaniemi and Leinonen (2023).

based on the previous findings in the iteration cycles (Haapaniemi, Leinonen, 2023).

The model identifies three major components within the single 3E-inquiry cycles: Exercise, Experiment and Experience. The entire process acquires complexity as each single inquiry cycle enters the next loop of Observe–Plan–Act–Reflect (stage 1, 2, 3 and so on), and more time and resources are allocated to the process. For each stage, more time is invested in the knowledgebuilding activities based on the previous findings, prototypes, artefacts or other design outcomes (Haapaniemi, Leinonen, 2023).

Key features for impact in the model are collaborative co-design, multiplatform, multisensory, embodied art and design processes that acknowledge participants as active contributors in constructing knowledge together, and it uses technological platforms to enhance designing practices and iterative processes (Durall Gazulla, Bauters, Hietala, Leinonen, & Kapros, 2020; Friedman, 2003; Hakkarainen, Viilo, Hakkarainen, 2010; Hakkarainen, 2009; Hakkarainen et al., 2004). Focus is given to team processes and practices where interdisciplinarity, multimodality and embodiment are seen as a natural element of constructing knowledge, as the participants' mind and bodies react to relational experiences and work as a reference on how they might interpret them, first, in the design challenge and, second, receiving them in the future (Khaner & Linds, 2015, p.147). These generated realms of experiences are of utmost importance in promoting cultural sustainability: the ability of imagining someone else's experiences, interpreting their responses and feeling empathy – qualities and features at the core of transmitting cultural meaning and relevant cultural heritage narratives in the form of experiences (Laine, 2016; Pine, Gilmore, 2011). The significant stories become accessible through co-creation of digitally enriched installation art, digital narratives and mixed reality productions, as well as performances and visual artwork.

3. Replicability and transferability of CHEM

CHEM is replicable and transferrable to the versatile places of interest –P2L– and their multifaceted and diverse needs. CHEM provides a tool to intervene, reactivate and save the cultural heritage sites and their narratives at a reasonable cost, preserving them for future generations as cultural venues, attracting investment, and ensuring their reuse and preservation for the future, aligned with sustainability principles. CHEM activates the entire community through art-based methodologies to transform unique cultural heritage to high-quality design content, digital and tangible, to enrich the place, ensuring its appeal for tourists and investors.

Cultural heritage can be defined as the legacy of physical artefacts (cultural property), built and natural environment, and intangible attributes of a group or society inherited from the past. Old industrial sites, urban heritage sites and other P2L hold cultural significance for local communities and

tremendous potential for tourism as creativity hubs. Preserving the uniqueness of the P2L is very timely, otherwise they lose their tangible and intangible heritage aspects as the places deteriorate.

Built environment heritage sites include a variety of canals, mines, breweries, potteries, forges, railways, cotton mills, as well as industrial, urban and rural sites. These sites tell us as much about our heritage as celebrated archaeological sites, cathedrals and castles do. UNESCO World Heritage inscriptions number 1 199 across 168 countries (2023). The World Heritage Committee approved the extension of five sites and examined the state of conservation of 263 sites that were already inscribed in their 45th session, in September 2023, in Saudi Arabia. Historic England lists over 5 000 "at risk" heritage sites, representing a rise of 24 in 2023 compared to the previous year. According to the Finnish Heritage Agency, nationally significant built cultural heritage sites are located around the country, and the number of cultural environments exceeds 1 200, listed in the Finnish inventory of built cultural environments.

4. The four pillars of sustainability: the green shift and regenerative design

CHEM aims to foster cultural connection and social cohesion, aligning with the New European Bauhaus (NEB) principles and sustainability principles in four dimensions: cultural, social, economic and environmental, which are made visible and tangible at each step of the design procedures. The sustainability and responsibility efforts of universities, as well as cities and communities, are guided by the UN's Sustainable Development Program, Agenda 2030, consisting of 17 goals set collectively by the UN member states. The Agenda 2030 emphasises the interdependence of the goals and is the same for all countries, regardless of their developmental stage. Agenda 2030 recognises the importance of education and RDI activities in facilitating necessary changes. Currently, the four pillars of sustainability include dimensions of cultural, social, economic and environmental sustainability. Today, culture is included in many of the United Nation's Sustainable Development Goals (SDGs) from 2015: for example, safe and sustainable cities, reduced inequalities, gender equality, and peaceful and inclusive societies. Although the goals are grouped around the economic, social and environmental pillars of sustainability, culture contributes horizontally to each pillar. Further, economic, social and environmental pillars assist the development of cultural heritage and creativity (Hosagrahar, 2017).
Culture has both direct and indirect roles in sustainability, as proposed by researchers Soini and Birkeland (2014), after analysing scientific discourse on cultural sustainability. As summed up by UCLG (2018): "Cultural rights, heritage, diversity, and creativity are core components of human and sustainable development." Cultural perspectives have been recognised in sustainable development research with significant importance. Art,

design and culture are seen as significant dimensions in understanding major societal issues, such as sustainable development (Lewis, 2020; as highlighted in the British Council's research report, The Missing Pillar, British Council 2020; Hosagrahar, 2017; Lineberry, Wiek, 2016).

CHEM promotes social sustainability through participation in workshops, increasing inclusivity in cultural events and encouraging innovative approaches to heritage preservation. Sustainable practices are demonstrated by showcasing how investments in cultural heritage and CCIs promote sustainable methods, such as the adaptive reuse of historic buildings, integration of renewable energy and hosting of eco-conscious cultural events. Inclusive cultural engagement means ensuring that all events and workshops are accessible to diverse audiences. Social sustainability can be strengthened by championing cultural and social inclusivity, as well as celebrating and endorsing various minorities, marginalised groups, subcultures and indigenous heritages.

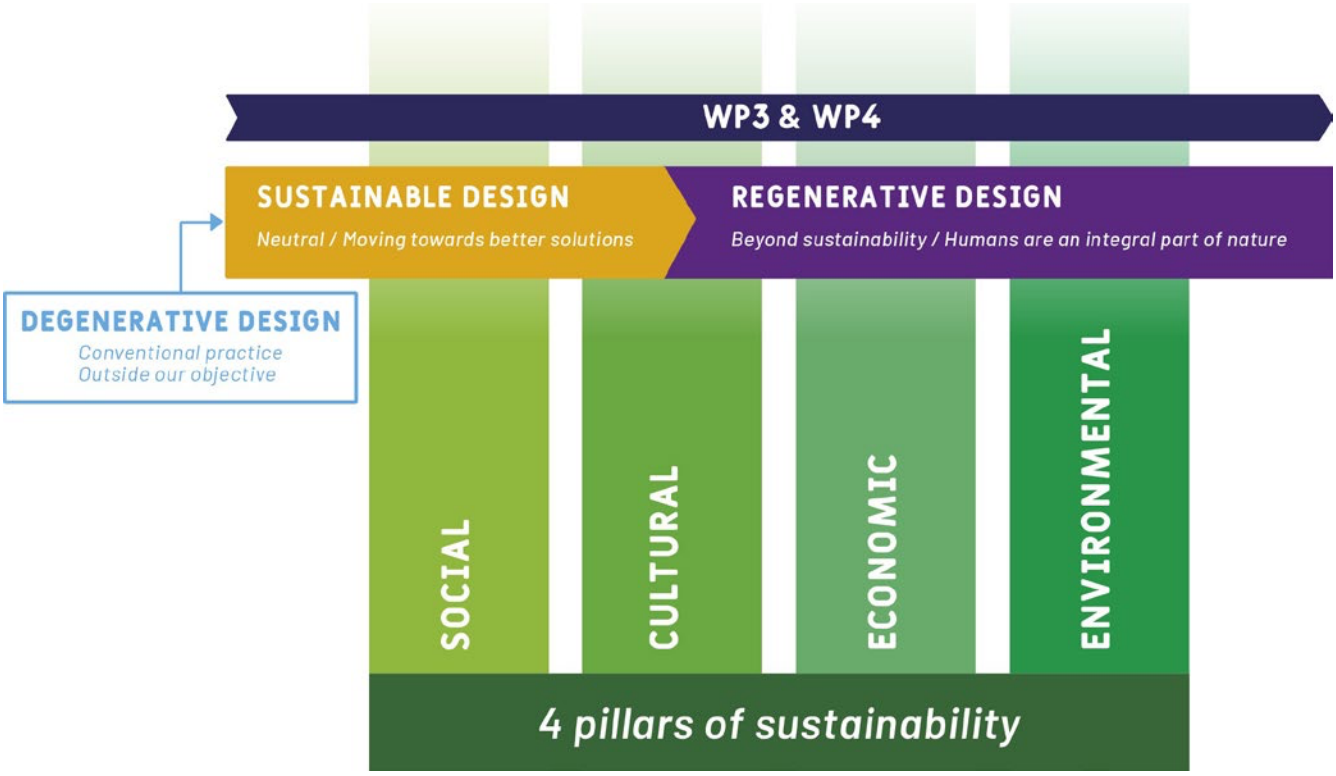

Figure 4. Regenerative design to address the 4 pillars of sustainability and reach beyond sustainable design by Haapaniemi, Kalmakurki, Savallampi and Vainio, visualisation by Kumpulainen.

In accordance with the Green Shift, emphasis in CHEM research design inquiries is given to ecological thinking and circular ideology in all four inquiries, particularly in applying them to the tangible, material elements of heritage-related design. Cultural modular design-research inquiry in CHEM realised with circular material highlights the importance of site-specific environmental factors. By moulding and prototyping with circular and recycled materials, the aim in CHEM is to reduce the carbon footprint by 70%. As a response to the climate crisis, the European Union is taking action and striving to become carbon neutral by 2050 (European Parliament, 2019; 2021).

Regenerative design encompasses the green shift and goes beyond the sustainable design principles (Cole, 2012). The principles of environmental sustainability are both a fundamental value and an integral part of CHEM processes, and the measures cut across the four dimensions of sustainable development horizontally. The goal is to move from sustainability towards regenerative design and development, where local actors, such as administrators, policy makers, CCI, entrepreneurs and citizens, are activated to implement the sustainability principles. Furthering reuse and recycling of materials from building processes and urban value chains, often referred to as "urban mining", reuse of architectural components and waste materials from other industries can all contribute extensively to local resource efficiency (Baiani, Altamura, 2022). These processes are integrated in CHEM in the Cultural modular design inquiry realised with circular material in urban spaces utilising demolition waste, replacing cement in construction with a Finnish circular-design-leading company, EcoUp (product Cubeco) and design universities' research units, BioSampo, Kymilabs and Creative Industries Research Unit, Xamk with design-research partners from France.

5. Transdisciplinarity, impact beyond academia and state-of-the-art CHEM

Transdisciplinary knowledge production includes non-academic stakeholders, together with various disciplines in academia, to address wicked problems and societal challenges to produce impact beyond academia (Caniglia et al., 2017). Transdisciplinary research produces knowledge that goes beyond the existing disciplines (Morton et al., 2015). It often draws from and contributes to hybrid fields that emerge around particular complex issues (Klein, 2017), such as sustainability in design and social engagement, as well as preserving cultural heritage in digital and tangible format with new interpretations and understanding of what heritage is. According to Seidl, it embodies a mission of science with society, rather than for society (Seidl et al., 2013); and it creates socially robust knowledge (Nowotny et al., 2003) by building on established methods to produce reliable knowledge. Transdisciplinary design research generates new networks and connections with societal impact. Therefore,

the transdisciplinary approach fits well with wicked problems that include elements of green transition and cross-innovation, also in a design context (Ferreira, Duxbury, 2017; Oliveira, 2016). Transdisciplinary research tackles transformations that involve versatile operators and horizontally cuts across the whole of society.

Service design helps find solutions with an optimal balance for all involved – organisations, entrepreneurs, customers and policy makers (Stickdorn, Schneider, 2012). Operational models, such as CHEM and the pedagogical model, are created in a systematic, solution-oriented and holistic manner, with special focus on design-related inquiry loops that are iterative, reflective and aligned with participatory design principles that foster co-development, co-design and user-centredness (Haapaniemi, Leinonen, 2023).

The integration of participatory art, design and co-creation methodologies in cross-innovation and urban development emphasises the significance of both the CCI and community involvement in designing appealing, aesthetical and regenerative urban spaces (Ventre, Cerreta, 2023; Ferreira, Duxbury, 2017; Oliveira, 2016). Cultural memory can be reactivated and reconstructed through digital storytelling that highlights the impact of immersive technologies (VR, AR, MR) in enhancing the understanding and engagement with historical and cultural heritage narratives (Fu, Mahony, Liu, 2023). Physical and digital spheres co-exist in immersive, three-dimensional installation art, highlighting the fusion of the two realms the public spaces to address the fragments of time; echoes of the past, the current time and transformations to the future, through new communication and interaction concepts for transformative experiences in 3D spaces (Tian, 2023). State-of-the-art technology in CHEM refers to incorporating innovative technologies, such as hologram-like digital characters, AR, VR and MR, and digital platforms, tools and processes to create digital design and multimodal installation art. The digital products, the process charts and the final models are deposited in the EU digital repository, the European Collaborative Cloud for Cultural Heritage (ECCCH), to give everyone access to the knowledge and data produced, aligned with the open science principles.

CHEM also investigates how digital technologies influence visitor engagement at heritage sites, emphasising the role of informal learning in enhancing visitor experience in the digital era and highlighting the shift from traditional methods of engagement to more interactive, digitally enhanced experiences, making heritage more accessible and engaging (Wang, 2022). To ensure state-of-the-art conservation, preservation and distribution through digitality, with ambitious maintenance of cultural richness and versatility in the digital age, CHEM includes a sub-framework of Cultural Heritage Information Systems (CHIS) to investigate user experience in relation to digital design processes and products, such as digitally enriched artefacts, objects and mappings.

6. Methodological framework of CHEM

To define the cultural heritage uniqueness of each place, data-gathering methodologies follow artbased, community engagement methods, aligned with ethnographic participatory-design principles, action research and creative, critical, communal and conceptual practice of inquiry (Blomberg, Burrel,
2009; Blomberg, Karasti, 2012; Robertson & Simonsen, 2012; Spinuzzi, 2005; Ventre, Cerreta, 2023; Thiollent, 2011). By engaging the community with CCI and art-based methodologies in collecting stories, devising narratives and gathering data to inform tangible and digital design, and installation art in public places, the transforming potential of art is acknowledged (Tian, 2023; Ventre, Cerreta, 2023; Wang, 2022). Participatory design and action research have been widely used in contexts where action, testing, observing, piloting and designing take place simultaneously in an iterative process (Blomberg, Burrel, 2009; Blomberg, Karasti, 2012; Somekh, 2005; Thiollent, 2011).

Participatory social research is an essential component strengthening the co-creation of knowledge. This involves diverse groups of citizens in the processes of shaping the memory and future of places (Laborgne et al., 2021; Lewin, Somekh, 2011). Participatory social research aims to link cultural heritage, the activities of artists, designers and activists, with the practices of cultural participants. These are mediated by art workshops and co-design inquiries and integrating the historical and social knowledge of the places being developed with the cultural expectations and practices of those involved. The criteria for rich data collection in CHEM consist of the following:

1. The quality of the artistic idea for the Cultural modular design realised with circular materials in urban spaces
2. The participatory dimension of the project – the inclusion of both residents and CCI representatives on an equal basis
3. Inclusiveness of the project
4. NEB principles integration: beautiful, sustainable, together
5. Usability for cultural heritage enrichment

The data collection phase is divided into two complementary phases. The first focuses on the critical analysis of the past of the places and processes involved in the project, to engage and integrate historical sources and wider stakeholders associated with the places and practices being developed. The first stage comprises of historical analysis, identity reconstruction and defining the genius loci for the selected cultural heritage areas. Both critical and participatory research techniques are used, including historical queries, expert interviews, scenario-workshop analysis, sentimental (meaning) mapping workshops with artists and stakeholders, to discover

and define the uniqueness of the cultural heritage of these forgotten cultural sites and the art and design practices attached to them. They can be used to learn about important moments, people and practices that define the memory of these cultural heritage areas. The process identifies not only important historical aspects and heritage moments, but also their current perception, impact and attributed meaning. The methods are complemented with art and drama workshop-based inquiries. Second, a methodology of social laboratory brings techniques and approaches of science and technology studies into the cultural realm, as researchers critically engage in the process of prototyping, production and implementation of the artistic interventions (Thiollent, 2011).

Participatory co-design, with an ethnographical approach, is used by conducting a hybrid, ongoing evaluation, seeking knowledge, skills and values flows between the involved actors, techniques, places and things, and to explore how the four pillars of sustainability (human, social, economic, and environmental) are defined and present during the artistic intervention process (Blomberg, Burrel, 2009; Blomberg, Karasti, 2012). The objectives of these phases are to ensure that the final culturalheritage-inspired design objects or products produced will entangle the cultural past with knowledge, skills, expectations and impressions of the various actors involved. The social-laboratory phase is concluded with a reflective meeting with the participants of the artistic interventions, to explore their perspective on the process. The final stage explores the impressions, perceptions and experiences of cultural-heritage-inspired artefacts among the audience (Pine, Gilmore, 2011).

Drama methodologies, led by professional drama pedagogues, seek to challenge the status quo. They imagine new possibilities of engagement, venturing across past-present-future boundaries of creative exploration and motivate fruitful dialogue (Dunn, 2016; Fels, 2015; Winston, Lin, 2015). Drama methodologies invite versatile social, cultural and political voices, unity, resistance, and creative presence inspired by the sites in which the data is collected (Ipid). Thus, the essence, narratives and aesthetics of each place are filtered through strong embodied presence. Engagement in these inquiries invites, challenges and questions the social and individual practices of participation. It seeks to voice new ways of engaging visitors and citizens alike and to understand who they are as individuals and as a community. Community Art focuses on artists' work with local inhabitants within that community, living in a specific place and building their identity around it. Community art strengthens the social fabric by activating the cultural heritage lineage and local stories derived from the community. The artist's task is not individual creative expression, but instead to serve as a facilitator, empowering and engaging the community, combining a participatory aspect with high aesthetic and artistic quality.

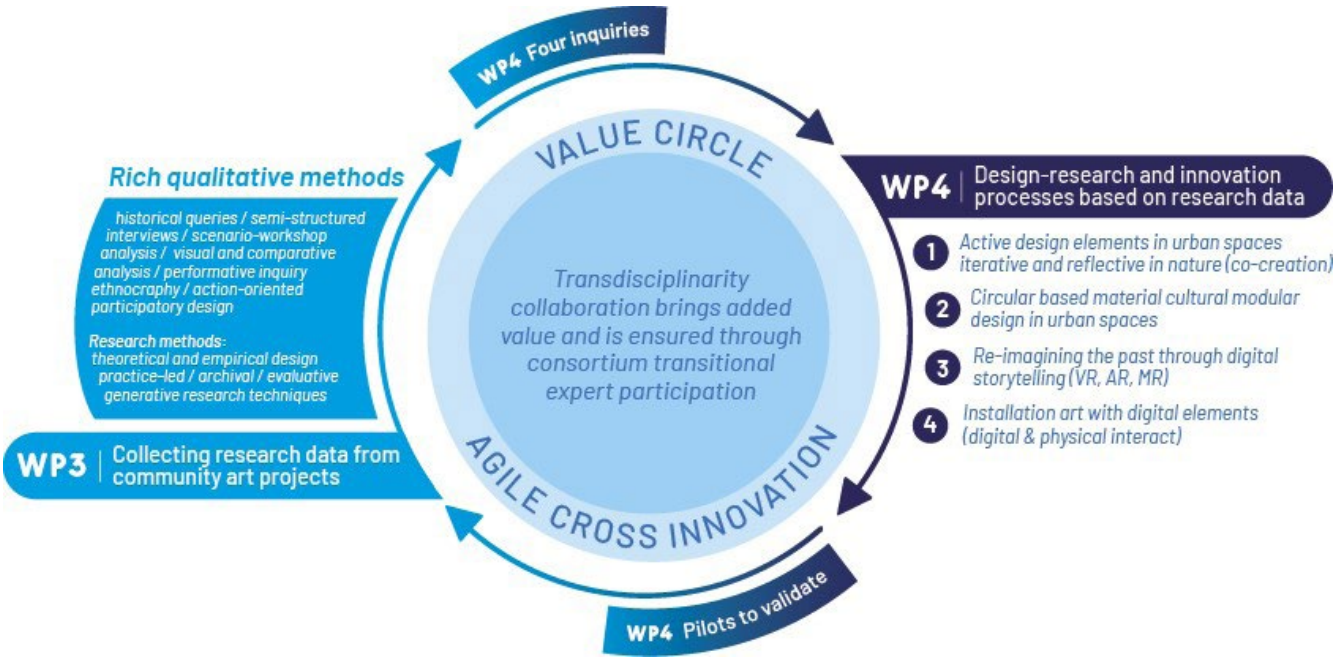

Figure 5. Value circle of the iterative process, where data collection and design-research inquiries intertwine by Haapaniemi, Kalmakurki and Vainio, visualisation by Kumpulainen.

The research-design inquiries are based on an interdisciplinary approach that encompasses the new advanced technologies, design, visual and performing arts. These are aimed to create a new ecosocial imagination for society, without distinction of race, gender and background, based on cultural heritage, a sense of belonging and site-specific dimensions. Iteration rounds for research-design inquiries, instead of a strict linear process, enable reflective lingering with the materials, forms, medium and the entire interdisciplinary co-design team, as CHEM pursues to have a wide spectrum and understanding of cultural heritage with indigenous nuances all transformed into products and artwork (Schön, 2017).

7. Ethics, gender balance, inclusion, diversity and representativeness

High ethical standards are consolidated by all parties participating in CHEM, in all phases of the activities, from collecting and devising the cultural heritage data through art-based methods, until the end products are exhibited. Informed consent from participants is requested prior to participation in the workshops. All participants' identities are anonymised, whether community art, drama pedagogy, ethnography, semi-structured interviews or observation. Preliminary data are stored in the cloud services, which require a two-factor authentication. When the cultural heritage data have been categorised, analysed, grouped and duly anonymised, it

will be stored in the ECCCH in accordance with the open science principles.

Gender balance, inclusion, diversity and representativeness are enhanced by creating a democratising, inclusive and polyphonic space for critical dialogue about the cultural heritage narratives of the past and their relevance today and in the future. Emphasis is given to inclusive stories evoked in compliance with equality and non-discrimination guidelines to provide representativeness, inclusion, diversity and ensure accessibility. On-site activities, exhibitions, community art and codesign workshops are organised at a low threshold, with free entrance to public places and cultural associate partners' premises. This promotes social and cultural inclusion, diversity and accessibility, as everyone is welcome to participate - different age groups, disabilities, minorities, cultural and language groups, genders including non-binary and transgender people, various local or global subcultures and marginalised people.

Societal resilience is promoted by strengthening the local cultural heritage narratives and providing a way for individuals and groups to express themselves and be heard, fulfilled and validated, not through commercialism but in deeply meaningful and valuable qualities that construct a local, sitespecific, individual and communal identity and sense of belonging. Especially with character-based interpretations of cultural heritage, the values and choices of people become central; the life situations are discussed and dealt with by addressing value sets denoted to different social groups, subcultures and minorities, women and non-binary included. Cultural heritage narratives that are derived from the lives of ordinary people, first nations, subcultures and minority groups, are equally valued and not preceded by the stories of majorities, kings and rulers.

8. Results, early findings, and conclusions

Expected outcomes of CHEM include the following:

1. Innovative solutions, validated in pilot trials, demonstrating how strategic investments in the spirit of the New European Bauhaus initiative in cultural heritage, which may include cultural landscapes, and the CCIs can be successfully realised.
2. Increase the understanding and visibility of the role that cultural-led innovation integrating the New European Bauhaus approach can play.
3. Wider involvement and social inclusion of citizens in the preservation and enhancement of cultural heritage through engagement with local ecosystems.

The overall goal of CHEM is to enable the transformation of cultural heritage into engaging digital and tangible artefacts, focusing on CCI and community involvement. In CHEM, art, design and culture are seen as drivers for sustainable development through

the four pillars of sustainability: cultural, social, economic and environmental.

Even though there is great interest in including CCI as a way towards thriving urban hubs, historical sites and sustainability, including social change, there is a lack of concrete methods and formats of cross-sectoral collaborations. CHEM offers a model and solution for interdisciplinary design through multiple modalities and inquiries that produce tangible and digital outcomes. Culture-led innovation ecosystems can be created and enhanced through interdisciplinary and transnational linkages, allowing organisations to tap into a larger base of ideas and technology and find complementary expertise and a pool of competences (de Vasconcelos Gomes et al., 2018).

The developed research design innovation processes interrelate and serve as examples of agile crossinnovation. In CHEM, there are two complementing layers of innovation processes - digital (online) and analogue (offline). In fact, these layers unify versatile generations of people as well as make the inquiries all-around-inclusive without a sharp border between online and offline to do the following:

4. enhance the sense of belonging and inter-generational unity

5. transmit cultural meaning across nations, genders, generations and online – offline realms

6. amplify and offer interpretations of NEB principles: Beautiful – Sustainable – Together

7. align with UN SDGs in four categories: cultural, social, economic, and environmental

8. address digitality, to be shared and stored in the repository European Collaborative Cloud for Cultural Heritage (ECCCH)

The economic impact of the CHEM model is significant, offering more opportunities for investments in preserving the cultural heritage P2L sites. By bringing art-based methodologies and digitisation to the preservation process, the CHEM model transforms these sites into vibrant centres of culture and learning. This contributes not only to the cultural vibrancy but also to the economic prosperity of the regions, creating business possibilities as well as jobs for CCIs and service sectors. Furthermore, the tourism sector benefits from the outcomes of CHEM, creating more value and prosperity.
The concept incubation and cross innovation are loaned to CHEM from the business world (de Vasconcelos Gomes et al., 2018; Oliveira et al., 2016). A process of ideation, prototyping, interdisciplinary co-design, demos, testing with end users and honing finally leads to end products displayed in digital and tangible exhibitions, festivals, events and performances. The outcomes rely on meaningful stories from the past and present, enabling envisioning the future through arts interventions and design interactions.

The cultural and societal sustainability impact is clear. The revitalised regional cultural heritage sites will become hubs for both stakeholders, local citizens and tourists. This will enhance local citizens' appreciation of their own places and culture, fostering a stronger sense of belonging to their living environment, and on a larger scale. It offers opportunities to learn, advance employment, exercise, socialise and be an active part of the community. CHEM provides a novel approach to employing various types of culture-led innovation methods, both together and separately in various design, social science and technological disciplines. It advocates creativity, dialogue, art, design, and cultural, social and economic sustainability with CCI (Loach, Rowley, Griffiths, 2017; Lopes, Farinha, Amado, 2017; Lineberry, Wiek, 2016).

Artists and designers can enhance cultural, social and economic sustainability through art and design, as they possess the power of imagination, creativity and new solutions, which are key factors in driving innovation (Lopes, Farinha, Amado, 2017). It is mutually important for designers, artists and creative industry representatives to provide a unique opportunity to explore, inspire, educate and empower participants in CHEM design-research inquiries, to harness the full potential of their imagination as a tool for creating the future change they desire through reinterpreting the past and present. Curiosity and the ability to imagine are transferrable skills that the business world, schools and academia alike should take seriously. Designers and artists are the catalysts and drivers of innovation, communication, social development and change. CCI are powerful vessels in delivering an evocative message, a story, a narrative and engaging people in collaborative, meaningful processes.

CHEM recognises that CCI can also play an important role in working with civil society, policy makers and administrators towards behaviour change in a given context, for instance the green shift to reduce energy consumption. To succeed, transdisciplinary frameworks in the public sector are needed – first, on the local, regional and national levels, and, finally, on the European and global levels. Transdisciplinary and transnational knowledge sharing is the key to success when implementing creative approaches to societal development for wider impact and gradual change (Jelinčić, Tišma, 2020; Laborgne et al., 2021). Art, design and CCI embody the dynamic spirit of the place, its commitment to excellence; and through adherence to regenerative design and sustainability principles in all four dimensions, they shape a better world for future generations. These notions of culture, art and design are deeply rooted in the Places to Learn - Cultural Heritage Enrichment Model, CHEM.

References

Agenda 21 s.a. Available at: https://sustainabledevelopment.un.org/outcomedocuments/agenda21

Agenda 21 for culture. 2004. United cities and local governments - committee on culture. PDF Document. Available at: https://www.agenda21culture.net/sites/default/files/files/documents/multi/ag21_en.pdf

Baiani, S., & Altamura, P. (2022). Reusable cities: a circular design approach to urban regeneration through materials reuse. In Sustainable Development Dimensions and Urban Agglomeration. Intechopen.

Blomberg, J., & Burrel, M. (2009). An ethnographic approach to design. In Human-computer interaction (pp. 87-110). CRC Press. DOI: 10.1201/9781420088892-11

Blomberg, J., & Karasti, H. (2012). Ethnography: Positioning ethnography within participatory design. In Routledge international handbook of participatory design (pp. 86-116). Routledge. DOI: 10.4324/9780203108543-6

Caniglia, G., Schäpke, N., Lang, D. J., Abson, D. J., Luederitz, C., Wiek, A., ... & von Wehrden, H. (2017). Experiments and evidence in sustainability science: A typology. Journal of Cleaner Production, 169, 39-47. https://doi.org/10.1016/j.jclepro.2017.05.164

Cole, R. J. (2012). Transitioning from green to regenerative design. Building Research & Information, 40(1), 39-53. https://doi.org/10.1080/09613218.2011.610608

Della Spina, L., Giorno, C., & Galati Casmiro, R. (2019). Bottom-up processes for culture-led urban regeneration scenarios. In Computational Science and Its Applications–ICCSA 2019: 19th International Conference, Saint Petersburg, Russia, July 1–4, 2019, Proceedings, Part IV 19 (pp. 93-107). Springer International Publishing. DOI: 10.1007/978-3-030-24305-0_8

Dunn, J. (2016). Demystifying process drama: Exploring the why, what, and how. Nj, 40(2), 127–140. DOI: 10.1080/14452294.2016.1276738

Durall Gazulla, E., Bauters, M., Hietala, I., Leinonen, T., & Kapros, E. (2020). Co-creation and co-design in technology-enhanced learning: Innovating science learning outside the classroom. IxD&A, 42, 202– 226. DOI: 10.55612/s-5002-042-010

Fels, L. (2015). Performative inquiry: Reflection as a scholarly pedagogical act. In Playing in a house of mirrors (pp. 151–174). Rotterdam, The Netherlands: Brill. DOI: 10.1007/978-94-6300-118-2_11

Friedman, K. (2003). Theory construction in design research: criteria: Approaches, and methods. Design studies, 24(6), 507–522. DOI: 10.1016/S0142-694X(03)00039-5

Ferreira, I., & Duxbury, N. (2017). Cultural projects, public participation, and small city sustainability. Culture in sustainability: Towards a transdisciplinary approach, 46-61.

Fu, Y., Mahony, S., & Liu, W. (2023). Reconstruction of cultural memory through digital storytelling: A case study of Shanghai Memory project. Digital Scholarship in the Humanities, 38(4), 1522-1535. DOI: 10.1093/llc/fqad044

Haapaniemi, H., & Leinonen, T. (2023). Towards a Pedagogical Model Applying Commedia dell'Arte and Art Workshops in Higher Education Design Studies. Open Education Studies, 5(1), 20220199. DOI: 10.1515/edu-2022-0199

Hakkarainen, P. S., Viilo M., & Hakkarainen K. (2010). Learning by collaborative designing: Technology-enhanced knowledge practices. International Journal of Technology and Design Education, 20, 109–136. DOI: 10.1007/s10798-008-9066-4

Hakkarainen, K. (2009). A knowledge-practice perspective on technology-mediated learning. International Journal of Computer-Supported Collaborative Learning, 4(2), 213–231. DOI: 10.1007/s11412-009-9064-x

Hakkarainen, K., Palonen, T., Paavola, S., & Lehtinen, E. (2004). Communities of networked expertise: Professional and educational perspectives. Amsterdam: Elsevier Scientific Publ. Co.

Hosagrahar, J. (2017). Culture and creativity for sustainable urban development. Valuing and Evaluating Creativity for Sustainable Regional Development, 3.

Jelinčić, D. A., & Tišma, S. (2020). Ensuring sustainability of cultural heritage through effective public policies. Urbani izziv, 31(2), 78-87.

Khaner, T., & Linds, W. (2015). Playing in entangled spaces: Exploring ethical know-how through embodied inquiry. Playing in a house of mirrors: Applied Theatre as reflective practice, 127-150.

Klein, J. T. (2017). Typologies of interdisciplinarity. The Oxford handbook of interdisciplinarity, 2, 21-34.

Laborgne, P., Ekille, E., Wendel, J., Pierce, A., Heyder, M., Suchomska, J., ... & Goszczynski, W. (2021). Urban Living Labs: how to enable inclusive transdisciplinary research?. Urban transformations, 3, 1-18. DOI: 10.1186/s42854-021-00026-0

Laine, M. (2016). Culture in sustainability–defining cultural sustainability in education. Discourse and communication for sustainable education, 7(2), 52-67. DOI: 10.1515/dcse-2016-0016

Lewin, C., & Somekh, B. (2011). Theory and methods in social research. SAGE Publications.

Lineberry, H. S., & Wiek, A. (2016). Art and sustainability. Sustainability Science: An Introduction, 311324. Springer.

Loach, K., Rowley, J., & Griffiths, J. (2017). Cultural sustainability as a strategy for the survival of museums and libraries. International journal of cultural policy, 23(2), 186-198. DOI: 10.1080/10286632.2016.1184657

Lopes, A. C., Farinha, J., & Amado, M. (2017). Sustainability through art. Energy Procedia, 119, 752-766.

Morton, L. W., Eigenbrode, S. D., & Martin, T. A. (2015). Architectures of adaptive integration in large collaborative projects. Ecology and Society, 20(4).

New European Bauhaus, European Commission, 2021. New European Bauhaus: beautiful, sustainable, together. - European Union (europa.eu) [accessed 25.5.2024]

Nowotny, H. (2003). Democratising expertise and socially robust knowledge. Science and public policy, 30(3), 151-156.

Oliveira, J. M., Laranja, M., Lahorgue, M. A., & Born, H. F. (2016). Cross Innovation approach and the creative industries: a case study in the city of Lisbon, Portugal. International Journal of Innovation: IJI Journal, 4(1), 1-12.

Pine, B. J., & Gilmore, J. H. (2011). The experience economy. Harvard Business Press.

Robertson, T., & Simonsen, J. (2012). Participatory design: An introduction. In

Routledge international handbook of participatory design (pp. 1-17). Routledge. DOI: 10.4324/9780203108543-1

Schön, D. A. (2017). The reflective practitioner: How professionals think in action. Routledge.

Seidl, R., Brand, F. S., Stauffacher, M., Krütli, P., Le, Q. B., Spörri, A., ... & Scholz, R. W. (2013). Science with society in the anthropocene. Ambio, 42, 5-12. DOI: 10.1007/s13280-012-0363-5

Soini, K., & Birkeland, I. (2014). Exploring the scientific discourse on cultural sustainability. Geoforum, 51, 213-223. DOI: 10.1016/j.geoforum.2013.12.001

Somekh, B. (2005). Action research. McGraw-Hill Education (UK).

Spinuzzi, C. (2005). The methodology of participatory design. Technical communication, 52(2), 163-174.

Stickdorn, M., & Schneider, J. (2012). This is service design thinking: Basics, tools, cases. John Wiley & Sons.

Stylianou-Lambert, T., Boukas, N., & Christodoulou-Yerali, M. (2014). Museums and cultural sustainability: stakeholders, forces, and cultural policies. International Journal of Cultural Policy, 20(5), 566-587. DOI: 10.1080/10286632.2013.874420

Thiollent, M. (2011). Action research and participatory research: An overview. International Journal of Action Research, 7(2), 160-174.

Tian, J. (2023, July). On the Application and Influence of Interactive Installation in Urban Public Art. In International Conference on Human-Computer Interaction (pp. 250-258). Cham: Springer Nature Switzerland. DOI: 10.1007/978-3-031-34609-5_18

UCLG. 2018. Culture in the sustainable development goals: A guide for local action. PDF Document. Available at: https://www.uclg.org/sites/default/files/culture_in_the_sdgs.pdf

de Vasconcelos Gomes, L. A., Facin, A. L. F., Salerno, M. S., & Ikenami, R. K. (2018). Unpacking the innovation ecosystem construct: Evolution, gaps and trends. Technological forecasting and social change, 136, 30-48. DOI: 10.1016/j.techfore.2016.11.009

Ventre, S., & Cerreta, M. (2023, June). Participatory Art and Co-creation Methodology in the

"Viale delle Metamorfosi" Project. In International Conference on Computational Science and Its Applications (pp. 277-294). Cham: Springer Nature Switzerland. DOI: 10.1007/978-3-031-37117-2_20

Wang, W. (2022). The Ways that Digital Technologies Inform Visitor's Engagement with Cultural Heritage Sites: Informal Learning in the Digital Era. Global Journal of Business Social Sciences Review (GATR-GJBSSR), 10(4).

Winston, J., & Lin, M. C. (2015). Navigating the boundaries of cultural difference through participatory drama. Research in Drama Education: The Journal of Applied Theatre and Performance, 20(2), 196-212.

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HOW CAN GENERATIVE AI TRANSFORM SMARTPHONE COMMUNICATION?: EXPLORING NEW DESIGN LANDSCAPES FOR EVERYDAY EXPERIENCES

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ABSTRACT | The emergence of generative AI promises to revolutionize our daily lives, enabling the creation of fresh content, chat responses, images, synthetic data, and even deep fakes. This cutting-edge technology is expected to transform the smartphone experience by facilitating the development of innovative features. The purpose of this study is to explore the potential of generative AI in enhancing smartphone communication. Through a case study of an industryacademia collaborative design project in India, we aim to propose exploratory solutions to the challenges associated with traditional smartphone communication. The research team, comprising company representatives, students, and faculty, envisioned a more emotionally rich communication experience on smartphones with generative AI. Specifically, the team proposed communication methods that convey tone and emotion based on contextual understanding, moving beyond traditional monotone expressions. Additionally, they explored the creation of immersive stories that evoke emotions. The results of this study suggest that generative AI has the potential to improve existing communication practices on smartphones and create new, enriching user experiences. However, the study also emphasizes the importance of being aware of the risks associated with generative AI's influence on human emotions. While the development and implementation of new communication methods with generative AI are still in their infancy, progress is rapid, necessitating ongoing research, implementation, and careful consideration of ethical and philosophical issues.

KEYWORDS | GENERATIVE AI AND DESIGN; UX DESIGN; SMARTPHONE; COMM1UNICATION DESIGN

1. Introduction

1.1 New design landscape: Generative AI

Design studies have been grappling with a significant theme: the evolution of technology, particularly in relation to artificial intelligence (AI). The intersection between generative AI and design practices has emerged as a rapidly evolving and crucial area of research within the design field. Generative AI refers to artificial intelligence systems capable of producing creative output and has made significant impacts across various design domains, including architecture, graphic design, and product design. Its application has the potential to transform how designers approach creativity, problem-solving, and innovation.

Recent advancements in AI algorithms now enable the processing of data in its natural form, facilitating the analysis of unstructured data such as raw text and images (Dwivedi et al., 2023). Moreover, there has been a growing demand for AI algorithms capable of handling unstructured data due to industrial needs related to text mining and natural language processing.

Recent contributions in this field have explored various themes, including generative design methods (Singh & Gu, 2012), human-AI collaboration in design (Feldman, 2017; Zhou et al., 2022), personalization and customization (Jiang et al., 2022), the ethical implications of creative AI (Rezwana & Maher, 2023), and AI-driven creative tools (Jeon et al., 2021).

As the latest AI advancements allow for more intuitive natural language processing, the practice of design is undergoing significant transformation. Additionally, there is a burgeoning landscape of possibilities for user experience, and the evolution of generative AI is reshaping traditional design methods, the essence of user experience, and the role of the designer.

1.2 A New Design Landscape: Design for day-to-day experiences powered by generative AI

Generative AI utilizes machine learning algorithms to analyze extensive datasets and produce new content resembling the input data. For instance, by training on a large image dataset, a generative AI system can create novel images resembling those in the training set. An important aspect of generative AI is its non-deterministic nature, meaning that identical inputs will yield varying outputs on each occasion.

By exploiting these properties of generative AI, new design paradigms emerge, such as designing for multiple outputs, designing for incompleteness, and designing for mental models. These new opportunities for design created by generative AI facilitate the creation of innovative everyday experiences and present promising avenues for exploration and development in design research and practice. In particular, the potential for user experience innovation in existing user interfaces (e.g., smartphones, computers, and other digital devices), where there is significant room for generative AI to be reflected, holds great promise to be realized in the near future.

2. Methodology

This research conducts a case study to derive insights for designing innovative smartphone communication experiences augmented by generative AI. It is widely assumed that generative AI has the capacity to generate various types of content, including chat responses, designs, synthetic data, and deep fakes, thereby becoming increasingly integrated into daily life. The critical issue lies in ensuring that these AI systems are aligned with human intentions and values. Consequently, the primary challenge surrounding generative AI is how to develop user experiences that effectively complement its capabilities. In line with this assumption, a collaborative industry project was undertaken as the basis for the case study.

2.1 A case: “Design for day-to-day experiences powered by Generative AI”: a Project Based Learning (PBL) collaborating with Samsung India

The case study presented here offers a concrete illustration of a collaborative initiative between industry and academia carried out at the MIT Institute of Design (MIT ID) in Pune, India. The objective of this project was to investigate and propose innovative communication experiences for smartphones empowered by generative AI. The specific details and parameters of the project are outlined in Table 1.

Items	Settings
Goal	Exploring and proposing novel communication experiences of smartphones powered by generative AI.
Design Brief	• To Identify opportunities that arise with the help of generative AI to assist or enhance mobile experiences in the above scenarios. • To define experiences and use cases from the point of view of various walks of life
Participants	• 4 master students in design management program • 4 mentors from Samsung India • 2 faculties from MIT ID
Project details	• Duration: 6 months lasting industry-university collaborative project • Project approach: Project Based Learning (PBL) • Location: Pune, India
Project activities	• Research: secondary research and primary research • Ideation • Concept development
Outcomes	• Research results: Primary and secondary research results • Concepts of new day-to-day communication experiences of smartphones powered by generative AI

Table 1. Detailed project settings "Design for day-to-day experiences powered by Generative AI"

The primary challenge was framed based on a design brief provided by the industry partner, a prominent digital device company in Asia, Samsung India. The partner expressed a keen interest in exploring the convergence of generative AI and communication experiences, with a particular focus on potential radical changes in UX design. Generative AI, therefore, has the potential to revolutionize traditional smartphone communication methods as well as user interfaces and experiences.

In accordance with this background, a comprehensive design brief was developed to explore various experiences and use cases. These included opportunities arising from the integration of generative AI to enhance mobile experiences in everyday scenarios such as entertainment, identity and expression, lifestyle activities (e.g., shopping, traveling), well-being, shared experiences, staying connected (communication and social media), staying informed, and financial planning.

The project enlisted the participation of four master's students from the design management program, chosen for their expertise in developing integrated product-service systems using design methodologies. These students were guided by two faculty members, the authors of this study, and were supported by four mentors from the collaborating company. Spanning a duration of six months, the project adopted a Project-Based Learning (PBL) approach, blending online and offline components in Pune, India.

2.2 Case Phases and Activities

The project activities were conducted in three phases: research, ideation, and concept development.

Phase 1: Research phase

This phase included three steps:

1. basic and secondary research: research to better understand generative AI, application challenges and opportunities for the technology, and contextual analysis of smartphones and communication.
2. user survey : to understand user behavior with respect to current smartphone functionality and identify user groups for the following individual interviews; a sample of 25 people was collected and surveyed for generations ranging from 18 to 55 years of age.
3. personal interviews: This anthropological approach provided deep insights into the target audience's daily smartphone communication experiences: 12 interviews were conducted with generations between the ages of 18 and 55.

Phase 2: Ideation phase

Key design development directions were defined and converged into three idea directions. Idea generation and refinement took place in an iterative process that included in-depth discussions with faculty and mentors. As a result, an idea direction was opened to further enrich the user's emotional expression in the areas related to Keyboard and Search in the generative AI.

Phase 3: Concept Development Phase

In this phase, specific solutions were designed and developed based on the narrowed-down themes:

1. User Personas Representative user personas were created, reflecting the findings of Phase 1 and 2.
2. communication experience design: Designed a new communication experience on smartphones that leverages generative AI. To materialize the experience, wireframes and user interfaces were designed to visualize the entire user experience.

Through these three phases, the project aimed to explore new communication experiences on smartphones utilizing generative AI. We proposed innovative communication experiences by moving back and forth between research, ideation, and concept creation, exploring directions in an exploratory manner.

3. Result

This case illustrates the potential for novel modes of communication facilitated by generative AI, a capability previously unavailable in smartphone communication. Generative AI holds promise for introducing more emotionally resonant communication methods that align better with human psychology, contextual situations, and interpersonal relationships, departing from the conventional reliance on mundane text and pictogram-based expressions.

3.1 Research result

During the research phase, the design team used a combination of secondary and primary research methods to explore the design possibilities and to chart the design trajectory. The secondary research included extensive investigation of generative AI and its impact on the smartphone communication experience. At the same time, the primary research phase included a user survey and personal interviews to delve into user behavior regarding current smartphone communication experiences and to gauge user attitudes toward current and future technologies, particularly generative AI. Ultimately, design direction emerged from the integration of these research efforts.

Secondary research provided an understanding of the potential impact of generative AI on the smartphone communication experience. The study particularly emphasized generative AI's capacity to revolutionize three traditional practices: file management, search, and keyboard use. In file management, the identified capabilities of generative AI include: 1. document generation, summarization, search, and change tracking, 2. fraud detection, 3. elimination of redundant processes and files, 4. analysis of document patterns to provide actionable insights. In the area of search, generative AI's capabilities encompass: 1. personalization, 2. intuitive search results, 3. image-based search initiation, 4. natural language processing (NLP). Regarding keyboard use, generative AI offers the following capabilities: 1. text rewriting and generation, 2. integrated search functionality within the keyboard, 3. suggestions for conversation style and tone analysis, 4. reduction of typing effort.

Building on this foundational knowledge, the primary study examined the communication challenges of current smartphones through surveys and personal interviews. Several specific issues emerged, highlighting the challenges faced by typical smartphone users, such as unidimensional communication, pictograms failing to adequately express

emotions, and frequent misunderstandings. Texting and messaging, as one-dimensional communication methods, often lack the depth and nuance of face-to-face interactions, resulting in misunderstandings and emotional disconnect. Current smartphone input methods prioritize efficiency and accuracy over the conveyance of tone and intent, neglecting important aspects of communication. Moreover, the primary survey revealed that users desire effortless communication, improved accuracy, and reduced anxiety.

Based on the extensive insights acquired during the research journey, the team refined their design objective: to devise smartphone input methods that enable users to convey their emotions, tone, and intentions with greater ease and precision in their communication interactions. Put succinctly, the central question becomes: "How can we leverage generative AI to facilitate the development of novel smartphone communication experiences that allow users to express emotions effortlessly?"

3.2 Ideation result

The initial ideation phase concentrated on two of the three topics: search and keyboarding, excluding file management. Through iterative sessions involving students, businesses, and faculty, the ideas converged into three broad directions using affinity diagrams.

First, enhancing tone and emotional expression to transform monotonous communication styles. Existing pictograms and stickers are often uniform and fail to convey messages accurately, sometimes leading to misunderstandings. Human emotions are more complex than what pictograms can express, necessitating the exploration of more nuanced expressions. Generative AI has the potential to support subtler and precise emotional expression for users, leveraging vast amounts of big data on communication patterns and individual behaviors on smartphones.

Second, exploring alternative input methods such as gestures and voice commands on smartphones. Existing methods like typing and voice input can be inconvenient, and users often experience frustration when gestures and voice commands fail, requiring repeated manual corrections. Generative AI can help develop new alternative input methods that address these challenges associated with current input techniques.

Third, generative AI can enhance existing search methods on smartphones. Users are often dissatisfied with search results from current search engines, especially when they need to find something for future use but struggle to relocate it later. Additionally, search engines frequently raise safety concerns by suggesting unsafe content. Generative AI has the potential to offer more desirable search methods for users by leveraging collective knowledge and big data on user searches, thereby addressing these challenges and improving search satisfaction and safety.

3.3 Conception result

Based on the design opportunities embodied through the research and ideation phases, the requirements for ideal smartphone communication were organized. In summary, the ideal communication should have the following characteristics: less manual, more accurate, and less anxiety-provoking. While meeting these requirements, the design team established two personas and developed two different proposed solutions.

Solution 1. A communication service that analyzes historical data and proposes heartfelt expression

The initial concept involves a communication service enhanced by generative AI, which examines past data and suggests appropriate expressions. Addressing prevalent issues identified in current communication services, the research findings indicate that existing platforms lack flexibility in adding a personal touch, struggle to find suitable emojis for conveying emotions, and often fail to deliver satisfactory messages. To address these challenges, a novel communication service was developed based on the following persona and scenario.

Persona and scenario:
Meet Rohan, a 17-year-old university student residing in Pune, India, who lives in a nuclear family and shares a close bond with his grandmother. He seeks to infuse every message sent from his smartphone with a personalized touch and is eager to explore inventive ways of communication to convey his affection for his loved ones. With his grandmother's birthday approaching and physical distance preventing an in-person celebration, Rohan is determined to send a heartfelt and customized birthday message that will bring joy to her.

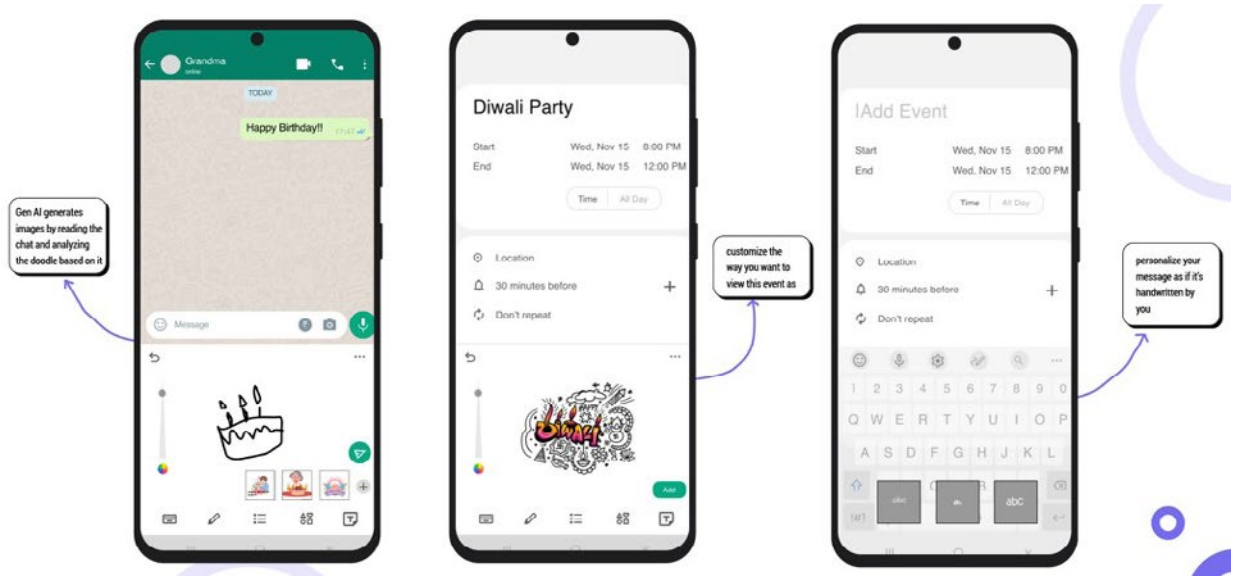

Figure 1. An intervention of generative AI for more heartfelt expression

New communication service:
Powered by generative AI, this communication service empowers Rohan to personalize his messages, craft heartfelt expressions, and convey the nuances of his emotions (Figure 1). The generative AI generates images by analyzing the conversation and interpreting the doodles accordingly. It then tailors the presentation of the event to Rohan's preferences and finally personalizes the message to appear as if handwritten by him.

Through this new communication service, users can convey their messages in alignment with their emotions, allowing for the expression of emotional nuances in a visual format. Moreover, the emotional transfer is highly individualized, enhancing the overall user experience.

Solution 2. Visualizing emotions based on deep learning

The second idea involves visualizing emotions by analyzing various data sources and expressing emotions through suitable mediums. Leveraging user historical data, including personal information and documented data such as photos, videos, files, and documents, as well as past conversations in certain applications, generative AI can assist users in effectively conveying their emotions. This technology is capable of discerning conversational contexts by recognizing tone, determining the nature of relationships, and identifying mutual interests.

Addressing prevalent issues identified in current communication services, the research findings indicate that existing platforms fail to adequately convey users' emotions and often leave them feeling disconnected from the recipients. Furthermore, users struggle to comprehend the emotions of the recipients during messaging interactions. To address these challenges, a novel communication service was developed based on the following persona and scenario.

Persona and scenario:
A 32-year-old software engineer based in Mumbai India, Kusha lives with her husband and a child, working long hours every day. She lives her parents away, so real-time talk with them seems impossible. She wants to prioritize her time with her family, however she struggles to emphasize with her family's feeling and emotions.

One day, just before a client meeting, Kusha receives a message from her mother that she is at the doctor's and has some news to give her. All her mother is able to tell her that her recovery is going well but she has to make some changes to recover faster. She feels overwhelmed and looks to get comfort and reassurance from Kusha.

A new communication service:
Assisted by generative AI, emotional communication is proposed as a feature. Users are prompted to select their emotional state from a range of options depicted on Plutchik's wheel of emotions (Plutchik, 1980),

which visualizes eight emotions through color theory (Figure 2). This feature allows users to customize their conversation accordingly. Generative AI facilitates creation, prediction, suggestion, text-to-speech (TTS), and automatic speech recognition (ASR), all of which are activated through various input modes (Figure 3). Following the user's emotional choice and the analysis of the situation, specific scenes with story-like backgrounds appear in the chat as images (Figure 4). Users have the flexibility to change their emotional state at any point during the conversation. The keyboard is redesigned to accommodate various input methods, including typing, voice messages, and drawing, based on the user's selected expression mode. For voice messages, users can edit the recording to adjust the tone of expression before sending it. Upon receipt, the recipient can listen to the message in the sender's voice profile.

Figure 2. Choose your feelings of today

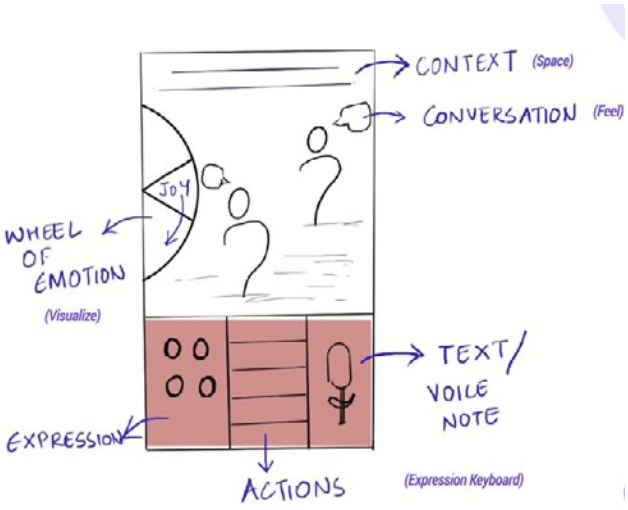

Figure 3. A sketch of multiple input mode to express emotions

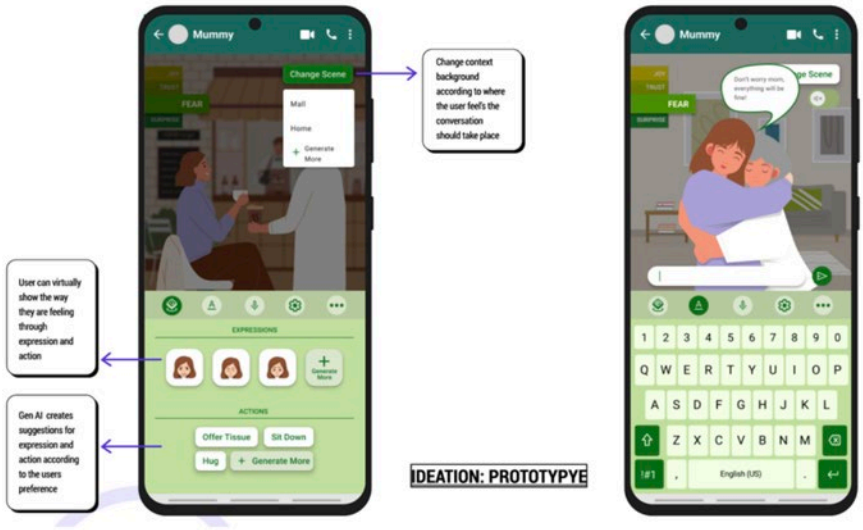

Figure 4. Fulfilling emotional expression with visual stories

Summative synthesis:
Implications of the two solutions

The two solutions suggest that generative AI has the potential to revolutionize the communication experience on smartphones. Addressing current problems of one-dimensional communication, use of irrelevant emojis, and misinterpretation, generative AI could bridge these gaps by helping users convey more authentic messages with a wider range of expressions. The study suggests a way of communicating that is best suited to the context and situation and allows for rich emotional expression, while leveraging historical and collective big data on individual smartphone use.

On the other hand, we need to be conscious of the fact that there are certain risks involved in technology intervening in the subtleties of emotional expression. The survey results indicate that, to date, smartphone communication has had certain inconveniences in terms of emotional expression, but people have been aware of these inconveniences. The more this becomes possible with the intervention of generative AI, which allows for expressions that better fit human emotions, the less likely users will be aware of the difference between their own emotions and the expressions on their smartphones. Furthermore, there is a danger that users will become confused about their own "true feelings" by perceiving that the expressions created by generative AI are their own feelings. Because of the dizzying technological progress of generative AI, ethical and philosophical considerations regarding human emotions and technological expressions of emotions are emerging as pressing issues.

4. Discussion

This study aims to explore the transformative potential of generative AI in everyday experiences, particularly in smartphone communication. Harnessing its non-deterministic nature, generative AI offers the prospect that identical inputs will produce diverse outputs each time. From these characteristics of generative AI emerge novel design approaches, including designing for multiple outputs, imperfections, and mental models.

The case study highlights the potential for creating new communication experiences on smartphones that enhance users' heartfelt and emotional expressions. By leveraging users' historical data, personalities, and social connections, smartphones have the potential to enrich communication experiences in a more personalized manner. Empowered by generative AI, smartphones can evolve into more empathetic and emotionally resonant communication tools.

This paper contributes to two important areas. First, it explores new design areas at the intersection of generative AI and smartphone communication experiences. As generative AI technologies continue to evolve rapidly, a new communication landscape is poised to emerge. Rather, there is a growing

need to immediately incorporate the daily evolving generative AI technologies into design and development, creating new communication experiences in a lean way with implementation. Second, we introduce a communication approach that prioritizes human-to-human connections, taking into account the user's personality, communication context, and relationships. As the traditional ways of communication are about to be qualitatively transformed by the technology of generative AI, this research raises questions about how to design communication in a way that is not an extension of the past.

One of the most compelling aspects of generative AI that is rapidly gaining importance is its ability to handle multi-modal inputs and outputs. This capability enables generative AI to process and integrate various types of data such as text, audio, images, and video, and generate responses that are equally diverse and contextually rich. The case study leverages this multi-modal potential to propose solutions that can significantly enhance smartphone interactions, making them more nuanced and engaging. For instance, by analyzing not just the textual content of a message but also the tone of voice, facial expressions, and contextual imagery, generative AI can craft responses that are more empathetic and aligned with the emotional state of the user. This leads to richer and more meaningful communication experiences.

Moreover, the multi-modal capabilities of generative AI allow smartphones to deliver personalized interactions that cater to the unique preferences and communication styles of individual users. As the AI system learns from the user's historical data, including their communication patterns and preferences, it becomes adept at predicting and adapting to their needs. This personalization is not just limited to content but extends to the mode of delivery as well. For example, if a user prefers visual information, the AI can prioritize infographics or video messages over text. Similarly, if a user tends to respond better to auditory cues, the AI can generate voice messages or audio summaries.

The immersive nature of these AI-driven interactions ensures that users remain more engaged and invested in their communication experiences. As smartphones evolve into more intelligent and intuitive devices, the integration of multi-modal generative AI stands to revolutionize how users interact with their devices and each other. This technology not only enhances the functional aspects of communication but also its emotional and social dimensions, making everyday interactions more profound and satisfying. Thus, the dynamic and adaptive nature of multi-modal generative AI holds immense potential to transform the landscape of smartphone communication, driving it towards a future where interactions are not only efficient but also deeply human-centric.

There is no doubt that it is also necessary to discuss here the risks and disadvantages that are likely to be latent in new ways of communication that take advantage of generative AI. Generative AI has been

discussed in this paper to play a supportive role in the expression of human emotions. However, this means, on the flip side, that the technology will intervene even in human emotions. In the first place, emotions are fundamental to human beings. The possibility of emotions being influenced by technology may not only necessarily have a positive impact, but may even involve the possibility of emotions being manipulated and controlled by technology. Humans do not always have a full understanding of their own emotions. In the realm of emotions, which includes such ambiguity, are the "emotions" guided by technology true emotions? This is a deep philosophical question.

It is important to recognize several limitations of this paper. First, the research methodology relies on a single case, a joint industry-academia project in India. Therefore, the insights derived require further validation through a variety of methodologies and across different national and cultural contexts. Second, the ideas generated in this study remain at the conceptual stage. Therefore, a major challenge is to verify new ways of smartphone communication using generative AI through implementation of services by partner companies. In particular, the challenge is to conduct empirical research, both qualitatively and quantitatively, on how the way people actually communicate has been transformed, and whether usability and emotional fulfillment have improved when compared to conventional methods.

Finally, we propose several avenues for future research. First, future studies could explore the specific types of everyday experiences enabled by generative AI on smartphones. It would be valuable to examine in greater depth the patterns of these experiences and how they evolve in various contexts, such as shopping, training, entertainment, and other daily activities. Second, it is crucial to investigate how generative AI can shape new experiences through interactions between smartphones and other devices. Research should focus on the transformation of user experiences facilitated by the integration of generative AI with diverse devices, equipment, and infrastructure, in tandem with technological advancements. Exploring how individuals of different ages and interests can engage with generative AI to enhance and experiment with their daily lives would also be highly meaningful. Various types of design research can contribute to these opportunities and improve overall well-being.

This emerging field poses a new academic challenge, drawing from the interdisciplinary nature of design disciplines—such as generative AI, communication design, UI/UX design, humancentered design, and service design—as well as from engineering and ergonomics in the realm of information technology. With the rise of generative AI, we anticipate that collective insights from these diverse disciplines will converge to further advance research in this domain.

References

Campos, C., Ducasse, J., Čopič Pucihar, K., Geroimenko, V., & Kljun, M. (2024). Augmented imagination: creating immersive and playful reading experiences. In Augmented Reality Games II (pp. 63-91). Springer, Cham. https://doi.org/10.1007/978-3-031-54475-0_4

Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., ... & Wright, R. (2023). "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. International Journal of Information Management, 71, 102642. https://doi.org/10.1016/j.ijinfomgt.2023.102642

Feldman, S. S. (2017, July). Co-creation: human and AI collaboration in creative expression. In Electronic Visualisation and the Arts (EVA 2017). BCS Learning & Development. https://doi.org/10.14236/ewic/EVA2017.84

Jeon, Y., Jin, S., Shih, P. C., & Han, K. (2021, May). FashionQ: an ai-driven creativity support tool for facilitating ideation in fashion design. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (pp. 1-18). https://doi.org/10.1145/3411764.3445093

Jiang, Z., Wen, H., Han, F., Tang, Y., & Xiong, Y. (2022). Data-driven generative design for mass customization: A case study. Advanced Engineering Informatics, 54, 101786. https://doi.org/10.1016/j.aei.2022.101786

Plutchik, R., (1980), Emotion: Theory, research, and experience: Vol. 1. Theories of emotion, vol. 1, New York: Academic. https://doi.org/10.1016/C2013-0-11313-X

Rezwana, J., & Maher, M. L. (2023). User Perspectives of the Ethical Dilemmas of Ownership, Accountability, Leadership in Human-AI Co-Creation. DOI:10.1145/3591196.3593364

Singh, V., & Gu, N. (2012). Towards an integrated generative design framework. Design studies, 33(2),
185-207. https://doi.org/10.1016/j.destud.2011.06.001

Suzuki, R., Gonzalez-Franco, M., Sra, M., & Lindlbauer, D. (2023, October). XR and AI: AI-Enabled Virtual, Augmented, and Mixed Reality. In Adjunct Proceedings of the 36th Annual ACM Symposium on User Interface Software and Technology (pp. 1-3). https://doi.org/10.1145/3586182.3617432

Thoring, K., Huettemann, S., & Mueller, R. M. (2023). The augmented designer: a research agenda for generative ai-enabled design. Proceedings of the Design Society, 3, 3345-3354. https://doi.org/10.1017/pds.2023.335

Yu, H., & Guo, Y. (2023, June). Generative artificial intelligence empowers educational reform: current status, issues, and prospects. In Frontiers in Education (Vol. 8, p. 1183162). Frontiers Media SA.
https://doi.org/10.3389/feduc.2023.1183162

Zhou, Z., Li, Z., Zhang, Y., & Sun, L. (2022). Transparent-AI blueprint: developing a conceptual tool to support the design of transparent AI agents. International Journal of Human–Computer Interaction, 38(18-20), 1846-1873. https://doi.org/10.1080/10447318.2022.2093773

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REGENERATIVE DESIGN IN TIBETAN REGIONS: PLACE-BASED LEARNING THROUGH STORYMAKING

Shuang Song, Linus Tan and Anita Kocsis.

ABSTRACT | This paper examines the practices of design anthropology through metaphors and methodologies informed by alternative lenses. It explores practices such as place-based learning and storymaking, which extend the remit of design within design anthropology and suggest alternative perspectives as demonstrated in the case studies. Harnessing the transformative potential of storymaking, the research underscores the pivotal role of narratives in reshaping humanity's perception of the Tibetan worldview and its relationship with the natural world. Key lessons gleaned from the research exemplify regenerative design principles through their integration of human and ecological systems, emphasizing the importance of incorporating Traditional Ecological Knowledge into design processes to achieve culturally relevant and regenerative outcomes. The paper advocates for place-based learning and storymaking to foster deep understanding and compassion. It also addresses the challenges and opportunities in balancing ecological conservation with community development, using community exhibitions and eco-learning programs as case studies. These insights can catalyze further dialogue among transdisciplinary practitioners regarding research methods deeply rooted in place-based contexts for narrative creation through storymaking, thereby fostering a paradigmatic shift toward a regenerative, collective learning climate.

KEYWORDS | Regenerative Design, Traditional Ecological Knowledge, Place-based Learning, Storymaking, Tibetan Worldview

1. Introduction: Regeneration, for whom and for what?

As a designer focused on ecological transitions, the Tibetan Indigenous communities in the Hengduan Mountain Region often evoke imagination for the region's rich biodiversity, diverse intangible cultural heritages, and strong sense of community and social bonds (Smyer, 2015). Moreover, the ecological mindset advocated by regenerative design principles, which emphasizes understanding the interconnectedness of all things and the co-evolution of humans and nature (Bellato et al., 2011; Mang & Reed, 2019; Pollock, 2012; Mang and Reed, 2011), has been an integral part of Tibetan everyday practices for millennia (Coggins, 2019; Yeh, 2014; Habito, 2007). They have coexisted with the land for generations, inherently understanding the appropriate positions and dynamic relationships between humans and nature. When external transdisciplinary teams formed by rural planners, scientists, designers, policymakers, and academics enter Tibetan communities to conduct co-design workshops, the local perspectives on development of their homeland have rarely been heard or effectively included in the planning process (Yeh, 2014; Guo, 2012). Therefore, when we talk about regenerative design in Tibetan regions, for whom are we designing?

This paper uses the regenerative design principles applied in the Zhonglu Township, Gyalrong Tibetan community, located under Mount Moerduo, as a case study to explore how design teams employ storymaking as a systemic catalyst to support community regenerative design. Regenerative design aims to design, build, and heal with the whole system in mind—a deeply integrated worldview that shifts from 'doing things to nature' to participation as partners with and as nature (Reed, 2007; Berry, 1992; Sterling, 2003). Gyalrong refers both to a unique branch of the Tibetan people, known as the Gyalrong Tibetans, and to a geographical area centered around Mount Moerduo, spanning a radius of thousands of miles (Li, 2014; Ju, 2020). In this community, mountains, water, and grasslands are not merely "protected areas" or "resources" nor just backdrops for human activity, but a shared space for all beings, including nature, spirits, and humans (Coggins, 2019).

However, since the 1950s, this region has undergone three industrial transformations due to the environmental crises. Following the extensive mica mining in the late 1970s, which caused severe geological changes and was subsequently banned, the community turned to traditional logging. Before 1998, the area heavily relied on logging as a primary industry, with "wood-cutting economy" constituting 80% of the county's fiscal revenue. Since 2000, the Gyalrong region, including Zhonglu Township, has been exploring regenerative tourism. The area's insufficiently modern production and living methods, coupled with inadequate infrastructure, mean that Zhonglu remains a traditional village with a semi-agricultural, semi-pastoral economy. Local youth, unwilling to endure the hardships of traditional farming life, seek work elsewhere, leading to a gradual decline in the transmission of traditional ecological knowledge (TEK) and intangible cultural heritage. In the context where neither scientists nor Indigenous people have perfect solutions to the systematic environmental challenges, how can designers weave the stories that make diverse sensory mechanisms and value orientations visible, including non-human perspectives?

To address this challenge, design anthropology encourages interdisciplinary cooperation within and outside design studios, generating concepts and prototypes, collaborating with stakeholders and various publics, and consciously focusing on promoting and driving change (Brown, 2011; Nelson and Stolterman 2012; Otto and Smith, 2013). Beyond expressing ecological knowledge and cultural heritages, regenerative design ultimately aims to articulate and practice ecological worldviews (Mang & Reed, 2019; Mehmood, 2020). In that sense, storymaking is a flexible tool that fosters cross-disciplinary collaboration and captures practices that cannot be fully encapsulated by regulations or Indigenous wisdom (Phillips and Bunda, 2018).

This paper aims to explore how the design team utilizes design anthropology methods in the Gyalrong Tibetan community of Zhonglu Township to investigate and achieve place-based knowledge. Using the Yunhe Center, a research-action lab that established an ecological learning center in Zhonglu, as a case study, it examines how place-based learning projects and community exhibition designs support the balance between ecological protection and community development, highlighting the importance of storymaking in regenerative design in Tibetan Indigenous communities.

2. Experiencing Place: The alternative ways of learning

2.1 A coming-to-know through experience

The Gyalrong Tibetan community lacks a written language, so their songs, dance culture, folk myths and oral stories, and embroidery traditions serve as crucial mediums for knowledge transmission (Li, 2014). Coming-to-know (Cajete, 2000), which is the way among Indigenous people acquire

knowledge, metaphorically entails an experience, a process, and a quest for knowledge and understanding. The Indigenous experience is evidenced not only through collective cultural expressions of art, story, ritual, and technology, but also through the more subtle and intimate expressions of individual acts of respect, care, words, and feelings that are continually extended to the land and its many beings (Cajete, 2000). Castellano (2000) described the characteristics of Indigenous knowledge as personal, oral, experiential, holistic, and conveyed in narrative or metaphorical language. To understand Indigenous knowledge, designers must begin with immersion in their everyday lives to gain insight into experiences and meanings that form the basis for reflection, imagination, and design (Nelson and Stolterman, 2012).

True knowing is based on directly experiencing a place (Cajete, 2000). This is why experiencing a place is key to exploring Indigenous knowledge, where knowledge is presented in "high contexts," in which multiple levels of information are shared through various levels of communication (Jessen et al., 2021). Just like the motifs in Gyalrong embroidery, each traditional pattern carries different meanings: blessings from the four directions, offerings for good fortune, warding off evil spirits, and the guardianship of local mountains (Dagyab, 1995). In traditional embroidered sashes, the motifs are arranged in a specific sequence to tell different stories (see Figure 1). These sashes are used in various rituals and celebrations, creating a nested relationship where smaller stories are embedded within larger scenarios. In this sense, experiencing a place refers to sense-making, which occurs over time through the relational interactions between people, their nature, and their social activities (Horlings et al., 2018).

Figure 1. Motifs of Traditional Embroidered Sashes

2.2 Place in Traditional Ecological Knowledge

Traditional Ecological Knowledge (TEK) refers to the knowledge, practice, and belief concerning the relationship of living beings to one another and to the physical environment, which is held by peoples in relatively non technological societies with a direct dependence upon local resources (Berkes, 1999). It is born of long intimacy and attentiveness to a homeland and can arise wherever people are materially and spiritually integrated with their landscape (Kimmerer 2000). This respectful attitude to enter into a heightened sense of awareness of the natural world allows the external teams intimate understanding of the processes of nature, and forms the foundation for respecting the compacts of mutual reciprocal responsibility shared with other inhabitants of one's environment. How something is related and the nature of causality in a given natural context are foci of deep reflection. The ways in which aspects of nature are transformed through time and space and the nature of proper orientation to "sacred place" demand the observation of subtle details that are the foundation of knowledge.

The regenerative process leads to the stories of place, a way to conceive of the role of the place in providing increased vitality, viability and ability to adapt to all those who are part of the place (Mang and Reed, 2020). This story can be treated variously as a framework, a mechanism and a process, rather than as a final product (Mang and Reed, 2012). The 'place-based learning' helps humans learn how to understand and co-evolve with their environments better, provided such storytelling explicitly addresses the relationship between humans and the ecology/non-human they are enmeshed in. Stories spoken from the heart hold a transformational power, they are a way for one heart to speak to another. They are a means for sharing knowledge, experience and emotion. As a mechanism, 'place-based learning' helps create the field of caring and commitment necessary for continuous potential building. It's calling on human actors to respond and remake meaning as its potential is realized or changes with regards to wider systemic changes through place-based learning.

2.3 Relational knowledge of the place

The fundamental belief of Indigenous worldview is that knowledge is relational, shared with all of creation (Hart, 2010). This encompasses not only interpersonal relationships or those with research subjects but also relationships with the cosmos, animals, plants, and the earth (Cajete, 2000; Kimmerer, 2002). Knowledge extends beyond the individual to encompass relational knowledge, implying that researchers are answerable to all their relations when conducting research. This way of learning and coming to know is deeply tied to environmental awareness and a reaffirmation of responsibility for the care of the Earth. It enables us to perceive

and pursue new potentials in ourselves, our families, communities, and our land (Haggard et al., 2002).

According to Otto Scharmer and Katrin Kaufer (2013), we cannot face today's disruptions by denying the past damage, but by envisioning forward, sensing, and actualizing the future as it emerges. At the core of such a profound transformation is the awakening of curiosity (open mind), compassion (open heart), and courage (open will) as powerful antidotes to regenerate from and with the place (Tuck 2009; Boutkan and Hadders, 2020). We need to come together with a radical commitment to co-create and live based on entirely new patterns, emerging from networks to communities into systems of influence (Wheatley, 2010). This involves moving forward with people in the pursuit of their dreams and aspirations rather than dwelling on their past (Leitão, 2020). That's where design anthropology comes into play; its observant participation nature emphasizes what is produced during fieldwork—such as social relations, practical knowledge, and new practices for the people involved—rather than what is produced after fieldwork (Glowczewski et al., 2013).

2.4 Design anthropology as wood-wide-web

An important feature of design anthropology is the way its practitioners work within multiple relationships and often complex roles involving different stakeholders, including designers, researchers from other disciplines, locals, government officials, and the public. Due to its engagement with multi-layered relationships, design anthropologists typically operate within multidisciplinary design teams, alternating between roles as researchers, facilitators, and co-creators in the design process. In doing so, stories play a crucial role that no amount of theorizing or recitation of statistics can reveal—they offer insights that generate empathy and build social bonds (Duncan, 1998). In a context where neither scientists nor Indigenous people have perfect solutions to systematic environmental challenges, how can designers weave stories that make diverse sensory mechanisms and value orientations visible, including non-human perspectives?

This paper proposes that design anthropology functions as a wood-wide-web in regenerative design—particularly in sensitive or precarious contexts such as Tibetan regions. It examines how designers, through participatory observation, facilitate communication and encourage storymaking to include the locals participating in regeneration processes for developing their homes. In the following discussion, the Yunhe Center's place-based learning projects and community exhibitions are used as empirical cases to explore the toolkit designers employ to learn from and with place, articulating and practicing TEK within the interdisciplinary teams.

3. Place-Based Learning: Thinking Like a Mountain

Learning the knowledge of place and the "dialects" of its plants, animals, and natural phenomena within the context of a "homeland" is a foundational element of Indigenous knowledge (Orr, 2004). In Tibetan belief, mountains are landmarks for their homeland and cultural identity, where people refer to each other as individuals from this or that mountain. Mountain gods serve as local guardians, and all things within and around the mountains are attributed to these deities. Each mountain has a name, character, and unique temper. In the Gyalrong Tibetan village, their Sacred Mountain is called Moerduo (Li, 2014). Together with surrounding mountains, they form mountain families with epic stories. In this sacred mountain system, from daily life to the spiritual world, all human wishes have the mountain gods to appeal to (Guo, 2012).

However, like Sacred Mountain Moerduo, global mountainous communities have experienced varying degrees of the degenerative process of take—make—waste (Kohn, 2013; Latour, 2004; Sullivan, 2010). With its rich biodiversity and precious minerals, Mountain Moerduo has been part of this degenerative story for the past 300 years, where resources are exploited for profit without reciprocity. How can we begin to regenerate these traumatized ecosystems and repair the sense of separation?

Since 2015, Yunhe Center began assisting in the creation of regenerative design in the Gyalrong Tibetan village, helping the communities celebrate and leverage the knowledge and wisdom of their traditional practices through eco-learning and regenerative tourism programs (UNESCO, 2020). In the case study of Yunhe Center, place-based learning under the sacred mountain is essentially about designing an experience that weaves human reconnection with nature.

In this sense, Thinking like a Mountain and Moving like a River encapsulate the essence of integrating TEK into design anthropology practices. Thinking like a mountain encourages a long-term, holistic perspective, recognizing the interconnectedness of ecosystems and the importance of deep time lenses. Moving like a river emphasizes adaptability, flow, and responsiveness to change, reflecting the dynamic nature of human and ecological systems. Together, these metaphors aim to inspire designers to address challenges in a creative way that is both resilient and in harmony with the natural world, fostering a more regenerative future.

3.1 Mountains as Teachers

Walking in the mountains can become a living classroom. The oral traditions of TEK offer a detailed prescription for "living in place," including elements of experience and metaphor (Kimmerer, 2002). Walking in the mountains can become a living classroom. The oral traditions of TEK offer a detailed

prescription for “living in place,” incorporating elements of experience and metaphor (Kimmerer, 2002). The Yunhe Center team has documented the oral traditions of the Gyalrong community through extensive participatory observation over the past nine years (see Figure 2). Below is an example of such oral traditions:

If one’s leg is painfully stung by nettles while walking, the antidote—sorrel—often grows nearby; crushing and applying it to the wound can provide relief. The Sichuan pepper trees commonly seen in the village are a major economic crop and are often planted along field edges to prevent cattle from entering and damaging the crops; their extensive root systems also help prevent wind erosion and stabilize the soil. The springs encircled by prayer flags are places where people pray to the mountain gods; Tibetans believe that the springs are the eyes of the mountain gods, and if they are polluted, human eyes will also fall ill.

Figure 2. Participatory observation about the oral traditions in the Gyalrong community

Through such deep listening and learning, a mountain transforms into a revered space. This sanctity is inherently subjective and even intimate, transcending objectivity (Guo, 2012). In Indigenous epistemology, something can only be fully understood when it is comprehended through all aspects of human experience—mind, body, emotions, and spirit (Cajete, 2003).

By facilitating the experience through rituals, observation, participation, meditation, storytelling, and everyday conversations—experiences that invite life back—it challenges the narrative of human separation from nature and reconsiders the reciprocal relationship between the people living on this land and the mountains (Seed, et al., 2007). In doing so, the Yunhe Center expands the notion of "teacher" beyond images of a person in a classroom. The "teachers" are mountains, other people, plants, animals, rivers, local villagers, community members, and our own imaginations, as nourished by relationships with them (Latour, 2004; Huan, 2016). This illustrates Bekoff's (2000) concept of holistic, heart-driven knowledge that is imbued with spirit and compassion, recognizing the full spectrum of interconnectedness between humans and nature.

3.2 Mountains as Pedagogy

Taking mountains as pedagogy involves recognizing that each territory near them has generated a unique link, relationship, and interaction. We need to prepare ourselves to engage productively with complex, multicultural, real-world communities and challenges (Kimmerer, 2002). When designing for the real world, any attempt to isolate design and treat it as a separate entity contradicts the inherent values of design as a foundational, life-supporting system (Papanek, 2012). In the Gyalrong community, Yunhe Center designed a learning program for high school students from urban areas aimed at promoting the eco-economic transition of the Gyalrong Tibetan village. Students engage in learning and researching Sichuan pepper from ecological, economic, cultural, and community perspectives, ultimately presenting reports and community presentations. The one-week learning module includes natural observation in the village, participation in traditional mountain deity worship ceremonies, interviews with Sichuan pepper farmers to understand their aspirations and environmental challenges, visits to inheritors of embroidery and folk songs, reading reports on the village's ecosystem diversity, and studying case studies from eco-designers. By engaging the head, hands, and heart, and weaving new stories from the old, it enables individuals and groups to grasp and share complex wholes and foster reciprocal relationships with the community as well as the mountain (UNESCO, 2020).

Among the mountains, there are lessons in culture, literature, poetry, botany, glaciology, science, history, spirituality, and the entire university curriculum (Frazier et al., 2019). When contemplating the pedagogy of mountains, we discover through historical research, social connections, and actions

that mountains can be seen as learning spaces, initiating co-creation from a deep-time and interdisciplinary perspective (Seed, et al., 2007). If the dialogue initiated around the project generates a storytelling process, where people experience the authentic place through actions and words, it can transcend the project and integrate into the community and beyond, creating what Atlee (2007) refers to as a new "story field." This mountain pedagogy reveals different values and meanings closely related to personal memories, local actors, and self-identity (Mang and Reed, 2012). In this sense, taking mountains as pedagogy that includes our embodied experience of places, has an acupuncture effect that ripples far beyond its direct impact.

3.3 Mountain Economy

Imagine a scenario where the mountains of the world form a network of learning spaces and focal points for ecosystem restoration and economic regeneration. What would economic theories, policies, and institutions look like if they aimed to promote human community in an ecologically responsible context rather than ever-increasing growth? John Cobb's book, co-authored with Herman Daly (1990), For the Common Good: Redirecting the Economy toward Community, the Environment, and a Sustainable Future, builds a bridge between economics and ecology, opening up possibilities for doing things differently.

For the past nine years, the Yunhe Center has been rooted in the Gyalrong community, developing a series of place-based learning programs focused on ecological economy, ecological restoration, and ecological design. These programs are grounded in participatory observation of place-based knowledge. By leveraging the interdisciplinary team led by designers, ecological, spiritual, and cultural knowledge is archived and transformed into learning programs for local and external students. Concurrently, market research and expansion are undertaken to attract external resources to the community through eco-tourism outreach. External experts and funding provide training in eco-tourism guidelines, homestay operation, and cultural heritage conservation, establishing mechanisms to empower the community. Ultimately, this ecological services-based economy model (see Figure 3) aims to engage local villagers and external visitors in gradually enhancing their ecological awareness, leading to ecological regeneration. These initiatives provide a mutual learning and practice space for the locals, government, and external stakeholders, and catalysts the mountain-centric, instead of user-centric, economy to support the regenerative circle. (UNESCO, 2020).

4. Storymaking: Moving as a River

Figure 3. Ecological services-based economy model by Yunhe Center

Process philosopher Alfred North Whitehead (1985) posits that the entire world flows like a river, as both the world and its entities are processes of change. Just as a river flows, the world exists in a state of flux, forming a network of ever-changing events. Theodor Schwenk (1976) suggests that human thought mirrors the design principle seen in the universe's formation, which is similar to fluid dynamics, where elements of a fluid relinquish their forms, becoming ready to merge with, integrate, and encompass everything. For Indigenous peoples, stories breathe their own breaths, they are organic in nature, and dynamic in process (Chawla , 2011), embodying inter-cultural, intergenerational principles and spanning time and space (Phillips and Bunda, 2018).

Mountains change over geological time; humans change over human time, and within this context, stories provide a way for humans to frame their understanding of the world, giving it shape and order (Fisher, 1987). This section, through a case study of community exhibitions, discusses how human anthropology links stories through fluidity, illustrating how Tibetans perceive and understand the world: through oral stories, songs, paintings, and images, telling how water systems sustain an invisible world. Participatory visual methods help evoke memories, emotions, and implicit cultural knowledge (Mannay, 2016). As a design methodological framework, storymaking can empower individuals, communities, and networks, serving as an alternative that respects the complexity of people and places, social structures, geography, and socio-political contexts (Metta, 2015; Lucarelli and Giovanardi, 2014).

Moving as a River provides a metaphor for understanding the dynamic, interconnected, and adaptive nature of storymaking,

emphasizing the importance of fluidity, integration, and continuous flow in knowledge archiving, learning, and co-creation. From 2023 to early 2024, the Yunhe Center collaborated with the external design team of Shanhailiang to design and plan three exhibition spaces in Zhonglu Township, Gyalrong community. These three spaces respectively showcase the ecological nature, culture, and life, as well as the spiritual beliefs of the Tibetan people. The case study on community exhibition examines the life experiences, productive labor, and living traditions constructed around the sacred Muerdo Mountains, mediated by the Gyalrong people. This dialogue between the land, deities, and humans, like the flowing rivers in the village, interlinks, emerges, and cycles continuously.

4.1 Place-based Knowledge Archiving

As a river flows and adapts to its surroundings, storymaking in the three community exhibitions involves the fluid collection and archiving of place-based knowledge, encompassing ecological, spiritual, and everyday practice wisdom. The first exhibition space is located in an old Tibetan house named after its owner—Worebo. It showcases the lives of three generations of Gyalrong people over nearly 100 years, highlighting their spiritual beliefs, family blood ties, emotional bonds, customs, community relationships, natural ecology, agricultural labor, and the inheritance of folk wisdom and craftsmanship (see Figure 4). The exhibition curator invited inheritors of intangible cultural heritage to redraw auspicious patterns on the doors and walls, hired experts as curatorial advisors, purchased many antiques from folk collectors, recorded village festival sounds with musicians, and interviewed several village elders. These participatory visual methods not only serve as powerful tools to understand people's sense of place and multi-sensory experiences but also engage them in meaningful reflection, negotiation, and potential regeneration actions (Tassi & Valsecchi, 2016).

Simultaneously, regenerative design encompasses "adjusting one's modes of being, behavior,

Figure 4. Exhibition space of the traditional Tibetan house

and communication, as well as the relationship to the broader life-evolution journey and coherence of the nested wholes—communities, ecosystems, the biosphere, and the cosmos—that we partake in" (Wahl, 2016). This principle is evident in the second exhibition space, which features the millennium murals in the Scripture Hall Tower of Salako Temple (see Figure 5). By using multimedia, the exhibition brings the divine statues from the imaginary world to the real space, with murals that move around the audience. The interpretation of Thangka stories, along with the display of five-colored prayer flags, religious instruments, and ritual symbols, showcases an aspect of Tibetan spiritual and cultural life. The need to re-create an intimacy with the Earth is essential to crafting the new story. As Berry (1988) states, by "creating some of our most powerful poetic references and metaphoric expressions" through the integration of cultural perspectives and scientific discoveries, this becomes a tool for addressing, and even solving, the challenges that threaten a sustainable existence (Berry, 1988, p. 16).

4.2 Alternative Learning Space

Figure 5. Millennium murals in the Scripture Hall Tower of Salako Temple

As rivers flow through different terrains, community exhibitions as alternative learning spaces encourage active engagement and artistic expression, allowing learners to immerse themselves in the local context and gain holistic understanding through multi-sensory experiences. (see Figure 6). In the Gyalrong Tibetan village exhibition design workshop, the curator led high

school students through three exhibition spaces: the Worebo exhibit of daily life, the spiritual world of the Sarako Monastery scripture hall, and the ecosystem of the White Tower Nature Observation Station. The curator introduced the entire process from project reception to exhibition completion, encouraging students to explore the place with multiple senses. The co-creation workshop examined how collaborative visual methods (maps, collages, videos, etc.) can be valuable tools for weaving stories. Ultimately, the students' collaborative works became part of the exhibition: short films about the Sacred Mountain, a map guide for village tours, a game design based on cultural heritage, and a renovation design proposal for the traditional watchtower. Multimedia, stories, and communicators intertwine to form the driving force of storymaking (Leavy, 2015).

Local learning exhibitions provide a safe space for learning and practicing design anthropology

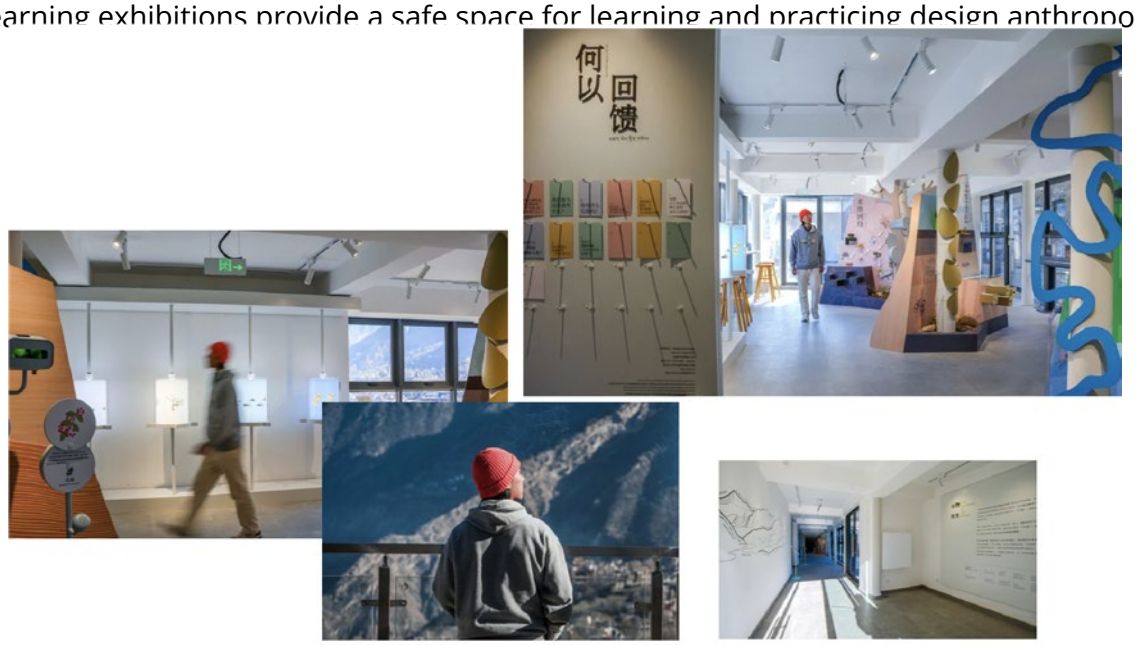

Figure 6. Exhibition space of the White Tower Nature Observation

as a system catalyst. Stories are translated into scientific language, government language, village language, and the language of external learners to communicate different needs, promoting dialogue and implementing empathetic actions through participatory observation. This creatively harmonious approach represents a continuous reciprocity of giving and taking, reflecting what we can do for the place (Mang and Reed, 2012).

Designers uncover old stories of living in a place and begin creating new ones, as we are not just storytellers but creators of stories (Kimmerer, 2013). This requires designers to deeply reflect on their contributions to understanding the regeneration and transformation of fragmented narratives (Irwin, 2020).

4.3 Remember, Connect, and Move Forward

Stories flow continuously, connecting past, present, and future. Moving as a River underpins the way of remembering, connecting, and moving forward, where past knowledge and experiences are integrated into present actions and future aspirations. The three exhibitions invite people to imagine the future differently, weaving stories that enable individuals and groups to grasp and share complex wholes. Principles of solidarity, respect, relationship, and reciprocity, embodied in human-land relationships, religious rituals, and folk beliefs, stem from this shared perspective, forming a common foundation of consensus: place (Y.Luo and Leitao, 2024). Human memory is based on stories, not data, and stories are the foundation of how people learn and organize what they know (Schank et al., 2009).

The accumulated knowledge of the remaining Indigenous communities worldwide represents ancient thoughts, experiences, and actions, which, if respected and preserved as an important repository of ecological wisdom, can form the basis for repositioning cosmology (Brush and Stabinsky, 1996). As rivers eventually flow into the sea, this paper intends to introduce Indigenous internationalism as a framework, cultivating place-based cooperative alliances among global Indigenous communities, culturally and economically. Māori intellectual Linda Tuhiwai Smith (1999), basing her work on the ocean as a giver of life and time patterns, outlines an image representing their agenda. She depicts four concentric circles to symbolize decolonization, healing, transformation, and mobilization for self-determination. These are not just goals but processes that connect, inform, and clarify the tensions between local, regional, and global contexts (Smith, 1999). Just as water forms a network of rivers, streams and oceans, the process of remembering, connecting, and moving forward involves weaving individual and collective stories from local, to global.

Conclusion

This paper delves into the rich interplay between design anthropology and the Tibetan worldview, demonstrating the profound impact of place-based learning and storymaking. By immersing ourselves in the Gyalrong Tibetan community's traditions and practices, we have gained valuable insights into how TEK can inform and enhance contemporary design methodologies. The integration of human and ecological systems is not merely an academic exercise but a practical approach to fostering sustainable and regenerative design.

The key lessons derived from this research underscore the transformative potential of embracing TEK and the wisdom embedded in Indigenous practices. The Gyalrong Tibetan community's harmonious relationship with nature offers a compelling model for rethinking modern design paradigms. Through place-based learning, designers can cultivate a deeper connection with the environment, leading to more empathetic and ecologically attuned solutions.

Storymaking, as a method, further enriches this process by weaving narratives that bridge cultural understanding and empathy. It allows for the preservation and transmission of Indigenous knowledge, ensuring that these valuable insights are not lost but instead integrated into the fabric of contemporary design practice. By listening to and telling the stories of communities like the Gyalrong Tibetans, designers can create more inclusive and context-sensitive projects.

Ultimately, this paper advocates for a paradigm shift in design anthropology, urging practitioners to look beyond conventional frameworks and embrace the lessons from TEK and Indigenous worldviews. By doing so, we can foster a more holistic and regenerative approach to design, one that honors the intricate connections between humanity and the natural world. The Gyalrong Tibetan community case study serves as a powerful testament to the enduring relevance of traditional knowledge in addressing the pressing environmental and social challenges of our time.

References

Whitehead, A. N. W., Griffin, D. R., & Sherburne, D. W. (1985). Process and reality : an essay in cosmology. The Free Press.

Atlee, T. (2007). Story Fields. Www.co-Intelligence.org. http://www.co-intelligence.org/StoryFields.html

BEKOFF, M. (2000). Redecorating Nature: Deep Science, Holism, Feeling, and Heart. BioScience, 50(8), 635. https://doi.org/10.1641/0006-3568(2000)050[0635:rndshf]2.0.co;2

Bellato, L., Frantzeskaki, N., & Nygaard, C. A. (2022). Regenerative tourism: A conceptual framework leveraging theory and practice. Tourism Geographies, 25(4), 1026–1046. https://doi.org/10.1080/14616688.2022.2044376

Berry, T. (1988). The Dream of the Earth. Thomas Berry. https://thomasberry.org/the-dream-of-the-earth/

Boutkan, E., & Hadders, H. (2020). Towards a Bioregional Model of Regenerative Communities and Transformative Learning. https://ecosystemcatalysts.org/wp-content/uploads/2020/06/BOUTKANHADDERS_SHORTPAPER_BIOREG.pdf

Cajete, G. (2000). Native Science. Santa Fe, N.M. : Clear Light Publishers.
Cajete, G. (2003). Look to the mountain : an ecology of Indigenous education. Kivakí Press.
Castellano, M. B. (2000). Updating Aboriginal traditions of knowledge. University of Toronto Press. In Dei G. J. S., Hall B. L., Rosenburg D. G. (Eds.), Indigenous knowledges in global contexts (pp. 21–36).

Chawla, D. (2007). Between Stories and Theories: Embodiments, Disembodiments, and Other Struggles. Storytelling, Self, Society: An Interdisciplinary Journal of Storytelling Studies, 3(1), 16–30. https://doi.org/10.1207/s15505340sss0301_2

Coggins, C. (2019). Sacred Watersheds and the Fate of the Village Body Politic in Tibetan and Han Communities Under China's Ecological Civilization. Religions, 10(11), 600. https://doi.org/10.3390/rel10110600

Dagyab, L. S., & Internet Archive. (1995). Buddhist symbols in Tibetan culture : an investigation of the nine best-known groups of symbols. In Internet Archive. Boston, Ma., U.S.A. : Wisdom Publications. https://archive.org/details/buddhistsymbolsi0000dagy

Daly, H. E., & Cobb, J. B. (1990). For the common good : redirecting the economy toward community, the environment, and a sustainable future. London Green Print.
Duncan, M. C. (1998). Stories We Tell Ourselves about Ourselves. Sociology of Sport Journal, 15(2), 95–108. https://doi.org/10.1123/ssj.15.2.95

Fikret Berkes. (1999). Sacred ecology : traditional ecological knowledge and resource management. Taylor & Francis.

Fisher, W. R. (1987). Human communication as narration : toward a philosophy of reason, value, and action | WorldCat.org. Search.worldcat.org. https://search.worldcat.org/title/Human-communication-as-narration-:-toward-a-philosophy-of-r eason-value-and-action/oclc/15014817
Frazier, A. E., Bryan, B. A., Buyantuev, A., Chen, L., Echeverria, C., Jia, P., Liu, L., Li, Q., Ouyang, Z.,

Wu, J., Xiang, W.-N., Yang, J., Yang, L., & Zhao, S. (2019). Ecological civilization: perspectives from N. Surname, N. Surname (LEAVE BLANK) [STYLE: _P/RoD RUNNING HEAD Even] landscape ecology and landscape sustainability science. Landscape Ecology, 34(1), 1–8. https://doi.org/10.1007/s10980-019-00772-4

Glowczewski, B., Henry, R., & Otto, T. (2013). Relations and Products: Dilemmas of Reciprocity in Fieldwork. The Asia Pacific Journal of Anthropology , 14(2), 113–125. https://doi.org/10.1080/14442213.2013.768697

Gonzalez, A., & Song, X. (2023, November 16). Towards a Mountain Teaching Pedagogy. Post Growth Perspectives. https://medium.com/postgrowth/towards-a-mountain-teaching-pedagogy-4305bac34730

Gunn, W., Otto, T., & Rachel Charlotte Smith. (2013). Design Anthropology. Taylor & Francis.
Guo J. (2012). 雪山之书. 云南人民出版社.

Habito, R. L. F. (2007). Environment or earth sangha: Buddhist perspectives on our global ecological well-being. Contemporary Buddhism, 8(2), 131–147. https://doi.org/10.1080/14639940701636117

Haggard, P., Clark, S., & Kalogeras, J. (2002). Voluntary action and conscious awareness. Nature Neuroscience, 5(4), 382–385. https://doi.org/10.1038/nn827

Hart, M. (2010). Licensed under Creative Commons Attribution Non-Commercial Share Alike License Indigenous Worldviews, Knowledge, and Research: The Development of an Indigenous Research Paradigm. http://markfoster.net/struc/Indigenous_worldviews.pdf

Horlings, L., Roep, D., & Wellbrock, W. (2018). The role of leadership in place-based development and building institutional arrangements. Local Economy: The Journal of the Local Economy Policy Unit, 33(3), 245–268. https://doi.org/10.1177/0269094218763050

Huan, Q. (2016). Socialist Eco-civilization and Social-Ecological Transformation. Capitalism Nature Socialism, 27(2), 51–66. https://doi.org/10.1080/10455752.2016.1164205

Irwin, T. (2020). The emerging transition design approach. Scholar.google.com. https://scholar.google.com/citations?view_op=view_citation&hl=en&user=dvMqKaUAAAAJ&citati on_for_view=dvMqKaUAAAAJ:4TOpqqG69KYC

Jessen, T. D., Ban, N. C., Claxton, N. X., & Darimont, C. T. (2021). Contributions of Indigenous Knowledge to ecological and evolutionary understanding. Frontiers in Ecology and the Environment, 20(2). https://doi.org/10.1002/fee.2435

Kimmerer, R. W. (2002). Weaving Traditional Ecological Knowledge into Biological Education: A Call to Action. BioScience, 52(5), 432. https://doi.org/10.1641/0006-3568(2002)052[0432:wtekib]2.0.co;2

Kohn, E. (2013). How Forests Think: Toward an Anthropology Beyond the Human. In Google Books. Univ of California Press. https://books.google.com.au/books?hl=en&lr=&id=xbMwDwAAQBAJ&oi=fnd&pg=PR8&ots=H69y JF-S3x&sig=VxZlNA4RC8BKQnSr5ywPk_cn1Yo&redir_esc=y#v=onepage&q&f=false

Latour, B. (2012). We Have Never Been Modern. In Google Books. Harvard University Press. https://books.google.com.au/books?hl=en&lr=&id=xbnK8NzMsm4C&oi=fnd&pg=PP11&ots=_VfMfftb_9&sig=U-iIpAeGdWE7fo-iuw-bLiFc7Y4&redir_esc=y#v=onepage&q&f=false

Leavy, P. (2014). Method meets art: Arts-based research practice. New York: Guild-Ford Publications.

Leitão, R.(2020) Pluriversal design and desire-based design: desire as the impulse for human

flourishing, in Leitão, R., Noel, L. and Murphy, L. (eds.), Pivot2020:DesigningaWorldofManyCenters-DRS PluriversalDesignSIGConference, 4 June, held online. https://doi.org/10.21606/pluriversal.2020.011
Article title [STYLE: _P/RoD Running head odd]

Li F. (2014). 嘉绒跳锅庄：墨尔多神山下的舞蹈、仪式与族群表述. In Google Books. Beijing Book Co. Inc. https://books.google.com.au/books?id=5Z9WEAAAQBAJ&printsec=frontcover&source=gbs_book_other_versions_r&redir_esc=y#v=onepage&q&f=false

Lucarelli, A., & Giovanardi, M. (2014). The political nature of brand governance: a discourse analysis approach to a regional brand building process. Journal of Public Affairs, 16(1), 16–27. https://doi.org/10.1002/pa.1557

Lupo, E., & F. Valsecchi. (2010). Designing local cultures evolution and socialization within the global knowledge. Conference: Proceedings Cumulus Conference 2010 "Young Creators for Better City and Better Life," 978-952-60-0046-6, 1–7.

Mang, P., & Reed, B. (2012). Designing from place: a regenerative framework and methodology. Building Research & Information, 40(1), 23–38. https://doi.org/10.1080/09613218.2012.621341

Mang, P., & Reed, B. (2019). Regenerative Development and Design. Encyclopedia of Sustainability Science and Technology, Living reference work entry, 1–28. https://doi.org/10.1007/978-1-4939-2493-6_303-4

Mang, P., & Reed, B. (2020). Regenerative Development and Design. Sustainable Built Environments, 115–141. https://doi.org/10.1007/978-1-0716-0684-1_303

Mannay, D. (2016). Visual, Narrative and Creative Research Methods: Application, reflection and ethics. Routledge & CRC Press. https://www.routledge.com/Visual-Narrative-and-Creative-Research-Methods-Application-reflection-and-ethics/Mannay/p/book/9781138024328

Mehmood, A., Marsden, T., Taherzadeh, A., Axinte, L. F., & Rebelo, C. (2019). Transformative roles of people and places: learning, experiencing, and regenerative action through social innovation. Sustainability Science, 15(2), 455–466. https://doi.org/10.1007/s11625-019-00740-6

Metta, M. (2015). Embodying Mêtis: The Braiding of Cunning and Bodily

Intelligence in Feminist Storymaking. https://espace.curtin.edu.au/bitstream/handle/20.500.11937/17198/234661_234661.pdf?seque nce=2&isAllowed=y

Nelson, H. G., & Stolterman, E. (2014). The design way : intentional change in an unpredictable world. The Mit Press.

Orr, D. W. (2004). Earth in mind : on education, environment, and the human prospect. Island Press.

Papanek, V. J. (2012). Design for the real world : human ecology and social change. Academy Chicago Publishers.

Phillips, L. G., & Bunda, T. (2018). Research Through, With and As Storying. https://doi.org/10.4324/9781315109190

Pollock, A. (2012). Conscious Travel: Signposts Towards a New Model for Tourism. https://skift.com/wp-content/uploads/2012/09/presentacion-anna-meira-pollock.pdf
Kimmerer, R.W. (2013). Braiding Sweetgrass : Indigenous wisdom, Scientific Knowledge and the Teachings of Plants. Milkweed Editions.

Schank, R. C., Abelson, R. P., & Wyer, R. S. (2009). Knowledge and memory : the real story. Psychology Press.
N. Surname, N. Surname (LEAVE BLANK) [STYLE: _P/RoD RUNNING HEAD Even]

Scharmer, O., & Yukelson, A. (2015). Theory U: From Ego-system to Eco-system Economies. Journal of Corporate Citizenship, 2015(58), 35–40. https://doi.org/10.9774/gleaf.4700.2015.ju.00005

Schwenk, T. (1976). Sensitive Chaos: the Creation of Flowing Forms in Water and Air. New York: Schocken Books.

Seed, J., Macy, J., Fleming, P., & Naess, A. (1988). Thinking Like a Mountain. New Society Publishers.

Smith, L. T. (1999). Decolonizing methodologies : research and Indigenous peoples. Zed Books.
Stabinsky, D., & Brush, S. B. (1996). Valuing Local Knowledge. Island Press.

Tuck, E. (2009). Suspending Damage: A Letter to Communities. Harvard Educational Review, 79(3), 409–428. https://doi.org/10.17763/haer.79.3.n0016675661t3n15

UNESCO. (2021, March 3). Creativity 2030 Issue Five - International Center for Creativity and

Sustainable Development under the Auspices of UNESCO. City.cri.cn. https://city.cri.cn/20210303/b4d3f221-6cce-c109-d5db-d79e5ed4842f-i.html

Wahl, D. C. (2016). Designing Regenerative Cultures. In Google Books. Triarchy Press. https://books.google.com.au/books?hl=en&lr=&id=-tD5DwAAQBAJ&oi=fnd&pg=PA10&dq=Wahl

Wheatley, M. J. (2010). Leadership and the new science : discovering order in a chaotic world. Great Britain]: Accessible Publishing Systems.

Y. Luo, I., & Leitao, R. M. (2024). Pluriversal Design in One Situated Place: An Approach Rooted in the interface between the Local and the Global. DRS Biennial Conference Series, DRS2024: Boston, 23–28 June, Boston, USA. https://dl.designresearchsociety.org/drs-conference-papers/drs2024/researchpapers/144/

Yü, D. S. (2015). Mindscaping the Landscape of Tibet: Place, Memorability, Ecoaesthetics. In Google Books. Walter de Gruyter GmbH & Co KG. https://books.google.com.au/books?hl=en&lr=&id=9fJeCAAAQBAJ&oi=fnd&pg=PP7&ots=UspMprYHLw&sig=jlPfTUeSvcLvJWVvs-bwSJBkRvE&redir_esc=y#v=onepage&q&f=false

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Author 1 add an author bio that describes research interests and main achievements in a maximum of 40 words. [LEAVE BLANK UNTIL FINAL ACCEPTANCE] [_P/RoD Author Bio and Acknowledgements]

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SHIFTING GRAPHIC DESIGN PEDAGOGY: CO-CREATING WITH CANCER SURVIVORS FOR INCLUSIVE CLINICAL TRIALS

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ABSTRACT | This paper outlines how students, faculty, medical practitioners, and community advocates came together to redefine community engagement in clinical trials in Los Angeles County. Clinical trials, the main path to determining whether medical treatments and prevention strategies are safe for humans, are historically inequitable in the United States. To combat the representation disparity between those living in the United States and those participating in clinical trials, in April 2022, the United States Food and Drug Administration instructed clinical trial sponsors to recruit more equitable groups (Office of the Commissioner, 2022). Although, with a long history of unethical acts of testing, communities of color in the United States mistrust medical institutions (Rodriguez & Garcia, 2013). Increasing diversity in these trials is imperative for equity in health access but challenging due to the need for more trust between communities of color and health institutions. Cedars-Sinai Cancer Research Center for Health Equity partnered with Designmatters at ArtCenter College of Design to invite design students to reimagine recruitment for clinical trials. The authors utilize this paper to highlight the importance of the agility of faculty in guiding students and those closest to the challenge through co-design activities to design solutions that reflect the needs of those historically marginalized.

This paper exemplifies how partnership-based pedagogy is an innovative format to bring interdisciplinarity in the classroom. The authors share how this format shapes the present and future of pedagogical approaches in the field by outlining their learning. This paper highlights how the crux of this educational format empowers students to vocalize their curiosity and learn as creatives, shaping them into more collaborative, committed, and confident practitioners. While students are the primary learners, through this paper, the authors explore the discomfort and

comfort of educators being learners themselves. In addition to demonstrating a collaborative and transformative student experience, this paper proposes a framework that educators can assess and utilize to create enabling conditions for co-design between partners, communities, and students by reflecting on what it takes for designers to collaborate, unpack creative bias, and design for value. Educators are more than teachers when executing partnership-based curricula. Through this paper, the authors highlight the unique dynamic of the classroom, where they served as managers, facilitators, and connectors—expanding their roles and challenges. The authors explore the nature of research and partnership-based pedagogy as an agent of inclusive and representative work. In addition to highlighting the need for educational innovation and the enabling conditions required to co-design with those, not in the classroom, it also sheds light on the three community-centered campaigns tangibly developed as the outcome of this pedagogical approach.

KEYWORDS | GRAPHIC DESIGN PEDAGOGY, CLINICAL TRIAL RECRUITMENT, CREATIVE BIAS, CO-CREATION, RESEARCH-DRIVEN DESIGN

1. Introduction

Graphic designers can claim to be one without a formal degree (Wong et al., 2018; Debbie, 2011), which makes it a unique discipline to develop pedagogical approaches. With the rise in artificial intelligence and templatization, visual design has become an adaptable tool for all. Still, according to Benson (2020), most employers seek to employ trained design practitioners, expecting fresh practitioners to demonstrate extraordinary competencies to secure said jobs. (Benson, 2020; Adu, 2015). While graphic design students are expected to learn and grow for the benefit of their prospective employers, the discipline remains imprecise (Meron, 2022). Meron (2022) argued that graphic design lacks academic literature to learn from, which transfers the focus to the visual function of the discipline from a theoretical one. Graphic design also lacks social, political, cultural, and economic frameworks and methods (Walker, 2017), often playing a significant role in production. Addressing the articulated disciplinary needs, this paper approaches said challenges through the lens of educators, students, and co-design participants in an interdisciplinary environment. It attempts to codify a participative and co-design curriculum that results in evidence-based visual design practice for students while benefiting from the critical perspectives of community organizers and leaders.

This paper is the outcome of a class taught by Designmatters at ArtCenter College of Design within a transdisciplinary classroom developed by the college's social innovation design department in late 2022. Designmatters collaborates with mission-driven non-profit organizations, industry, and international development agencies, leading to an immersive and impactful research experience for students. The partner for this course, Cedars Sinai Cancer Research Center for Health Equity, is a leading cancer research center in a nonprofit hospital in Los Angeles. Both institutions have had the privilege of building a robust relationship of trust through continual partnership since 2018, which sets projects up for a collaborative and transparent environment for the students to develop authentic outcomes and products.

It may be difficult for individuals to create similar learning experiences without a similar institutional model of long-term partnerships. Hence, this paper focuses on the key strategies identified during and after the course to better devise enabling conditions and recognize disabling conditions of co-design and participatory practice in a classroom.

Drawing on literature review, post-course reflective roundtable discussions, and a proposed framework, this paper sheds light on the intersectionality of class and care, revealing the profound impact of social and environmental factors on design and access. It champions the value of co-design with individuals with lived experience, offering a unique reflection on the course methodology, challenges, and potential for future iterations. It attempts to reflect on the nature of learning in a unique classroom and is an exercise in creating a reflexive design practice. The reflective analysis is used as a systematic search for patterns, logic, and order, whereas the reflexive approach is the resulting framework. This paper proposes key pillars to a participatory-centric curriculum wherein the reflexive approach is utilized to engage in the reciprocal nature of perception and ethical action (Cunliffe, 2004; Buchert, 2021). The authors define reflexive pedagogy as the central theme of investigation to indicate that educators and students need to self-assess the circumstances as they are happening in the class to understand the nuances of applied design learning.

2. The Gap Between Medical Institutions and Communities

Context defines communication. Since it is crucial to learn from historical evidence to develop better and holistic outcomes, the faculty and partner recognized the need to understand the challenging context between medical institutions and communities when framing the project brief for the class. This paper delves into the strategies and tools used in the classroom to develop evidence-based practice, but in this section, the authors elaborate on the history of the subject matter to establish the significance of community engagement and co-design process for this project.

Historically, inequities in public health have been a result of race and class discrimination, where poverty led to health vulnerabilities. Simultaneously, the wealthy could retreat to country estates to distance themselves from infections (Institute of Medicine et al., 1988). The clear distinction between classes left those more vulnerable— individuals experiencing poverty and discrimination—to clean their surroundings, which they did not have the privilege to address. Additionally, to develop medication for the affluent, the US engaged in several illegal acts of testing individuals; for instance, a Guatemalan study in 1946 infected at least 5,128 individuals without prior consent (Rodriguez & Garcia, 2013). Another example of non-consensual experimentation led by the US government

is named the Tuskegee Syphilis experiment between 1932 and 1972, which left the participants without treatment (Rodriguez & Garcia, 2013).

Even today, US healthcare is tied to economic, social, and political factors—systematically designed to marginalize underrepresented communities. It was as late as 1974 when The Belmont Report (1979) established the ethical considerations and challenges in biomedical research. This report summarized the ethical principles into three [parts]: respect for persons, beneficence, and justice (Centers for Disease Control and Prevention). However, the ethical considerations led to regulating biomedical testing, not the marginalization or underrepresentation in research until 2022, when the FDA instructed research sponsors to recruit more equitably to combat health inequities (Office of the Commissioner, 2022). More recently, in 2020, 4,922 patients participated in clinical trials of 18 approved drugs, where 73% of the trial participants were White, 5% were Black/African American, 14% were Asian, and 6% were Latino/Hispanic (Owens-Walton et al., 2022), compared to the population share of 59.3% White, 12.6% Black, 5.9% Asian, and 18.9% Latino/Hispanic (U.S. Census Bureau, 2022).

In addition to institutional efforts to change research and testing for biomedical interventions, individuals like Dr. Nancy Krieger (Krieger, N. 2005) are trying to evolve traditional medical research to focus on community-based participatory research (CBPR). It is a process that aims to build partnership through trust, respect, and shared decision-making, which is also the pillars of the design process and strategies used in this course. In the Applied Design and Pedagogy: Pedagogical Innovation in the Classroom section, the authors outline the following subtopics that build on trust, relationship, and justice:

1. Designing for individuals and interdisciplinary learning
2. Creating an equitable and participatory learning environment
3. Addressing mistrust and bias through design
4. Team-building and brief-focused classwork

3. Understanding Design's Role in Disrupting Exclusionary Praxis

In 2017, George Aye highlighted that design students dedicate their time and skills to comprehend complex problems but often lack an understanding of power and its role in complex systems (Aye, 2017). The first generation of constructive design researchers focused on ergonomics, usability, and psychology (Koskinen, 2010), whereas colleges rarely operationalized design research that could disrupt inequitable systems. Hence, they rarely questioned power distribution

or were trained to engage in community-centered practice. The lack of co-creation eventually led to an art and design education agenda that did not prioritize research, with a few exceptions. While developing a robust research-driven design curriculum, the University of Art and Design Helsinki realized that few senior faculty had experience leading research.

In contrast, their curriculum focused more on strategic objectives than the School of Design had hoped (Keinonen & Koskinen, n.d.). The bigger challenge, however, is the shifting nature of design, which means that the pedagogy must contribute to the continually expanding methods students must grasp (Chmela-Jones, 2017). Design pedagogy perpetuates hierarchical structures by encouraging students to create in isolation and away from co-creation opportunities, such as design mechanics or addressing the politics of design (Singh Rathore & Schlaug, 2024). Bringing in community partners in the design process aims to hold the practitioners and students accountable for their outputs (Tarallo, 2013). It demonstrates the value of shared decision-making in design processes. This paper proposes that educators focus on a pedagogy that builds on participatory and co-creation with those closest to the challenge, equips students with critical thinking and tools to navigate power structures, design with community members, and create equitable systems.

4. Framework Methodology

This paper reflects on the need for teaching evidence and research-centric visual design practice by examining techniques used in the classroom and insights and lessons learned documented through a post-class interdisciplinary roundtable of designers, community members, and faculty. The undergraduate studio course, co-hosted by the Graphic Design and social innovation design departments, took place in the fall of 2022 and included students from the Graphic Design, Interaction Design, Product Design, Fine Art, and Illustration departments. The studio's project brief focused on increasing awareness of and enrollment in cancer-related clinical trials within diverse communities, specifically Korean and Latinx communities in Los Angeles. The class learning outcomes included: (1) the intentionality of the design process and its relationship to bias and delivery; (2) in-depth guidance for research aimed at understanding communities' perspectives; and (3) structuring deliverables based on feedback and co-design.

The course culminated in the three multi-media campaigns centering communities' experiences and perspectives. Since the class and curriculum were uniquely designed, the faculty recognized the need to reflect on the challenges and achievements of the course through an interdisciplinary roundtable, continuing documentation through the collaborative approach defined by a participation-centric curriculum.

The following two sections highlight the learnings of the class and roundtable discussion and propose a framework to create the enabling conditions of participatory environments and co-creation in a visual design studio classroom. The framework's analysis, documentation, and proposal are developed through primary research, i.e., qualitative data collection, during and after the course.

5. Applied Design and Pedagogy: Pedagogical Innovation in the Classroom

When it comes to class, hierarchy, and societal needs, care has been different for everyone. The Committee for the Study of the Future of Public Health (1988) argued that the public responsibility for the health of the population needs to become more fiscally possible because, before the nineteenth century, diseases were used as tools to segregate the rich and poor (Institute of Medicine, 1988). However, with the plague, it became more evident that the wealthy could not escape contact to avoid illness. In this section, the authors explore how pedagogical innovation can bring sensitivity and awareness to the classroom. In order to understand and address inequities in public health outreach, the authors implemented qualitative strategies like focus groups and community dialogues that students could lead and learn by doing. Articulated in the following teaching and management strategies, the authors outline the impact on student and community engagement below.

5.1 Designing for individuals and interdisciplinary learning

Design students have research opportunities in their classrooms, but fewer that include research participants and introduction to participatory practicum. A core component of this class was to co-design concepts through participatory methods and community engagement. It focused on introducing students to human-centered design, its critique, and tools to engage with research participants. The class equipped students with tools and tactics to engage community members through interviewing, listening, creating user journey maps, and taking community members along with them through the creative process. During the course and the roundtable discussion, the class acknowledged how the politics of people, design, and research intersect through lived experience. Centering the class on lived experience and those closest to the challenge helped the students learn through primary research and sources. The class soon realized that individuals do not know about clinical trials unless they are diagnosed with cancer, and even then, it is difficult to find a suitable trial for themselves. Even individuals with a family history of cancer are often unaware of cancer clinical trials and the process to participate in them.

Using participatory research, the students engaged with those experiencing and in remission from cancer to understand the lived experience and those conducting health research to learn about the qualitative

and quantitative data available to identify behaviors and trends in the field. Since research stakeholders shared the value of introducing clinical trials earlier in the diagnostic process, the students were able to design tools and products that focused on proactive engagement and learning processes—challenging the misconception that clinical trials are only for cancer patients with a terminal diagnosis. The classroom aimed to shift the traditional focus from designing from organizations to designing for individuals in order to underscore the significance of applied design. The curriculum served students from different disciplines, such as Fine Art, Interaction Design, Product Design, and Graphic Design, to learn from each other and research participants, resulting in a unique blend of art, usability, and a learning experience. During the roundtable, the students stated that interacting with health professionals and community members distinguished this class from other classes. It provided them an environment to learn from real-world experiences and depart from traditional prompt-based classes.

5.2 Creating an equitable and participatory learning environment

Through a participation-centric curriculum, the faculty created an environment that emphasized equity, co-creation and commitment to the lived experience of the community members. Mindful of the barriers that students sometimes face in accessing research opportunities outside of the classroom and class time, including access to transportation, time and funds, the faculty arranged for field trips to health clinics with provided transportation during regular class time, and invited partners and community members into the classroom for discussion and engagement. The cancer research center handled recruiting healthcare workers and community members to engage in this experience through its relationship with health clinics and other support organizations. The cancer research center organized compensation for community members for whom participation was a burden, and the class offered options to join sessions virtually for those that could not travel to the college. Students also received stipends to cover any out of pocket expenses related to the class, including supplies and prototyping materials. This all helped set an equitable foundation for the class. The classroom environment also guided the students to reflect on the historical marginalization, devise ways of partnership, and build a robust process supported by evidence of community engagement. Through co-creation and participation, the students developed outcomes that centered the authentic needs of impacted individuals, creating a sense of belonging for prospective participants of cancer clinical trials. The objective of grounding in the community and those closest to the challenge helped the classroom learn from, and design with individuals who have felt excluded—who do not see themselves reflected in verbal or visual outreach components of medical institutions. The intentional tools used in the classroom emphasized the critical role

of interaction in making effective products, bridged the gap between design students and their subject, and the criticality of field interaction and understanding the community perspectives. As a result, students experienced the value of making decisions through consensus, community feedback, and effective communication between the designer and stakeholders.

5.3 Addressing mistrust and bias through design

Reflecting on the historical marginalization and impact of healthcare practices helped the students discuss the instances of eugenics, discrimination, and mistrust. The lack of institutional accountability was a central theme in the classroom. It helped students design campaigns to gain trust and build an intentional and authentic relationship. During the roundtable discussion, the students underscored the value of addressing personal bias and positionality as a designer.
They recognized the challenging nature of the class due to its different format and learning experience. More importantly, they noted that a critical challenge for design students is to learn to design for systems they are not beneficiaries of, which is often different from the perspective they come across in other classes. Designing for different languages helped the students reimagine communication in and outside the medical institution. As a result, the students focused on community and interpersonal relationships.

"With the [omnipresent] mistrust of medical institutions, we relied on the community as a guiding factor for our project. We were fascinated by how strongly the concept of community works. So we took advantage of [the mistrust] through our application and concept. It was fascinating how we had to get deep into this and how much of this health problem does not involve health aspects. We are talking about communities around Los Angeles; we are talking about income and transportation. This course made us consider the many aspects of just one problem."

FACULTY MEMBER, ROUNDTABLE DISCUSSION

5.4 Team-building and brief-focused classwork

The unique dynamic of the classroom was not limited to research and partnership. Divided into three teams, the students navigated different skills, interests, and personalities to arrive at successful outcomes. The students worked together to complement their skills. During the roundtable, the students emphasized the value of learning from each other as being more significant than the challenges they faced. However, teamwork is more challenging within a competitive design institution that fosters individuality more than cooperation. In a competitive and individualistic environment, it can be challenging to break through the focus on

personal portfolio pieces and work towards a common goal defined by a partnership-based project brief. More importantly, any discomfort in collaboration and focus on said individuality can make it difficult to evaluate the work done in the classroom and achieve success—in terms of experience, learning, and outcomes. When done authentically, this participative and interdisciplinary environment can emphasize stepping out of one's comfort zone to create meaningful work and impact for the students.

The social innovation department specifically seeks and frames projects with partners in which the student-designed outcomes may be moved beyond the walls of the classroom and into further development toward real-world pilot implementation; with this specific partner, all of the previous projects had some level of implementation for student projects. As a result, educators were not just engaging in discourse and supporting creative endeavors; they also acted as project and research managers tasked to lead the project through educational components. In most instances, one is either managing a project or teaching, but in this instance, both roles influence each other. As a result, while the beneficiaries of this process are students and partners, the faculty are responsible for managing expectations, creating through learning, and designing an intentional yet fast-paced environment.

6. Building Co-Design and Participation-Centric Curriculum

This section describes the key framework for enabling conditions of success to create a participative curriculum and environment that educators can use to create a similar opportunity for their classrooms. This framework is intended to demonstrate the value of lived experience and reflexive collaboration, driven by the belief that values outweigh the effort and difficulty of the process. In order to develop a visual design class focused on applied methodology, educators and partners can reflect on the following key learnings as ideological pillars of the curriculum and engagement:

- **Foster a transparent classroom environment:** Design as a discipline is shaped by privileged perspectives, and the classroom can see this impact on materials the students may develop. It is imperative that the classroom is centered on sharedpower and decision-making to ensure it develops tools that foster shared decision-making. Educators can develop this environment by modeling the behavior themselves and sharing references that encompass the results they expect from the students. During the course, the educators showcased case studies that demonstrated critical analysis and strategic solutions. They also featured works from students grappling with similar challenges to encourage a dialogue and foster peer-

learning discussions throughout the term. Alongside faculty's own research and projects, each lecture ended with a space for reflections and observations, where the faculty and students could share successes and failures. With these intentional yet small steps, faculty nurtured a classroom environment that enabled students to collectively celebrate successes and confront failures head-on.

· **Value students, teachers, and participants' perspectives alike:** Reflexivity and reflections do not come easy in a fast-paced environment, but they are a crucial step in valuing the perspectives of all stakeholders. In this course, the educators built reflection space for all tools and tactics shared; they demonstrated the needs before assigning tasks and created space for students to reflect on their emotions as well as their work. As a result, the students were able to bring their full selves to the class, be more in tune with themselves as creatives, and get an opportunity to vocalize their needs. When the classroom valued listening and reflection, it seamlessly translated to research participant sessions and interviews. The intentionality of these actions led to more collaboration that created conditions for shared power.

· **Commitment to partnership:** Since there are several moving pieces, educators, partners, community members, and students form a dynamic web; everyone must maintain open communication and collaborative spirit. True partnership meant transcending the traditional roles and working together seamlessly. This united effort empowered participatory practices and ultimately delivered inclusive outcomes to benefit the end-user and all stakeholders. In this class, beyond learning, students contributed by translating knowledge into impactful design deliverables. Educators, in addition to guiding, offered art direction and expertise while managing projects. Lastly, the partners were deeply engaged in bringing those closest to the challenge to the classroom, facilitating research partnerships, and amplifying meaningful experiences.

Students continually express the need for tools and methods that contribute to sustainable and inclusive practice (Lupton et al., 2021). The Program Learning Outcomes of the social innovation design department drive towards ensuring students understand how to collaborate through transdisciplinary and team-based work; how to center communities in their work through advocacy and social change; how to apply ethical design research practices; and how to seek out resources to understand historical, cultural and community contexts of any design brief. The overall goal of the Program Learning Outcomes is to create a community of equity-minded designers in the classroom and post-graduation.

As a result of this endeavor, the faculty recognized that empowering students to vocalize their needs and insights leads to a space that values the external collaboration of non-designers. By reflecting on the enabling conditions of the successful class, the authors identified the classroom to be more confident, committed, and collaborative to design for the greater good. Creating space for reflection and exchange also held educators responsible for bringing their full selves to the classroom and addressing challenges as a group rather than making decisions themselves.

7. Project Outcomes

A key part of pedagogical innovation is ensuring the learning objectives of the classroom are not sacrificed. Where students can learn and practice community-centered tools, a visual design curriculum needs visual artifacts and centers each student's growth. Hence, the co-design process and the proposed framework are not the only outcomes of this class. Here are the three projects shared with the clients, with one in production, that student teams proposed. These three projects are briefly described below to illustrate how the final design outcomes connect and reflect the stakeholders' experiences. The cancer research center hired a student as a Fellow to continue developing the concepts for a pilot implementation planned for later in 2024.

7.1 Cure for the Community

Students: Xiyu Chen, Jesslyn Lee, Megan Pantisks

This student team worked with older adults in Latinx and Korean communities to create a campaign that offered 1) easy-to-understand, basic information about clinical trials and 2) positive personal stories from individuals who have previously participated in clinical trials to create a personal connection. The message is welcoming, inviting people to Be Part of the Cure: Participating in a clinical trial can help save not just your life, but the lives of others in your community. The overall campaign tone is friendly to respond to the community members' expressed desire for connection, but professional to build trust for the information being shared. The campaign uses an illustrative style, integrating handwritten text and hand-drawn characters and iconography that can be customized for different languages. The decision to develop an illustrative language is a reflection of field engagement and study that helped the students better understand the aesthetics that would resonate with the audience. Campaign materials were designed for specific local sites mentioned by community members, such as bus stops, churches, community centers and retirement communities.

7.2 DIVERCT

Students: Taiga Haruyama,
Cindy Chu, Lillian Yian Lin

This project empowers healthcare workers, including oncologists, nurses, patient navigators and primary care physicians to be confident and culturally sensitive sources of information about clinical trials for their patients. The main outcome is a website that features up to date clinical trial information and community guides to help healthcare workers understand the cultural needs of their patients. The website is supplemented with a print campaign that includes two sets of posters for healthcare settings. Posters for healthcare workers announce "Healthcare Providers are Information Providers" with a QR code to the website. Healthcare workers will also be given pins that state "Ask me about clinical trials" and "Clinical trials provide hope." For patients, posters describe the benefits of clinical trials. The student team also designed a portable information booth for healthcare workers to take with them to community events, responding to a stated need for something eye-catching that can spark conversations. DIVERCT responds to the lack of conversation about cancer clinical trials, to encourage dialogue through simple artifacts like the pins, posters, and the information booth.

7.3 Our Trial

Students: Noah Cousineau,
Vanessa Huang, Haoran Xu

This student team designed a social media program to offer education and support for cancer patients, from those in remission to those who are newly diagnosed, based on the individual experiences described by cancer patients in the classroom. After a user enrolls in "Our Trial" at the recommendation of their healthcare provider, they can select which communities (similar cancers, similar ethnic or cultural backgrounds, interests, locations, etc.) they want to join. Users can connect via chat or through healthcare clinic-hosted in person support groups. Those further along in their cancer treatments can offer advice to those newly diagnosed, and those who have participated in clinical trials can share their experiences with others who might be eligible. "Our Trial" uses pop art tones and fluid groovy shapes of the 60s/70s, a playful iconography that resonates with many cultures and with the adult age groups most likely to be diagnosed with cancer.

8. Conclusion

Design educators face the dual task of defining the present and shaping the future of their discipline simultaneously. At this pivotal time, while visual templates and tools are readily available for anyone to use, design educators have an opportunity to define how research, community-centered, and evidence-based practices can bring more value to formally educated graphic designers. Research, community-centered, and evidence-based visual design pedagogy means an intentional and critical creative process, which can help graphic design students firmly situate themselves as valued professionals.

As illustrated in this paper, co-designing with those closest to the issues helps faculty and students better understand the nature of power, the impact of design work, and the reality of (multi-lingual) implementation. The proposed framework highlights the need for an honest, agile, and collaborative classroom that respects and co-designs with individuals most impacted by the design choices made and have lived experience of the problems the project brief is addressing. There are various purposes that design can serve, and this paper proposes how design pedagogy can evolve to better align with the intended goals of the project brief, its environment, and the historical context of the identified problem.

References

Adu, A. (2015). Graduate employability: The link between design education and the graphic design industry. Kwame Nkkrumah University of Science and Technology, Kumasi, Ghana.

Aye, G. (2021, August 13). Design Education's Big Gap: Understanding the Role of Power. Greater Good Studio. https://medium.com/greater-good-studio/design-educations-big-gap-understanding-the-role-ofpower-1ee1756b7f08

Benson, Cheung. (2020). Double 'Blind Spots' of the Academia and Design Industry.

Buchert, M. (2021). Reflexive, Reflexivity, and the Concept of Reflexive Design. Dimensions. Journal of Architectural Knowledge, 1(1), 67-76. https://doi.org/10.14361/dak-2021-0109

Centers for Disease Control and Prevention. "About." Www.cdc.gov, 3 Nov. 2022, www.cdc.gov/tuskegee/about.html.

Institute of Medicine (US) Committee for the Study of the Future of Public Health. The Future of Public Health. Washington (DC): National Academies Press (US); 1988. 3, A History of the Public Health System. Available from: https://www.ncbi.nlm.nih.gov/books/NBK218224/

K.A. Chmela-Jones (2017) Flourishing in graphic design education: incorporating Ubuntu as a curricular strategy. The Design Journal, 20:sup1, S1048-S1057, DOI: 10.1080/146069925.2017.1353048

Keinonen, T., & Koskinen, I. (n.d.). Research Driven Design Education. Retrieved May 1, 2023, from https://ilpokoskinen.com/media/6.0_Research_Driven.pdf

Koskinen, I. (2010). Lab, Field, Showroom: Doing Design While Doing Research. Retrieved May 1, 2023, from https://ilpokoskinen.com/media/3.KOSKINENcorreto.pdf

Krieger, N. Defining and investigating social disparities in cancer: critical issues. Cancer Causes Control 16, 5–14 (2005). https://doi.org/10.1007/s10552-004-1251-5

Meron, Y. (2022) Graphic design and artificial intelligence: Interdisciplinary challenge for designs in the search for research collaboration, in Lockton, D., Lenzi, S., Hekkert, P., Oak, A., Sádaba, J., Lloyd, P. (eds.), DRS2022: Bilbao, 25 June-3July, Bilbao, Spain. https://doi.org/10.21606/drs.2022.157

Owens-Walton, J., Williams, C., Rompré-Brodeur, A., Pinto, P. A., & Ball, M. W. (2022). Minority Enrollment in Phase II and III Clinical Trials in Urologic Oncology. Journal of Clinical Oncology, 40(14), 1583-1589. https://doi.org/10.1200/JCO.21.01885

Office of the Commissioner. (2022, April 13). FDA takes important steps to increase racial and ethnic diversity in clinical trials. U.S. Food And Drug Administration. https://www.fda.gov/news-events/press-announcements/fda-takes-important-steps-increase-racial-and-ethnic-diversity-clinical-trials

Office for Human Research Protections. "The Belmont Report." U.S. Department of Health and Human Services, 18 Apr. 1979, www.hhs.gov/ohrp/regulations-and-policy/belmont-report/read-the-belmont-report/index.html.

Singh Rathore, Nidhi & Schlaug, Monica (2024). The (Re)Search for Inclusive Healthcare: Designing Pedagogy and a Reflexive Practice. Learn X Design 2023, Future of Design Education.

Rodriguez, M. A., & García, R. (2013). First, Do No Harm: The US Sexually Transmitted Disease Experiments in Guatemala. American Journal of Public He alth, 103(12), 2122-2126. https://doi.org/10.2105/AJPH.2013.301520

Rosenkrantz, Barbara G. 1972. Public Health and the State. Harvard University Press, Cambridge, Mass.

Reverby SM. "Normal exposure" and inoculation syphilis: A PHS "Tuskegee" doctor in Guatemala, 1946–1948. J Policy History. 2011;23(1):6–28.

Sue Walker (2017) Research in Graphic Design, The Design Journal, 20:5, 549-559, DOI: 10.1080/14606925.2017.1347416

U.S. Census Bureau. (2022). U.S. Census Bureau QuickFacts: United States. Census Bureau QuickFacts. https://www.census.gov/quickfacts/fact/table/US/PST045222

Wong, Shaw Chiang & Idris, Muhammad Zaffwan & Chuen, Tan. (2018). What Makes An Undergraduate Graphic Design Education Valuable?. Journal of Education & Social Sciences. 11. 73-82.

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RESEARCH ON BRAND EXPERIENCE DESIGN STRATEGY FOR MR VIRTUAL COMMUNITY BASED ON AHP-QFD MODEL

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ABSTRACT | In recent years, the academic community has paid more and more attention to virtual communities, but the research on brand experience design for MR virtual communities is still relatively insufficient. This paper applies an integrated AHP-QFD research methodology based on the user requirements perspective to propose a set of specific design strategies. Firstly, user requirements are collected through the interview method and observation method, and the card classification method is used to classify the attributes of user requirements, initially obtaining 4 categories and 17 user requirements. Secondly, AHP is used to construct a hierarchical model of user requirements, and the user requirements are weighted. Finally, QFD is used to transform the user requirements into 12 specific design elements, and the design elements are ranked according to the degree of weighting. Based on the design elements, a set of design strategies for the MR virtual community brand experience was sorted out: the principles of interactivity and consistency, sociality and diversity, aesthetics and intuitiveness, user-centered and personalization. Through the comprehensive use of the AHP-QFD model, this paper can explore user requirements more objectively and scientifically, effectively guide the design of the MR virtual community brand experience in the future, and provide new ideas for the research and development of similar brand experience designs.

KEYWORDS | VIRTUAL COMMUNITIES, BRAND EXPERIENCE, DESIGN STRATEGY, AHP-QFD

1. Introduction

With the rapid development of Augmented Reality (AR), Virtual Reality (VR) and Mixed Reality (MR) technologies, people have higher expectations for immersive digital experiences that go beyond the boundaries of traditional screens (Flavián et al., 2019; He et al., 2018). Traditional social media and online communities can no longer fully meet modern society's needs for new types of social experiences, and the emergence of MR virtual communities provides a new platform to support richer and deeper exchanges and experiences, which is expected to become a key bridge to connect virtual and real and promote further integration of human society (Al-Quran, 2022). MR virtual communities refer to the combination of Mixed Reality (MR) technology to form a unique online community and interactive social space based on digital networks (Ridings & Gefen, 2004). In MR virtual communities, users can exchange information and ideas, as well as immerse themselves in a hybrid scenario that combines reality and virtual reality through devices such as head-mounted displays, providing users with richer and more intuitive ways of communicating and enhancing the sense of interactivity and participation in the user experience (Allcoat et al., 2021; Bec et al., 2021; Lomicka, 2020; Rokhsaritalemi et al., 2020). It not only represents a possibility for the future of socialising but also brings unprecedented convenience and fun to people's daily lives (Hoyer et al., 2020; Jamil et al., 2022). Brand experience refers to the comprehensive feelings and perceptions of users during their interactions with a brand (Van der Westhuizen, 2018), and brand experience in MR virtual communities is not only about shaping its brand image but also a key factor in driving business growth, maintaining customer relationships, and enhancing users' loyalty to the brand (Kaur et al., 2020; Kim & Chao, 2019; Mostafa & Kasamani, 2021).

There has been an increasing academic interest in virtual communities in recent years, but current research on virtual communities focuses on technological innovation, management, definitional classification, user behavior, and applications, with fewer

design studies (Agag & ElMasry, 2016; Baldus et al., 2015; Kapoor et al., 2018; Panigrahi et al., 2018). Moreover, the concept of MR virtual community is relatively new, and the research on MR virtual community brand experience design is still relatively insufficient. Furthermore, the existing research in this area is not well user-centred, so it is necessary to form design strategies through mining and research on user requirements to guide the future brand experience design of the MR virtual community (Bu et al., 2021).

This paper adopts a combination of qualitative and quantitative methods, primarily utilising the combined AHP-QFD (Analytic Hierarchy Process-Quality Function Deployment) research methodology, to conduct the brand experience of the MR virtual community. Finally, the paper outlines a set of design strategies for the MR virtual community's brand experience, providing new ideas for developing similar brand experience designs.

2. Research Methodology

In modern design research, user needs-driven approaches to design innovation include the Kano model (Kano), Analytic Hierarchy Process (AHP), Quality Function Deployment (QFD), Theory of Inventive Problem Solving (TRIZ), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), and so on (Jin, 2023). In recent years, a number of scholars have constructed integrated models from these methods and applied them to the development of design projects.

AHP (Analytic Hierarchy Process) is a qualitative and quantitative research method proposed by Professor T.L. Saaty, a mathematician at the University of Pittsburgh, USA, in the 1970s. The method is primarily used to ascertain the weighting coefficients of the user's needs, which helps the researcher to prioritise and make optimal decisions (Canco et al., 2021; Munier & Hontoria, 2021).

QFD (Quality Function Deployment) was initially proposed by Japanese scholars Prof. Yoji Akao and Prof. Shigeru Mizuno in the late 1960s and further developed and refined in the 1970s (Ginting et al., 2020). QFD is a quantitative research methodology for analyzing user requirements that focuses on transforming user requirements into design elements to increase user satisfaction (Jaiswal, 2012; Li & Zhang, 2021).

However, the AHP method can determine the weight of each user requirement, but it cannot directly quantify user requirements into specific design elements (Bagassi et al., 2020). QFD can transform user requirements into design elements, but it cannot capture important user requirement indicators (Ginting & Ishak, 2020). Therefore, this study develops a set of design strategies for MR virtual community brand experience through the integrated AHP-QFD research framework (Figure 1) to guide future MR virtual community brand experience design.

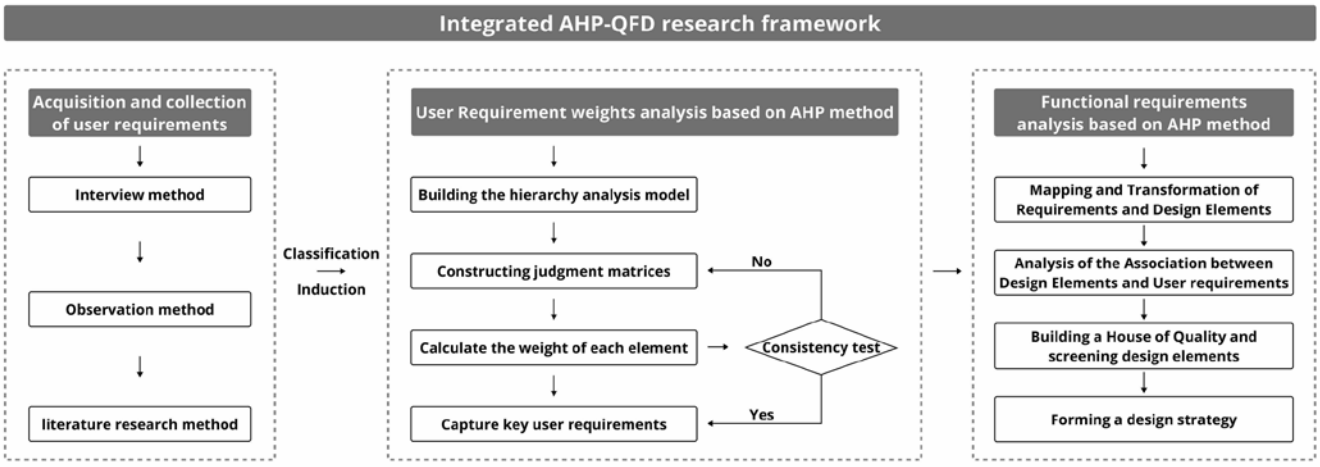


Figure 1. Integrated AHP-QFD research framework. Source: Author's own work

3. Research on the MR virtual community's brand experience design strategy using the AHP-QFD model

3.1 User requirements extraction

This paper will focus on users' brand experience requirements in the MR Virtual community, necessitating an investigation into the target user base to better meet their needs and enhance their experience. Define the characteristics of the target group: all ages, interest in relevant technologies and experiences, high acceptance of emerging things, high demand for socialising, etc. At this stage, a research method combining semi-structured interviews and on-site observation was used to conduct a user survey on 37 people (aged 10-70, 16 females, 21 males), both online and offline, who met the target characteristics in terms of their habits of using the MR virtual community, purpose of use, problems encountered when using it, use scenarios, attitudes towards using it, needs, experience, and so on. Table 1 displays the demographic information of the respondents.

The collected valid information was used to hierarchically unfold the user requirements through a card classification method, grouping the requirement words with high similarity and overlap into one category and excluding low requirement words (Conrad & Tucker, 2019). Preliminarily, 4 categories (17 items) of user requirements are obtained for function, interaction, emotion, and sensory. Finally, a more scientific and comprehensive user requirement hierarchy development table for the MR virtual community brand experience was constructed, as shown in Table 2.

Table 1. Demographic information of respondents (based on semi-structured interviews with 37 individuals).

	Option	Number of people	Proportion
Gender	Male	21	56.76 %
	Female	16	43.24 %
Age	10-24	15	40.54%
Siyi Wang, Jinming Chen			
	25-39	13	35.14%
	40-54	7	18.92%
	55-70	2	5.41%
Degree of education	Junior High School or Below	3	8.11%
	Senior high school	5	13.51%
	Undergraduate	19	51.35%
	Postgraduate or Higher	10	27.03%
Economic income level	5,000 and below	11	29.73%
	5,000 -10,000	5	13.51%
	10,001-15,000	8	21.62%
	More than 15,000	13	35.14%

Table 2. MR virtual community brand experience user requirements hierarchy.

Requirements and criteria	Requirements secondary criteria	Specific description of requirements
Functional requirements B1	Comprehensive content C1	Rich and varied content categories.
	High sociability C2	Desire to create interactive communities within the community.
	Community guidelines C3	Good community guidance and management system.
	Personalization C4	Want personalised content recommendations and services.
Interaction requirements B2	Immersive interactive experience C5	Immersive, high-resolution, high-fidelity visual graphics effects.
	Clear information architecture C6	Want to be able to locate and retrieve information quickly.
	High usability C7	Platform and equipment are easy to operate.
	Smooth and sensitive C8	Ensure a smooth, low-latency interactive experience.
Emotional requirements B3	Value identification C9	Desire for values resonance.
	Vivid narrative style C10	The story is tight and provides good narrative pacing and style.
	Wear comfort C11	Having a good wearing experience and providing a rest reminder service.
	Positive incentive C12	Desire to be seen, recognised, and receive positive feedback.
	Privacy and security C13	Guaranteed privacy and security.
Sensory requirements B4	Multimodal C14	Gain multi-dimensional perception, including sight, touch, hearing, and more.
	High visual appeal C15	Provide a recognisable and aesthetically pleasing visual style.
	Anti-fatigue and anti-dizziness C16	Ensure comfortable visuals and prevent dizziness and fatigue during use.
	Environmentally adaptive C17	The interface's visual effects match the changes in the external environment.

3.2 Calculation and analysis of user requirement weights based on AHP method

In 3.1, the user requirements in the MR virtual community brand experience were categorised but not ranked in terms of importance. In order to further clarify the focus of the subsequent design, the AHP hierarchical analysis method was applied at this stage to clarify the weight of each user requirement and improve the accuracy of the user requirement analysis.

The AHP hierarchical analysis method constructs the hierarchical analysis model, as shown in Figure 2. The hierarchical analysis model divides into the target level, criterion level, and subcriterion level based on the user requirements and design objectives of the MR virtual community brand experience. The target level, is the MR virtual community brand experience design strategy; the criterion level, is the functional requirements (B1), interaction requirements (B2), emotional requirements (B3), and sensory requirements (B4); and the sub-criteria level, is the user requirements corresponding to the attributes of the requirements, with a total of 17 items, which are comprehensive content (C1), high sociability (C2), community guidelines (C3), personalization (C4), immersive interactive experience (C5), clear information architecture (C6), high usability (C7), smooth and sensitive (C8), value identification (C9), vivid narrative style (C10), wear comfort (C11), positive incentive (C12), privacy and security(C13), multimodal (C14), high visual appeal (C15), anti-fatigue and anti-dizziness (C16), and environmentally adaptive (C17).

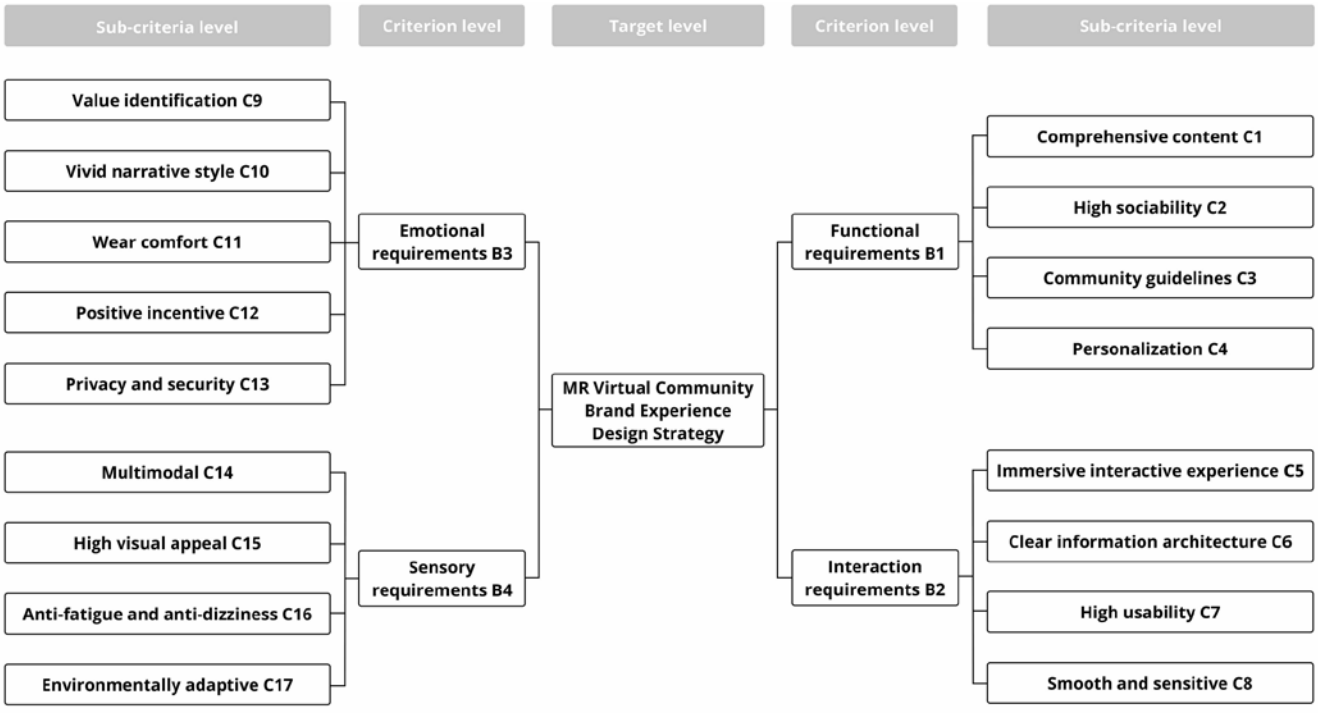


Figure 2. MR virtual community brand experience hierarchy model. Source: Author's own work

In order to ensure the scientificity and objectivity of the results of user demand weighting, a total of 17 researchers, experts, and target users were invited in this study to establish a questionnaire of neighbouring evaluation indexes through the scale method of 1 to 9 levels, to compare the importance of the demands of each level and score them two by two, to take the average of the evaluated results and to compare them to construct the judgement matrix, and then to calculate the weight value of the demands by using Matlab and to score the matrix. Then use Matlab to calculate the weight value of the requirements and conduct a consistency test on the matrix scoring to further identify the more important user requirements. The specific calculation process is as follows, and the results are shown in Table 3 and Table 4.

1. Constructing a judgement matrix:

$$R=\begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1j} \\ a_{21} & a_{22} & \cdots & a_{2j} \\ \vdots & \vdots & \ddots & \vdots \\ a_{i1} & a_{i2} & \cdots & a_{ij} \end{bmatrix}$$

Among them, aij·aji=1, j≠1, 2, …, n.

2. Weight calculation: Apply the geometric mean method to find the average value of Vi based on the judgement matrix.

$$V_i=\sqrt[n]{\prod_{i}^{n} S_{ij}}$$

The calculation results are normalised to obtain the average value of each weight W1 and the weight vector W.

$$W_1=\frac{\sqrt[n]{\prod_{i}^{n} S_{ij}}}{\sum_{i=1}^{n}\sqrt[n]{\prod_{i}^{n} S_{ij}}}$$

$$W=\left(w_1 w_{2,\cdots} w_n\right)^T$$

3. Calculate the maximum characteristic root (λmax):

$$\lambda_{max} = \frac{1}{n} \sum_{i=1}^{n} \frac{S_{wi}}{W_i}$$

Where Swi is the ith component of the vector Sw, n is the order.

4. Consistency of results test (ICI):

$$I_{CI} = \frac{\lambda_{max} - n}{n - 1}$$

$$I_{CR} = \frac{I_{CI}}{I_{RI}}$$

Where n is the value corresponding to the evaluation scale of judgement moments; IRI is the consistency index; and ICR is the consistency ratio.

Finally, it is necessary to test the consistency of the calculation results; when ICR≦0.1, the consistency test passes, and vice versa, it fails.

Table 3. Indicator weights at the criterion level.

Demand Attributes	B1	B2	B3	B4	Weighting	I_{CR}
B1	1	1/2	1/3	1	0.1411	0.004
B2	2	1	1/2	2	0.2631	
B3	3	2	1	3	0.4547	
B4	1	1/2	1/3	1	0.1411	

Table 4. Indicator weights at the sub-criteria level.

Secondary Indicators	Judgement matrix					Weights	Relative weights	I_{CR}	Ranking
C1	1	1	3	4	x	0.3845	0.0543	0.008	7
C2	1	1	3	4	x	0.3845	0.0543		7
C3	1/3	1/3	1	2	x	0.1433	0.0202		14
C4	1/4	1/4	1/2	1	x	0.0878	0.0124		16
C5	1	3	2	4	x	0.4658	0.1226	0.012	2
C6	1/3	1	1/2	2	x	0.1611	0.0424		11
C7	1/2	2	1	3	x	0.2771	0.0729		6
C8	1/4	1/2	1/3	1	x	0.0960	0.0253		13
C9	1	1/2	3	2	4	0.2618	0.1190	0.015	3
C10	2	1	4	3	5	0.4162	0.1892		1
C11	1/3	1/4	1	1/2	2	0.0986	0.0448		9
C12	1/2	1/3	2	1	3	0.1611	0.0733		5
C13	1/4	1/5	1/2	1/3	1	0.0624	0.0284		12
C14	1	1/2	4	5	x	0.3118	0.0440	0.017	10
C15	2	1	6	7	x	0.5302	0.0748		4
C16	1/4	1/6	1	2	x	0.0962	0.0136		15
C17	1/5	1/7	1/2	1	x	0.0618	0.0087		17

Finally, to ensure the scientificity of the results, a consistency test was performed on the calculation results. The ICR of the criterion level is 0.004≦0.1, and the ICR of the sub-criteria level is 0.008, 0.012, 0.015, and 0.017, respectively, which are all less than 0.1, and the consistency test is passed. From the results of the relative weight calculation ranking table in Table 4, it can be seen that the emotional requirements have the highest weight value (0.4547), followed by the interaction requirements (0.2631) in the needs category, which indicates that the emotional requirements are the most important in the brand experience of the MR virtual community, followed by the interaction requirements. The top 10 ranking of secondary user requirements includes vivid narrative style (C10), immersive interactive experience (C5), value identification (C9), high visual appeal (C15), positive incentive (C12), high usability (C7), high sociability (C2), comprehensive content (C1), wear comfort (C11), and multimodal (C14). Thus, paying more attention to these needs will significantly boost user satisfaction with the MR virtual community branding experience.

3.3 Design element analysis based on the QFD method

In order to further determine the conversion of user requirements into specific design elements, this paper applies QFD after AHP hierarchical analysis to convert user requirements into design elements through quantitative analysis. Design elements are an important part of building a house of quality (HOQ). As a result, it is necessary to map user requirements to design elements and decompose design elements before using QFD. Considering the high similarity of MR, AR, and VR virtual communities and the generality of design features, there are many commonalities among them. Therefore, it is highly informative to integrate the design features of VR and AR virtual communities into the development of MR virtual communities.

Firstly, the relevant design elements of the MR virtual community brand experience are preliminary obtained through the literature research method (Table 5); secondly, five virtual communities with a high usage rate or popularity on the market are selected through the case study method, including the MR virtual community, AR virtual community, and VR virtual community, and analysed in terms of the product name, type, and design elements, respectively (Table 6). Finally, the Delphi method was used based on the literature research method and the case study method to make sure that the design elements were objective, scientific, and complete. We invited two professors from the UX design research direction, two interaction designers, and one brand strategy designer to propose modifications to the inferred design elements. Finally, through collation and summarization, we identified 12 design features (Table 7).

Table 5. Analysis of literature related to brand experience in MR virtual communities.

Literatures	Design elements
(Dan et al., 2021)	Interaction: seamlessly blends virtual and reality; high-fidelity storytelling interface; intuitive gesture interaction.
(Park et al., 2022)	Function: structuring diverse content; designing multiplayer synchronization and collaboration platforms. Interaction: high-fidelity storytelling interface. Emotion: diversity of cultures and contexts. Sensory: multisensory synchronization.
(Herckis et al., 2020)	Function: designing multiplayer synchronization and collaboration platforms; user preferences. Emotion: emotional design; logging achievement paths; clear privacy settings and controls; first-person perspective narration.
(Gomes et al., 2020)	Interaction: clear information architecture; seamlessly blends virtual and reality; intuitive gesture interaction. Sensory: visual balance and unity.
(Sorathia et al., 2017)	Function: structuring diverse content. Interaction: intuitive gesture interaction with voice control, consistency. Emotion: Logging Achievement Paths.
(Serghides et al., 2024)	Function: designing multiplayer synchronization and collaboration platforms based on user preferences. Interaction: high-fidelity storytelling interface; intuitive navigation elements; intuitive gesture interaction. Emotion: first-person perspective narration.
(Jeon et al., 2024)	Interaction: high-fidelity storytelling interface; Intuitive gesture interaction with voice control; intuitive navigation elements. Sensory: multisensory synchronization.
(Barbara et al., 2021)	Interaction: seamlessly blends virtual and reality; high-fidelity storytelling interface. Emotion: first-person perspective narration; diversity of cultures and contexts.

Table 6. The MR virtual community case study.

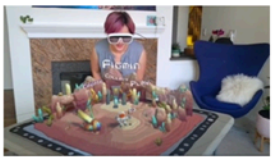
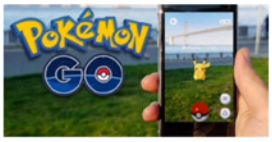
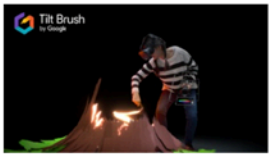
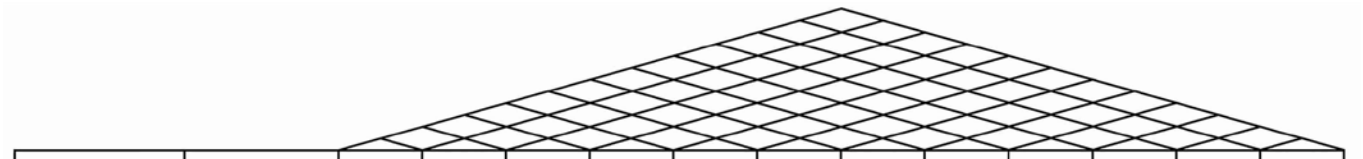
Product name	Product picture	Product type	Design elements
Figmin XR	 (Image from Google)	MR Virtual Community	Function: decorate rooms, games, educational experiences, and so on. Interaction: seamlessly blends virtual and reality; intuitive gesture interaction with voice control; consistency; simple, intuitive elements and layout. Emotion: logging achievement paths and leaderboards; first-person perspective narration. Sensory: multisensory synchronization; balanced and unified visual brand design.
Pokémon Go	 (Image from Google)	AR Virtual Community	Function: treasure hunt. Interaction: high-fidelity storytelling interface; simple, intuitive elements and layout. Emotion: emotional design; first-person perspective narration; logging achievement paths; clear your privacy settings and controls. Sensory: multisensory synchronization; balanced and unified, yet dynamically soft visual brand design.
HADO	(Image from Google)	AR Virtual Community	Function: sports competitions, fitness. Interaction: high-fidelity storytelling interface that seamlessly blends virtual and reality; intuitive elements; intuitive gesture interaction with voice control. Emotion: emotional design; first-person perspective narration; clear privacy settings and controls. Sensory: multisensory synchronization; balanced and unified visual brand design.
Tilt Brush	 (Image from Google)	VR Virtual Community	Function: painting, sculpture. Interaction: high-fidelity storytelling interface; intuitive elements and layout; intuitive gesture interaction with voice control. Emotion: first-person perspective narration; diversity of cultures and contexts; logging achievement paths; privacy settings. Sensory: multisensory synchronization; balanced and unified, yet dynamically soft visual brand design.
Beat Saber	(Image from Google)	VR Virtual Community	Function: music games, sports experiences. Interaction: high-fidelity storytelling interface; intuitive elements and layout; intuitive gesture interaction with voice control; consistency. Emotion: first-person perspective narration; logging achievement paths and leaderboards; clear privacy settings and controls. Sensory: multisensory synchronization; unified visual brand design; simple elements and layout.

Table 7. MR virtual community brand experience user requirements-design elements conversion.

Criterion level B	User requirements C	Summary of design elements D
Functional requirements B1	Comprehensive content C1	Structuring Diverse Content D1 Designing multiplayer synchronization and collaboration platforms D2 Community credit and reward mechanisms D3 User Preferences D4 High-fidelity storytelling interface that seamlessly blends virtual and reality D5 Simple, intuitive elements and layout D6 Intuitive gesture interaction with voice control, consistency D7 Emotional design, first-person perspective narration, diversity of cultures and contexts D8 Logging Achievement Paths and Leaderboards D9 Clear privacy settings and controls D10 multisensory synchronization D11 Balanced and unified, yet dynamically soft visual brand design D12
	High sociability C2	
	Community guidelines C3	
	Personalization C4	
Interaction requirements B2	Immersive interactive experience C5	
	Clear information architecture C6	
	High usability C7	
	Smooth and sensitive C8	
Emotional requirements B3	Value identification C9	
	Vivid narrative style C10	
	Wear comfort C11	
	positive incentive C12	
	Privacy and security C13	
Sensory requirements B4	Multimodal C14	
	High visual appeal C15	
	Anti-fatigue and anti-dizziness C16	
	Environmentally adaptive C17	

The House of Quality (HOQ) is the core element of the QFD methodology, including the target user requirements and the relationship matrix of related design requirements. As shown in Figure 3, with user requirements and their weights as the left wall and design elements as the roof, three experience design experts of MR Virtual Communities were invited to score the relevance of user requirements and design elements of the MR Virtual Communities brand experience. The weight of strong relevance is 1.5, indicated by "●"; the weight of average relevance is 1.2, indicated by "◎"; and the weight of weak relevance is 1, indicated by "△". The House of Quality (HOQ) is constructed by taking the sum of the products of all the user requirements and the corresponding weights as the final weight degree of the element. This study divides the design elements into three levels based on their weight degree, as illustrated in Table 8. The four design elements of Level 1 and the five design elements of Level 2 should take precedence in the MR virtual community brand experience design strategy ranking table, while the three design elements of Level 3 should receive secondary consideration.



User requirements	Weight	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12
C1	0.0543	●	△						△				
C2	0.0543	◎	●						◎				
C3	0.0202			◎									
C4	0.0124				●						△		
C5	0.1226	△	◎			●		●	●			●	◎
C6	0.0424						△	◎					
C7	0.0729						●	●				△	
C8	0.0253					●	◎	△					
C9	0.1190	△	◎						◎	◎			
C10	0.1892	△				●			●			◎	
C11	0.0448				◎								
C12	0.0733									●			
C13	0.0284		◎	△							●		
C14	0.0440					◎						●	
C15	0.0748					◎	●					△	●
C16	0.0136						◎	△				◎	●
C17	0.0087					△							
Weighting of design requirements		0.5774	0.4598	0.0526	0.0724	0.3731	0.3141	0.3830	0.7300	0.2528	0.055	0.6410	0.2797
Arrange in order		3	4	12	10	6	7	5	1	9	11	2	8

Figure 3. House of Quality (HOQ). Source: Author's own work

Table 8. Sequencing of design elements.

Hierarchy	Design elements	Ranking
Level 1	Emotional design, first-person perspective narration, diversity of cultures and contexts D8	1
	multisensory synchronization D11	2
	Structuring Diverse Content D1	3
	Designing multiplayer synchronization and collaboration platforms D2	4
Level 2	Intuitive gesture interaction with voice control, consistency D7	5
	High-fidelity storytelling interface that seamlessly blends virtual and reality D5	6
	Simple, intuitive elements and layout D6	7
	Balanced and unified, yet dynamically soft visual brand design D12	8
	Logging Achievement Paths and Leaderboards D9	9
Level 3	User Preferences D4	10
	Clear privacy settings and controls D10	11
	Community credit and reward mechanisms D3	12

4. Derivation of brand experience design strategies for MR virtual communities

The above results led to the further sorting and summarization of the design elements into four design principles: interactivity and consistency, sociality and diversity, aesthetics and intuitiveness, user-centered and personalization. Together, these four principles form the basis of the MR virtual community brand experience design, which not only relates to user satisfaction in the process of use but also determines the user's loyalty to the community and willingness to promote it to others.

4.1 Principle of interactivity and consistency

Interactivity is the key to ensuring that users can communicate and operate effectively with the MR virtual community. Consistency allows users to experience a unified operating logic in all parts of the community, reducing learning costs and increasing user efficiency. This principle includes three design elements: emotional design, first-person perspective narration, diversity of cultures and contexts (D8), multisensory synchronization (D11), intuitive gesture interaction with voice control, and consistency (D7). In particular, emotional design and first-person perspective narration make the experience more immersive for users, while respecting and reflecting different cultural backgrounds through diverse virtual environments and character design. High-quality visual and auditory effects and haptic feedback technology create a synchronized multi-sensory immersive experience for users. Intuitive gesture interactions and voice control make sure that the experience is consistent, letting users interact with the virtual environment naturally.

4.2 Principle of sociality and diversity

The sociality of MR virtual communities refers to encouraging communication and interaction among community users, thereby deepening the ties among community members and enhancing the overall cohesion and social activity of the community. On the other hand, diversity is embodied in community content, activities, and user groups, which can attract a wider range of users to participate and satisfy the needs and interests of different users, thus enhancing the vitality and attractiveness of the community. This principle includes three design elements: designing multiplayer synchronization and collaboration platforms (D2), community credit and reward mechanisms (D3), structuring diverse content (D1). Specifically, real-time synchronization and the provision of collaboration platforms, such as virtual meeting rooms, to support effective cooperation among community members; the establishment of a credit scoring system and transparent rules for rewards and penalties to maintain community order by rewarding active members and punishing non-compliance; and the creation of an ecosystem of diversified and high-quality content through personalization to cater to the needs of different users.

4.3 Principle of aesthetics and intuitiveness

Aesthetics enhances the user's sensory experience through attractive visual design, making the MR virtual community appear more professional and engaging. Intuitiveness enhances the user experience by ensuring that the user interface is easy to understand and operate, and that users can quickly find the function or information they are looking for. This principle consists of three design elements: balanced and unified, yet dynamically soft visual brand design (D12), simple, intuitive elements and layout (D6), high-fidelity storytelling interface that seamlessly blends virtual and reality (D5). Specifically, the brand identity is strengthened by uniform colours, visual elements, and typography, while the dynamic effects are soft to ensure visual comfort and reduce vertigo and fatigue; a simple interface design is adopted to enable new users to quickly get started and effectively operate community functions; and high-quality visual presentation, as well as engaging storytelling and character interactions, are combined to create a virtual experience that seamlessly blends with the real world. The combination of high-quality visual presentation, compelling storytelling, and character interaction creates a virtual experience that seamlessly integrates with the real world.

4.4 Principle of user-centered and personalization

User-centered emphasises that design should be centred on the needs and experiences of users, ensuring that community services and features meet their expectations. Personalization enables users to tailor the community experience to their preferences, which helps to enhance their positive feelings

about the community and promotes long-term engagement and support. This principle includes three design elements: user preferences (D4), clear privacy settings and controls (D10), logging achievement paths and leaderboards (D9). Specifically, personalization is provided to enable users to tailor the interface and interaction experience to their individual preferences; privacy settings panels are designed to be easy to understand and operate to ensure that users are able to control the use of and access to their personal information; and an achievement system and leaderboards are established to motivate cooperation, competition, and participation among users within the community.

5. Conclusions

To improve users' brand experience in MR virtual communities, this paper explores and constructs an integrated AHP-QFD theoretical design strategy development process, guided by user requirements. Firstly, interviews and on-site observations are conducted with the users of the MR virtual community, and attributes of user requirements are classified by the card classification method, initially obtaining 4 categories and 17 user requirements. Secondly, the AHP model is applied to rank the weights of the user's requirements to further obtain the important user requirements. Finally, the QFD model transforms the important user requirements into specific design elements, outputs their weights, and ranks them. This paper finally summarizes the design elements into four design principles, forming a relatively complete set of design strategies for the MR virtual community brand experience. From a theoretical perspective, the integrated AHP-QFD method's design strategy development process not only meets user-centered needs but also compensates for the limitations of single-method research to a certain extent, providing a framework for addressing design issues. From a practical perspective, it provides ideas for user demand-driven MR virtual community brand experience design; it systematically builds a design framework for MR virtual community brand experience, which provides a relatively complete set of strategy guidance for the development of MR virtual community brand experience.

References

Agag, G., & El-Masry, A. A. (2016). Understanding consumer intention to participate in online travel community and effects on consumer intention to purchase travel online and WOM: An integration of innovation diffusion theory and TAM with trust. Computers in human behavior, 60, 97-111. https://doi.org/10.1016/j.chb.2016.02.038

Al-Quran, M. W. M. (2022). Traditional media versus social media: challenges and opportunities. https://doi.org/10.47577/technium.v4i10.8012

Allcoat, D., Hatchard, T., Azmat, F., Stansfield, K., Watson, D., & von Mühlenen, A. (2021). Education in the digital age: Learning experience in virtual and mixed realities. Journal of Educational Computing Research, 59(5), 795-816. https://doi.org/10.1177/0735633120985120

Bagassi, S., De Crescenzio, F., & Piastra, S. (2020). Augmented reality technology selection based on integrated QFD-AHP model. International Journal on Interactive Design and Manufacturing (IJIDeM), 14(1), 285-294. https://doi.org/10.1007/s12008-019-00583-6

Baldus, B. J., Voorhees, C., & Calantone, R. (2015). Online brand community engagement: Scale development and validation. Journal of business research, 68(5), 978-985. https://doi.org/10.1016/j.jbusres.2014.09.035

Barbara, J., Koenitz, H., & Bakk, Á. K. (2021). The ethics of virtual reality interactive digital narratives in cultural heritage. International Conference on Interactive Digital Storytelling (pp. 288-292). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-92300-6_27

Bec, A., Moyle, B., Schaffer, V., & Timms, K. (2021). Virtual reality and mixed reality for second chance tourism. Tourism Management, 83, 104256. https://doi.org/10.1016/j.tourman.2020.104256

Bu, L., Chen, C.-H., Ng, K. K., Zheng, P., Dong, G., & Liu, H. (2021). A user-centric design approach for smart product-service systems using virtual reality: A case study. Journal of Cleaner Production, 280, 124413. https://doi.org/10.1016/j.jclepro.2020.124413

Canco, I., Kruja, D., & Iancu, T. (2021). AHP, a reliable method for quality decision making: A case study in business. Sustainability, 13(24), 13932. https://doi.org/10.3390/su132413932

Conrad, L. Y., & Tucker, V. M. (2019). Making it tangible: hybrid card sorting within qualitative interviews. Journal of Documentation, 75(2), 397-416. https://doi.org/10.1108/JD-06-2018-0091

Dan, Y., Shen, Z., Zhu, Y., & Huang, L. (2021). Using mixed reality (MR) to improve on-site design experience in community planning. Applied Sciences, 11(7), 3071. https://doi.org/10.3390/app11073071

Flavián, C., Ibáñez-Sánchez, S., & Orús, C. (2019). The impact of virtual, augmented and mixed reality technologies on the customer experience. Journal of business research, 100, 547-560. https://doi.org/10.1016/j.jbusres.2018.10.050

Ginting, R., & Ishak, A. (2020). An Integrated of AHP–QFD Methodology For Poduct Design: A Review. Jurnal Ilmiah Teknik Industri, 8(1). https://doi.org/10.24912/jitiuntar.v8i1.6901

Ginting, R., Ishak, A., Malik, A. F., & Satrio, M. R. (2020). Product development with quality function deployment (QFD): a literature review. IOP Conference Series: Materials Science and Engineering (Vol. 1003, No. 1, p. 012022). IOP Publishing. https://doi.org/10.1088/1757-899X/1003/1/012022

Gomes, A., Figueiredo, L., Correia, W., Teichrieb, V., Quintino, J., da Silva, F. Q., Santos, A., & Pinho, H. (2020). Extended by Design: A Toolkit for Creation of XR Experiences. 2020 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct) (pp. 57-62). IEEE. https://doi.org/10.1109/ISMAR-Adjunct51615.2020.00029

He, Z., Wu, L., & Li, X. R. (2018). When art meets tech: The role of augmented reality in enhancing museum experiences and purchase intentions. Tourism Management, 68, 127-139. https://doi.org/10.1016/j.tourman.2018.03.003

Herckis, L., Cao, J., Fashimpaur, J., Henson, A., Rodgers, R., Corbett III, T. W., & Hammer, J. (2020). Exploring hybrid virtual-physical homes. Proceedings of the 2020 ACM Designing Interactive Systems Conference (pp. 669-680). https://doi.org/10.1145/3357236.3395561

Hoyer, W. D., Kroschke, M., Schmitt, B., Kraume, K., & Shankar, V. (2020). Transforming the customer experience through new technologies. Journal of interactive marketing, 51(1), 57-71. https://doi.org/10.1016/j.intmar.2020.04.001

Jaiswal, E. S. (2012). A case study on quality function deployment (QFD). IOSR Journal of Mechanical and Civil Engineering, 3(6), 27-35. https://doi.org/10.4271/890652

Jamil, K., Dunnan, L., Gul, R. F., Shehzad, M. U., Gillani, S. H. M., & Awan, F. H. (2022). Role of social media marketing activities in influencing customer intentions: a perspective of a new emerging era. Frontiers in Psychology, 12, 808525. https://doi.org/10.3389/fpsyg.2021.808525

Jeon, H., Jo, T., Yeo, D., An, E., Kang, Y., & Kim, S. (2024). The way of water: exploring the role of interaction elements in usability challenges with in-car VR experience. Virtual Reality, 28(3), 121. https://doi.org/10.1007/s10055-024-01001-3

Jin, Y. (2023). Office space design based on Kano Model, AHP, QFD Methods. https://doi.org/10.21606/iasdr.2023.166

Kapoor, K. K., Tamilmani, K., Rana, N. P., Patil, P., Dwivedi, Y. K., & Nerur, S. (2018). Advances in social media research: Past, present and future. Information Systems Frontiers, 20, 531-558. https://doi.org/10.1007/s10796-017-9810-y

Kaur, H., Paruthi, M., Islam, J., & Hollebeek, L. D. (2020). The role of brand community identification and reward on consumer brand engagement and brand loyalty in virtual brand communities. Telematics and Informatics, 46, 101321. https://doi.org/10.1016/j.tele.2019.101321

Kim, R. B., & Chao, Y. (2019). Effects of brand experience, brand image and brand trust on brand building process: The case of Chinese millennial generation consumers. Journal of International Studies, 12(3). https://doi.org/10.14254/2071-8330.2019/12-3/1

Li, M., & Zhang, J. (2021). Integrating Kano model, AHP, and QFD methods for new product development based on text mining, intuitionistic fuzzy sets, and customers satisfaction. Mathematical Problems in Engineering, 2021(1), 2349716. https://doi.org/10.1155/2021/2349716

Lomicka, L. (2020). Creating and sustaining virtual language communities. Foreign Language Annals, 53(2), 306-313. https://doi.org/10.1111/flan.12456

Mostafa, R. B., & Kasamani, T. (2021). Brand experience and brand loyalty: is it a matter of emotions? Asia Pacific Journal of Marketing and Logistics, 33(4), 1033-1051. https://doi.org/10.1108/apjml-112019-0669

Munier, N., & Hontoria, E. (2021). Uses and Limitations of the AHP Method. Springer. https://doi.org/10.1007/978-3-030-60392-2

Panigrahi, R., Srivastava, P. R., & Sharma, D. (2018). Online learning: Adoption, continuance, and learning outcome—A review of literature. International Journal of Information Management, 43, 1-14. https://doi.org/10.1016/j.ijinfomgt.2018.05.005

Park, N., Regenbrecht, H., Duncan, S., Mills, S., Lindeman, R. W., Pantidi, N., & Whaanga, H. (2022). Mixed reality co-design for indigenous culture preservation & continuation. 2022 IEEE Conference on Virtual Reality and 3D User Interfaces (VR) (pp. 149-157). IEEE. https://doi.org/10.1109/VR51125.2022.00033

Ridings, C. M., & Gefen, D. (2004). Virtual community attraction: Why people hang out online. Journal of Computer-mediated communication, 10(1), JCMC10110. https://doi.org/10.1111/j.10836101.2004.tb00229.x

Rokhsaritalemi, S., Sadeghi-Niaraki, A., & Choi, S.-M. (2020). A review on mixed reality: Current trends, challenges and prospects. Applied Sciences, 10(2), 636. https://doi.org/10.3390/app10020636

Serghides, C.-G., Christoforides, G., Iakovides, N., & Aristidou, A. (2024). Design and implementation of an interactive virtual library based on its physical counterpart. Virtual Reality, 28(3), 124. https://doi.org/10.1007/s10055-024-01023-x

Sorathia, K., Sharma, K., Bhowmick, S., & Kamidi, P. (2017). Pragati-A Mobile Based Virtual Reality (VR)
Platform to Train and Educate Community Health Workers. Human-Computer Interaction–INTERACT
2017: 16th IFIP TC 13 International Conference, Mumbai, India, September 25-29, 2017, Proceedings,
Part IV 16 (pp. 459-463). Springer International Publishing. https://doi.org/10.1007/978-3-319-680590_51

Van der Westhuizen, L.-M. (2018). Brand loyalty: exploring self-brand connection and brand experience. Journal of Product & Brand Management, 27(2), 172-184. https://doi.org/10.1108/jpbm-07-2016-1281

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DESIGN AND BIOMATERIALS: INTEGRATING NEW MODELS FOR SUSTAINABLE DESIGN

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ABSTRACT | Over the past few decades, human society has experienced rapid development, accompanied by a significant increase in consumption in daily life. This change has led to a large influx of chemical substances into everyday garbage, causing severe environmental pollution. This pollution disrupts the balance of natural ecosystems and threatens human health. In response to this challenge and concern for human well-being, designers have started to meet market demands by launching a series of design solutions centred around sustainability. In the context of sustainable development and based on material innovation, this research explores the advantages of biomaterials in green fashion design, such as renewability, degradability, and environmental friendliness. Based on these advantages, a piece of clothing was designed, inspired by the Bagua diagram created by ancient Chinese philosophers. The interaction of yin and yang in the Bagua diagram symbolizes the harmonious coexistence and mutual dependence between humans and nature, a concept reflected in the arrangement of loofah. Moreover, the natural characteristics of the loofah make it an ideal habitat for fungal growth, further embodying the concept of symbiosis.

The sustainability model of this design is mainly reflected in three aspects: 1) Material renewability: The materials used in the design are regenerative, meaning they are degradable and can be decomposed by microorganisms under natural conditions, thus avoiding long-term environmental pollution. 2) Design innovation: It provides designers with new ideas for sustainable design, reducing reliance on traditional clothing materials (such as polyester, nylon and so on.) and consequently lowering landfill waste and environmental pollution. 3) Symbiotic concept: The design emphasizes the close connection between humans and nature, advocating for a harmonious coexistence.

Through this design approach, the research aims to establish a new model of sustainable design that adapts to modern development, achieving a balance between economic, social, and environmental dimensions. This model meets people's needs for fashion and comfort, mitigates environmental stress, and promotes the development of a circular economy. Therefore, this research provides new ideas and methods for sustainable design from the dimension of material innovation and is expected to bring breakthroughs to the innovation of sustainable development models.

KEYWORDS | DEGRADABLE MATERIALS, GREEN DESIGN, SUSTAINABLE DEVELOPMENT MODEL, SUSTAINABLE DESIGN, MATERIAL INNOVATION

1. Introduction

With the rapid growth of the global economy and population, people's living consumption levels continue to rise, leading to increasingly serious environmental problems. Many chemical substances enter daily life garbage, causing environmental pollution problems to become more prominent. This pollution destroys the balance of natural ecosystems and seriously threatens human health. It also has a profound impact on the Earth's ecosystem. In 2015, 193 countries of the United Nations jointly signed "Transforming Our World: The 2030 Agenda for Sustainable Development," formally proposing 17 Sustainable Development Goals (SDGs) and 169 specific targets, aiming to promote global sustainable cooperation and development. Against this backdrop, sustainable development has gradually become a global consensus, and people have begun to focus on reducing the environmental impact while ensuring the quality of life. The design field has also started to focus on achieving harmony among the environment, society, and the economy while meeting people's needs. Concepts such as green and sustainable design have gradually gained attention, and designers have begun to explore how to integrate sustainable development concepts into design.

In recent years, "sustainable development" topics have maintained a hot research status, focusing mainly on sustainable development strategies and economic, agricultural, and industrial sustainability. Rajkishore Nayak and others mentioned the environmental impact of manufacturing various textile fibres, covering challenges related to sustainable development. Sofia Soledad Duarte Poblete and others have researched and analyzed emerging materials related to sustainable design, encouraging their responsible development, dissemination, and adoption. Sandy Black discussed in her book how the fashion industry should respond to environmental and social responsibilities, from the fashion industry's impact on the environment to the practice of eco-friendly materials in sustainable fashion and prospects for future eco-friendly fashion.

The concept of sustainable design is rooted in the strategy of sustainable development. It reflects a deep understanding of the theoretical system under the concept of sustainable development, thus awakening and examining the defects and non-sustainability of traditional design. In this context, the so-called "re-design" concept belongs to sustainable design. It is a design method that comprehensively considers human development needs, environmental protection, and social responsibility. In the book "Designing for Sustainability: A Practical Exploration," Tracy Bamra elaborates on eco-friendly design through four dimensions: green design, ecological design, sustainable development, and sustainable design. She advocates that designers should integrate social responsibility elements when making design choices, thus transforming from a design method that solves single problems to a comprehensive design strategy that assumes social responsibilities. The book proposes to integrate the concept of sustainable development through design. Biological materials, as a powerful choice embodying the concept of sustainable development in sustainable design, are being adopted by more and more designers (Jones & Williams, 2020).

Research on biological materials at home and abroad has achieved certain results, mainly focusing on preparing biological materials, performance optimization, and their applications in medical, construction, packaging, and other fields (Zhang et al., 2019; Li & Li, 2021). These studies have laid the foundation for applying biological materials in fashion design. However, in the field of fashion design, the application of biological materials is still in the exploratory stage (Wang & Zhang, 2022). Some researchers have tried applying biological materials to fashion design, but there are still areas for improvement. First, the application scope of biological materials is limited, mainly accessories such as buttons and zippers (Smith & Brown, 2021). Second, there needs to be more innovation and fully tap the potential of combining them with culture, design, and art.

Based on the concept of sustainable development, this paper explores the innovation of fashion design materials, which helps enrich the theoretical system of green design and sustainable design. It pays attention to environmental pollution and human health and, through design practice, provides new ideas and methods for sustainable design, promoting sustainable development in fashion design.

2. _P/RoD Sustainability

With the growth of the global population, the demand for resources by humanity continues to increase, leading to increasingly serious problems such as resource depletion, environmental pollution, and ecological damage. In the face of this severe situation, sustainable development emerged at the right moment, becoming the focus of attention for governments, businesses, and academia worldwide. Governments, businesses, and academia have begun to realize the urgency

of adopting sustainable practices to ensure long-term social and ecological well-being.

The traditional industrial production model has led to many environmental problems, such as resource depletion, air pollution, and water pollution, which seriously threaten the Earth's ecosystem (Sachs, 2015). Sustainable development is key to the long-term survival and development of human society. It maintains the stability of the Earth's ecosystem and the sustainable development of human society by reducing the environmental burden, improving resource efficiency, and protecting biodiversity (WCED, 1987).

In terms of the environment, the long-term security and stability of human society are inseparable from the health of the Earth's ecosystem. The advocacy of clean production and environmental protection technology in sustainable development can effectively reduce the emission of pollutants and decrease the negative environmental impact (UNEP, 2012). For example, the use of low-carbon and zero-emission technologies to reduce air pollution from industrial activities can improve air quality and reduce the formation of acid rain and photochemical smog, which plays an important role in protecting human health and the integrity of ecosystems in urban and natural environments (IPCC, 2014). At the same time, paying attention to ecological protection and maintaining biodiversity also plays an important role in the stability of ecosystems (Díaz et al., 2019).

In terms of the economy, sustainable development advocates for a circular economy, emphasizing the coordinated development of the economy, society, and the environment. A good environmental condition can reduce production costs and decrease economic losses caused by environmental damage (Geissdoerfer et al., 2017). These measures can promote long-term stable economic development by ensuring sustainable forestry management for the continuous supply of timber and promoting renewable energy to reduce price fluctuations (FAO, 2020).

In terms of society, the traditional development model has ignored the equitable distribution of resources and social participation, expanding the wealth gap and increasing social conflicts (Sen, 1999). However, sustainable development promotes inclusive growth, positively impacting human well-being (Raworth, 2017).

3. _P/RoD Sustainable Design

3.1 _P/RoD Rise and Development

Sustainable design has evolved from its initial presence in a few areas to gradually infiltrating various industries and fields. It has become an integral part of modern industrial and consumer product design. Sustainable design emphasizes reducing environmental impact during product design, manufacturing, and consumption, improving resource efficiency, and enhancing the sustainability of the product life cycle. It focuses on the environmental

impact generated by the product itself and considers the environmental and social responsibilities throughout the entire production and usage chain.
The global design field's deep reflection on the relationship between human development and environmental challenges has given rise to the concept of "sustainable design." This concept represents a continuous process of exploration and innovation. Its development can be roughly divided into four main stages: the green design stage, the eco-design stage, the product-service system design stage, and the design for social equity and harmony stage (Fuad-Luke, 2009).

Green Design Stage: Originating in the 1980s and 1990s, this stage emphasized using materials and energy with low environmental impact. It included concepts such as reducing the consumption of materials and energy, recycling materials, and designing for reusability, such as "harmless design," "demountable design," and "durable design" (Cramer et al., 2004; Chapman, 2005).

Eco-Design Stage: This stage went beyond just focusing on the result and instead considered environmental issues at all stages, aspects, and links of product design. It involved reducing energy and material consumption during product production, avoiding pollution emissions, and reducing the generation and treatment of waste materials (McDonough & Braungart, 2002; Zurbrügg, 2003).

Product-Service System Design Stage: This stage moved beyond focusing solely on "materialized products" and entered the field of "system design," which intervened at the level of "products and services," aiming to create new business models (Manzini & Vezzoli, 2008; Mont, 2002). Design for Social Equity and Harmony Stage: This is the latest frontier of sustainable design research, focusing on social equity and harmony and people's consumption and values. This stage involves the sustainable development of local cultures, respect for cultural diversity, attention to vulnerable groups, and promoting sustainable consumption patterns (Gibbs, 2009; Thackara, 2005).

3.2 _P/RoD Application of Sustainable Design in the Fashion Industry

In the consumer goods sector, the fashion industry, one of the largest industries globally, stands out for its significant consumption of resources and environmental impact. Traditional fashion production models come at the cost of high energy consumption and pollution, with extensive use of non-renewable resources and synthetic chemicals, leading to severe environmental problems (Joy et al., 2012). Sustainable fashion has emerged as a new design concept and business model to address these challenges, gradually gaining attention. Sustainable fashion not only focuses on the environmental and social impact of products throughout their design, production, sales, and consumption cycles but also requires innovation in technologies and materials to reduce negative environmental impacts (Fletcher, 2008).

Sustainable fashion is more than just environmentally friendly products; it is a comprehensive design and management strategy to achieve a triple balance of economy, society, and environment (McKinsey & Company, 2020). Its core characteristics include using eco-friendly and renewable materials, reducing carbon footprints and pollution emissions, optimizing supply chain management to minimize resource waste, and promoting fair trade and social responsibility. These characteristics are reflected in the products and the ethical and moral values embedded in the design process and brand culture (Niinimäki, 2020).

The application of sustainable design in the fashion industry is mainly manifested in the following aspects:

Material Innovation: Seeking environmentally friendly, renewable, and biodegradable alternative materials to reduce dependence on traditional fossil energy sources. Such materials can be decomposed by microorganisms into harmless substances under natural conditions and re-enter the ecological cycle. Moreover, reducing the use of harmful chemicals to minimize pollution of soil, water, and air (Harrison et al., 2005). At the same time, avoiding the long-term presence of traditional fossil energy-derived materials in the environment after disposal helps alleviate the issue of "white pollution," effectively reducing the fashion industry's environmental burden, especially regarding greenhouse gas emissions and resource consumption (Perry, 2014).

Lifecycle Management: Within the framework of sustainable design, focusing on the entire lifecycle of clothing from design, production, and use to disposal to minimize environmental impact. Clean production technologies are employed during production to reduce energy consumption and pollution emissions, enhancing efficiency. Additionally, waste is treated and resourcefully utilized to achieve the goals of a circular economy (Fletcher & Tham, 2019).

Design Innovation: Actively exploring eco-friendly materials, low-carbon processes, and technologies to green and environmentalize clothing. Providing designers with new sustainable design ideas reduces reliance on traditional clothing materials (such as polyester, nylon, etc.), thereby reducing landfill waste and environmental pollution. The design emphasizes the close connection between humans and nature, advocates for harmonious coexistence between humans and nature, and encourages green consumption (Bick et al., 2018).

As consumer awareness of environmental protection and sustainability continues to grow, the position of sustainable fashion in the market is gradually rising. An increasing number of brands and designers are turning to sustainable fashion, winning consumer trust and support through green innovation and social responsibility. In the long run, sustainable fashion helps enhance brand image and market competitiveness and brings long-term stable economic benefits and social influence to businesses (Amed et al., 2022).

3.3 Potential of Biomaterials in Sustainable Design

Biomaterials, known for their renewability, biodegradability, and environmental friendliness, are gradually becoming a key choice in sustainable design. The extensive application of these materials reflects the effective substitution for traditional resources and profound consideration for environmental protection. Research and application of biomaterials in the design field are gradually gaining attention, with scholars and designers actively exploring their potential in fashion.

Renewability is a significant advantage of biomaterials, typically derived from plants or other natural resources. They can absorb carbon dioxide during growth, reducing greenhouse gas emissions (Avermaete et al., 2019). For example, plant-based raw materials like bamboo fibre, hemp fibre, and soybean fibre not only have low energy consumption during growth but can also naturally decompose, reducing the environmental burden of waste (Koo et al., 2019). Compared to traditional synthetic materials, the biodegradability of these materials allows them to decompose rapidly into harmless substances after disposal, making them more in line with the concept of a circular economy in design and promoting the reuse of resources and reduction of waste (Gao et al., 2021).

The unique properties of biomaterials have attracted many scholars to study their application in fashion, providing designers with rich creative inspiration. Lee et al. (2018) research shows that biomaterials like bioplastics and bioc fibres can be used in traditional textiles and improve their performance and comfort through improved production processes. At the same time, Rissanen and McQuillan (2016) explored how to achieve more environmentally friendly clothing production methods through biomaterials, including the use of agricultural by-products (such as rice husks and corn cobs) as raw materials to reduce dependence on fossil fuels. Miller (2020) mentioned that designers are trying to use food waste (such as coffee grounds and apple peels) as new textile materials, reducing production costs and effectively utilising waste resources. These explorations show the great potential of biomaterials in achieving sustainable design goals (Liu et al., 2021). Sustainable design is an important way to address global resource scarcity and environmental pollution challenges and a key strategy for promoting human social welfare and long-term economic stability. Implementing sustainable practices, including promoting clean production technologies and using environmentally sustainable materials, provides an effective and long-term path to sustainable development for current and future generations.

4. _P/RoD Application Practice of Biomaterials in Fashion Design

In line with the principles of sustainable development, a new model of integrating design with biomaterials is sought within the context of sustainable design. Based on this, through repeated experiments and comparisons of the performance of different materials under different ratios, more sustainable clothing materials are identified.

4.1 _P/RoD Design Concept and Principles

In this highly developed industrial society, the environment has been damaged during industrialization. We hope to guide people to re-examine the relationship between humans and nature and think about how they should coexist with other living beings. Fungi in nature are decomposers, like bacteria and microorganisms. Fungi decompose organisms into various inorganic substances, making the land more fertile and thus recycling and regenerating, creating new life. This symbiotic relationship between species is contrary to the interspecies relationships we take for granted in evolutionary theory (predator-prey relationships) – they are not trying to destroy each other; as anthropologist Luo Qinghuan said in "The Last Day of Matsutake," the message it conveys is ultimately about "symbiosis," about how "I" can continue to evolve with "non-I" instead of losing ground in confrontation. It is about how "I" and "non-I" can continue to co-evolve instead of consuming each other in confrontation – this is the rule of the fungal world, which can, should, and is also our rule.

Therefore, a raincoat was designed, which, when used in rainy weather, the moist environment and the heat generated by the human body can jointly create an environment suitable for the growth of mycelium. On the other hand, mycelium can provide waterproof and warm protection to protect people from external harm, achieving mutual benefit.

In appearance, loofah pulp is used as an ornament, arranged and combined to form the symbol created by ancient Chinese philosophers – the Bagua diagram. The Bagua diagram, as an important symbol of traditional Chinese culture, originated from ancient Chinese philosophers' profound insight into the universe's law of operation. Based on the theory of Yin and Yang and the five elements, it summarizes various phenomena in the world into eight basic trigrams. Each trigram represents a basic element of nature and corresponds to different aspects of human life. The interaction of Yin and Yang in the Bagua diagram expresses a dynamic balance of opposites and movement, emphasizing the complementary nature of humans and opposite forces in nature. This philosophical concept deeply explains that humans and nature are not isolated existences but integral parts of each other. Introducing loofah pulp into the design and arranging it into the shape of the Bagua diagram symbolizes the interdependent relationship between humans

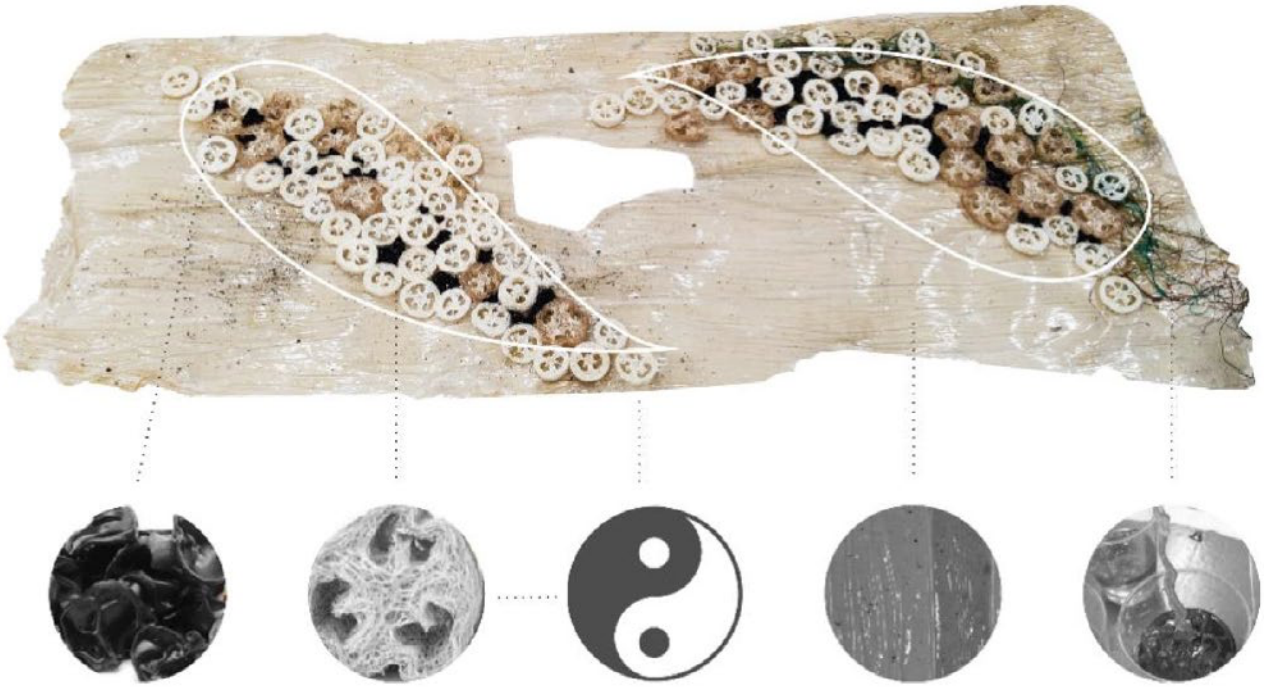


Figure A.Design Showcase

and nature. Moreover, the arrangement of loofah pulp forms a visual echo, emphasizing the concept of the intertwining of human survival and natural forces. In addition, loofah pulp as a culture medium for fungi further reflects the symbiotic coexistence of different organisms, highlighting the concept of harmonious coexistence.

4.2 _P/RoD Experimental Process

4.2.1 Materials and Methods

Materials: Water, sodium alginate, glycerin, gelatin, agar, calcium chloride solution, wood ear, fungal culture pack.

Method One:

1. Add 200 ml of water to a measuring cup, measure and add 3 grams of sodium alginate, mix with a blender, then add 3 ml of glycerin and continue to mix;

2. Place the coloured fabric in a wooden embroidery hoop, and add 100 ml of water and 3 grams of calcium chloride to a spray bottle;

3. Spray the fabric 2-3 times, then pour the sodium alginate mixture into a 3 mm wooden embroidery ring;

4. Add the fungal culture pack to the mixed sodium alginate and store it in a cool place.

Method Two:

1. Prepare the embroidery hoop with textiles ;

2. Pour 240 ml of water into a pot and turn on the electric stove with a small flame;

3. Measure 48 grams of gelatin powder and slowly add it, then add colour;

4. Add 10 ml of glycerin and stir, then scoop out the foam;

5. Turn on the heater and wait 3 minutes to cool, then pour the material into the ring and add the fungal culture pack to the mixed gelatin solution, storing it in a cool place.

Method Three:

1. Add 300 ml of water and 8 grams of agar to a pot simultaneously;

2. Turn on the small flame and start stirring;

3. Add 6 ml of glycerin and stir for 5-8 minutes;

4. When it starts to "gel," pour the mixture into the ring (only 0.2-3 mm). Add 10 ml of glycerin with the remaining agar, stir, and pour into the next ring;

5. Add the fungal culture pack.

Method Four(Shoes):

1. Melt 45 grams of pine resin in a pot;

2. Add 20 ml of 95% alcohol, stir and melt, then add 5 grams of wax and continue to stir;

3. Add waste materials (fungal culture pack, etc.) and pour quickly into the mould.

Method Five:

1. Add 9 grams of sodium alginate to 600 ml of water and stir with a mixer ;

2. Pour the stirred solution into a cup with prepared dye, and then suck the solution into an injector with multiple colours;

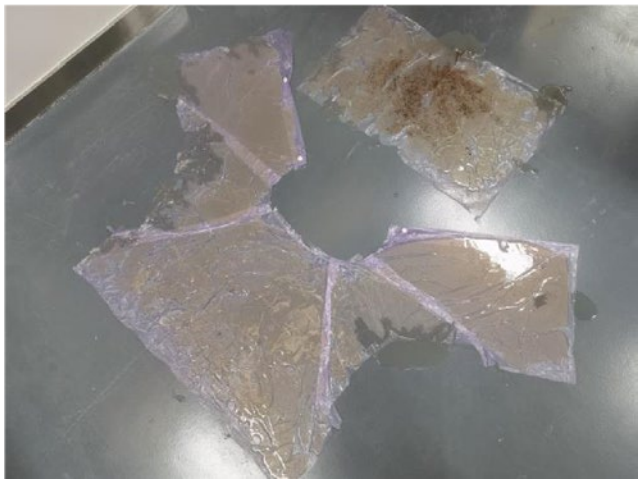
3. Squeeze the solution into calcium chloride and dry to get line-shaped ornaments.

4.2.2 Experimental Methods and Result Analysis

(1) Experimental Methods

The experiment adopts a research design combining a controlled variable method and a comparative experiment. Specifically, the controlled variable method refers to effectively controlling other factors that may affect the experimental results, except for the research variable, to ensure the accuracy and reliability of the experimental results. On the other hand,

_P/RoD Figure B



_P/RoD Figure C

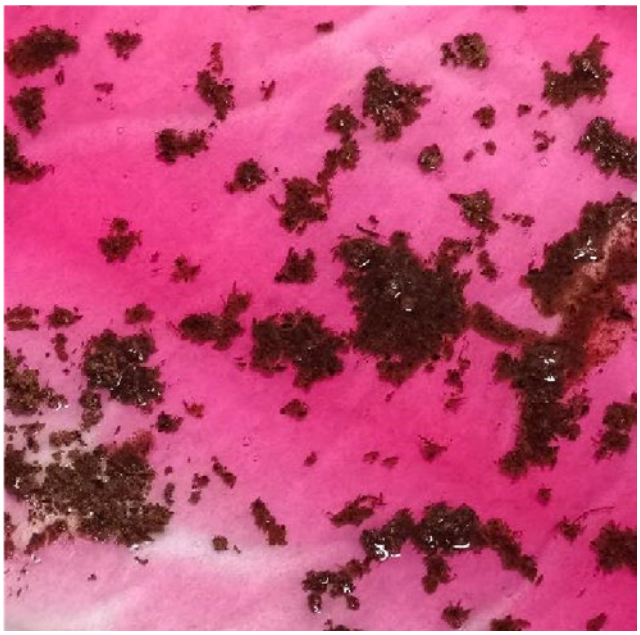
_P/RoD Figure D

_P/RoD Figure E

the comparative experiment is based on the controlled variable method, and it explores the specific impact of the research variable on the experimental results by comparing the changes in results under different experimental conditions.

(2) Experimental Results

P/RoD Figure F



P/RoD Figure G

P/RoD Figure H

P/RoD Figure I

The solution made in Method One had a thicker thickness in the embroidery hoop (Figure B), making it difficult to dry. Therefore, the original recipe was increased six times (1200 ml of water, 18 grams of sodium alginate, 18 ml of glycerin), poured into the cut mould (Figure C), and the solution dried rapidly, forming a very thin film. However, it was difficult to de-mould, with multiple parts breaking directly during the demolding process, and due to the rapid drying, it was difficult to shape (Figure D, Figure E).

_P/RoD Figure J.Finished product display

Method Two used the solution made with 48g of gelatin, 10ml of glycerin, and 100ml of water as the control group (Figure F). In the experimental groups 1, 2, and 3, fungal culture packs (Figure G), wood ear mushrooms (Figure H), and fungal culture packs and wood ear mushrooms (Figure I) were added, respectively. In this scheme, the solution served as a growth bed for fungi, but the material was too soft to dry easily and was prone to mould growth.

Therefore, in the final experiment, a ratio of 240g of gelatin, 50 ml of glycerin, and 1200 ml of water was used for production, and it was found that this produced excellent toughness, maintaining structural integrity under external forces and being less prone to breaking. At the same time, the material had strong adhesion, with loofah pulp firmly attached to it. Additionally, it was simple to shape, and melting and reshaping could be easily achieved.

Figure K. AI-generated blueprints of future designs

In summary, the experiment provided a sustainable clothing material with easy drying, good adhesion, and strong toughness. In the design, the combination of loofah pulp and the Bagua diagram was attached to the sustainable material-made clothing, showing the harmonious coexistence between humans and nature. This provided new ideas and new materials for sustainable design for designers.

(3) Future Outlook

The author's practice of biomaterials in sustainable design initially focused on the basic attributes of clothing and wearability and integrated traditional cultural concepts into the design. In the future, it is necessary to continue in-depth research on the characteristics of biomaterials, combined with modern design contexts, to create more design-oriented, wearable clothing.

5 _P/RoD Summary

Since the inception of the First Industrial Revolution, humanity's pursuit of enhanced production
efficiency and quality of life has led to extensive utilization of fossil fuels and chemical substances in manufacturing processes. While this has significantly propelled societal productivity and played a crucial role in various sectors, the negative environmental and ecological impacts cannot be overlooked. Issues such as over-exploitation of resources, emission of harmful substances, and disruption of ecological balance underscore the profound environmental effects of material selection and use. Against this backdrop, striking a balance between economic development and environmental protection has emerged as an urgent and critical challenge.

This article provides a comprehensive overview of the current applications of sustainable materials in fashion design, analyzing the challenges they face and proposing strategies for future growth. It integrates traditional cultural symbols like the Bagua diagram and loofah pulp into practical applications, enriching aesthetic expression and deepening cultural heritage narrative. Using these symbols in fashion design bridges the gap between ancient wisdom and modern expression, facilitating discussions on sustainability and ecological harmony. Employing elements from traditional Chinese philosophy evokes a sense of cultural pride among consumers and guides reflection on environmental protection. Integrating eco-friendly materials like biomaterials into fashion design has become a new design paradigm in pursuing sustainable development. This approach promotes the widespread application of sustainable design principles and contributes to global green development with wisdom and strength. Building on this, the article further explores how strategic innovation can drive the fashion industry towards greater sustainability and environmental friendliness, achieving a win-win situation for the economy, society, and environment.

References

Adams, R., Hernandez, D., & Clark, A. (2023). Innovative applications of biomaterials in fashion design. Journal of Sustainable Fashion, 15(3), 45-62. https://doi.org/10.1016/j.jsf.2023.07.003

Amed, I., Berg, A., & Marguerite, B. (2022). The State of Fashion 2022. McKinsey & Company.

Bak-Andersen, M. (2021). Reintroducing materials for sustainable design: Design process and educational practice. Routledge.

Black, S. (2008). Eco-chic: The fashion paradox. Black Dog.

Black, S. (2012). The sustainable fashion handbook. Thames and Hudson.

Bocken, N. M. P., De Pauw, I., Bakker, C., & van der Grinten, B. (2014). Product design and business model strategies for a circular economy. Journal of Industrial and Production Engineering, 31(5), 308-320. https://doi.org/10.1080/21681015.2014.883905

Bick, R., Halsey, E., & Ekenga, C. (2018). The global environmental injustice of fast fashion. Environmental Health, 17(1), 1-7. https://doi.org/10.1186/s12940-018-0433-7

Chapman, J. (2005). Sustainable Design: A Critical Guide. Rizzoli International Publications.

Cramer, J., Schuur, T., & R. H. (2004). Designing for sustainability: The theory and practice of life cycle assessment. Journal of Cleaner Production, 12(8), 871-882. https://doi.org/10.1016/j.jclepro.2004.01.007

Fletcher, K. (2008). Sustainable Fashion and Textiles: Design Journeys. Earthscan.

Fletcher, K. (2014). Sustainable Fashion and Textiles: Design Journeys. Routledge.

Fletcher, K., & Tham, M. (2019). Fashion and Sustainability: Design for Change. Laurence King Publishing.

Fuad-Luke, A. (2009). Design Activism: Beautiful Strangeness for a Sustainable World. Routledge.

Gao, W., Tan, X., & Zhang, Y. (2021). Green technologies and sustainable design: The role of biodegradable materials. Journal of Cleaner Production, 281, 125-136. https://doi.org/10.1016/j.jclepro.2020.125136

Geissdoerfer, M., Savaget, P., Bocken, N. M., & Hultink, E. J. (2017). The circular economy – A new sustainability paradigm? Journal of Cleaner Production, 143, 757-768. https://doi.org/10.1016/j.jclepro.2016.12.048

Gibbs, D. (2009). Sustainable development and the green economy. Geoforum, 40(1), 35-39. https://doi.org/10.1016/j.geoforum.2008.12.006

Harrison, R., Newholm, T., & Shaw, D. (2005). The ethical consumer. SAGE Publications.

Joy, A., Sherry, J. F., Venkatesh, A., Wang, J. J., & Chan, R. (2012). Postmodern consumer culture. Journal of Consumer Research, 39(3), 367-391. https://doi.org/10.1086/664047

Koo, J., Kim, H., & Jeong, Y. (2019). Biodegradable Materials in Textile Applications. Woodhead Publishing.

Lee, J., Hwang, Y., & Park, J. (2018). Application of bio-based materials in modern fashion. Fashion and Textiles, 5(1), 12-24. https://doi.org/10.1186/s40691-018-0134-z

Liu, X., Zhang, H., & Chen, Y. (2021). Food waste as a resource: Biodegradable textile materials from coffee grounds and apple peels. Waste Management, 118, 73-80. https://doi.org/10.1016/j.wasman.2020.08.024

Manzini, E., & Vezzoli, C. (2008). Product-Service System Design for Sustainability. Springer.

McDonough, W., & Braungart, M. (2002). Cradle to Cradle: Remaking the Way We Make Things. North Point Press.

McKinsey & Company. (2020). The State of Fashion 2020: Navigating the New Era. McKinsey & Company.

Miller, R. (2020). Innovations in sustainable fashion materials: A case study approach. Sustainability, 12(4), 1535-1548. https://doi.org/10.3390/su12041535

Mont, O. (2002). Clarifying the concept of product-service system. Journal of Cleaner Production, 10(3), 237-245. https://doi.org/10.1016/S0959-6526(01)00039-7

Nayak, R., Jajpura, L., & Khandual, A. (2023). Traditional fibres for fashion and textiles: Associated problems and future sustainable fibres. In Sustainable fibres for fashion and textile manufacturing (pp. 3-25). Woodhead Publishing.

Niinimäki, K. (2020). Fashion in a Circular Economy. Palgrave Macmillan.

Ormondroyd, G. A., & Morris, A. F. (Eds.). (2018). Designing with Natural Materials. CRC Press.

Papanek, V. (1995). The Green Imperative: Ecology and Ethics in Design and Architecture. Thames & Hudson.

Perry, P. (2014). Sustainability in the Fashion Industry. Routledge.

Poblete, S. S. D., Romani, A., & Rognoli, V. (2024). Emerging materials for transition: A taxonomy proposal from a design perspective. Sustainable Futures, 7, 100155. https://doi.org/10.1016/j.sftr.2024.100155

Rissanen, T., & McQuillan, H. (2016). Sustainable Fashion and Textiles: New Directions. Palgrave Macmillan.

Sachs, J. D. (2015). The Age of Sustainable Development. Columbia University Press.

Scaturro, S. (2008). Eco-tech fashion: Rationalizing technology in sustainable fashion. Fashion Theory, 12(4), 469-488. https://doi.org/10.2752/175174108X346977

Smith, J., & Brown, T. (2021). The role of biomaterials in fashion accessories. Fashion Technology and Materials, 8(2), 87-99.

Thackara, J. (2005). In the Bubble: Designing in a Complex World. MIT Press.

Wang, X., & Zhang, Q. (2022). Exploring the use of biomaterials in garment design: Challenges and opportunities. Textile Research Journal, 92(11), 1590-1605. https://doi.org/10.1177/00405175221080820

WCED, S. W. S. (1987). World Commission on Environment and Development. Our Common Future. Oxford University Press.

Yang, Y., Zhang, H., & Zhao, L. (2019). Biomaterials: Preparation and performance optimization. Materials Science and Engineering Review, 98, 1-20.

Zurbrügg, C. (2003). Solid waste management in developing countries. Waste Management & Research, 21(1), 40-50. https://doi.org/10.1177/0734242X0302100105

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CULTURAL REGENERATION OF DOMESTIC WASTES FROM PARTICIPATORY DESIGN PERSPECTIVE

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ABSTRACT | Background: Environmental and social issues arising from waste management are critical topics addressed by the United Nations Sustainable Development Goal 12, which focuses on responsible consumption and production. Modern cities are increasingly dominated by consumerism, making the promotion of sustainable lifestyles and consumer awareness essential. Goal: As fundamental units of self-government and administration, communities play a crucial role in addressing social conflicts and promoting sustainable practices at the grassroots level. This study aims to develop innovative tools and strategies for sustainable cultural innovation through participatory design methods within urban communities. Methodology: A participatory curatorial project called "Throw away Museum", which includes workshops and exhibitions in the community, was initiated to recruit the public to participate and pay attention to the life cycle of the production, use and disposal of domestic wastes. The project employs archival practices as an artistic strategy and conducts ethnographic research with local communities. This approach aids in developing assessment dimensions and application guidelines for using archives as a communication tool in participatory design. Conclusion: The findings suggest that archives can effectively function as communication tools, providing public access to community curation and allowing individuals to express themselves creatively through exhibitions. This design practice addresses public issues in diverse forms, Qianwen ZHU, Lei Zhang facilitating collaborative solutions with the public, fostering civic and ecological awareness, enhancing public participation, strengthening interpersonal connections, and promoting a broader environmental symbiosis. Ultimately, this approach enables public participation to form a sustainable narrative force.

KEYWORDS | DOMESTIC WASTE, CULTURAL REGENERATION, PARTICIPATORY DESIGN, COMMUNICATION DESIGN, DESIGN TOOL

1. Introduction

The process of globalisation in China, marked by China's accession to the WTO, has led to consumerism taking over the daily lives of most Chinese people (Bao, 2008). This surge in consumerism significantly influences public consumption behaviors, with one of the most critical implications being the social and environmental issues stemming from excessive waste generation. According to the United Nations Statistics Division's Glossary of Environment Statistics, waste is defined as:

"materials that are not prime products (that is, products produced for the market) for which the generator has no further use in terms of his/her own purposes of production,transformation or consumption,and of which he/she wants to dispose.Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products,and other human activities, Residuals recycled or reused at the place of generation are excluded."

(UNITEDNATIONSSTATISTICSDIVISION, 1997)

Waste represents one of today's most pressing meta-problems, highlighting the critical need for society to transition towards a circular economic model that promotes sustainable production and consumption, rather than following the simplistic extract-produce-discard pathway. While improving waste management techniques is necessary, it is crucial to address the fundamental issues by redesigning the relationship between humans and resources and rethinking our production and consumption patterns (M. Simon et al., 2020). Domestic waste is perceived by the public as daily refuse produced within residential settings. In modern urban environments, it is common to observe a significant volume of disposables and even items that appear nearly new in rubbish bins. This phenomenon underscores the prevailing consumer attitudes toward waste, highlighting a disposable culture among users.Decades ago, numerous artists began utilizing trash as a creative medium, with trash art emerging as the most prominent example of this practice. This genre, often referred to as Junk Art, involves the transformation of discarded materials from consumer society into art pieces. By

removing these objects from their mundane contexts and imbuing them with new aesthetic and functional values, artists not only challenge traditional perceptions of art but also critique consumerist culture.

Cultural regeneration has emerged as a global strategy to foster urban renewal and drive economic and social transformation (García, 2005). This approach to cultural regeneration has also been implemented in projects aimed at enhancing community resilience through regeneration. Cultures of Resilience (CoR) represents a cultural experiment underway in London, predicated on the belief that art and design can meld community creativity with reflective originality to foster a more resilient society. Additionally, Cultural strategies fulfill four crucial roles in promoting sustainable development: they serve as catalysts and educators for raising awareness about climate change and fostering the development of 'ecological citizenship' (Duxbury et al., 2017).

Today's society is experiencing a shift toward sustainability, with the field of design becoming increasingly interwoven with other disciplines. Participatory design has risen as an open, collaborative approach that leverages the collective wisdom of the public to propel sustainable development forward. Communities, serving as the bedrock of grassroots governance and focal points for social conflicts, have become critical venues for public involvement in sustainability goals and initiatives. In recent years, a variety of social organizations in Shanghai have incorporated sustainable lifestyles, ecological consciousness, intergenerational exchanges, and active aging into their community activities. These efforts resonate with the sustainable 'lifestyles' and 'awareness' goals set forth by the United Nations (UnitedNations, n.d.), see as Table 1. Achieving these sub-goals involves a long-term strategy of integrating sustainable practices into daily life through design, thereby fostering a culture that supports the broader sustainability objectives.

Table 1: Expressions of Sustainable Lifestyles and Awareness in Sustainability Goals.

SDG 4: Quality Education	4.7: By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for **sustainable development and sustainable lifestyles**, human rights, gender equality, promotion of a culture of peace and non–violence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development.
SDG 12: Responsible Consumption and Production	12.8: By 2030, ensure that people everywhere have the relevant information and **awareness for sustainable development and lifestyles in harmony with nature.**"

The research question of this study is to explore the application of participatory methods in the cultural regeneration of household waste, with the aim of raising public awareness of sustainable art and fostering civic ecological responsibility. To address this, the paper initiates a community-based collaborative curatorial project, which utilizes everyday objects as a starting point and employs participatory curation to engage the public in discussions on social issues, thereby integrating household waste into a new cultural context.

In the first phase, we reviewed relevant literature and case studies on participatory design, summarizing the levels of participation within this field. In the second phase, we conducted field research in a typical community in Shanghai to collect qualitative data, using thematic analysis to identify the applicable dimensions of participatory design methodology for this community. In the third phase, we implemented Practice-led research through workshops, developing tools for various types of participants and completing the collaborative curation. This phase aimed to stimulate discussion and reflection on waste. In the final phase, we proposed action guidelines and practical strategies for the collaborative curation project.

2. Theoretical background

The origins of Participatory Design can be traced back to the Nordic political democratization movement in Scandinavia during the 1970s. This method serves as a guide for design practice, where designers or researchers typically co-create with participants by organizing workshops. Conceptually, Participatory Design can be seen as the abstract essence of these workshops, which serve as its practical manifestation (SHEN et al., 2018). Participants have varying levels of language proficiency, knowledge backgrounds, and personal emotional experiences. The visual advantages of design tools help overcome communication barriers, facilitating the conveyance of complex information, uncovering implicit cognition and emotions, improving communication quality, and enhancing the collaborative experience (Zhong & Liu, 2018).

Liz has made significant contributions to the field of participatory design tool innovation (Figure 1). She divides the use of these tools into two phases: individual thinking and collective thinking. Tools for individual thinking assist users in understanding their own perceptions and experiences, while tools for collective thinking help users explore emotions and express future ideas, feelings, and aspirations. Liz also categorized participatory design tools based on behavioral patterns, proposing a model of 'Tell-Make-Enacting.' These three types of tools are not limited by a fixed sequence and can be used in any order or combined in various ways(E. B.-N. Sanders et al., 2010).

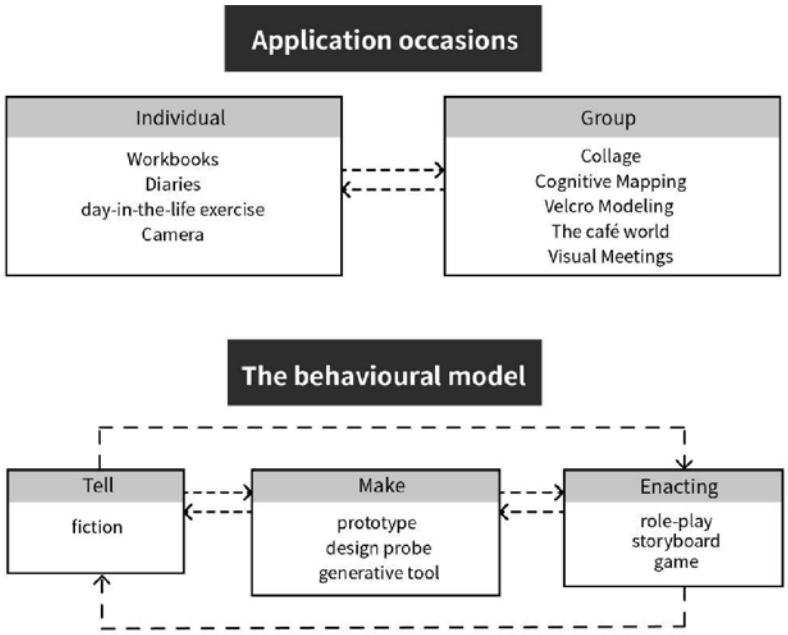


Figure 1. Different types of tools in participatory design.

The tools used in participatory design are not unique to its methodologies; they originate from various disciplines, including product design, service design, architectural design, sociology, and theatre. This diversity highlights the openness and adaptability of design tools within the participatory design framework. In Chinese communities, a wide range of these tools is currently employed in urban planning and spatial revitalization. According to Ryo Yamazaki, the early stages of community design often focus on constructing physical infrastructure to address immediate practical concerns. However, he contends that without incorporating cultural creativity, communities may struggle to maintain growth once these issues are resolved, as there would be a lack of compelling reasons for people to come together. (Ryo, 2011). Despite these insights, participatory tools in China often fall short in cultivating a genuine community culture. They are frequently used merely as symbols of participation, lacking substantial research or practical application.

Nina Simon's influential work, "The Participatory Museum," has significantly impacted the museum industry. She develops a participation theory for museums, emphasizing engagement as a foundational principle. Simon posits that a participatory museum transcends the conventional museum format by enabling visitors to create, share, and interact with others around a thematic framework. This model integrates participation techniques and philosophies extensively (Simon, 2010). On the practical front, participatory curating manifests through digital platforms like social media, as well as through offline modalities such as focus groups, educational workshops, and calls for contributions and topic-specific research.

These activities facilitate the dissemination of information and involve the public in aspects of museum management.

Participation pathways in museums are categorized into three types: grassroots, top-down, and an intermediate facilitation approach. Grassroots initiatives involve community members initiating and organizing museum-related projects, often sparking changes at higher organizational levels. Top-down approaches are characterized by museums leading and implementing strategies to engage the community in alignment with their missions. Meanwhile, the facilitation approach positions museums as stewards, supporting but not dominating the participatory activities (Black, 2012).

Drawing on WolfBrown's 'Public Involvement Spectrum', which delineates levels of public participation in artistic activities(Brown et al., 2011). we have classified the actual levels of participation in participatory exhibition design into the following four categories (Figure 2):

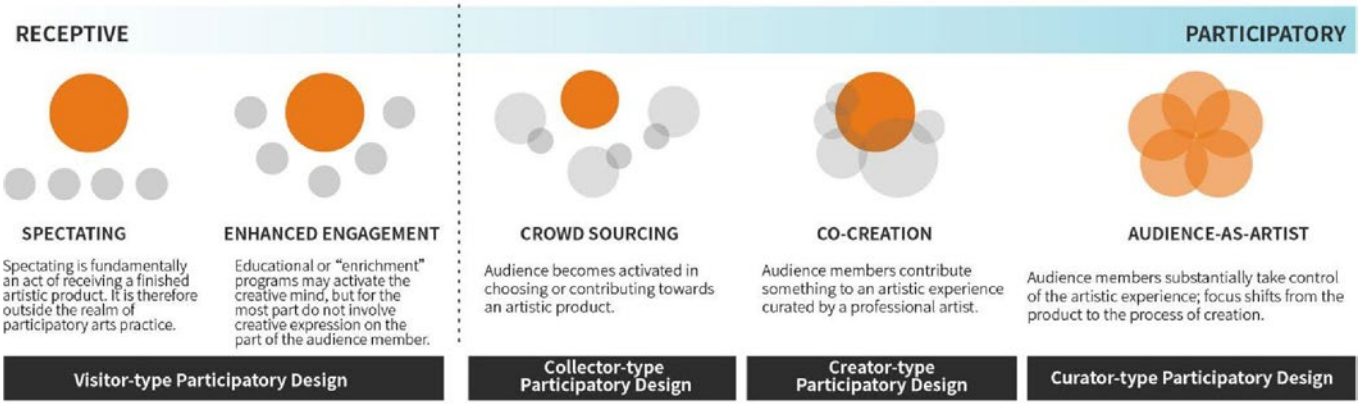
1. Visitor-type Participatory Design: Upon the completion of community curation, individuals engage as visitors. They interact with the exhibition by viewing and sharing, and leave interactive footprints, such as voting or messaging, on the installations at the curation site.

2. Collector-type Participatory Design: During the curatorial process, participants contribute objects and collections and share the stories behind these items. This engagement supports professionals by providing substantive content and material resources that enrich the exhibition's primary themes.

3. Creator-type Participatory Design: Participants in this role actively develop exhibits that align with the exhibition's thematic direction. They employ creative tools, supplied by professionals, to effectively realize their creative visions.

4. Curator-type Participatory Design: In this approach, participants conceptualize the curatorial theme, select and organize exhibits. Professionals assist by facilitating and co-creating, enhancing the collaborative aspect of the exhibition process.

Figure 2. Level of co-curatorial involvement.



we propose the following three hypotheses based on literature review and case studies:

1. The application of participatory design methodologies in creating community culture in Shanghai necessitates the development of design tools tailored to the specific characteristics of each community.

2. Participatory design tools can promote cultural regeneration based on domestic waste in local communities and raise ecological awareness among citizens.

3. Action guidelines and strategies derived from co-curatorial projects can offer viable pathways for addressing similar scenarios and themes.

3. Methodology

3.1 General context of the study

The typical understanding of waste or trash encompasses items that are overlooked, forgotten, or intentionally discarded. The lifecycle of waste starts with the production of goods, positioning consumers not only as direct producers of waste but also as agents of waste reduction, sorting, and transformation (Zhang, 2021). This participatory curatorial project utilizes everyday 'waste/garbage' as exhibition materials to spotlight routine behaviors of 'Buy', 'Use', and 'Throw away', encouraging participants to shift from discarding to collecting waste.The project's framework guides participants through a structured process of engagement:

1. Observation: Observe the domestic wastes in a different view.

2. Collection: Select objects and create archive for the exhibition.

3. Action: Engage participants in sharing personal stories with others.

4. Communication:Invite participants to collaborate on curating exhibitions.

This pathway brings public attention to often-overlooked aspects of daily life, highlighting their broader societal and environmental implications. The exhibition serves as a platform to engage visitors in dialogue, promoting a culture of recycling and enhancing ecological awareness among citizens.

3.2 Participatory observation

Figure 3. Leshan Community

The term "Lao Po Xiao" is uniquely Chinese, often used to describe aging, deteriorated, and compact residential neighborhoods in major cities like Shanghai. This descriptor merges the characteristics of being "old(Lao)," "shabby(Po)," and "small(Xiao)." Typically constructed in the mid-20th century or earlier, these structures are in poor condition. Despite this, their central locations in urban cores confer significant residential and investment appeal. To enhance the quality of life and well-being of residents, and to foster the concept of a "15minute community living circle" aimed at improving public services and grassroots governance, every community in Shanghai features a facility known as a "living box." This new living space combines elements of art, exhibitions, and leisure to create a vibrant community hub. However, in practice, these spaces have not become the focal points of cultural activity they were intended to be. The lack of resident participation can be attributed to several factors, including perceptions that community cultural events are merely administrative exercises, the repetitive and outdated themes of activities, and a general absence of community belonging among residents.

We gathered first-hand information through various methods including joining community online chat groups, conducting participatory observations in the field, and documenting the entire process by using field notes. These notes comprised textual descriptions, photographs, and memos. Subsequently, the data was organized via thematic analysis.

3.3 Practiced-led Research

Archives are records curated and preserved for their cultural, historical, and evidential value, maintained either permanently or long-term. They may include a diverse array of materials such as manuscripts, letters, photographs, maps, books, illustrations, and

digitized texts. Increasingly, contemporary scholars from non-historical disciplines, including artists and designers, are adopting various critical and aesthetic approaches to archives. These approaches often focus on constructing meanings, influencing situations, and fostering new processes for knowledge creation. They offer alternative interpretations and contextualizations of meaning that diverge from official narratives, suggesting that archival art is less about the past but more about the future(Carbone, 2020).

We visualize and present a collective archive of discarded items from everyday life as a narrative form, encouraging participants to contribute objects along with their backstories, express personal perspectives or inspirations, and inspire others to engage with society in novel ways. The communication tool categorizes participants into four types: tourist, collector, creator, and curator. The design of the tool specifically targets the latter three types, recognizing that different participant types may experience varying factors influencing their cost of participation. Consequently, the tool was designed to accommodate all participant types and allows for adjustments based on practical application.

The table below shows the workshops held during the practice-led research process , see as table 2.

Table 2: Workshop Schedule

Number and Date	Duration	Number of participants	Participants	Test Goals
May 2023	None	5 persons	Collector–type Participants; Adults	Completing the co–creation of rubbish archives through the collection of participants' rubbish
Workshop 1 Jan 2024	2 hours	4 persons	Creator–type Participants; 3–6 year–old child	Participants are invited to share stories of choosing rubbish through the archive toolkit
Workshop 2 Jan 2024	3 hours	8 persons	Creator–type Participants; Adults	Participants utilize the archive toolkit to collect stories from fellow participants and invite their friends and family to join.
Workshop 3 Feb 2024	18hours	14 persons	Curator–type Participants; 9–12 year–old child	Participants employ the archive toolkit to gather stories associated with litter, inviting friends and family to join the initiative. They are encouraged to explore the community, utilizing the archival skills they have learned to compile a community archive. This process culminates in the creation of a curatorial model design.

3.4 Informal Discussions

Ongoing observation facilitates brief, unstructured conversations with various participants. These interactions can occur during discussion periods in workshops or while viewing an exhibition of co-created works alongside the participants.

3.5 Questionnaire Survey

In Workshop 3, the participants included 14 children, with their parents also participating in various stages. A questionnaire was distributed to the parents to gather multidimensional data for the study.

4. Results

4.1 Key Dimensions of Applying Participatory Methods in Neighborhood

Based on field observations of the following four scenarios, we employed thematic analysis to identify and interpret the textual data (Table 3). The detailed analysis process involved three levels of coding, resulting in the identification of sub-themes and overarching themes from the field notes, ultimately leading to a structured analysis (Table 4).

Table 3: Field Research for Leshan Community

Scene Serial No.	Title	Time
Scenario 1	Discussion with the resident design team on implementing participatory projects in the community.	8 January 2024
Scenario 2	Conducted the initial in-person survey of residents' needs in collaboration with a team of resident designers responsible for community cultural activities.	13 January 2024
Scenario 3	Observe the venue of the resident team's first cultural event in the community.	16 January 2024
Scenario 4	Directly observe the interactions within an online chat group of community residents.	20 January 2024

Table 4: Coding example

Scene Serial No.	Title
01	The meeting took place in community activity centres, a small two-story building. The ground floor typically serves as a convenience service area, offering services such as dispensing medicine spoons, haircuts, blood pressure measurement, and shoe repair. Each booth is manned by a person (1-1 Convenience Service). The first floor functions as a library, and the meeting rooms are provided to the community as activity spaces (1-2 Public Space). When I first met the operational staff, I noticed they were quite young. Two of the main individuals in charge had backgrounds in design education (1-3 Design Specialists). Z, one of the principals, remarked, "This is an age-friendly community, and we want to showcase the vitality and value of the elderly (1-4 Value of the Elderly). One college teacher I collaborated with in another community spent nearly a year collecting mementos from seniors, and these seniors continued to contact her to donate items (1-5 Everyday Items). The trash-themed project you're working on is also a great fit for our community, as we maintain a part dedicated to sustainable themes (1-6 Promoting a New Lifestyle)."

I responded, "Yes, I hope you can reach out to more residents to participate."

Z added, "We can organize the core members of the community council to help you gather participants (1–7 Community Backbone Leaders), but I hope the project itself can attract more people (1–8 Project Autopoiesis). The elderly here often sunbathe on the green, so you can come by sometime to interview or speak with them directly. If you're going to initiate a project, conduct thorough research beforehand. The residents here might not be as receptive as those near your university (1–9 Slow Acceptance)."

I smiled and said, "I also have limited interaction with the elderly near my school. One reason is the language barrier; I feel that if I don't understand Shanghainese, I can't fully grasp the essence of our conversations. Another reason is the challenge of engaging with the elderly."

Z continued, "We hope your project can facilitate intergenerational communication because the elderly often feel excluded from society. If you can make them feel valuable (1–10 Discovering Individual Values), their participation will increase. Some active members have very full daily schedules, and the place where we meet is also where they practice dancing. I recommend visiting this place frequently before starting your activities. It will be beneficial for your project, and you should be prepared for the possibility that the project may not go as initially planned; adjustments will need to be made based on actual conditions (1–11 Project Compromise)."

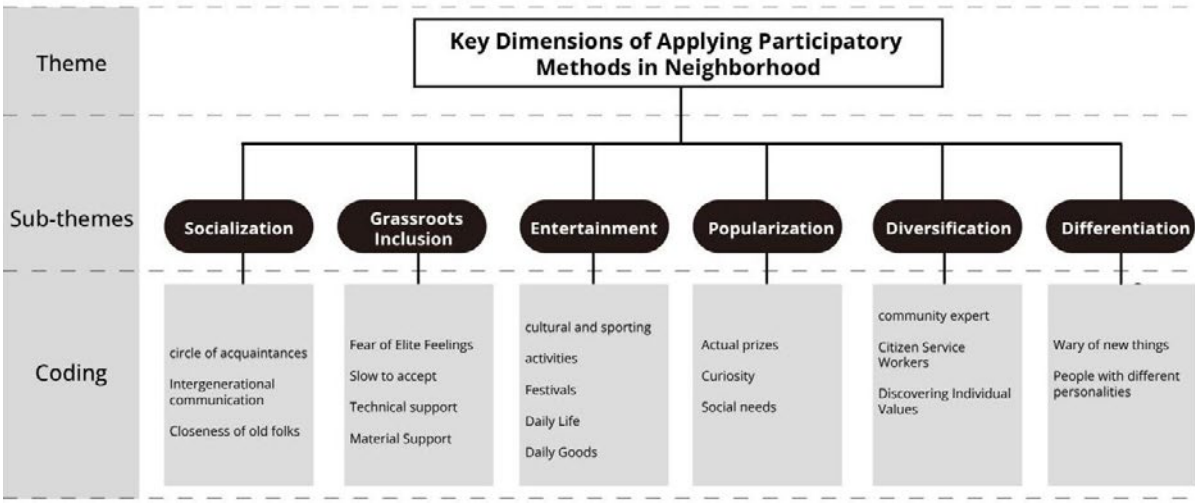
I asked, "So, are there many children here?"

Z replied, "Yes, a lot. You'll see kids coming out of school after 4 o'clock, and their parents walking them on the green. You must have seen it when you walked over here; there's a kindergarten at the intersection (1–12 Children)."

Z, who has been in charge of community operations for over two years, mentioned that the "ministers" are the grassroots leaders of this community, specifically hired as the operations team. I also attended the following day's meeting with the minister and the secretary of the neighborhood committee of Lishan 1–7 village, and learned that they hoped to encourage young people to focus on the community (1–13 Young People's Energy) and to leverage the community's own resources to secure policy support (1–14 Striving for Resources).

The coding and categorization process identified six sub-themes. These sub-themes represent the applicability demensions of participatory design methods in the community. Additionally, they provide diverse and inclusive references for the development and application of design tools (Figure 4).

Figure 4. Thematic analysis



1. Socialization: Assesses whether the tool fosters dialogue and mutual understanding within the neighborhood, thereby fostering emotional connections.

2. Grassroots Inclusion: Ensures that the participation threshold is accessible to all community members, including disadvantaged individuals, non-literate residents, preschool children, and others.

3. Entertainment: Evaluates whether the tool can generate interest or provide a relaxing experience, encouraging participants to engage beyond their everyday routines.

4. Popularization: Engages people emotionally, intellectually, or experientially through the lens of daily life, thereby sparking imagination and discussion.

5. Diversification: Stimulates the unique characteristics and self-worth of each individual within the community.

6. Differentiation: Uses appropriate mediums to avoid generating resistance within the community.

4.2 Archive-centred participatory Design Tools

Due to the low level of engagement as collectors type participants—primarily resulting from limited participation time—workshops were not feasible for them. Instead, all other participant types engaged in archival co-creation exhibitions focused on domestic waste through workshop formats. The design of the participatory tools was guided by three primary objectives (Figure 5):

1. To make the tools accessible to as many community members as possible;

2. To enhance participants' civic ecological awareness and stimulate their imagination during the process;

3. To assist participants in visually displaying the results of the exhibition.

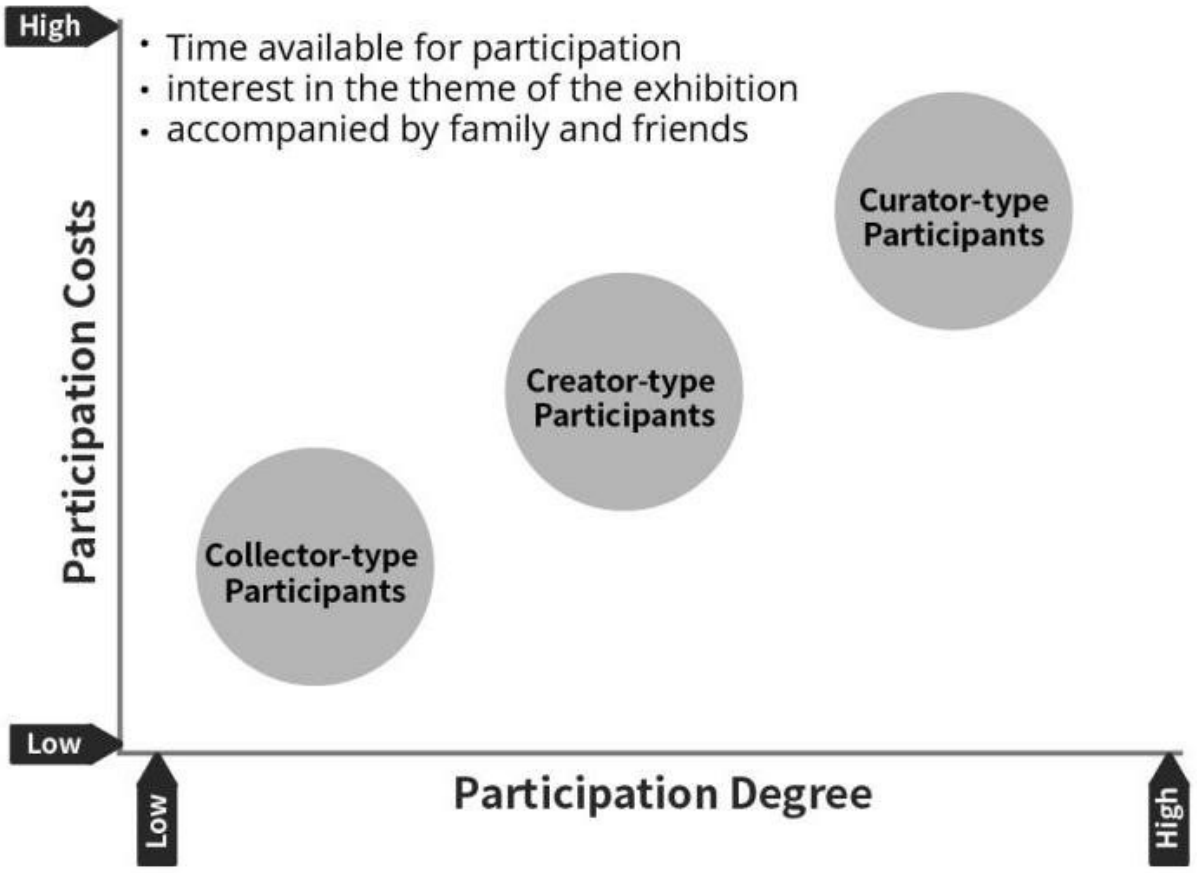


Figure 5. Levels of Participation Among Different Participants

Figure 6. Rubbish provided by participants.

Participants are invited to contribute a bag of unsorted rubbish as a means of engagement, assisting professionals in generating the main content and providing material support (Figure 6). This contribution marks the completion of the engagement process for collector-type participants. The method involves objects from different individuals, employing the visual style of archival photography as a reference. The focus is on detailed descriptions of the objects, which are then artistically combined in collages to establish a thematic connection through a visual narrative.

Figure 7. Exhibition of Works in Galleries in Vienna

The co-created works were exhibited in the gallery, where participants contributed everyday materials, and professionals facilitated creative expression by reconstructing these object combinations into individual visual images (Figure 7). We observed the exhibition alongside the participants, engaging in informal discussions throughout. Feedback revealed that participants were initially surprised by the photograph which not only highlighted a sense of conflict but also prompted participants to reflect on environmental concerns and the nature of waste. The discussions indicated a growing awareness and concern among participants about the implications of trash (Table 5).

Table 5: Informal Discussions with actors

Participants	Informal Discussions
Participants 1	I never pay attention to the garbage I throw away. This garbage reminds me of things that are easily forgotten. It feels like garbage is like the footprints of my life. I think the topic of garbage is quite interesting
Participants 2	These photos make me unable to recognize the garbage. I feel that the garbage is quite dirty. It seems like there is a sense of order now, a very special feeling."
Participants 3	The labels in the photo are the price tags I collect every time I buy second-hand clothes.I almost always wear second-hand clothes, mainly because they were cheap, but I really felt that shops were very attentive to selling second-hand clothes.

Workshop 1 Participatory Methods for Creator-Tpye Participants

This workshop targets creative participants—those who can contribute their own ideas to the curation theme, possess creative skills, and are proficient in using the tools provided by professionals. The 'archival drift box,' a designated design tool, aids in the curation process. This tool kit includes a tool box (Figure 8), instructions for the toolkit (Figure 9), and several archive forms, primarily used for observing, documenting everyday waste. (Figure 10).

Figure 8. Tool box

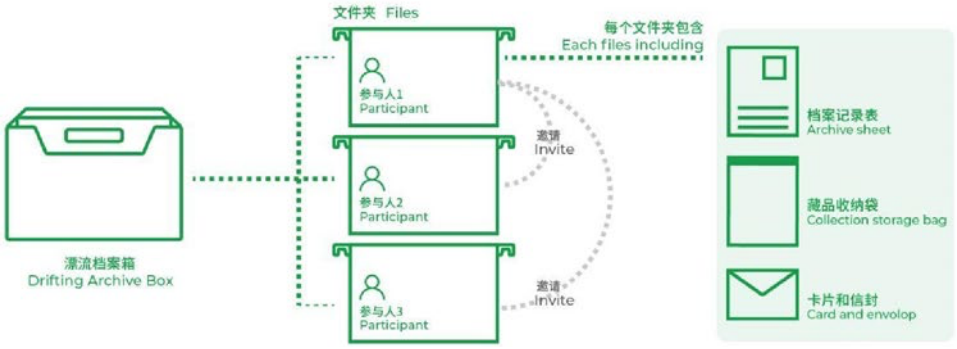


Figure 9. Instructions for the toolkit

Figure 10. Archive forms.

We invited six participants to collect a piece of waste daily using the toolkit for one week. Upon completion, they were to place the filled forms and collected waste into a box and pass it along to friends, relatives, or strangers. This design tool effectively transforms individual contributions into a collective endeavor, shifting the focus from 'me' to 'we.' The initial user of the box acts as a liaison, gathering all materials to return to the author, who then collaborates with participants to organize a community exhibition.

During the workshop, participants were instructed to bring three pieces of waste to the site and select an anonymous piece from another participant. They were then asked to speculate on the backstory of the waste and infer the personality of its owner. The goal was to encourage participants to adopt

Figure 11. Workshop test.

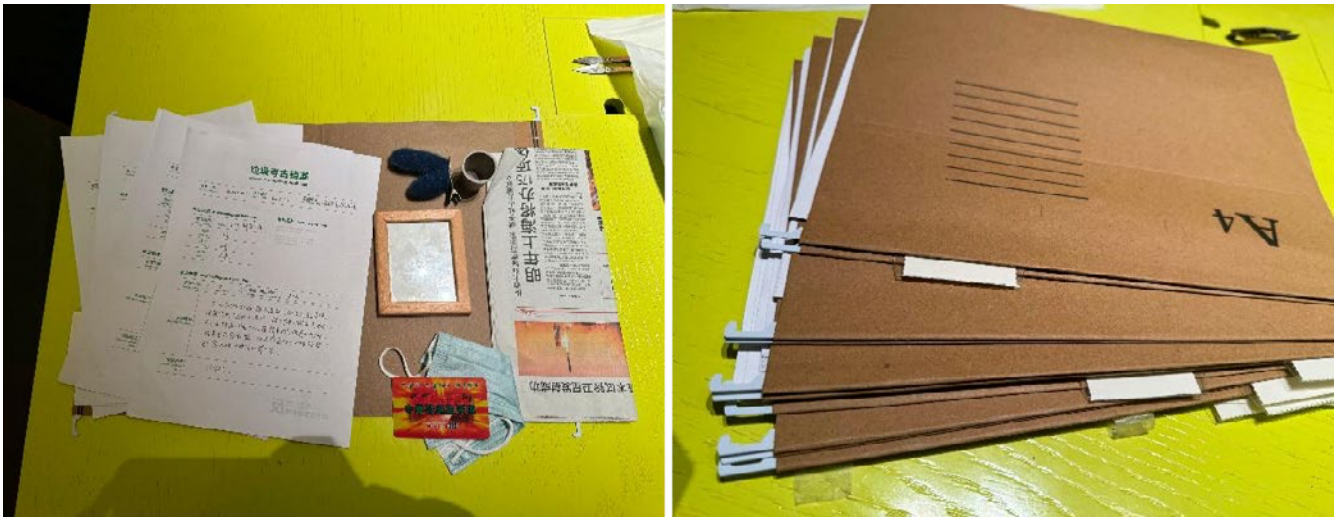


Figure 12. recycled toolkit

new perspectives and consider the waste from an unfamiliar viewpoint (Figure 11). Using waste as props in this setting added a tangible, experiential element to the creative atmosphere, prompting participants to step outside their personal viewpoints and engage in documenting the archive.

After three weeks, the four archive kits were recycled (Figure 12), and the retrieved archives were showcased under the theme "Community Window Story." The exhibition was set in the window of a local community coffee shop (Figure 13). This choice of location underscores the integration of the exhibition into the everyday community landscape, rather than confining it to a specific cultural venue. the exhibition serves as a touch point designed to spark attention, dialogue, and reflection among community members.

Figure 13. Exhibition in Coffee Shop

Workshop 2
Participatory Methods for Creator-Tpye Participants

After completing the adult workshop, we returned to the Leshan community to recruit parentchild pairs with children aged 3-6 to participate in a new workshop (Figure 14). We invited children in the community to bring sustainable items from their daily lives to contribute to the workshop (Figure 15). The items were then displayed in a public space (Figures 16). The design tool was tested with four different groups of children, assessing its accessibility and relevance within the children's community.

Workshop 3
Participatory Methods for Curator-Tpye Participants

The curatorial workshop involved the entire process of curating living waste. Fourteen children from grades four to seven participated in the workshop. The content is divided into three stages: Stage one is observation, Stage two is action, and Stage three is communication. Each stage progresses to a deeper level of participation and scope, accompanied by the co-creation of corresponding curatorial content. During the curatorial process, five roles were established to provide guiding instructions for participants at each stage, with incentives introduced to enhance participant motivation.

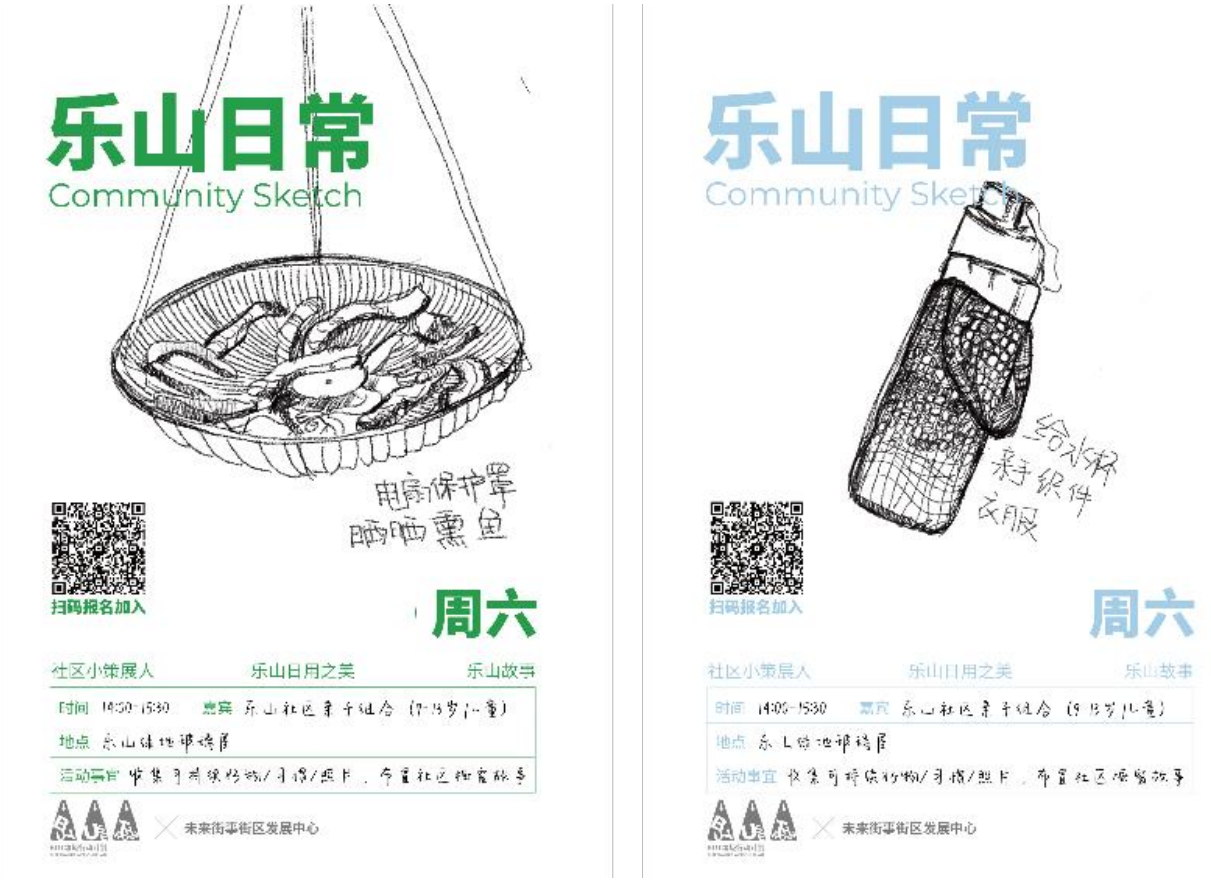


Figure 14. Workshop poster

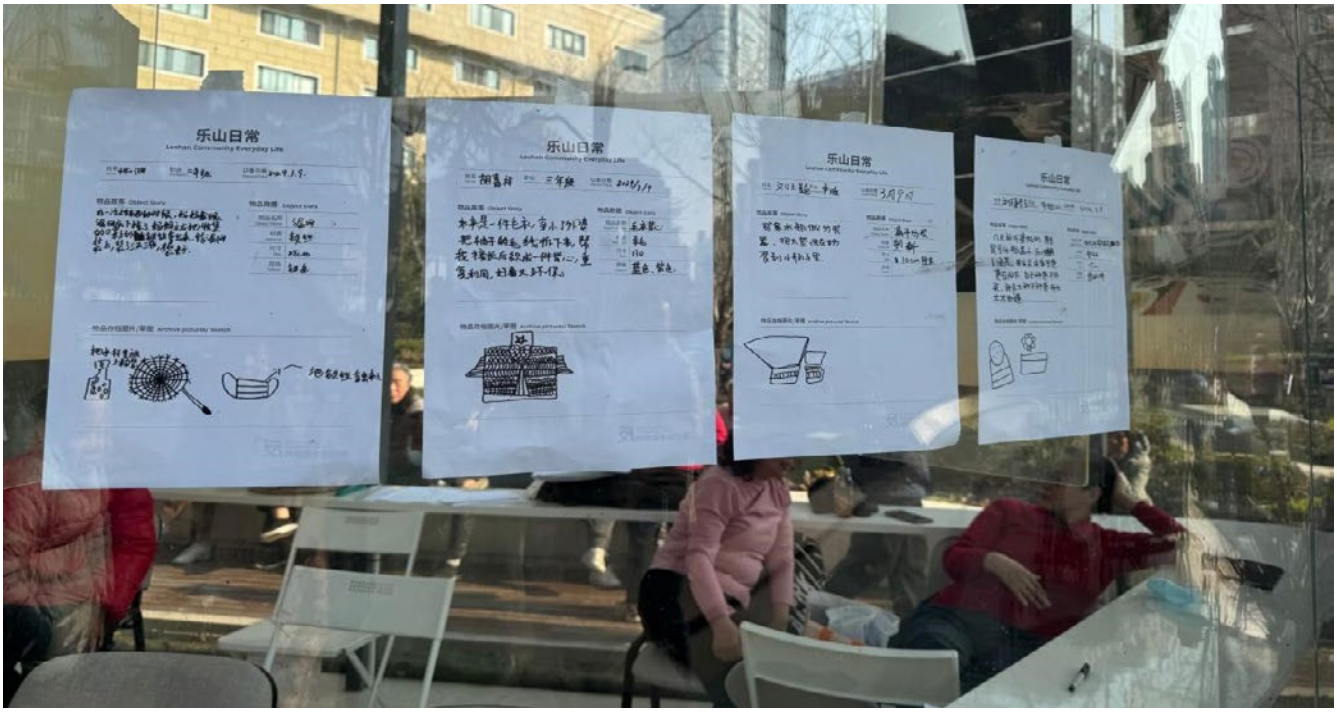


Figure 15. Archives completed by participants

Figure 16. Exhibition in community

The main goal of Stage one was to emphasize behavioral change among participants by initiating the act of 'observation'. In this stage, the roles of collector, observer, and archivist were established to increase engagement with the external environment and clarify the perspective participants were expected to adopt for observation (Figure 17).

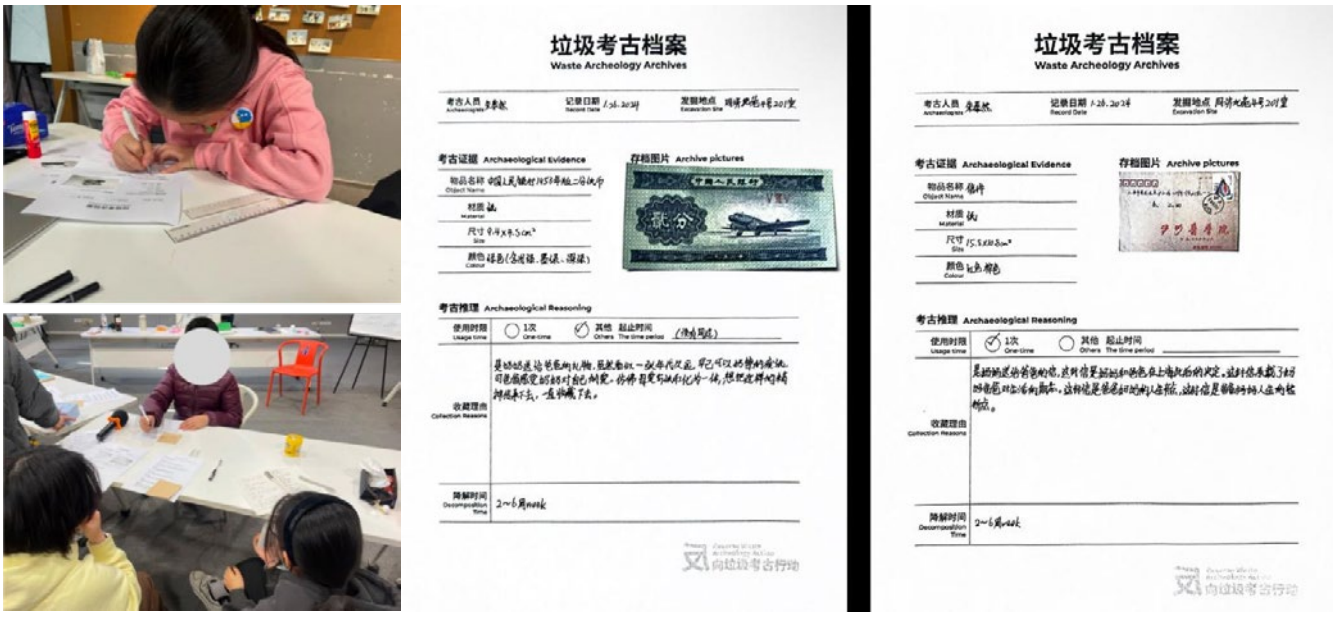


Figure 17. Participants were interviewing each other in pairs about the stories behind the rubbish

The goal of Stage two is to shift the participants' perspective from focusing on the 'object' to the 'community.' The behavior emphasized in this stage is action, specifically through activities such as a community walk (Figure 18) and subsequent creative expression. After the walk, participants were asked to draw the route from memory and create hand-drawn reflections on archival photographs, utilizing existing photographs as references (Figure 19). This phase highlights action, including both fieldwork during the community walk and creative expression afterward.

The aim of stage three was to create a small exhibition of the archives from the last stages, which required participants to set up the exhibition according to the appropriate conditions (Figure 20). Participants need to consider how to present the exhibit so that it engages in a dialogue with the viewer. Participants chose to hide some of the objects under cardboard boxes, as well as placing rubbish generated during the curation process on the ground, using materials to mark it.

Figure 18. Community walking

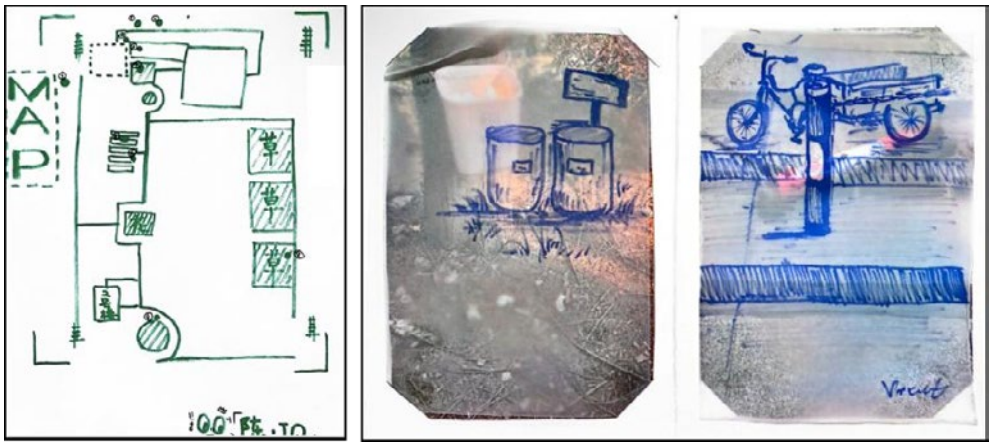


Figure 19. Hand-drawn reflection

Figure 20. Exhibition Venue

After the curation, We conducted a return visit to the participants for the questionnaire survey and collated the results according to the three levels of affective design (instinctive, behavioural and reflective). The results showed that the behavioural phase of the participatory curation helped participants deepen their thinking about the theme of household waste and basically achieved the effect of fostering eco-citizenship (Table 6).

Table 6: Summary of the questionnaire based on the behavioural hierarchy

The behavioural level	Summary
Instinctual level	Community walks are enjoyable and provide a fun experience.
	Engaging in conversation while filling out profiles helps enhance family bonding.
Behavioural level	Discovering materials in everyday life and being able to make creations similar to those made by professional designers.
	Our work doesn't have to be paintings or photographs, we can even exhibit our ideas!
Reflection level	Sustainability can be integrated into everyday life.
	Objects can be repurposed and used sustainably.
	Developed a new understanding of the concept of sustainability.
	Gained a deeper understanding of the community's spatial environment.
	Experienced the mindset of a designer

5.Conclusion

During the three workshops mentioned in the article, we observed changes in participants' perceptions of garbage through informal discussions or questionnaires, and we created a dialogue with the public through participation in community curation activities. Participatory design can benefit from the use of archives as a communication tool. The use of community curation as a long-term residency project will gradually develop a new culture of sustainable living in urban communities. For this purpose, we propose action guidelines and strategies for community curation.

5.1 An Action Guide to Community Participatory Curating

Based on the workshop practice, a participatory curatorial action guide was developed, focusing on community scenarios. This guide offers practical guidance for applying participatory design methods in community building. The action guidelines are intended to assist the public and community workers in independently conducting curatorial activities (Table 7).

Table 7: Guidelines for public and community

Stage	Goals	Participant behaviour	Roles	Task
Stage 1	Arouse attention to the exhibition theme and exhibition objects	observation	Collectors Actor Archivist	Through the completion of the dossier, participants' understandings and reflections on the graphic and textual aspects related to the theme are collected
Stage 2	Practicing a deeper understanding of the curatorial theme through walking within the region	Action	Activist	Participants use their cameras to record scenes and objects of interest during the walk, and use text or hand–drawing to create a secondary version of the photo.
Stage 3	Display of works completed in the first two phases	Communication	Curators	Displaying obejects or works in public spaces and using visual techniques to draw public attention to them

5.2 Participatory Curatorial Strategies in Community Contexts

Activate participant creativity through different roles

In practice, we used identity props, such as an archival toolkit, to frame participants' involvement as an act of modern urban rubbish archaeology, designating them as archaeologists in the archival process. We assigned different roles at each stage of the curatorial practice (Figure 20). These identity props enabled participants to break free from habitual thinking, allowing them to view everyday behaviors and objects from new perspectives, thereby stimulating greater creativity and ideas (Figure 21).

Figure 21. Identity props

Figure 22. Community photos

A parent and child documented their experience of this practice during a walk in their neighborhood (Figure 22). The images on the left were taken by the child, while those in the center and on the right were captured by the parent. These photographs, accompanied by notes from the walk, reflect how both the child and parent began to develop new perspectives and reflections on everyday objects during the activity.

Table 8: Informal Discussions with participants

Photos	Informal Discussions
Cat House	Another kitty litter put up by a kind person, but no Ben cat went in to live there. It feels like feral cats prefer a little more originality.
Chair	An unblemished rattan chair that had been abandoned at the rubbish dump. Judging from the batter on the armrests, it had been used for a long time and was well maintained. Could it be that the old man who used to sit on this chair passed away and the younger generation disposed of the chair as rubbish?
Tree	Shanghai's winter is getting colder and colder, and plants that are not frost–resistant are wrapped up tightly. I just don't know if the plants will be uncomfortable.

Children as a link in Community cultural activities

A community is a complex ecosystem composed of places, people, cultures, values, and organizations. The applicability of participatory design in different contexts must be adapted to the specific circumstances of each location. Fei describes the social structures of Chinese and Western societies using the metaphors of bundles of firewood and ripples, respectively. In Western societies, social groups are like bundles of firewood, with clear boundaries between them. In contrast, Chinese social structures resemble ripples, where each person is the center of a circle of influence, with each outward layer encompassing different levels of interpersonal relationships, including those within the community, family, workplace, and broader society (FEI, 1985).

In this study, we used the parent-child combination to participate in curatorial activities in the form of experiments in old neighbourhoods and received good feedback. After the children became friends or partners with each other, families began to participate in community-related cultural activities because of the "children" as a link, and parents entered into dialogue, chatting and socializing more quickly and naturally because

of the friendship between the "children". The parents also enter into dialogue, chatting and socialising with each other more quickly and naturally because of the friendship between their children(Figure 22). In community design, finding interpersonal bonds can be a powerful way to advance the design process and enhance the impact of the project.

Figure 23. Parent-child pairs are invited to conduct walking observations in the community.

The Third Place as an exhibition space

Third spaces are physical locations where people can experience warmth, conviviality, spiritual support, and a sense of belonging. These include cafes, pubs, libraries, and hairdressers, where individuals from diverse backgrounds can gather in a relaxed and casual atmosphere(Oldenburg, 1989). This concept emphasizes that relationships need to be nurtured and that communities are often built on simple elements like a few tables, friendly shopkeepers, and a shared desire to meet and connect. Curatorial venues are chosen with this idea aiming to visually present the daily life and culture of community members within these third spaces.
These settings are ideal for the creation and

dissemination of community culture. Third spaces can be found in neighborhood centers, parks, squares, and even at the end of streets. Some "temporary spaces," which are rent-free, unregulated, and often overlooked, can also serve as exhibition spaces, adding a unique visual tension and authenticity.

References

Bao, Y. (2008). Shanghai Weekly: Globalization, consumerism, and Shanghai popular culture. Inter-Asia Cultural Studies, 9(4), 557–567. https://doi.org/10.1080/14649370802386461

Black, G. (2012). The Engaging Museum: Developing Museums for Visitor Involvement. Routledge. https://doi.org/10.4324/9780203559277

Brown, A. S., Gilbride, S., & Novak, J. (2011). Getting In On the Act: How Arts Groups Are Creating Opportunities for Active Participation. https://folio.iupui.edu/handle/10244/950

Carbone, K. (2020). Archival Art: Memory Practices, Interventions, and Productions. Curator: The Museum Journal, 63(2), 257–263. https://doi.org/10.1111/cura.12358

Duxbury, N., Kangas, A., & De Beukelaer, C. (2017). Cultural policies for sustainable development: Four strategic paths. International Journal of Cultural Policy, 23(2), 214–230. https://doi.org/10.1080/10286632.2017.1280789

FEI X. (1985). From the Soil: The Forndations of Chinese Society. SDX Joint Publishing Company.

García, B. (2005). Deconstructing the City of Culture: The Long-term Cultural Legacies of Glasgow 1990. Urban Studies, 42(5/6), 841–868.

Oldenburg, R. (1989). The Great Good Place: Cafés, Coffee Shops, Community Centers, Beauty Parlors, General Stores, Bars, Hangouts, and how They Get You Through the Day. Paragon House.

Ryo Y. (2011). Community Design. Faces Publishing LTD

Sanders, E. B.-N., Brandt, E., & Binder, T. (2010). A framework for organizing the tools and techniques of participatory design. Proceedings of the 11th Biennial Participatory Design Conference, 195–198. https://doi.org/10.1145/1900441.1900476

SHEN, Y., YANG, Y., KINOSHITA, I., & XU, M. (2018). Theory Analysis And Sustainable Operation Mode Research On Participatory Design In The Context Of Community Design. Journal of Architecture, S1, 179–186.

Simon, M., McQuibban, J., & Condamine, P. (2020). Zero Waste Cities. https://zerowastecities.eu/

Simon, N. (2010). The Participatory Museum. Museum 2.0.

United Nations. (n.d.). United Nations Sustainable Development. Retrieved 1 August 2024, from https://www.un.org/sustainabledevelopment/

United Nations Statistics Division. (1997). https://unstats.un.org/UNSDWebsite/

Zhang, J. (2021). Waste as a Vibrant Matter: Waste Study under the Perspective of Materiality. Sociological Studies, 36(2), 204–230.

Zhong, F., & Liu, X. (2018). Design for People, with People, by People: The Path, Challenge and Opportunity of Social Innovation Design. ZHUANGSHI, 5, 40–45. https://doi.org/DOI:10.16272/j.cnki.cn11-1392/j.2018.05.008

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DESIGN-DRIVEN INNOVATION (DDI) AS A CATALYST FOR TRANSFORMATION: A CASE STUDY OF THE AIR-MEMBRANE VERSION OF HUO-YAN LABORATORY

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ABSTRACT | This paper explores how the Huo-Yan Laboratory developed by Tongji University's College of Design and Innovation and BGI Genomics Co., Ltd. embodies transdisciplinary design-driven innovation. Robert Verganti, a representative scholar of design-driven innovation (DDI), proposes a third type of innovation that embeds new meanings into products and services, beyond merely focusing on technological or market advances. Through expert interviews and card-sorting methods, this paper analyzes and summarizes the composition of the interpreter network in this DDI project. It explores how the visions of key interpreters can be transformed into collectively achievable meanings during the product innovation process, thereby generating significant social impact. The study visualizes and supplements Verganti's classic model by specifically detailing critical interactive relationships. The results indicate that the project successfully created a radical design solution to urgent social needs. This highlights the importance of transdisciplinary collaboration in generating social value and driving social change. Additionally, it provides a practical example of design-driven transdisciplinary collaboration for Tongji University's "Innovative Design and Intelligent Manufacturing Disciplinary Group", contributing Chinese solutions and insights to the theory of DDI.

KEYWORDS | DESIGN-DRIVEN INNOVATION, NETWORK OF INTERPRETERS, AIR-MEMBRANE VERSION OF HUO-YAN LABORATORY, TRANSDISCIPLINARY

1. Introduction

The creative concept of the "Huo-Yan Laboratory" originated from the vision of BGI Genomics Chairman Wang Jian. In the early stages of the COVID-19 pandemic, BGI Genomics rapidly developed the Huo-Yan Laboratory for COVID-19 nucleic acid testing. The name "Huo-Yan" is derived from Sun Wukong's "Fiery Eyes" in "Journey to the West," one of China's four great classical novels. Just as Sun Wukong could identify demons and monsters with his "Fiery Eyes," BGI Genomics accurately detects various viruses through the Huo-Yan Laboratory.

The COVID-19 pandemic, which began at the end of 2019, quickly spread, becoming a particularly significant infectious disease worldwide. BGI Genomics Co., Ltd. recognized the need to rapidly build a large number of testing laboratories. In mid-February 2020, Mr. Su from Tongji University began conceptualizing an inflatable membrane structure for a protective isolation system. He led his team to apply for a patent and develop a prototype. Subsequently, BGI CEO Mr. Yin and Mr. Su from Tongji University, based on the needs and challenges of COVID-19 testing, collaboratively conceptualized and developed the Air-membrane Version of Huo-Yan Laboratory (Fig.1). This project played a crucial role in global pandemic control, providing timely support to several countries and receiving widespread recognition from the public and governments.

Reports related to the Air-membrane Version of Huo-Yan Laboratory have accumulated over 2.2 million mentions, including more than 60 reports by CCTV and over 80 by the People's Daily. The CCTV documentary "Scientific War on COVID-19" featured the Huo-Yan Laboratory as the only showcased testing facility. Over 20 international officials visited and highly praised the contributions of the Huo-Yan Laboratory, with more than 10 officials sending letters of appreciation. The President of Serbia awarded the Huo-Yan team the "Order of the Serbian Flag, 1st Class," making it the only enterprise to receive this honor. Various levels of government and related departments sent a total of 23 letters of appreciation to the BGI Huo-Yan team, expressing high recognition of their contributions during the pandemic.

Figure1. The Air-membrane Version of Huo-Yan Laboratory was selected for the Best Scientific Image of the month in the top international journal Nature in June 2020 (image sourced from the internet).

This project demonstrates that design is not only the aesthetic driver of innovation but also a comprehensive innovation management practice. It encompasses a new set of processes, mindsets, capabilities, and organizational setups. By analyzing the success of this project from the theoretical perspective of DDI, this paper aims to provide theoretical guidance for the "Innovation Design and Intelligent Manufacturing Discipline Group" initiated by Tongji University in 2021. This group, led by the design discipline, is oriented towards major national development strategies (Fig. 2).

Figure 2. The First Tongji Innovation Design and Intelligent Manufacturing Summit (photo from the Internet).

2. Theoretical background

2.1 Theoretical Foundation

Verganti is the most cited and authoritative scholar in the field of innovation of meaning, and much of the theoretical work on this topic is based on his research findings (De Goey, Hilletofth, & Eriksson, 2019). We have studied two of Verganti's seminal works: "Design-Driven Innovation" (DDI) published in 2006 (Verganti, 2006) and "Innovation of Meaning" (IOM) published in 2018 (Verganti, 2018). The reason for selecting DDI as the primary theoretical basis is that DDI mainly focuses on enterprises, discussing the relationship between companies and the intrinsic meaning of their products, which highly aligns with our research case. Although the Air-membrane Version of Huo-Yan Laboratory demonstrates radical innovation in the intrinsic meaning of the product, the process of meaning creation more closely follows the DDI design discourse. The IOM process, with its highly detailed methodological tools, tends to be somewhat restrictive. Therefore, we analyze the case of the Huo-Yan Laboratory from the DDI perspective.

2.1 Current State of Research

Verganti introduced the concept of DDI in 2003 (Verganti, 2003). Unlike previous frameworks, this concept focuses explicitly on innovation in the meaning of products, providing new strategies for companies to develop more valuable products. In DDI, product meaning refers to the value a product creates for consumers, including utilitarian, emotional, psychological, and socio-cultural values (Verganti, 2006).

Currently, some scholars consider DDI a strategic direction, particularly in the upstream stages of the innovation process (Dell'Era, Magistretti, Cautela, Verganti, & Zurlo, 2020; Sarpong & Maclean, 2012). Some researchers focus on how to construct meaning, such as Professor Knudsen from Oldenburg University, who proposed in 2019 that the construction of meaning in DDI begins with a paradox and is realized through a series of frameworks (Knudsen & Haase, 2019). Other scholars, like sociology professor Krippendorff and management professor Micki Eisenman, have explored understanding meaning, introducing concepts like second-order meaning and secondorder understanding (Eisenman, 2012). Professor Wang Hanyou from Nanjing University of Aeronautics and Astronautics' School of Economics and Management suggests that there are two paths to achieving product meaning innovation: user-driven innovation and DDI. The former, through in-depth contact and analysis of user needs, is effective for incremental meaning innovation, while the latter is a radical meaning innovation based on subtle changes in socio-cultural institutions, proposing entirely new product meanings that go beyond existing user experiences and perceptions (Wang, 2019). Professor Chen Jin from Tsinghua University's School of Economics and Management, a Yangtze River Scholar, points out that

the process of intrinsic product meaning innovation in DDI is relatively obscure, with very few detailed records and a lack of case reviews on the meaning construction process. Specific issues include: the theory may be limited to specific business or market needs without considering broader socio-cultural contexts; the tools and methods on which DDI relies may not fully capture and handle complex socio-cultural dynamics; and the emphasis on economic benefits in DDI might overlook socio-cultural values, leading to an overemphasis on short-term economic returns rather than long-term social impact or sustainability.

Moreover, the relationship between technology and meaning innovation is a key research focus. For instance, Trabucchi and Verganti from Politecnico di Milano, combining meaning innovation theory, emphasize the interaction between technology and meaning, stating that technological innovation not only drives the creation of new meanings but that new meanings can also redefine and enhance the value of existing technologies (Trabucchi, Pellizzoni, Buganza, & Verganti, 2017). In 2017, Goto Satoru from Universidad de Hurtado explored the specific role of technological insights in the integration process of products and services, filling a research gap (Goto, 2017).

2.3 Research Conclusions

Through the study of DDI, we found that its process is relatively obscure, with few detailed records, especially concerning the construction of intrinsic product meanings and how new meaning frameworks are built. Although many researchers in the fields of business and technological innovation have proposed related theories, there is still a lack of articles or cases that highlight the importance of designers and design thinking, necessitating further research. Therefore, we conducted an in-depth study of the Air-membrane Version of Huo-Yan Laboratory with these issues in mind. Through this case study, we hope to supplement the process of constructing new product meanings in the design context of China while emphasizing the crucial role of design thinking in this process. This not only enriches the theoretical foundation of DDI but also provides valuable references for future research.

3. Methods

3.1 Expert interviews

The expert interview method allows for the rapid and objective collection of expert experience and subjective judgments, providing in-depth exploration of the research subject (Yue, Xiahou, & Li, 2020). To understand how radical innovation emerged in the Air-membrane Version of Huo-Yan Laboratory, our study aimed to identify: (1) the roles and team collaboration methods of different participants; (2) the project iteration process and reasons for its success; and (3) the social impact of the project. The research team developed a semi-structured interview guide and invited core members of the project to participate in expert interviews

(Table 1). The interviewees included project leaders and collaborators from various functional departments involved in the Huo-Yan Laboratory. To gather information from multiple perspectives, the interviewees also included other participants in the business ecosystem, such as technical consultants, to investigate the entire network and system. Aggregating opinions from project participants from multiple perspectives enhances the accuracy of the research results and enriches the research data. Additionally, the sample size (N = 8) in this study aligns with qualitative research recommendations (Dworkin, 2012).

The interview guide included five themes, with the most important for this study being "team division of labor," "design innovation process," and "project impact". After a pilot interview, the research team refined the wording of questions based on interviewee feedback to avoid leading questions, further improving the guide. Interviewees were allowed to expand on additional content flexibly, ensuring data accuracy.

The interviews were conducted from July 18 to 22, 2024, via online Tencent meetings or face-to-face meetings, lasting between 40 and 90 minutes. At least two research team members were present at each interview. Before starting the interviews, research team members briefly introduced themselves, explained the research context and the purpose of the interview, and confirmed that the interview was conducted with informed consent. They also obtained permission to record and photograph the interviews (Fig. 3), while ensuring the anonymity of the stored data. The interviewees, as key information providers, were core members who participated in the entire iteration process of the Air-membrane Version of Huo-Yan Laboratory and made significant contributions to the project.

Table 1. Basic Information of Interviewees.

Participant	Name	Self-described role	Date of interview	Interview time	Interview form	Interview topic
1	Mr. Su	Project Leader	2024.07.18	60min	In-person meeting	-Project Management and Team Division -Technological and Design Innovation -Language and Meaning in Product Design -Business Models and Organizational Collaboration -Value Proposition -Project Impact and Future Outlook
2	Mr. Chen	Technical Supervisor	2024.07.22	80min	Online Meeting	-Willingness to Cooperate and Role Assumption -Business Resource Integration and Departmental Supply Chain Improvement -Goal Vision and Business Strategy -Reasons for Exceeding Company Expectations and Industry Impact -Future Iteration Plans and Development Strategies

3	Mr. Kun	Designer	2024.07.18	70min	Online Meeting	-Team Division of Labor and Individual Roles -Challenges Encountered in the Design Process and Execution Status -Construction of Product Meaning and Roles of the Three Parties -Supplier Sources and Responsibilities -Product Vision and Concept Origins -Social Impact and Future Development
4	Ms. Li	Business and Promotion	2024.07.20	30min	Online Meeting	-Origin of Cooperation and Co-creation Methods -Involved Departments and Resource Integration -Alignment of Project Meaning with Company Vision -Project Competitive Advantage and Investment Value -Impact of the Project on the Company
5	Ms. Yu	Document Writing	2024.07.18	30min	In-person meeting	-Roles Assumed and Team Communication Methods -Project Progress from an Observer's Perspective -Project Conception, Process Management, and Future Planning -Social Impact and Initial Predictions
6	Mr. Wang	Product Manufact-uring	2024.07.18	40min	In-person meeting	-Professional Background and Responsible Sections -Division of Labor and Cooperation Model among Three Parties -Interdisciplinary Integration Results in the Implementation Process -Basis of Previous Research and Project Presentation -Personal Growth and Impact during the Project
7	Ms. Zhou	On-site Managem-ent and Logistics	2024.07.22	40min	In-person Meeting	-Role Allocation and Participation Process -Communication Methods and Departments Involved at the Experiment Site -Iteration Process and Social Impact at Different Stages -Unexpected Surprises During the Supervision Process -Future Iteration Directions for Derivatives
8	Mr. Liu	Technical Advisor	2024.07.22	50min	In-person meeting	-Professional Background and Technical Challenges -Collaboration Methods and Challenges Encountered -Impact of Vision, Mission, and Meaning on Project Advancement -Social Impact and Predictions

Figure 3. Interview settings.

3.2 Card-sorting

Card sorting is commonly used to create an effective information structure that matches the mental models of the target group, enabling them to easily find, interpret, and cluster information (Wentzel, Muller, Beerlage-De Jong, & Van Gemert-Pijnen, 2016). There are two forms of card sorting: open and closed (Katsanos, Zafeiriou, & Liapis, 2022). This study employs the closed card sorting method to cluster information from the interview texts. Closed card sorting involves participants being given numerous cards and different predefined categories, with the task of placing the cards into these established categories (Adamides, Christou, Katsanos, Xenos, & Hadzilacos, 2015). In this study, the categories were derived from key classifications extracted from the literature review.

The steps for processing interview data in this study are as follows (Fig. 4):

1. Initial Reading and Keyword Collection

   Research team members print and carefully read the paper versions of the interview texts, circling keywords to collect entries and establish preliminary insights.

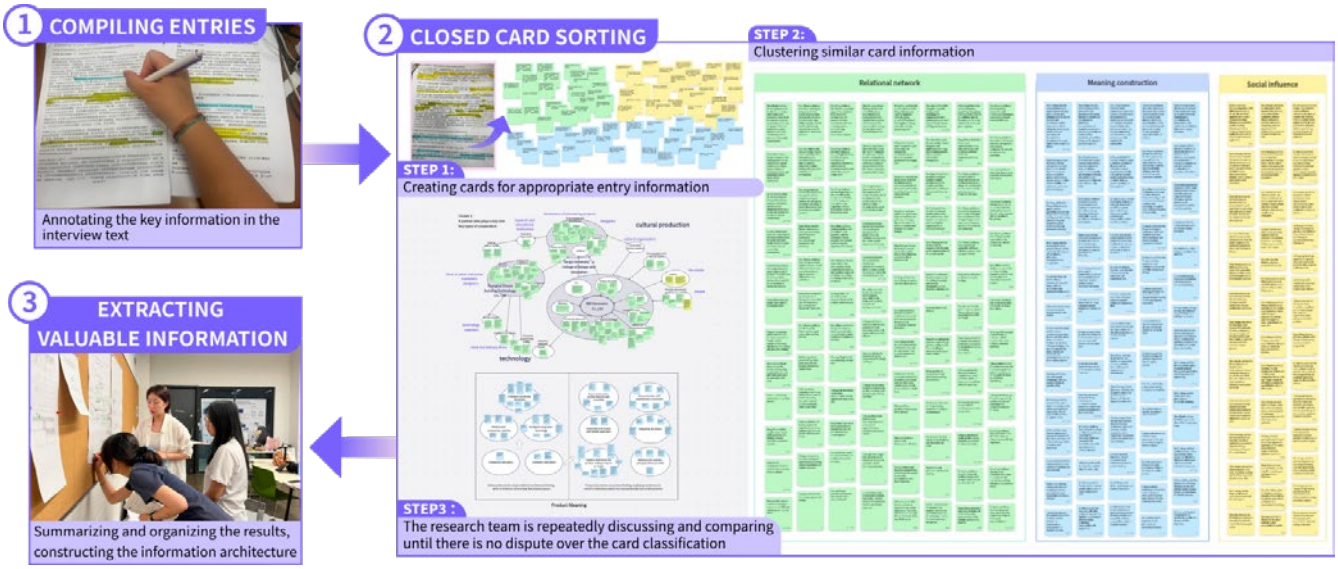
2. Card Creation and Clustering

   Useful information is extracted from the collected entries to create cards on Boardmix. Using conclusions from the literature review in the previous section, team members assess the validity of the card information and drag the cards into the pre-established categories of “Meaning Construction,” “Network Relationships,” and “Social Impact,” thereby clustering similar card information. This step is carried out sequentially by team members to ensure full understanding and judgment of the card information. After classification, the team conducts a semi-structured discussion around the research question itself to ensure that each researcher’s viewpoints are understood and considered (Barriball & While, 1994). Cards are continuously discussed, dragged, counted, integrated, and sorted until there is no dispute over the classification, finalizing the clustering results (Back & Collins, 2021).

3. Induction and Logical Structuring

   The card sorting results are summarized and organized, and relationships are mapped against the theory. Then, the cards are dragged to create logical diagrams, thus constructing the information architecture.

Figure 4. Data processing and analysis procedure.



4. Discussion

The author conducted an information architecture analysis of the cards categorized under the interpreters' theme, systematically identifying and organizing the key organizations and individuals involved in the Air-membrane Version of Huo-Yan Laboratory project. Subsequently, the author matched these subjects with the types of interpreters proposed by Verganti, ultimately constructing the network of interpreters for the Huo-Yan Laboratory (Fig. 5).

4.1 Network of Interpreters

Faced with the urgent social need for large-scale rapid testing brought by COVID-19, BGI Genomics Co., Ltd. quickly assembled the Huo-Yan Laboratory project team. This team served as a bridge for discourse between various internal departments such as laboratory testing and smart manufacturing, and external interpreters, actively building a transdisciplinary collaboration network to swiftly respond to societal challenges.

Mr. Su is the most critical interpreter and mediator in the network. A building materials industry exhibition became the opportunity for him to meet and maintain contact with Mr. Yin, the CEO of BGI Genomics. This cultural organization sowed the seeds for innovative collaboration between these two professionals from disparate fields, particularly from a materials perspective. Mr. Su's academic research and practice focus on architecture design and urban planning. Since 2008, he has been exploring modular building design for emergency aid logistics and transportation, as well as the application of membrane materials in architectural spaces, resulting in several related patents. In the collaboration with BGI Genomics, he not only led the Tongji University's College of Design and Innovation design team to take on the roles of developers of pioneering projects and designers, but also connected BGI Genomics Co., Ltd. to new interpreters through his network in the educational and academic circles.

Another critical interpreter in the Huo-Yan Laboratory project was Shanghai Etopia Building Technology Co., Ltd. Working in close collaboration with the design team, this company assumed the role of firms from other industries within the network, having long explored the application potential of PVC membrane structures. Their participation brought important technology resources such as membrane retailers, enabling cross-domain innovative applications at the material technology level for the iteration of Air-membrane Version of Huo-Yan Laboratory products from single-layer to double-layer membranes.

Additionally, when the Huo-Yan Laboratory encountered technical challenges in achieving the required negative pressure standards, Mr. Su, through his connections at Tongji University's College of Architecture and Urban Planning, established a link with Mr. Liu's intelligent environment building research team. As research and educational institutions deeply engaged in spatial environment research, they provided expert technical guidance on new air systems as well as recommended reliable retail and delivery firms, ensuring the product met the stringent standards of P2 level laboratories.

During COVID-19, local governments and public health departments, as main customers, became key recipients and evaluators of the meaning of the Air-membrane Version of Huo-Yan Laboratory. More importantly, they emerged as crucial bridges for Chinese design to expand both domestically and internationally. Through transdisciplinary collaboration with the key interpreter design team, BGI Genomics Co.,

Ltd. achieved results on media platforms such as design award institutions and academic publications.

4.2 Critical Interactions Among Interpreters

Based on the study of the Huo-Yan Laboratory project, the relationship lines connecting various units are clearly defined. Considering the distinction between key interpreters and regular interpreters, the relationships between different entities should vary. To explore the interactions that played a critical role in the radical innovation of the Air-membrane Version of Huo-Yan Laboratory, we further integrated relevant card information and, upon analysis, derived three insights:

1. Cross-Organizational Leadership Team (See the line labeled 'a' in Figure 5)

   Based on mutual trust and consensus on collaborative innovation, the cooperation between BGI Genomics Co., Ltd. and Tongji University's College of Design and Innovation transcended the boundaries of traditional client-supplier relationships. High-frequency online communication meetings averaging six times daily facilitated a closely collaborating leadership team. This stimulated the potential of the design team as the key interpreter, enabling it to connect breakthrough resources across industries and academic research fields such as air membrane supplier and new air system technology. Meanwhile, in the process of constructing the product vision and meaning, the design team maintained a convincing value-leading role, ensuring that through several iterations, the modular vision of the Air-membrane Version of Huo-Yan Laboratory - being mobile, easy to transport and assemble, while also aesthetically pleasing with an excellent user experience - was thoroughly implemented.

2. Design-Led Transdisciplinary Value Integration (See the line labeled 'b' in Figure 5)

   As core interpreters, the design team and design executors formed a complete value integration chain from market needs to engineering technology by arranging dedicated personnel to be stationed in Shenzhen, which served as a logistics transfer hub for raw materials and finished products or maintaining close communication with BGI Genomics' engineering team. This ensured that the value demands of multiple stakeholders including domestic and international customers, BGI Genomics, suppliers, and laboratory personnel were promptly heard and expressed. Transdisciplinary collaboration drove product iteration. For example, the P2 grade hard indicators for virus detection laboratories needed to consider the impact of the air membrane space's enclosure on the psychological state of laboratory personnel, as well as

the adaptability to spatial conditions in different application sites. Radical innovation of the air membrane mobile detection laboratory was achieved through the discourse between experience and technology considerations.

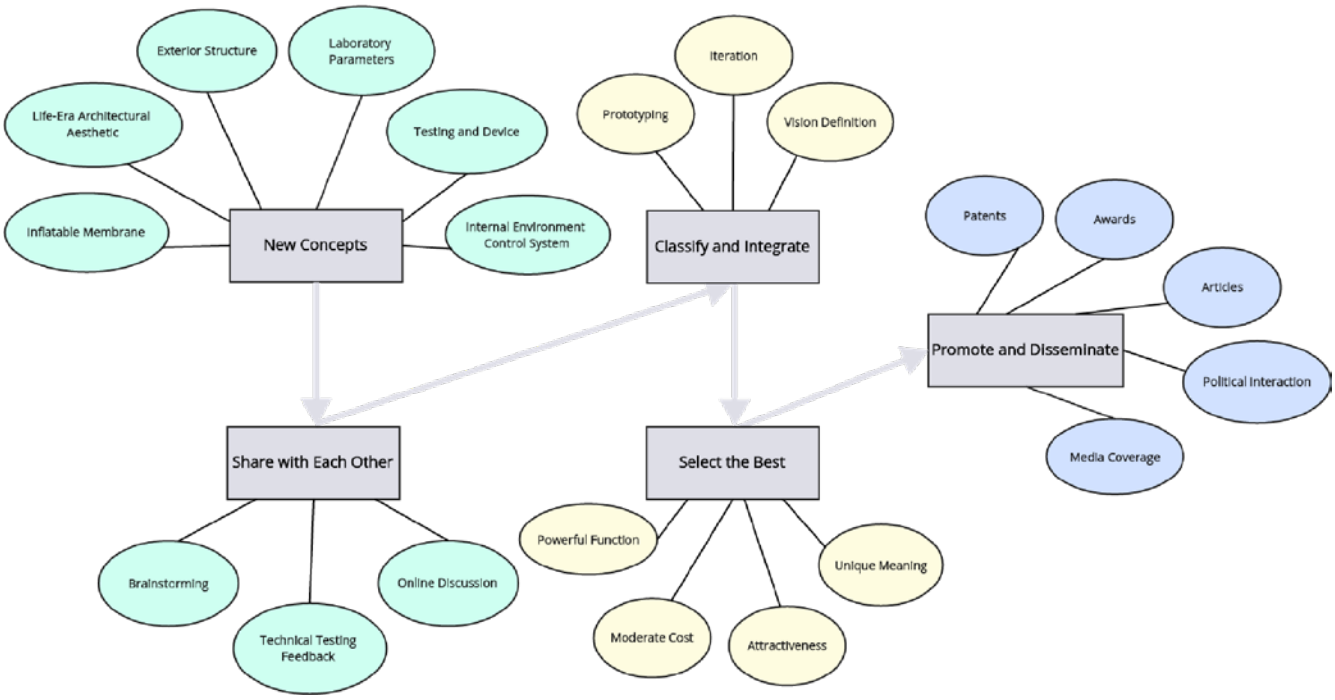
3. Prototype-Driven Product Meaning Realization (See the line labeled 'c' in Figure 5)

When a company obtains radical innovation in product meaning through design-driven research, it needs to transition to a more conventional solution-oriented product development phase. The prototype testing methodology, a critical component of design thinking, plays a pivotal role in this product development process. It serves to ensure that the new intrinsic meaning of the product can be effectively realized and implemented. In the emergency caused by the rapid spread of COVID-19, although clients at the time could hardly afford the costs of prototyping, which had been the usual practice for BGI Genomics in delivering solutions in the past, considering the varied needs of different stakeholders and the technical challenges of product innovation, BGI Genomics decided to financially support the design team's prototyping efforts. The company maintained an open attitude towards trial and error. As a tangible communication tool, prototypes promoted active participation from various entities from the company to suppliers, collectively iterating the solution hundreds of times in just over ten days, efficiently promoting the complete cycle of the DDI process.

4.3 Design Dialogues

BGI Genomics Co., Ltd., in collaboration with Mr. Su and other interpreters, conducts design dialogues for open discussions and radical innovation. The project team brings together ideas from experts and practitioners across various fields through brainstorming, prototyping, and technical testing. These ideas are then filtered to develop feasible and practical design concepts, ensuring the sustained promotion and implementation of DDI within the project (Fig. 6).

Figure 6. Design dialogues of the Huo-Yan Laboratory.



1. Proposal of New Ideas

Mr. Su, with his extensive experience in spatial design, is the key figure in proposing new ideas. He has independent research achievements in inflatable structure isolation rooms and unique insights into the relationship between buildings and urban life forms. During brainstorming sessions, Mr. Su proposed that to quickly respond to public health emergencies and align with the development trend of life-era architecture, the use of inflatable structures should continue for the construction of the Huo-Yan Laboratory. As a novel design, it lacks market precedents for reference. To evaluate feasibility, Genomics Co., Ltd. utilized its extensive expert resources in the laboratory field, inviting domestic experts and over thirty engineers to propose design standards and optimization suggestions. To meet national certification requirements, Mr. Su's team integrated traditional laboratory parameters into the inflatable laboratory design, innovatively using double-layer inflatable structures to create a negative pressure space. Genomics Co., Ltd. simplified the testing process into three steps: sample preparation, nucleic acid extraction, and nucleic acid detection, corresponding to the layout of each inflatable module. Suppliers of intelligent control systems and other equipment also provided feedback on equipment layout and other issues.

Due to time constraints, the Huo-

Yan Laboratory adopted a rapid iterative process of designing and implementing simultaneously, establishing a "concept design-structural design-productionconstruction-on-site inspection-feedback-design optimization" cycle, integrating resources and ideas from partners in different industries. In the early versions, new needs or ideas constantly emerged during practice, prompting Mr. Su's team to make design modifications. Once the product took shape, Genomics Co., Ltd.'s overseas marketing teams would gather local requirements to better adapt to specific conditions. Due to the high time and economic costs of transporting materials and components during the pandemic lockdown, Mr. Su's team prioritized logistics and delivery processes in the product design. They aimed to compress the volume of the inflatable laboratory to save transportation costs and used prefabricated inflatable modules to reduce installation difficulty, allowing for remote guidance of engineering personnel during lockdowns. In summary, Mr. Su's team integrated their product design experience with building design, continuously updating design concepts in response to the requirements and standards of other interpreters.

2. Sharing of New Design Concepts

Due to the need for rapid iteration, interpreters and the project team of the company share new design ideas through instant e feedback or group discussions, involving everyone in solving design and technical issues. Project personnel generally use WeChat video calls for frequent communication, as previously mentioned. Meanwhile, Genomics Co., Ltd continually introduces new expert teams to modify or supplement product design concepts.

3. Integration of New Concepts

Core project members maintain an open attitude towards design discussions, integrating new ideas proposed by interpreters and constructing the vision for the Huo-Yan Laboratory, which has undergone radical innovation in its conceptual dimensions. Genomics Co., Ltd. transitioned from providing standardized, integrated genetic testing laboratories to offering systematic solutions for the design, production, transportation, installation, use, and recycling of inflatable laboratories. Through categorizing and integrating various viewpoints, the project team gradually clarified the new vision. Mr. Su's understanding of architecture is "to use the minimum skin to effectively create the largest space volume isolated from nature"; BGI Genomics Co., Ltd.'s corporate vision is "benefiting humanity

with genetic technology." At the intersection of these visions, the vision of the Air-membrane Version of Huo-Yan Laboratory emerged: "creating flexible and efficient spaces for the interaction between humans and technology with a product-oriented mindset," allowing more people globally to enjoy the benefits brought by technology.

4. Selection of Design Concepts

Genomics Co., Ltd. has multiple R&D teams working on new nucleic acid testing laboratories, resulting in various products, such as laboratories combining metal frames and inflatable structures. However, these products could not match the functionality of traditional laboratories and lacked unique innovative meaning in product language. In contrast, the Air-membrane Version of Huo-Yan Laboratory not only has powerful functions and moderate costs but also possesses attractiveness and innovation in product language and intrinsic meaning, making it a design project that Genomics Co., Ltd. has chosen to invest heavily in. In terms of product language and meaning, the project team adheres to two main points for the design of the Huo-Yan Laboratory: first, standardizing the productization of buildings, offering innovative Chinese laboratories as products for external customers, providing differentiated excellent products and services; second, combining emergency and regular use, allowing the Huo-Yan Laboratory to go beyond short-term emergency nucleic acid testing needs and maintain its unique product features and advantages, meeting deeper needs such as public health testing and precision medicine. Through this design concept, the Huo-Yan Laboratory can continue to function as a multi-functional space product.

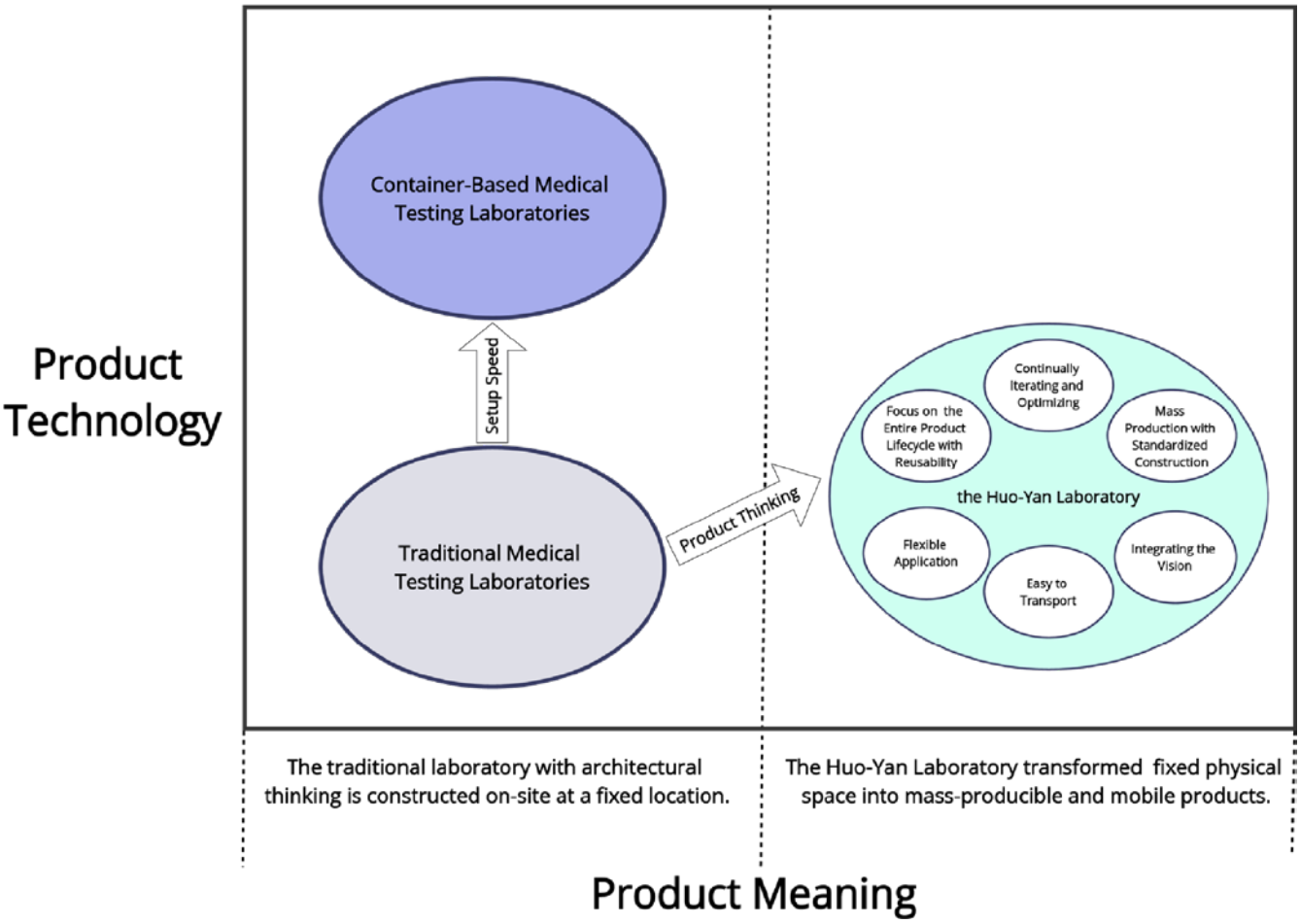
5. Promotion and Dissemination of Product Meaning

Mr. Su's team and BGI Genomics Co., Ltd. actively carried out a series of promotional activities to spread the concept of inflatable building productization. These activities include applying for technical patents, submitting for international awards, publishing academic articles, engaging in interactions with political leaders, and cooperating with media reports. Through these efforts, the team successfully established the Air-membrane Version of Huo-Yan Laboratory as a benchmark, enhancing societal recognition and acceptance of the entire solution. Although some competitive products emerged later in the market, the Huo-Yan Laboratory's status as an initial product was already established in both academia and the market.

4.4 From Architectural Thinking to Product Thinking

Inflatable technology, known for its quick setup and removal, is commonly used in rapidly deployed temporary buildings, but few companies explore the intrinsic meaning behind inflatable buildings. The Air-membrane Version of Huo-Yan Laboratory represents a new architectural concept and way of thinking. Its radical meaning lies in the shift from architectural thinking to product thinking (Fig. 7). In the design dialogues, the company and interpreters acquired new ideas and visions, pushing the transformation of biological testing laboratories from engineering projects to industrial products. They believed that the inflatable structure of the Huo-Yan Laboratory considered the mobile attributes of the product, expanding the laboratory's reach in the global market through modular production, standardized installation, and improved logistics efficiency. As a systematic product and service solution that made significant contributions to the global fight against the pandemic, the Air-membrane Version of Huo-Yan Laboratory has shown the potential to become a design classic.

Figure 7. Comparison of the traditional laboratory, container-based laboratory, and Huo-Yan Laboratory.



The Air-membrane Version of Huo-Yan Laboratory was designed as a comprehensive

solution, integrating multidisciplinary knowledge and technology to achieve refined lifecycle management of the product. The design and production processes considered cost control. The 5.0 version of it combined containers and inflatable modules, the iterative upgrading approach also reflected product thinking. In logistics, Mr. Su proposed the concept that logistics determine the building product, setting the size and weight of the Huo-Yan Laboratory based on civilian aviation luggage compartments to meet the procurement needs of overseas countries like Saudi Arabia and Kazakhstan. In terms of usage, the design team considered the cost-effectiveness issue rarely addressed in traditional buildings, allowing the Huo-Yan Laboratory to be disinfected and stored for reuse.

The successful development of the inflatable laboratory also demonstrated the advantages of building productization. As a new architectural paradigm lacking existing concepts and standards, the R&D team overcame technical challenges to maintain the unique details of the product. The initial XY chromosome shape and later time tunnel-like light strips in the product's appearance design catered to the flexible installation characteristics of inflatable materials, unifying futuristic aesthetics with flexible building techniques. For internal environmental control, the team adopted intelligent integration technologies, including light-interactive access control, environmental sensors, and cabin pressure intelligent control systems.

5. Conclusion

The Air-membrane Version of Huo-Yan Laboratory serves as a crucial carrier of China's technological interpretation of the "Community of Shared Future for Mankind." Through an engineered paradigm, it has been built in various countries around the world, efficiently aiding in global pandemic prevention and control, and becoming a "Chinese symbol" in the global fight against COVID-19. This project's success once again validates the value of radical innovation in product intrinsic meaning.

This project also provides a successful case study for DDI. It demonstrates how design can act as a catalyst for transformation, achieving a fusion of technology and humanities through close collaboration among transdisciplinary teams, offering new insights and directions for future innovation. The successful experience of this project not only provides valuable practical references for the role of the design discipline in addressing major societal challenges but also significantly contributes to the theoretical research and practical application of DDI.

Furthermore, the Air-membrane Version of Huo-Yan Laboratory project showcases new organizational forms and cooperation models. The close collaboration between BGI Genomics Co., Ltd. and Tongji University transcended the traditional client-contractor model, resulting in highly frequent exchanges

and cooperation, ensuring rapid response and efficient execution during crises. This close cooperation model provides new directions for future research on organizational definitions and types in innovation theory, facilitating further exploration of more flexible and efficient organizational structures and cooperation mechanisms.

References

Adamides, G., Christou, G., Katsanos, C., Xenos, M., & Hadzilacos, T. (2015). Usability Guidelines for the Design of Robot Teleoperation: A Taxonomy. IEEE Transactions on Human-Machine Systems, 45(2), 256-262. doi:10.1109/THMS.2014.2371048

Back, P., & Collins, A. M. (2021). Negotiating the green obstacle course: Ranking priorities and problems for municipal green infrastructure implementation. doi:10.1016/j.ufug.2021.127436

Barriball, K. L., & While, A. (1994). Collecting data using a semi-structured interview: A discussion paper. Journal of Advanced Nursing, 19(2), 328-335. doi:10.1111/j.1365-2648.1994.tb01088.x

De Goey, H., Hilletofth, P., & Eriksson, L. (2019). Design-driven innovation: a systematic literature review. European Business Review, 31(1), 92-114. doi:10.1108/ebr-09-2017-0160

Dell'Era, C., Magistretti, S., Cautela, C., Verganti, R., & Zurlo, F. (2020). Four kinds of design thinking: From ideating to making, engaging, and criticizing. Creativity and Innovation Management, 29(6). doi:10.1111/caim.12353

Dworkin, S. L. (2012). Sample Size Policy for Qualitative Studies Using In-Depth Interviews. Archives of Sexual Behavior, 41(6), 1319-1320. doi:10.1007/s10508-012-0016-6

Eisenman, M. (2012). Understanding Aesthetic Innovation in the Context of Technological Evolution. doi:10.5465/amr.2011.0262

Goto, S. (2017). Technology Epiphany and an Integrated Product and Service. Journal of Technology Management and Innovation, 12(2), 34-44. doi:10.4067/S0718-27242017000200005 Katsanos, C., Zafeiriou, G., & Liapis, A. (2022). Effect of Self-efficacy on Open Card Sorts for Websites. Paper presented at the International Conference on Human-Computer Interaction. doi:10.1007/978-3-031-06424-1_7 Knudsen, L. S., & Haase, L. M. (2019). The construction of meaning in design-driven projects: a paradox initiated process. International Journal of Design Creativity and Innovation, 7(3), 129-143. doi:10.1080/21650349.2018.1501281

Sarpong, D., & Maclean, M. (2012). Mobilising differential visions for new product innovation. Technovation, 32(12). doi:10.1016/j.technovation.2012.07.003

Trabucchi, D., Pellizzoni, E., Buganza, T., & Verganti, R. (2017). Interplay between technology and meaning: How music majors reacted? Creativity & Innovation Management, 26(4), 327-337.

doi:10.1111/caim.12234

Verganti, R. (2003). Design as brokering of languages: Innovation strategies in Italian firms. 14(3), 34-42. doi:10.1111/j.1948-7169.2003.tb00050.x

Verganti, R. (2006). Innovating through design. Harvard Business Review, 84(12). doi:10.1177/1059601106286889
Verganti, R. (2018). Overcrowded. Designing Meaningful Products in a World Awash with Ideas. PROJECT MANAGER (IL)(34), 48-48. doi:10.3280/PM2018-034012

Wang, H. (2019). User classified algorithm and model based gold jewelry design definition. Cluster Computing-the Journal of Networks Software Tools and Applications, 22, S6741-S6753. doi:10.1007/s10586-018-2574-4

Wentzel, J., Muller, F., Beerlage-De Jong, N., & Van Gemert-Pijnen, J. (2016). Card sorting to evaluate the robustness of the information architecture of a protocol website. International Journal of Medical Informatics, 86(feb.), 71-81. doi:10.1016/j.ijmedinf.2015.12.003

Yue, Y., Xiahou, X., & Li, Q. (2020). Critical Factors of Promoting Design for Safety in China's Subway Engineering Industry. International Journal of Environmental Research and Public Health, 17(10), 3373. doi:10.3390/ijerph17103373

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Dr. Su has played a significant role in numerous influential projects, including the planning and design of the Shanghai Expo 2010, the conceptual planning of Beijing's Tongzhou Sub-center, the preservation and development of multiple historical towns in Southern China (e.g., Jiangnan Six Towns), and urban planning initiatives in international cities across Angola, Zambia, and Russia. He is frequently invited to deliver keynote speeches and lectures on future-oriented smart city innovations at prominent platforms, such as TED Global, Tencent WE Summit, CCTV's One Person One World series, and executive training programs for municipal leaders in Shanghai and Beijing. Additionally, Dr. Su serves as an innovation mentor at Tongji University's Innovation Incubator and several renowned institutions and enterprises.

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PEMO, POSITIVE EMOTION: A GAMIFIED AI JOURNALING WEBSITE CENTERED ON FACILITATING USERS IN DEVELOPING MORE POSITIVE NARRATIVE IDENTITIES

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ABSTRACT | Contemporary young individuals commonly tend to immerse themselves in pessimistic narrative identities, often slipping into pessimistic mindsets unconsciously. Narrative Identity Therapy and Expressive Writing Therapy in psychology offer potential transformations for pessimistic individuals. However, expressive writing has limitations in emotional regulation, conversational therapy with oneself often leads users to merely document negative occurrences without effectively addressing their pessimistic emotions. Hence, we propose the design of a gamified AI interaction website named PEMO, signifying Positive Emotion. PEMO facilitates a shift in users' pessimistic narratives through post-journaling dialogues with ChatGPT-4.0. Users may opt for traditional pen-and-paper journaling, with handwriting recognition pens transferring text to computers. The trained GPT4.0 model embodies three personas: Family, Close Friend, and Wisdom Figure. These personas emulate counseling techniques, utilizing continuous questioning to guide users toward actively disengaging from pessimistic narrative identities. Leveraging natural language processing, user sentiment analysis generates flowers corresponding to diary emotions. These flowers converge to form a socially oriented Diary Garden, where users can visit each other's gardens, observing emotional states to enhance user engagement. PEMO is dedicated to using gamification and AIGC interventions to guide users toward better self-reflection and overcoming "pessimistic narrative identities" through engaging interactive formats.

KEYWORDS | PESSIMISTIC NARRATIVE IDENTITIES, EXPRESSIVE WRITING, AI INTERACTIVE WEBSITE, GAMIFIED SOCIAL SCENARIOS, EMOTION RECOGNITION, CUSTOMIZED GPT 4.0, MULTIMODAL EMOTION RECOGNITION

1. Introduction

1.1 Background

In the current era, contemporary young people generally face psychological health problems and pessimistic emotions to varying degrees. Although mental health is an individual issue, it has broader societal implications. Psychological disorders can undermine social trust and reduce behaviors that promote societal prosperity, such as workforce participation and entrepreneurship. Mental health also influences people's visions of the country's future and human progress, making it a significant concern. Our investigation reveals that adults under 30 are generally more pessimistic than older groups, with the younger Generation Z being the most pessimistic age group in China. Although some young individuals appear to withdraw from intense competition, their pessimistic outlook on the future cannot be ignored. How to help young people alleviate anxiety and pessimism in this era is a significant topic that requires careful consideration by designers.

Given this background, the field of psychology has proposed various healing methods, such as "Narrative Identity Therapy" and "Expressive Writing Therapy." Both therapies are psychological treatments used to improve mental health, each with unique theoretical foundations and practical applications. Moreover, many researchers combine the two therapies to achieve better therapeutic effects. Therapists can encourage clients to express their emotions through writing and then help them reconstruct and reinterpret these writings through Narrative Identity Therapy.

In addition to traditional psychological healing theories such as "Narrative Identity Therapy" and "Expressive Writing Therapy," AI's application in psychology has become increasingly widespread with technological advancements. Examples include AI emotional analysis, virtual psychological therapists, and AI mental health prediction models,

all playing significant roles in psychological therapy, mental health assessment, and prevention. Integrating AI into the field of psychology has become a significant trend. According to a Psychology Today report, AI's application in mental health is proliferating, with the global AI medical market expected to reach $19 billion by 2025. Multiple studies indicate that the application of AI technology in mental health assessment and treatment improves efficiency and significantly enhances patients' psychological well-being. AI has become crucial in promoting innovation and development in mental health services.

1.2 Research Questions

Explore the scalability and limitations of Expressive Writing and Narrative Identity as therapeutic methods for emotional regulation.

Investigate how AI technology and gamified design can mitigate the limitations of Expressive Writing and more effectively guide users away from pessimistic narrative identities.

1.3 Research Goals

Design and validate the effectiveness of a gamified AI interactive diary website, "PEMO."

2. Literature Review

2.1 Narrative Identity Therapy

Narrative identity therapy is a form of psychotherapy where individuals construct and shape their identities through narrating and understanding their life stories. How a person recalls their past experiences and views the details of their life constitutes their "narrative identity." This therapeutic approach helps individuals reassess and reconstruct their life stories, allowing them to view their lives more positively and optimistically. Narrative identity therapy also facilitates a deeper understanding and integration of one's identity, helping individuals establish a more positive self-concept. By narrating and reconstructing their understanding of traumatic events, individuals can mitigate the impact of negative emotions and promote psychological healing. Numerous studies have shown that narrative identity therapy has significant positive effects in reducing PTSD symptoms, alleviating anxiety and depression in chronic illness patients, and helping adolescents achieve higher self-esteem.

The formation of our narrative identity naturally develops and deepens as we age, and the narrative styles of our caregivers significantly influence it during childhood. The presence of good listeners and whether these listeners respond to and affirm our narratives also impact the formation of our narrative identity. Through extensive interviews and dialogues, McAdams ultimately categorized two distinct narrative styles: redemptive narratives and contaminative narratives. Research indicates that individuals with a "contaminative" narrative style do not believe they can change their current circumstances or accept past events, leaving them adrift in life with regret. Conversely, a redemptive narrative style can significantly mitigate the

impact of adverse events on individuals and is positively correlated with subjective well-being. That is, the more an individual interprets events as under their control, the better they can process the impact of adverse events, turning crises into opportunities and achieving positive transformations.

This design research explores how to assist individuals with a contaminative narrative style (i.e., a pessimistic narrative identity) in gradually transitioning to a redemptive narrative style (i.e., an optimistic narrative identity) to help alleviate anxiety and improve happiness levels.

2.2 Expressive Writing Therapy

Expressive writing therapy is a method that promotes emotional release and mental health through writing. Research has found that writing helps individuals process and express emotions, reducing stress and improving psychological well-being. Through writing, individuals can freely express and explore their inner emotions and experiences, helping them better understand these feelings.

Smyth (1998) found that a four-day expressive writing intervention improved participants' scores in emotional management by 30%. This study also found that the writing group showed significantly lower emotional reactivity and stress levels than the control group. A survey by Pennebaker et al. demonstrated that individuals participating in expressive writing showed significant enhancement in immune function indicators (such as T-cell activity) and a 40% reduction in the number of illness occurrences. A meta-analysis by Pennebaker and Chung (2011) summarized over 30 studies on expressive writing, revealing an average effect size of 0.47, indicating that expressive writing has a moderate effect in reducing post-traumatic depression and anxiety symptoms.

Currently, this therapeutic method is widely used in psychological clinical counseling and treatment, demonstrating significant effects in dealing with psychological trauma, managing emotions, improving mental health, and enhancing physical health. Despite the substantial research supporting its effectiveness, expressive writing also has certain limitations:

Expressive writing requires individuals to sincerely recall and document negative emotions and events, which can initially lead to increased emotional distress. Pennebaker et al. found that some participants reported emotional deterioration during the initial phase of expressive writing. If the participants do not have robust psychological resilience or proper guidance, this short-term discomfort might cause more significant distress in the initial stages. Moreover, the effectiveness of expressive writing varies significantly among individuals; not everyone can alleviate anxiety through writing. Although expressive writing therapy offers a convenient method for individuals to confront and manage stressful events, the sense of "unresolved issues" it can bring has been a concern for many participants.

2.3 Combined Application of Expressive Writing and Narrative Identity Therapy

To address the limitations of expressive writing, some researchers have proposed combining expressive writing with narrative identity therapy. Studies indicate that a combined approach of expressive writing and narrative identity therapy significantly improves issues like psychological trauma, depression, and anxiety. The narrative identity shift significantly reduces short-term emotional discomfort. For example, a study found that a treatment group using a combination of expressive writing and narrative identity therapy had higher mental health scores than groups using either method alone (Lepore & Greenberg, 2002). Case studies show significant improvements in dealing with complex emotions and reconstructing self-identity through the combined application of these therapies. For example, a study on domestic violence survivors found that their self-esteem and life satisfaction significantly improved after using the combined therapies (Smyth & Helm, 2003).

Combining the two therapeutic methods allows individuals to record daily emotions and events through expressive writing and, subsequently, through narrative identity therapy, reassess and redefine their life stories, enhancing self-identity and psychological resilience.

2.4 Applications of AI in Mental Health

Existing AI Counseling Tools and Their Effects:

AI technology in mental health applications has become a significant trend. Existing AI counseling tools such as Woebot, Wysa, and Ginger have shown remarkable effects in providing immediate support and improving mental health. These tools not only increase the accessibility of mental health services but also significantly enhance users' psychological well-being through various technical means.

For example, Woebot, a chatbot based on cognitive-behavioral therapy (CBT), can converse with users, providing emotional support and CBT techniques. Research shows that users of Woebot significantly reduced depressive and anxiety symptoms after two weeks. Woebot guides users to identify and adjust negative thinking patterns, helping them develop healthier emotional coping mechanisms.

Ginger combines AI and human therapists to provide instant mental health support. The AI component is used for initial assessment and emotion monitoring, while human therapists offer personalized treatment plans. Research indicates that this combination effectively improves users' mental health status. Ginger's AI technology can analyze users' text inputs and behavioral data to provide real-time emotion management suggestions and crisis interventions.

AI technology in mental health applications not only provides new therapeutic methods but also significantly enhances the efficiency and accessibility of mental health services. The successful application of AI counseling tools like Woebot, Wysa, and Ginger marks a profound technological transformation in the mental health field. The widespread use and significant effects of these tools further demonstrate the enormous potential of AI in improving the quality and effectiveness of mental health services.

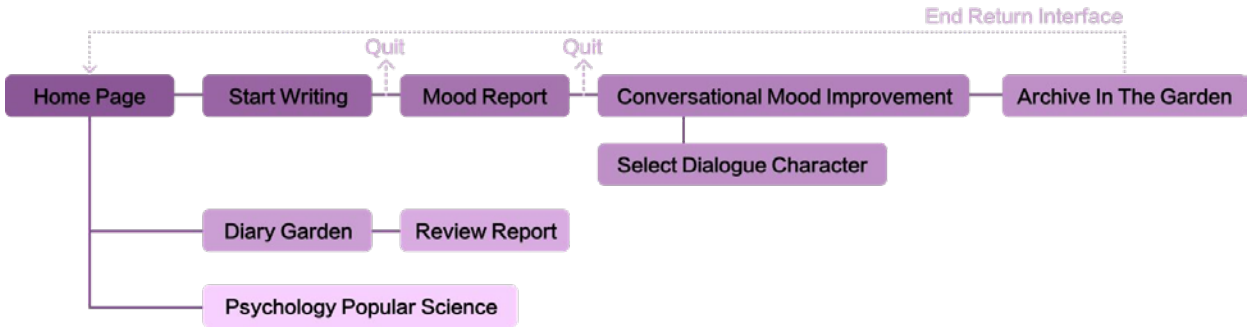
The Role of Gamification in Mental Health Interventions:

Expressive writing requires long-term persistence to see apparent effects. Appropriately introducing a gamified design can increase user engagement and stickiness. Reward systems and progress tracking can provide users with immediate feedback and a sense of achievement, helping to enhance continuous participation and helping users achieve psychological healing and change their narrative identities. Additionally, gamified design can reduce the burden of therapy, making mental health interventions more interactive and engaging, reducing the monotony and tedium of traditional therapy. Lowering the threshold for psychological healing makes it more universal and easier. Moreover, gamified design can improve users' self-efficacy, helping them build better selfmanagement capabilities and enhance their control over their mental health.

3. Design Methods (Design of the PEMO Platform)

This design research will use expressive writing and narrative identity therapy as the foundational design principles to create a gamified AI interactive diary website called “PEMO,” meaning “positive emotion.” PEMO aims to change users’ pessimistic narratives through AI chat interactions after diary writing. With handwriting recognition pens transmitting text to a computer, users can write on paper. The trained GPT-4.0 model has three identities: “Family,” “Best Friend,” and “Wise Sage.” These roles mimic psychological counseling methods, using continuous questioning to actively guide users to escape pessimistic narratives. We use natural language recognition technology to identify user emotions, generating flowers corresponding to the diary’s emotions. These flowers gather to form a social “diary garden” where users can visit each other’s gardens, viewing emotional states to increase user engagement. PEMO aims to guide users better through gamification and AIGC, leading them to self-reflection and escape from “pessimistic narrative identities.”

Figure 1. PEMO platform user usage overall framework



The specific main functions of the PEMO platform are introduced as follows:

3.1 User Diary Writing Module

The healing aspect of expressive writing is closely linked to users’ diaries, but this is not limited to traditional diary forms. It includes various recording methods, such as essays, thoughts, and notes. PEMO provides users with a free, open writing environment, encouraging them to record their moods, thoughts, and experiences at any time, whether detailed diary entries or brief fragments.

Users have two main choices for diary writing on the PEMO platform:

Online Writing Interface: Users can type directly on the PEMO platform’s writing interface, designed to be simple and easy to use, with multiple font and format options. The platform also features an autosave function to ensure content is not lost unexpectedly.
Handwriting Recognition Upload: PEMO offers a handwriting recognition upload function for

users who prefer handwritten records. Users can write their diaries on paper, use a handwriting recognition pen to convert the text to digital format and upload the content to the cloud. This retains the healing experience of physical writing while making handwritten content easy to store and manage electronically.

To enhance the writing experience, PEMO also offers additional options within the handwriting recognition upload function:
Notebook Synchronization: Users can choose specific bright notebooks that synchronize writing content to the platform in real-time via Bluetooth or Wi-Fi.
OCR Optimization: Advanced optical character recognition (OCR) technology ensures high accuracy in converting handwritten text, preserving the original style and format.

Handwritten Diary Templates: The platform provides printable templates for emotional records, goal setting, and daily reflection, allowing users to choose suitable templates for writing.

Figure 2. PEMO writing input interface. The left picture is the display mode and the right image is the hidden mode.

3.2 Emotional Recognition Using Natural Language Processing

PEMO uses advanced natural language processing (NLP) technology to recognize and analyze emotions in diary content. Core functions include:

Emotion Analysis and Feedback: Deep learning models trained to recognize various emotional states accurately in diary entries. The platform offers empathetic phrases and personalized emotion management suggestions immediately after diary completion.

Emotion Visualization: Emotional states are tagged and weighted, generating an artistic visualization of emotions. For instance, a diary might reflect 70% happiness and 30% anxiety, with a comprehensive emotional evaluation presented artistically.

Emotion-Corresponding Flower Generation: Flowers representing emotional states are generated and arranged in the user's "diary garden," visually reflecting emotional changes.

Figure 3. PEMO Feedback interface. Picture A: Generate flowers and words of comfort corresponding to the user's mood; picture B: flower and diary emotion visualization chart; picture C: Pessimistic emotion display and dialogue AI selection; picture D: Pessimistic emotion display and dialogue AI selectionThe left picture is the display mode and the right image is the hidden mode.

3.3 AI Role Interaction (Family, Best Friend, Wise Sage)

After diary completion and emotional feedback, PEMO offers interaction with three AI roles: “Family,” “Best Friend,” and “Wise Sage,” each with unique dialogue styles and guiding methods to help users move away from pessimistic narratives.

Family Role: Warm and supportive dialogue, offering emotional security and encouragement.

Best Friend Role: Intimate and empathetic interaction, sharing experiences, and providing suggestions.

Wise Sage Role: Thoughtful and insightful guidance, prompting deep reflection and self-discovery.

Personalized psychological support is based on emotional state, with AI roles dynamically adjusting interaction strategies.

3.4 Generation of Emotional Flowers and Formation of “Diary Garden”

Each time a user completes a journal entry and performs an emotional analysis on the PEMO platform, the system generates corresponding floral patterns based on the user’s emotional state. These emotional flowers are not only symbols of emotions but also visual representations of emotional changes. Different emotional states generate different types and colors of flowers:

Positive Emotions: Happiness, satisfaction, and excitement generate brightly colored, full-bloomed flowers.

Negative Emotions: Emotions such as sadness, anxiety, and anger generate darker-colored, wilted flowers.

Neutral Emotions: Emotions such as calmness, contemplation, and boredom generate neutralcolored and shaped flowers, such as elegant orchids or common daisies.

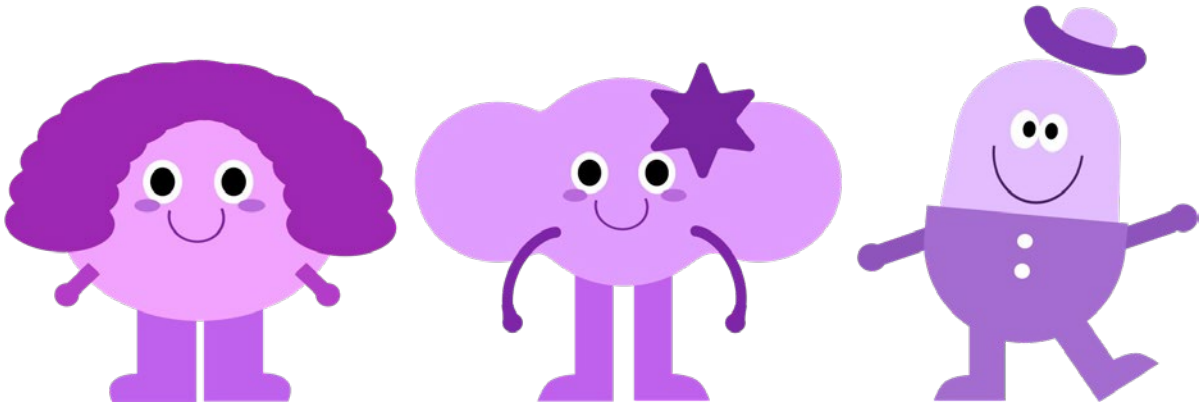


Figure 4. Three AI dialogue roles, from left to right: family role, Best Friend Role, and wise sage role.

These flowers are automatically arranged in the user's "Diary Garden," creating a unique emotional landscape. Users can intuitively review their emotional changes over different periods by viewing the flowers in the garden.

Garden Management and Personalization
Users can personalize and manage their Diary Garden, including:

Garden Layout: Users can freely adjust the layout of flowers in the garden, choosing different arrangements such as chronological order, emotion type, or random placement.
Garden Themes: The platform offers various garden themes and background settings, allowing users to choose themes that match their preferences, making the garden more personalized and aesthetically pleasing.

Flower Descriptions: Users can add brief descriptions to each flower, recording their feelings and events at that time. This allows users to understand the stories behind each flower better when revisiting the garden. Clicking on a flower reveals the journal entry written at that time, along with the platform-generated emotional review report, emotional visualizations, dialogues with AI characters, and the flower's state change process.

Social Interaction and Visiting Features

The Diary Garden module is a space for personal emotional display and a platform for user interaction and communication.

Users can make their gardens public and invite friends or other users to visit. Visiting features include:

Visits and Comments: Users can visit others' Diary Gardens, browse their emotional flowers, and leave encouraging and supportive comments. This allows users to share emotional experiences and build emotional connections.

Likes and Shares: Users can like their favorite gardens and flowers and share them on social media through the platform's sharing feature, attracting more attention and participation.

Emotional Communication: While visiting others' gardens, users can engage in emotional exchanges and interactions with the garden owners, sharing their emotional stories and insights enhancing mutual understanding and support.

The Diary Garden is a platform for users to showcase their emotional changes and a tool for selfreflection and emotional healing. Through the flowers in the garden, users can visually observe their emotional fluctuations and development, identifying patterns and triggers. The flowers representing positive emotions continually inspire users, reminding them of their past joyful moments and helping them maintain a positive mindset.

Figure 5. Flower opening status changes (left) and garden homepage (right).

4. Research Methods

4.1 Main Technical Implementation:

Using a handwriting recognition pen to transfer written text into the computer.

Application of natural language processing (NLP) and emotion recognition technologies.

Training the GPT-4.0 large model to simulate psychological counseling and customize three AI interactive characters.

User Research and Data Collection:

Participants: How Platform Testers Were Selected

The PEMO platform considered the following factors when selecting participants:

Diversity and Representativeness:

Demographic Characteristics: To ensure a representative sample, participants were selected from various age groups, genders, professions, and educational backgrounds. The primary target group was women aged 18-35 with a high standard of living and basic educational background.

Psychological Health Status: Participants with different psychological health statuses were chosen, including emotionally stable individuals (subdivided into generally stable and highly stable), emotionally volatile individuals (subdivided into mild, moderate, and severe), and those requiring psychological counseling.

Technological Proficiency: Participants with varying levels of technological proficiency were included, ranging from users familiar with online platforms to those less acquainted with technology, ensuring the platform's design was universally applicable.

Volunteer Recruitment Methods:

Recruitment information was disseminated through social media, mental health forums, and platform user communities to attract volunteers. Appropriate incentives were provided to encourage active participation in the research.

4.2 Data Collection Methods:

(Preliminary) User Interviews and Writing Emotion Habits Data Collection:

Diary Texts: Users' diary entries on the platform, including handwriting recognition uploads and direct input texts, were collected. Writing habits and emotional content were analyzed to study different users' emotional expressions.

Emotion Tags: Each diary entry was analyzed for emotions using NLP technology and emotion recognition algorithms, generating emotion tags and intensity scores. The emotional fluctuations in most diaries were observed, and extensive text data were used to train AI models for faster and more accurate recognition of users' writing habits.

Content Themes: Diary content was analyzed thematically to identify common emotional issues and psychological concerns, such as work stress, interpersonal relationships, and personal growth. Various themes and common concerns were collected to facilitate better emotional counseling.

Visual Preferences: Testers from different backgrounds were interviewed, and reference images were shown to select visual styles for the platform and flowers that were generally preferred and accepted by most participants.

(User Testing) Platform Usage Recording:

Usage Frequency: Users' login frequency, the number of times, and duration of using different functional modules were recorded.

Interaction Records: The number of interactions with AI characters, dialogue content, and user feedback were documented.

5. Research Results

5.1 User Emotional Changes

Pre- and Post-Diary Emotional State Comparison:

A pre-post experimental design assessed PEMO's impact on users' emotional states using standardized emotional assessment tools (SAS and SDS). Data analysis showed significant improvements in emotional states after intervention.

Anxiety Levels: SAS scores decreased from 28.5 to 22.1 ($t(95) = 4.56$, $p < 0.01$).

Depression Levels: SDS scores decreased from 31.2 to 24.3 ($t(95) = 5.23$, $p < 0.01$).

These results indicate that PEMO significantly reduces anxiety and depression through expressive writing and AI interaction.

Impact of Different AI Roles on User Emotions: Users were grouped based on chosen AI roles, with emotional state changes assessed before and after interaction.

Family Role: Anxiety was reduced by 6.3 points, and depression by 5.2 points.

Best Friend Role: Anxiety was reduced by 5.7 points, and depression by 4.8 points.

Wise Sage Role: Anxiety was reduced by 4.5 points, and depression by 4.0 points.

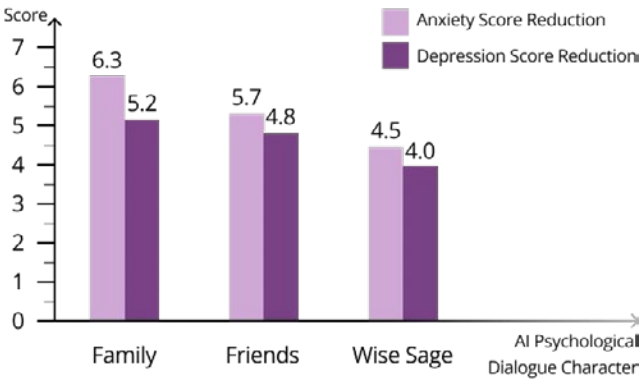


Figure 6. A bar chart showing the reduction in anxiety and depression scores of different AI roles in alleviating user emotions.

The “Family” role most effectively provided emotional support, while the “Wise Sage” offered unique advantages in reflective guidance.

5.2 User Experience Feedback

User Satisfaction Survey:

A detailed satisfaction survey assessed user experience, with 121 users providing feedback. The overall satisfaction was high, with scores as follows:

Overall Satisfaction: 4.25/5

Function Satisfaction: 4.1/5

Interface Design Satisfaction: 4.37/5

Interaction Experience Satisfaction: 4.4/5

Users appreciated the gamified design and AI interaction but suggested improvements in system response speed.

Evaluation of Gamification and AI Interaction Experience:

Quantitative Evaluation: Users provided quantitative feedback on their satisfaction with the gamification design and AI interaction experience. The satisfaction score for the gamification design was 4.1 out of 5, and for the AI interaction experience, it was 4.3 out of 5.

Qualitative Feedback: Through user interviews and open-ended questionnaires, detailed opinions and suggestions for improvement about the platform’s functionality were collected. Feedback included comments such as redundant homepage design, high

user entry barrier due to the necessity of a computer, overly digital visual style lacking warmth, long waiting times for the AI character, instances where the AI failed to understand the user, and the AI not recognizing when the user's mood had already improved, and they wanted to end the interaction.

Experimental Results:

1. Gamification Design: Most users found that gamification elements significantly increased the platform's attractiveness and engagement. The diary garden feature, where each diary entry generates a flower, was widely recognized as an innovative and enjoyable design.

2. AI Interaction Experience: Users expressed satisfaction with their interaction experience with the AI character, considering the emotional support and guidance provided by the AI to be effective. However, some users reported that the personalized feedback from the AI character could have been more sufficiently accurate and in-depth. While the emotion recognition in the diary section was relatively precise, it struggled to adequately match the user's psychological state when the diary entries lacked sufficient detail, necessitating better recognition through subsequent dialogue processes. Nonetheless, the emotion recognition during the dialogue could have been more accurate and required continuous calibration.

3. Analysis and Discussion: The gamification design and AI interaction experience are considered the core highlights of the PEMO platform, significantly enhancing user experience and emotional support effectiveness. However, to further improve user satisfaction, the platform needs to optimize the AI character's ability to provide personalized feedback, ensuring more accurate responses to users' emotional needs.

6. Discussion

6.1 Research Findings

Effectiveness of PEMO in Guiding Users Away from Pessimistic Narratives:

PEMO significantly improves emotional states, reducing anxiety and depression. AI roles' guided questioning and emotional support help users reframe problems, effectively changing pessimistic narratives. User feedback indicated an 85% positive impact on emotional expression and narrative transformation.

Low Rejection Rate of AI Among Young Users:

Initially, researchers and designers expressed concerns that user resistance to AI psychological counselors would affect the overall usage of the platform. However, surveys and experiments revealed that 85% of young users aged 20-25 do not exhibit a high level of aversion to AI psychological counseling. Most participants indicated, "The

experience with AI counseling is not worse than that with most human counselors," "Talking to AI actually reduces psychological pressure," and "Talking to AI makes it easier to reveal one's troubles because the process feels like talking to oneself." The possible reasons for this are as follows:

4. Young people generally have a higher acceptance of new technologies and innovations.

5. Due to social environment and mental state, many young people face significant social pressure. Since mental health remains a relatively stigmatized topic, they may prefer anonymous and non-human assistance.

6. With advancements in AI technology, personalized voice interactions and more human-like empathy have reduced the perceived coldness of the technology.

However, 67% of participants also expressed concerns about how AI protects their privacy, which could affect their overall user experience.

Impact of Gamification and AI Interaction on Mental Health:

Among the 121 participants, 45 had prior experience with psychological counseling. Of these, 56% felt that although AI counseling could provide light companionship and guidance in the short term, repeated usage revealed that AI could not match the communication depth of human therapists.

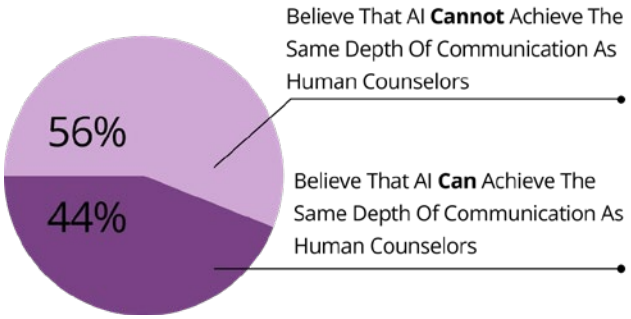


Figure 7. Regarding the question "Do you think AI can achieve the same level of communication depth as human counselors? ", pie chart.

This phenomenon arises because each person's voice contains unique timbre, loudness, and frequency information. While acoustic analysis technologies can reflect specific emotional cues, they are limited by the single voice modality and cannot fully comprehend a person's emotional state. A comprehensive understanding and analysis of emotions necessitate combining visual, auditory, and tactile cues, similar to the "multimodal intuitive response" observed in offline counseling services. Human therapists instinctively and subjectively utilize these cues to grasp the context quickly. However, participants felt that AI's capabilities still need to measure up to those of real psychological counselors.

Experiments and interviews show that in specific structured scenarios, AI can better understand human emotions when given appropriate instructions. However, the challenge lies in human emotions' inherently unstructured, or highly complex structured, nature. Emotions are volatile;

one might be happy and suddenly unhappy, making it difficult for AI to predict these changes accurately.

It is unreasonable to expect AI to achieve such a level of understanding. Nonetheless, on the Pemo platform, AI still provides significant value, especially in situations where individuals feel lonely or distressed for various reasons but have not reached severe levels of anxiety or depression. AI can alleviate these feelings through conversation, with experiments showing AI's efficacy in this regard to be notably evident.

In addition to AI's anxiety-relieving effects, which significantly boost user engagement, gamification features such as the "Diary Garden" have also markedly increased user participation and platform stickiness. Surveys indicate that 92% of users found gamification elements enhanced their willingness to use the platform. The personalized interaction of AI roles and emotion recognition technology offers tailored psychological support. The differential impact of various roles on emotional improvement further substantiates the effectiveness of personalized interventions.

6.2 Research Limitations

Sample Size and Research Duration:

The sample size of 200 users is relatively small, limiting generalizability. Future research should expand the sample size for more excellent reliability. The four-week intervention period is short, and future studies should consider more extended observation periods to verify long-term effects.

Potential Issues with Platform Technology and User Habits:

User feedback indicated the need for improvements in system response speed and interface design. Some users, especially those unfamiliar with digital diaries and AI interaction, found adaptation challenging. Differences in user habits affect platform adoption and widespread use.

6.3 Future Research Directions

Multimodal emotion recognition: Introducing Multiple Emotion Detection Methods Beyond Text Recognition

In psychological counseling, emotion detection based solely on text recognition may not fully capture the user's emotional state. In the future, the platform can introduce the development of multimodal emotion recognition, aiming to enhance the accuracy and depth of emotion detection by introducing multiple methods rather than relying solely on text analysis. These methods include facial expression analysis, voice intonation recognition, physiological signal monitoring, and behavioral pattern analysis.

Further Optimization of PEMO Platform Features and User Experience:

Future research should optimize platform technology and enhance system response

speed and stability. Analyzing user behavior data for more personalized experiences is essential. Developing training and support materials can help users adapt better, especially those unfamiliar with technology.

Potential Applications of AI in Other Mental Health Interventions:

Exploring AI applications in other mental health areas, such as anxiety disorders, depression, and PTSD, is crucial. Researching AI technology's cross-cultural applicability and effectiveness and developing culturally sensitive platforms can meet global user needs. Ensuring data security and privacy protection is vital as AI applications expand.

7. Conclusion

7.1 Research Conclusions

Potential Positive Effects of PEMO in Helping Young People Escape Pessimistic Narratives:

Emotional Improvement: PEMO helps users identify and manage negative emotions, promoting emotional improvement.

Narrative Restructuring: AI roles' guided questioning and support help users reframe problems, changing pessimistic narratives.

Increased Engagement: Gamified design and social elements enhance user engagement and platform stickiness.

Gamification and AI Interaction as an Effective Approach for Mental Health Interventions:

Innovative Intervention: Combining gamification and AI creates a novel mental health intervention method.

Personalized Experience: AI roles' personalized interaction and emotion recognition provide tailored support, improving intervention effectiveness.

Data-Driven Improvement: User data collection and analysis help continuously optimize platform functions and services.

7.2 Practical Implications

Providing an Innovative Mental Health Intervention Method with Practical Application Value:

Practical Application: PEMO's design and functions practically demonstrate mental health interventions, combining psychological theories with modern technology.

User Friendliness: Gamified and social elements make interventions more accessible and userfriendly, reducing psychological barriers and increasing willingness to accept psychological interventions.

Providing Reference and Inspiration for Future Development of Related Technologies and Platforms:

Technology Integration: PEMO showcases

the potential of integrating AI and gamified design, providing practical experience for future developments.

Functional Innovation: Features like handwriting recognition, emotion recognition, and AI role interaction offer insights for future mental health intervention technologies.

Data-Driven Design: User data collection and analysis provide an effective model for optimizing future mental health technologies.

8. Summary

This paper aims to design and validate a diary gamification AI interactive website called "PEMO," exploring its effectiveness in helping young people overcome pessimistic narrative identities. The research combines the theoretical foundations of narrative identity therapy and expressive writing therapy, leveraging AI and gamification technologies to provide users with an engaging and interactive platform for self-reflection and emotional regulation.

The "PEMO" platform employs digital innovation and advanced AI technology to effectively address young people's short-term feelings of loneliness, anxiety, and sadness. Using gamification design, the platform enhances user engagement and motivation, making self-reflection and emotional regulation more enjoyable and interactive. However, due to the current single-modal emotion recognition approach, while the platform excels in short-term emotional alleviation, its effectiveness in providing long-term empathy and emotional comfort requires further improvement and testing.

The study suggests gradually incorporating more modalities of emotion recognition technology to enhance the platform's long-term efficacy. Multimodal emotion recognition can integrate various data sources, such as facial expressions, voice tones, and physiological signals, to offer more comprehensive and precise emotional analysis, thereby improving user experience and platform effectiveness.

An increasing number of young people are beginning to accept and embrace the application of AI in the field of psychological healing. This positive social phenomenon provides a broad prospect for the emergence of innovative mental health intervention methods. As the user base continues to grow, the platform's data and feedback will drive rapid technological development and refinement, offering more efficient emotional support and psychological guidance to many young people.

In conclusion, this paper explores the short-term emotional regulation effects of the "PEMO" platform and proposes feasible solutions for improving long-term empathy through multimodal emotion recognition technology. In the future, with continuous technological advancements and positive societal response, AI psychological healing platforms will bring more innovation and possibilities to young people's mental health.

References

Smith, M. (2018). Narrative therapy for post-traumatic stress disorder in military veterans: A randomized controlled trial. Journal of Traumatic Stress, 31(2), 203–213.

Clark, L. F., Farrington, A., & Henson, C. E. (2015). The effectiveness of narrative therapy with chronic illness patients. Health Psychology, 34(12), 1239–1247.

White, M., & Epston, D. (1990). Narrative Means to Therapeutic Ends. Norton & Company.

Pennebaker, J. W., & Chung, C. K. (2011). Expressive writing: Connections to physical and mental health. Oxford Handbook of Health Psychology.

Smyth, J. M. (1998). Written emotional expression: Effect sizes, outcome types, and moderating variables. Journal of Consulting and Clinical Psychology, 66(1), 174–184.
Pennebaker, J. W., Kiecolt-Glaser, J. K., & Glaser, R. (1997). Disclosure of traumas and immune function: Health implications for psychotherapy. Journal of Consulting and Clinical Psychology, 55(2), 239-245.

About the Authors:

Author 1 add an author bio that describes research interests and main achievements in a maximum of 40 words. [LEAVE BLANK UNTIL FINAL ACCEPTANCE] [_P/RoD Author Bio and Acknowledgements]

Author 2 add an author bio that describes research interests and main achievements in a maximum of 40 words. [LEAVE BLANK UNTIL FINAL ACCEPTANCE]

Acknowledgements: this section is optional. You can use this section to acknowledge support you have had for your research from your colleagues, student's participation, internal or external partners' contribution or funding bodies. [LEAVE BLANK UNTIL FINAL ACCEPTANCE]

PULI PROJECT SEMILLAS DEL FUTURO: IMPLEMENTING DESIGN-LED EDUCATION TO TRANSFORM COMMUNITIES.

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ABSTRACT | The project “Semillas del futuro” emerges as a transformative initiative rooted in design-led education for social innovation. This paper presents the second stage of the collaborative academic project between Japan and Mexico under the Post Urban Living Innovation (PULI) Program. This project aims to empower children in Monterrey’s Campana Altamira community by integrating technology, design thinking, and sustainable practices into their education. Through an iterative design process, university students, professors, and researchers from both institutions analyze local issues and co-create solutions with community members, mainly with young people. The project adopts a multidimensional approach, drawing on theoretical frameworks emphasizing the pivotal role of education in tackling complex societal challenges. It leverages design thinking methodologies, ethnographic research, and collaborative problem-solving to develop a sustainable educational model. Divided into three iterative stages - research and conceptualization, prototyping, and implementation and testing - the project fosters continuous improvement and community empowerment. During the initial stage in 2023, workshops in Mexico and Japan identified waste management and education accessibility as focal points for intervention. The subsequent phase, currently in progress, focuses on prototyping tangible solutions. Collaborating with a Design professor and students, the emphasis is on designing equipment to process recycled plastics, promoting active student engagement in the design process and instilling a sense of ownership and responsibility. Rather than opting for ready-made solutions, the emphasis is on empowering university students to actively engage in the design process. By immersing themselves in the iterative journey of creating this equipment, students not only gain valuable hands-on experience but also internalize the importance of design in addressing environmental challenges within their own community inside the campus in Monterrey, Mexico. As part of this phase, students from both universities convene for workshops

to promote the prototyping project. Additionally, the “Semilla Lab” is proposed as a mobile design space within the Monterrey campus, fostering interdisciplinary collaboration and hands-on learning. Inspired by the Japanese educational system, Semilla Lab aims to equip students with practical skills and sustainable practices, preparing them to address real-world challenges and drive positive change in society.

In summary, this program promotes hands-on learning, creativity, and critical thinking among participants. Through activities such as upcycling, recycling, and micro-manufacturing, participants are encouraged to develop practical skills and innovative solutions to local problems. The program also emphasizes inclusivity, bottom-up innovation, and cultural sensitivity, ensuring that solutions are tailored to the community’s needs and aspirations. The implementation process involves close collaboration between university stakeholders and community members, with a focus on sustainability, accessibility, and infrastructure development. By engaging residents in the design and production of tangible solutions, the project fosters a sense of ownership and pride, empowering them to address environmental, educational and venture challenges in their own community.

KEYWORDS | DESIGN LED EDUCATION, SOCIAL INNOVATION, SUSTAINABLE PRACTICE

1. Introduction

The project is focused on co-design with Mexican communities emphasizing the importance of involving local stakeholders, particularly young people, in the process of identifying and solving community issues. This participatory approach not only ensures that the solutions are contextually relevant but also fosters a sense of ownership and empowerment among community members. In regions facing significant socio-economic challenges, design education can play a crucial role in equipping children with the skills and mindset needed to address local problems and improve their quality of life.

The project "Semillas del futuro" emerged as a transformative initiative rooted in design-led education for social innovation during an international collaborative project between universities in Mexico and Japan. During a series of workshops in both countries focused on the topic of "education for the future", professors, students, community members, and researchers proposed to concentrate on education for children and teenagers and decided to focus on the community surrounding the Monterrey campus, Campana Altamira, as a key location for the implementation of this initiative.

This paper presents two stages of this collaborative project called Post Urban Living Innovation PULI Program (Chiba University, 2015) which aims to address post-urban living challenges through innovative design solutions by fostering international collaborations. However, for this research, the main focus is on the second and last phase where the first approach with the Mexican community of La Campana was made. By integrating technology, design methodologies, and sustainable practices into education, the "Semillas del futuro" project specifically targets empowering children in Monterrey's community. However, the collaboration is ongoing for this project; the next iteration will take place in September in Japan, and we are expecting to continue our collaboration for at least five years.

2. The Community

Campana Altamira, is a community nestled in the mountains of Monterrey, Nuevo León, Mexico, that faces a unique set of challenges and opportunities that make it a compelling focus for design intervention. The urbanization development has resulted in

an informal settlement perched 700 meters above sea level, resulting in significant risks of flooding and landslides, especially during the rainy season (Gobierno del Estado de Nuevo Leon, 2016). Due to inadequate planning and urbanization, homes in these mountainous regions experience urban segregation in terms of accessibility and service provision. Many areas are inaccessible to motorized vehicles, and residents in the higher parts of the district must walk an average of 35 minutes to reach the nearest bus stop (Gobierno de Municipal de Monterrey, Nuevo León, 2021, p.14).

In addition to the problems related to its location, this community faces most of the urban problems of an informal settlement including the provision of basic services, poor environmental conditions like inadequate garbage disposal, insecurity, and lack of health and educational facilities (Menshawy, A, 2011). Despite these challenges, the community of Campana Altamira is deeply rooted in a strong sense of identity, social cohesion, and cultural diversity. The residents, originally migrants from various parts of Nuevo León and other regions of Mexico, have cultivated a shared identity centered on hard work, sacrifice, and a collective effort to build their homes and communal spaces. This rich cultural tapestry is reflected in the diverse traditions and celebrations, including the revered December festivities, posadas, and the veneration of religious figures, whose images are commonly found in homes and public spaces.
However, insecurity remains a pressing concern for the inhabitants of Campana Altamira. Approximately 34% of residents report feeling unsafe in their neighborhood, with heightened perceptions of insecurity at night. Problems such as alcoholism, drug addiction, and youth altercations are prevalent, contributing to the overall sense of insecurity. In addition, basic services such as electricity, drainage, and waste management are very problematic for the community. The difficulty for most service providers to access the upper parts of the mountain results in a shortage of basic services and deficient facilities. In the case of waste, public and private garbage collection services cannot access the upper part of the community, resulting in an accumulation of garbage that endangers the community, causing significant short- and longterm health and environmental issues. In terms of education, 10% of children and young people aged 5 to 18 have dropped out of school in the last three years, accounting for 131 cases of school desertion.

Additionally, 795 individuals aged 15 and older lack any form of schooling, and 564 are illiterate, representing 2.88% of the total population. Despite these daunting challenges, Campana Altamira presents a significant opportunity for innovative design solutions aimed at improving the quality of life for its residents.

By focusing on co-design with the community, particularly for educational purposes, design interventions can address these multifaceted issues. Design education is particularly vital for children in impoverished communities, as

it equips them with practical skills, fosters creativity, and encourages critical thinking, ultimately empowering them to drive positive change within their community.

3. The process

In the pursuit of fostering socially conscious, innovative, and proactive individuals, we propose an educational model focused on the design process for social innovation (Figure 1) (Martínez Baca, A. et al. 2024), aimed at creating a self-sustaining program capable of long-term continuation. The model follows a structured, iterative design process divided into three stages: 1) Research and Conceptualization, 2) Prototyping, and 3) Testing. This approach guides participants through an organic journey of problem-solving and innovation. The model operates within a continuous learning loop, beginning with university students, professors, and researchers from Tec de Monterrey and Chiba University, who collaboratively develop solutions for local social issues. Community members are gradually introduced during the Testing stage of the first loop and progressively integrated into the earlier stages of the design process in subsequent iterations. The goal is for community members to autonomously replicate the process, enabling them to propose and develop solutions to their own local challenges.

Figure 1. Proposal of Iterative educational model for social innovation based on the design process

3.1 Stage 1 /Initial Loop - Analyze, identify opportunities and propose

The initial stage in 2023 consists of two workshops with international students, the first one in Mexico and the second one in Japan. During the first workshop in Monterrey, Mexico the objective was to analyze the opportunities to design an intervention for the education of the future. The team investigated the educational issues around their campus and decided to focus on childhood and basic education inside the community of Campana Altamira, which is expected to have a long-term positive impact on improving living conditions at different levels. Since this workshop involved international students, being able to immerse themselves in the Mexican context helped them to look at the issue from more than one angle and to understand the

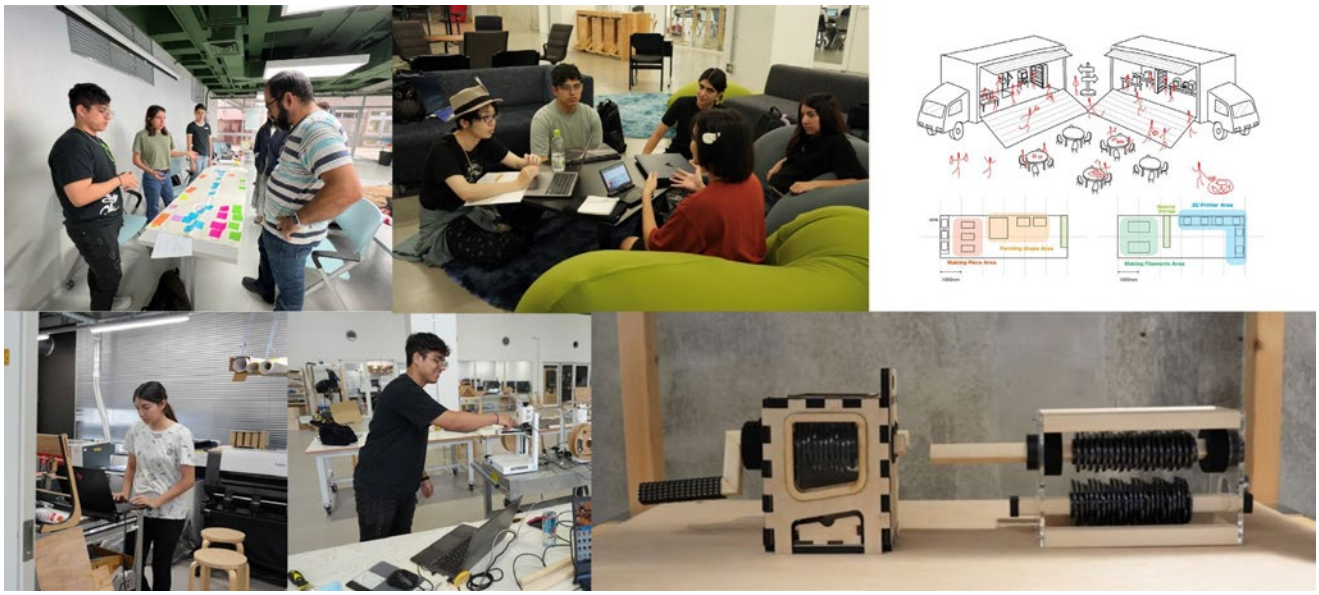

Figure 2. Workshop sessions and results during the first stage of the PULI project in Mexico and Japan.

problem from more than one perspective. As a result of this multicultural exchange, the “Semillas del Futuro” project emerged, where students, teachers, and researchers identified and proposed to focus on waste management and accessibility of education as key areas of intervention.

Afterwards, the Mexican participants had the opportunity to travel to Japan to continue with the second iteration of the workshop where the Mexican students were able to immerse themselves in the Japanese context and observe and analyze different educational and entertainment interventions that address the same issue. This process was very beneficial to the project by following iterative methodology of education based on the design process (Figure 2) likewise the students proposed a physical and movable space, where different products and design solutions could be generated using the waste materials of the same community focusing on plastics. The students also prototyped machines that would facilitate plastic recycling, emphasizing that these machines could be produced on campus or in the community. This hands-on involvement promotes a deeper understanding of environmental challenges and instills a sense of responsibility and ownership.

As a result of this Collaborative workshops involving students, professors and researchers from both institutions proposed the “Semilla Lab,” a name for a mobile hybrid space that aims to foster interdisciplinary collaboration and hands-on learning, inspired by the Japanese educational system. This design lab or creative space is designed to equip students with practical skills and sustainable practices, preparing them to address real-world challenges and drive positive societal change.

3.2 Stage 2 / Second Loop - Co-design with the community

Following the international workshops, as part of the University initiative (Iniciativa Campana Altamira, 2024), the Design Professor of Mexican University initiated contact with community members, authorities of the Campana Altamira social program, coordinators, and students. This initial approach resulted in the participation of twelve first-year secondary students in a foundational training loop (Figure 3). The objective was to immerse these students quickly into the discipline of design, teaching them ideation, drawing, model making, and mold production for accessory creation. The six-session activity provided a comprehensive learning experience, where students grasped the design process from ideation to production of their proposals.

Given that the participating students are teenagers aged 10-15 and have never been exposed to the Design Thinking method, we have adapted the process into a simpler, more relatable approach that aligns with their daily experiences. The approach needs to be adapted to the rural context, where teenagers might not have the same exposure to technology or design methodologies. This includes addressing unique challenges and leveraging local resources and knowledge (Gazali, et al, 2018). Additionally, this workshop is designed to be highly interactive

Figure 3. first plastics session and workshop with students from Campana Altamira community.

and hands-on activities such as creating physical prototypes and engaging in creative expression to ensure better engagement and understanding (Fisher, et al, 2013). This process allows students to observe and solve everyday unresolved issues creatively.

Building on the success of the initial engagement, the “Semillas del futuro” program conducted a second iteration of the PULI Workshop, involving 15 junior high school students from the Campana Altamira community, three students from a Mexican University, and a Researcher and professors from Japanese University in a hybrid modality. This phase aimed to equip students with design tools and knowledge to identify and address local problems. Under the guidance of University students and professors from Japanese and Mexican Universities, students developed preliminary proposals for implementation, focusing on sustainability and entrepreneurial skills.

This 5-day workshop was designed to run 2 different approaches. During the first half of each session, the focus was on co-design (Figure 4), where students from the Mexican university, Japanese researchers, professors, and young members of the community focused on running the design process to identify problems in the Altamira community to propose innovative and conceptual solutions to improve these conditions. The second part of the session focused on the technical part where the students were taught plastic treatment processes (Figure 5). During this part, through educational videos and examples of global initiatives, students learned about reusing and designing products from plastic waste. This hands-on activity, involving collection,

Figure 4. Hybrid Co-design session to identify community problems and propose possible solutions.

Figure 5. Practical session on plastic recycling and injection molding techniques.

cleaning, color sorting, shredding, and plastic injection molding, provided a tangible understanding of recycling processes and the creation of value from waste materials.

During the co-creation hybrid session, the students were divided in 3 teams following these steps of design process:

- Identifying Problems

Students began by mapping the generation of plastic waste in their daily activities, identifying individual and community issues, and creating a list of needs. Rather than using the traditional emphasis method in design thinking, which focuses on identifying problems, we implemented an adapted solution mapping method. Solution mapping involves tools that help uncover and understand solutions from the grassroots level. These tools are designed to explore the community's capacity to innovate and solve daily challenges (Taepoer, et al., 2023). We chose this method to gain deeper insights into the students' daily lives and to demonstrate that design is not solely about creating sophisticated, aesthetically pleasing products, but fundamentally about problem-solving. To adapt solution mapping, we asked participants to identify solutions to plastic bottle waste within their living environment. Examples included a vase made by one participant's mother and mini-games played with friends using used plastic bottles. This approach ensures that solutions are

generated from the bottom-up. Additionally, we introduced the concept of the user-designer, a fundamental principle in design, to help students understand that they can actively participate in the design process.

- Ideation process

Students learned to ideate new solutions to tackle the problems they considered relevant. Building on the solutions they identified in the previous step, they began the ideation process by voting on the most pressing problems or promising solutions. Once a theme was chosen, students brainstormed and drew as many ideas as possible.

During this phase, we emphasized the importance of not being afraid to draw and ideate. Encouraging them to freely express their ideas through sketches helps them become more comfortable with the design process.

- Defining and design

Teams utilized design tools to refine and select the most effective solutions, iterating through various sketches. They evaluated and voted on their peers' sketches and ideas, providing feedback and suggestions. Following this, they revisited and revised their problem definitions and solutions based on the feedback received.

Interestingly, some teams began by defining the problem before refining their solutions, while others approached it in the reverse order. This variation in process highlighted different approaches to problem-solving and solution development. Ultimately, the teams made decisions regarding their final design and the specific solutions they would prototype in the subsequent phase.

- Cardboard Prototyping

In this phase, students constructed and validated their volumetric designs with support from university students and AI tools. This stage marks the introduction of technological advancements, specifically AI, to the students, emphasizing the importance of leveraging technology correctly in the design process.

The use of AI tools helps students refine their prototypes, while cardboard prototyping provides a tangible, hands-on approach. By working with cardboard, students are encouraged to engage in the prototyping process without feeling overwhelmed, as they are using familiar and easily accessible materials. This practical experience helps demystify prototyping and fosters a more comfortable and creative design experience.

As a result of this co-design process, significant contributions could be identified. Each team decided to focus on different problems in their environment. Two of them focused on the problem of garbage management in the community, and another team on the problem of public lighting and electricity. Due to the co-design process, teams came up with very interesting ideas and proposals that included the recycling of plastics with a feasible approach for

the community members to develop and implement them with the help of the educational institutions.

The two teams concentrating on waste management each adopted distinct and innovative strategies. The first team suggested creating a neighborhood organization and garbage collection system that would be managed and led by the community members themselves. They also designed a product to support this system, ensuring it accounted for the geographic features of the Campana Altamira community (Figure 6). The second team, also focusing on waste management, identified stray dogs as key stakeholders. They proposed installing feeders to improve the dogs' lives and prevent them from scavenging through garbage for food (Figure 7).

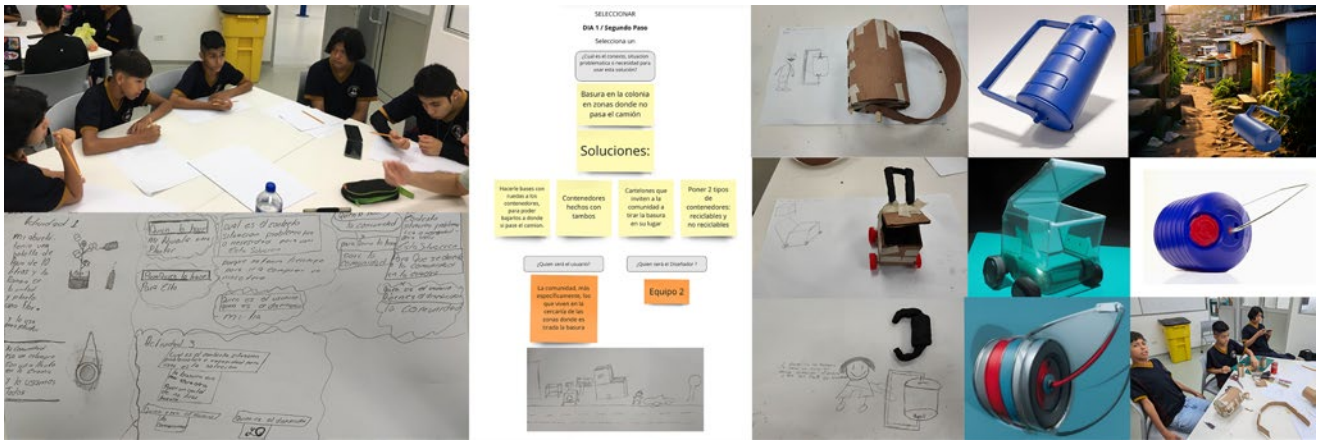

Figure 6. Co-design Process during Hybrid Puli Workshop. A waste management system designed for the community allows residents to roll their garbage down from the mountaintop until it reaches a place for the public trash collection vehicle.

Figure 7. Co-design Process during Hybrid Puli Workshop. A dog feeder for the stray dogs, which are considered community stakeholders. Without a stable food source, these dogs tear through residents' trash, worsening the waste management conditions in Campana Altamira.

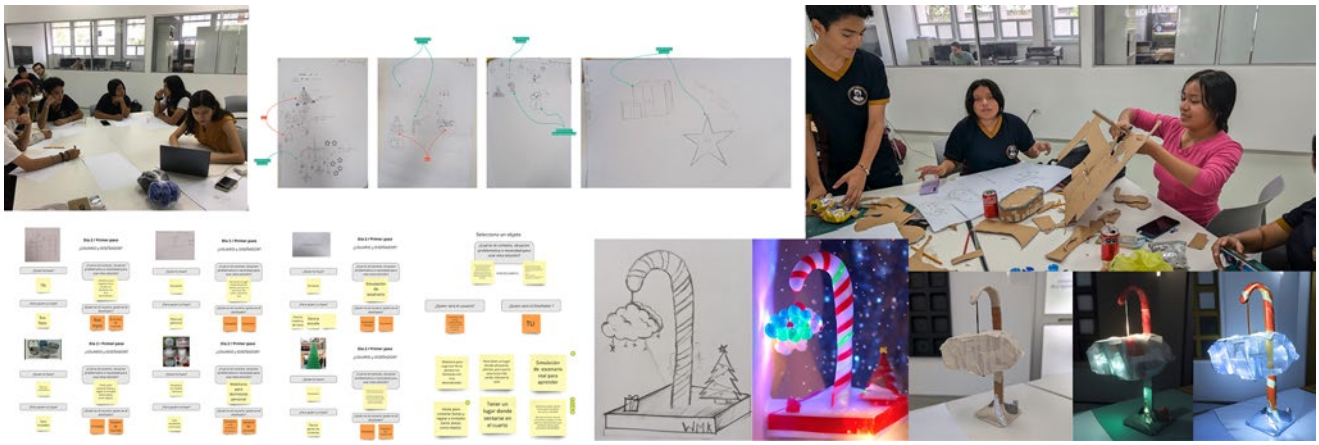

Figure 8. Co-design Process during Hybrid Puli Workshop. Design of a public space installation to promote natural vigilance to reduce crime.

Similarly, the team addressing the issue of insufficient public lighting proposed installing lights in a public park, incorporating cultural elements like Christmas celebrations.
Their plan aimed to create a decorative feature that would enhance community engagement, encouraging people to spend time outdoors and interact with the public space. Additionally, the increased lighting would improve natural surveillance, helping to prevent crime in the area (Figure 8).
The initiative achieved significant outcomes:

-Problem-Solving and Design Methodology: Students successfully identified and proposed to solve complex community issues that include social, economic, organizational, cultural, and healthimpacting aspects using design methodologies, emphasizing recycling and creating new products from plastic waste.
-Co-design approach: Because the co-design process involved the community inhabitants as stakeholders, each proposal effectively addressed various aspects of the social issues facing the community. This level of comprehensive engagement would have been challenging to achieve without the active participation of the Altamira residents in the design process.
-Increased Participation: From twelve to fifteen students, with a 60% return rate, indicating sustained interest.
-Engagement and Learning: The program instilled an appreciation for design as a discipline and sparked interest in future educational and entrepreneurial activities.
-Community Collaboration: Strengthened ties with community members, authorities, parents, and educational institutions, fostering a collaborative environment for continuous engagement.

Additionally, one of the primary goals of this workshop was to highlight the importance of sustainability (Martínez Baca, A. et al. 2024). However, traditional classroom teaching methods proved insufficient for instilling these values, as students often struggle to grasp sustainability when it is neither a primary value nor a familiar concept in their daily lives.

In the final products presented by the

students, one team notably focused on improving their community's waste management system to enhance waste collection. This achievement is a significant milestone for the workshop, demonstrating that the students are beginning to think about sustainability on a systemic level. This progress provides optimism that future stages of the workshop can further integrate and emphasize sustainability values.

This case study illustrates the profound impact of integrating design education into community initiatives. By engaging secondary students in Campana Altamira, the program not only addressed local issues but also empowered the participants with valuable skills and knowledge. The iterative design process, combined with real-world problem-solving and entrepreneurial training, provided a robust framework for fostering innovation and sustainable development within the community.

4. Conclusions

The "Semillas del Futuro" project demonstrates the transformative potential of integrating design education with community involvement to address local socio-economic challenges. Through international collaboration and a focus on co-design, this initiative empowered young people in the Campana Altamira community, equipping them with practical skills and a creative mindset necessary for social innovation.The project's success underscores the importance of involving community members, particularly youth, in the design process. By doing so, solutions were not only contextually relevant but also fostered a sense of ownership and empowerment among participants. The initiative's iterative approach, combining technology, design methodologies, and sustainable practices, provided a comprehensive educational experience that extended beyond traditional learning environments.Key outcomes of the project included increased participation, effective problem-solving, and strengthened community collaboration. The involvement of local stakeholders ensured that diverse aspects of social issues were addressed, while the hands-on activities and co-design sessions deepened the students' understanding of environmental challenges and instilled a sense of responsibility and ownership.By focusing on practical applications of design thinking and entrepreneurial skills, the project has paved the way for sustainable development and innovation within the Campana Altamira community. This case study highlights the significant impact of design education on empowering young people to drive positive change, emphasizing the role of universities and educational institutions in fostering such initiatives.Despite the difficulties, Campana Altamira is also a landscape rich with opportunities for innovative design interventions aimed at improving the quality of life for its residents.

Through case studies, theoretical insights, and practical examples, we aim to demonstrate the transformative power of design in creating sustainable, resilient, and thriving communities. By highlighting the opportunities for positive change, we hope to inspire

designers, policymakers, and community members to collaborate in reimagining and revitalizing Campana Altamira. The resilience and creativity of Campana Altamira's residents provide a strong foundation for collaborative design efforts that can transform the community. By focusing on inclusive, bottom-up approaches that engage residents in the codesign process, we can develop solutions that are tailored to the unique needs and aspirations of the community.

Overall, "Semillas del Futuro" is a current project on development for the future of education aiming to address complex social problems through collaborative and design-led approaches, to demonstrate that meaningful community engagement and empowerment can lead to lasting improvements in quality of life.

5. Limitation and future work

Despite the promising outcomes of the "Semillas del Futuro" project, several limitations need to be addressed. Firstly, the project's scope was limited by its initial engagement duration and the number of participants. Expanding the program's reach to include more students and community members could provide a broader impact and more diverse perspectives.

Resource constraints, such as limited materials for prototyping, access to technology, and sustained funding, can affect the ability to fully implement and scale the proposed solutions within the community. Ensuring the sustainability and scalability of the initiatives without constant institutional support is crucial. Furthermore, while the focus on plastic recycling and waste management is commendable, other pressing issues like access to basic services, security, and comprehensive education need to be integrated into future iterations of the project.

The program currently relies on a master-apprentice model, which needs to be re-evaluated (Souleles, 2017). Our goal is to reduce this dynamic and encourage students to be more proactive in their learning. However, it is understandable that during the initial iteration, students perceived the situation as a typical classroom setting, largely due to the age and social class gap between them and the university students.

Looking ahead, we aim for a more integrated co-design experience where university students contribute without dominating the decision-making process. We plan to address this issue further, focusing on creating a more seamless and collaborative environment. Enhancing communication strategies will be a key aspect of this discussion, ensuring that students feel more engaged and empowered in the design process.

The next iteration of the "Semillas del Futuro" project is scheduled to take place in Japan in September 2024. This phase aims to continue developing the solutions proposed during the initial codesign process with the community of Campana Altamira. By relocating the project to Japan, the team will leverage

the advanced technological resources and innovative educational practices available in Japanese institutions. This iteration will focus on refining and testing the educational model developed during the initial workshops. Participants will have the opportunity to engage in hands-on sessions to further explore the practicality and sustainability of their proposed solutions. The collaboration between Mexican and Japanese universities will also benefit from enhanced cultural exchange and knowledge transfer, fostering a more robust and comprehensive approach to addressing the complex issues faced by the Campana Altamira community.

Future work should aim to build a more robust, self-sustaining model that empowers local stakeholders to continue the initiatives independently. This could involve developing bottom-up design programs and training modules to equip community members with the skills needed to manage and sustain the projects. Additionally, incorporating digital tools and platforms could enhance communication and collaboration among participants, making the project more resilient to external disruptions. Expanding the research to include longitudinal studies would provide valuable insights into the long-term impact of the project on the community. Finally, exploring partnerships with local businesses and government agencies could offer additional resources and support, ensuring the project's ongoing success and integration into broader community development strategies.

References

Chiba University (Director). (2015). Post Urban Living Innovation Program. PULI. Retrieved July 15, 2024, from https://design-cu.xsrv.jp/puli/vision/ https://doi.org/10.5281/zenodo.13763980

Fisher, K., Bishop, A. P., Fawcett, P., & Magassa, L. (2013). Infome @ teen design days. Proceedings of the Sixth International Conference on Information and Communications Technologies and Development: Notes - Volum. https://doi.org/10.1145/2517899.2517914

Gobierno Municipal de Monterrey [Dirección Técnica de la Secretaría del Ayuntamiento] . (2021). Proyecto del Programa Parcial de Desarrollo Urbano “Distrito Campana-Altamira 2020-2040.” In https://www.monterrey.gob.mx/pdf/gacetas/2021/GacetaEnero2021EspecialDistritoCampanaAltamira.pdf (GACETA MUNICIPAL, Edicion XXVII). ÓRGANO INFORMATIVO DEL AYUNTAMIENTO DE MONTERREY, NUEVO LEÓN.

Iniciativa Campana-Altamira. (2024). Plan de trabajo 2024 Retrieved July 10, 2024, from https://campanaaltamira.org/

M. Ghazali, N. M. Suaib, S. Sulaiman, N. Ibrahim, A. L. Hananto and A. Beran, “Preliminary Work on Design Thinking: Addressing Challenges using Low-fidelity Prototyping with Rural Teenagers,” 2018 International Conference on ICT for Rural Development (IC-ICTRuDev), Badung, Indonesia, 2018, pp. 158-161, doi: 10.1109/ICICTR.2018.8706867.

Martínez Baca, A., Martínez Nimi, H., Savira, A., & Chacón Quintero, J. C. (2024). PULI Program Tec de Monterrey-Chiba University 2023: Co-designing a cross cultural educational program for social good [IFE Conference Proceedings]. In Programa PULI Tec de Monterrey-Chiba: Co-diseño de programa educativo transcultural dirigido por el diseño. Instituto para el Futuro de la Educación, Tecnológico de Monterrey. https://doi.org/10.5281/zenodo.13764010

Menshawy, A. E., Aly, S. S., & Salman, A. M. (2011). Sustainable upgrading of informal settlements in the developing world, Case study: Ezzbet Abd El Meniem Riyadh, Alexandria, Egypt. Procedia Engineering, 21, 168–177. https://doi.org/10.1016/j.proeng.2011.11.2001

Souleles, N. (2017). Design for social change and design education: Social challenges versus teacher-centred pedagogies. The Design Journal, 20(sup1), S927-S936. https://doi.org/10.1080/14606925.2017.1353037

Taepoer, R.A., Ono, K., Malasan, P.L., Triharini, M., Puspita, A.A., Prameswari, I., & Sugandi, Y. (2023). Solution Mapping Tools: Identifying a Bottom-Up Approach to Social Innovation. Jurnal Sosioteknologi, 22 (2). https://doi.org/10.5614/sostek.itbj.2023.22.2.8

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DESIGN FUTURES FOR TRADITIONAL CRAFT: A COLLABORATIVE AND INTERNATIONAL APPROACH.

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ABSTRACT | The potential of traditional craftsmanship to become part of contemporary design, not merely as a source of inspiration, but as a driver to address the issues of sustainability and ethical integrity of the production system in a innovative way, is leading to a growing interest in its production and consumption models at different geographies. Indeed, it is only by making the value components of traditional craft supply chains that it will be possible to ensure the repositioning of these great socio-technical-cultural heritages on alternative forms of value system, feeding new flows of experience. These new value systems, guided by design, make it possible to explore new directions for the protection, revitalisation and repositioning of traditional craftsmanship.

The paper will present the results of FRONTIER, an international collaborative project, among Universities in Italy, Colombia and Brasil, that encourages the recovery and promotion of ancient textile-related crafts of their territories, through different drivers: creative processes supported by encounters with designers and artists, technological integration, the renewal of processes, ranging from digital fabrication to the virtual production of models also thanks to the introduction/ replacement of biomaterials. The international research group, adopting responsible advanced design approach, created responsible innovation pathways, able to involve the academic communities, craft enterprises and their related territories, in the research for a link between innovation, design and traditional craft. The results are a combination of new emerging cutting-edge technologies, platforms and development of methodologies, curricula, entrepreneurial skills and vocational training courses, creation of sustainable relationships and networks with sectors and different stakeholders to promote innovation, employment and sustainable growth.

KEYWORDS | TRADITIONAL CRAFTSMANSHIP; DIGITAL TECHNOLOGIES; SUSTAINABILITY; CO-DESIGN; RESPONSIBLE INNOVATION

1. Introduction: Exploring new complexities: traditional craft and design cultures

The potential of traditional craftsmanship to become part of the contemporary design discourse is leading to a growing interest in its production and consumption models, at different geographies and socio-economical systems. In a more complex perspective, traditional craft is strictly linked to the relationship between design cultures and innovation: it can be considered as a driver to address issues of sustainability and ethical integrity of the production system; as a catalyst capable of contributing to the specific cultural identity of a territory; an object and subject in the dynamics of material and immaterial heritage's preservation and enhancement. According to this perspective, the close and historical affinity between design and craft can be assumed, in its most extreme borders, as an activator of changes. In particular, design – as mediator of knowledge and needs - can play a strategic role in triggering innovation processes in wide territories across the globe.

The paper is framed in a research field that deals with the relationship between design and territories. This topic is widely investigated by design cultures, through different perspectives. Beatrice Villari (2012; 2018) introduces the territory as a place of continuous exchange between people, artefacts, natural elements, and knowledge, that is handed down, sedimented and reworked. It is a set of tangible and intangible elements capable of transformation and design. According to this interpretation, the territory is no longer defined through individual identities or in geographic terms, but as a reservoir of know-how and, thus, as a cultural space (Bortolotto, 2010) made up of social, economic, natural, political factors. So, the territory can be considered as a transformative field in which collaborative design methods lead to co-creation and co-production of prototypes that face contemporary challenges. The research presented in this paper perfectly fit into the binomial design-territory, reading it through the enhancement of local craftmanship in context characterized by high-cultural traditions, but, at the same time, strong conflictual and emergency conditions (Cardozo Vasquez et al., 2019).

The paper develops the discussion according to the following structure.

In the first paragraph, it presents an innovative vision of the relationship between design and craftmanship. It is only by making the immaterial components of traditional craft supply chains usable and reactivatable through the co-creation with new subjects (designers, artists, digital experts) that it will be possible to ensure the repositioning of these great socio-technicalcultural heritages on alternative forms of value system, feeding new flows of experience in the wake of a global transition marked by complex problems which can only be solved through collaborative and experimental approaches.

Starting from these premises, a specific design driven approach is presented, as a methodology used to frame the applied experience. It links the concept of Responsible Innovation to that of Advanced Design. The primary objective is to propose a design model attentive to both the material (available resources) and immaterial (relationships, know-how) aspects of a territory, as well as to the values that define its social and cultural identity, and the stakeholders involved.

The third paragraph introduces the applied experience, the funded project called "FRONTIER: Design Innovation and Traditional Craft" developed between 2022 and 2023 as an international collaboration between the University of Bologna in Italy, UNAL of Palmira in Colombia, and UNISINOS of Porto Alegre in Brazil. The aim, methodology, phases, tools and results of the project are explained in the following paragraphs, focusing on the national and transnational developments, as expected in the program.

Finally, the conclusion summarizes the main cultural, social, and educational impacts, trying to frame them through a holistic vision that takes into consideration both local and global contexts and led the experience to be a replicable model.

2. New Links Between Traditional Craftsmanship and Innovation by Responsible Design

Traditional craftsmanship is regarded as a living tradition according to the Convention for the Safeguarding of the Intangible Cultural Heritage (UNESCO, 2022), encompassing a broad range of practices and approaches (Gianfrate, 2024). This expansive definition includes both historical techniques and contemporary innovations, as well as the organization of work and creativity, to preserve the essence of traditional craftsmanship and its cultural values. The ecosystem of traditional craftsmanship integrates explicit and profound knowledge of materials and tools, alongside tacit knowledge derived from human expertise, mastering production processes, creativity, and work organization, all deeply connected to specific territories and locales.

This connection is emphasized by Fløysand and Jackbsen (2010), who highlight how the spatiotemporal context influences social relations and the production of both formal

and informal knowledge. The growing interest in traditional craftsmanship is driven, according to Frayling (2017), by the current economic climate and, according to Sennett (2009), by the human dignity inherent in skilled craftsmanship. Consequently, craftsmanship becomes a significant model for design, production, and consumption, contributing to specific values such as cultural identity, sustainability, and the preservation of tangible and intangible knowledge.

This new value system, guided by design, make it possible to explore new directions for the protection, revitalisation and repositioning of traditional craftsmanship through different drivers. Traditional craftsmanship integrates into contemporary design sectors not only as a source of inspiration but also as a catalyst for addressing sustainability and ethical integrity in production systems. The collaboration with planners, designers, technologists, and artists must be a primary vector of innovation, making the value components of traditional craft supply chains usable and reactivatable.

Hybrid skills (manual + digital) activate responsible change processes by pursuing a holistic approach to innovation, with technologies serving the socio-economic component, supporting new relational languages, structures, and ethical issues. Innovation is driven by the ability to adapt to new circumstances, co-create solutions with end users, and design new organizational and cross-sectoral workflows.

This collaborative approach enhances traditional craft techniques by combining them with emerging technologies to develop new products, services, and professions. Platforms and methodologies are created to foster entrepreneurial skills and vocational training, promoting innovation, employment, and sustainable growth. Through new tools and innovative approaches, the heritage of craftsmanship becomes more accessible, usable, and interactive, creating opportunities for exchange, profit, and interaction in various contexts, including virtual ones. This cultural heritage is reinterpreted through a new ontological definition that highlights its systemic nature, facilitating analysis, comparison, and interpretation of these phenomena, and involving a plurality of voices to capture new trends and future practices.

The connection between innovation, design, and traditional craftsmanship can manifest through various trajectories:

- **Valorization and Promotion:** Elevating and promoting traditional craft techniques by integrating them with emerging cutting-edge technologies.
- **Fusion of Know-How and Technology:** Merging traditional expertise with new and digital technologies to develop superior and novel products, services, and professions.
- **Platform and Methodology Development:** Creating platforms and developing methodologies, curricula, entrepreneurial skills, and vocational training courses to generate employment

and revitalize businesses where tradition meets innovation.

- **Sustainable Relationships and Networks:** Establishing sustainable relationships and networks with cultural and creative sectors, institutions, universities, research institutes, regional and national authorities, businesses, and other stakeholders to foster innovation, employment, and sustainable growth.

The potential of emerging and digital technologies, alongside strategies for knowledge valorization, focuses on innovation and repositioning within the value chain. This involves experimentation, optimization, accessibility, and creating new experiences flowing through innovative tools and approaches, making heritage more accessible, usable, and interactive.

Information, stories, techniques, aesthetic canons, places, equipment, sounds, and related materials can be transformed into data nodes within new product or service chains and value components. This process interweaves the physical and virtual worlds, enhancing the interaction and utilization of cultural heritage.

3. RAD Methodological Approach

To address the complexity of traditional crafts, encompassing both tangible products and the intangible knowledge required to create and sustain production traditions, and to propose new responsible economic-cultural models for innovation, the research group investigated three dimensions:

1. Identity: Social factors, traditions unique to each region, and creative-productiveinnovative skills derived from historically layered technical and artistic knowledge (Calabrese, 1999).

2. Community: Relationships among various ecosystem actors, and the community's active involvement in recreating the heritage itself (Celaschi, Formia, Iñiguez Flores et al., 2019).

3. Sustainability: Geographical configuration, resources, and raw materials, along with social inclusion and responsibility.

This cross-cultural analysis, focusing on specific productive sectors, revealed that traditional craft is deeply rooted in a complex substrate of skills, traditions, and relationships unique to each environment, which have developed over time. Simultaneously, it highlighted a common need across different territories for process renewal, knowledge recovery, and strengthening territorial networks.

The adopted model to address these challenges is Responsible Advanced Design (RAD) (Formia, Gianfrate & Succini, 2023), which has been tested in complex transnational contexts and within heterogeneous working groups. One example of RAD application is the international project "Winter School Design for Responsible Innovation" [1] that involved, through a collaborative process, the University of Bologna, the TEC of Monterrey and UC de Santiago of Chile with the aim of investigating

[1] https://adu.unibo.it/winterschool/

the relationship between design, gender equity, inclusion and ethics in a transversal and interdisciplinary perspective. Other experiments have been conducted in third mission activities, particularly in knowledge innovation processes developed with companies in the productive sector of the Emilia-Romagna region (Italy).

This approach stems from the principles and theoretical foundations of Advanced Design (AD) (Celaschi, 2016; Celi, 2015; Iniguez Flores et al., 2019), a methodology that the Advanced Design Unit (ADU) of the Department of Architecture at the University of Bologna has been exploring scientifically and through local and international action research projects since 2013. ADU investigates how AD can transform economic-cultural models within traditional, organizational, educational, and socio-technical contexts, promoting an integrated and collaborative approach among all key actors and communities in the product/service value chains (Succini et al., 2021).

The four key dimensions of Advanced Design (Celaschi, 2016) – designing for the future anterior, collecting semi-finished products with a shelf innovation perspective, imagining projects without clients, and researching outside domains for extreme design solutions – define this systemic approach, its objectives, and application tools.

This approach leads to:

- Activating iterative multi-stakeholder creative design processes for continuous innovation.
- Embracing visions, needs, and perspectives across scales through co-design processes.
- Anticipating the future by experimenting with technological, methodological, or process solutions to broaden the long-term visions of products and services.
- Considering the temporal factor by continuously engaging with the accumulated material and immaterial heritage and contemporary and future influences on it.

Since 2020, the principles of Responsible Innovation (Stilgoe et al. 2013) have been integrated into this approach, aiming to initiate research and project forms that promote ethical-social innovation balance, consider social and environmental impacts from the early project stages, and propose sustainable, open-access, inclusive, and non-hegemonic development strategies.

The interconnection between Advanced Design and Responsible Innovation led to the formulation of the Responsible Advanced Design (RAD) approach and its testing in various local and international contexts. From 2020 to the present, these experiments have allowed for the validation and refinement of certain practices, altering the interaction among the various constitutive factors.

Responsible Advanced Design can be synthesized into four macro-actions: Responsible Thinking, Responsible Community, Responsible Production, and Responsible Design (Succini, 2023). Each

macro-action, depending on the context in which it is applied, can be more or less dominant or present. Based on the project goal and the composition of actors, each macroaction offers a series of RI-oriented actions and tools adaptable to the situation.

4. Cross Countries Experimentation: the Frontier Project

Within the FRONTIER Project, the Responsible Advanced Design approach served as a starting point for initiating dialogue among the partner universities, sharing visions, and conducting a research, training, and action process among young designers and researchers, and the traditional knowledge characteristic of the three territories: Italy, Colombia, and Brazil.

"FRONTIER: Design Innovation and Traditional Craft" commenced in late 2022 as an international collaborative initiative involving the University of Bologna, UNAL of Palmira in Colombia, and UNISINOS of Porto Alegre in Brazil. This project aims to revitalize and promote traditional textile crafts by integrating customized digital technologies in the areas of Biocreativity, Data Visualization, and Artificial Intelligence (Llorach, 2021; Sangüesa & Guersenzvaig, 2019). By doing so, it seeks to enhance cultural heritage, foster creativity, and emphasize the unique artisanal identity of the respective regions.

Participants from the three universities explored the intersection of innovation, design, and traditional craftsmanship to develop projects that enhance and promote traditional artisanal techniques through the integration of cutting-edge and emerging digital technologies. By merging traditional know-how with new and/or digital technologies, the aim was to preserve and modernize products, services, and professions. This was achieved by fostering sustainable relationships and networks with cultural and creative sectors, institutions, universities, research centers, regional and national authorities, businesses, and other stakeholders, all with a focus on innovation, employment, and sustainable growth.

Information, stories, techniques, aesthetic canons, places, equipment, sounds, and materials were interpreted as data and incorporated into nodes of new value chains for products or services, intertwining the physical and virtual worlds (Gianfrate et al., 2024). Through an analysis of traditional craft supply chains, the project responses were characterized by a strong connection to local territorial capital, understood as a systemic ensemble of material and immaterial elements, factors, and resources, including communities, entrepreneurs, landscapes, as well as capacities for innovation, traditions, infrastructure, and both explicit and tacit skills.

Participants in the International Workshop envisioned how traditional factors contributing to value creation could be

extracted, repositioned, or recombined in different, including virtual, contexts. They explored how diverse usage modalities could generate opportunities for exchange, profit, and interaction, offering alternatives to mere production, thus making this heritage more accessible, usable, and interactive.

The collaboration between designers and artisan communities resulted in a fusion of cultural identity and preservation of material and immaterial knowledge heritage with the creation of products and services. This was achieved through the highly customized use of digital technologies to activate new hybrid and "phygital" (physical + digital) artisanal skills, promoting a responsible transformation process for society.

The application of RAD Methodological Approach to FRONTIER, has been started with the macroaction of Responsible Design: through the support of an open-source cataloging tools, each country mapped various factors characterizing the textile production process, including materials, production/processing techniques, patterns, and reference communities. This led to the activation of Responsible Thinking, resulting in the development of Design Experience, which included cross-disciplinary competence modules on potential frontier technological innovations relevant to traditional crafts.

The interaction among these macro-actions initiated experimental design workshops within each university and subsequently among the different research groups, tools included in Responsible Production, leading to the development of prototypes integrating elements of material culture, immaterial culture, new technologies, and responsible innovation strategies. Finally, Responsible Community was built through various tools: peer-to-peer reviews, knowledge sharing, and co-design in complex contexts, as will be analyzed further.

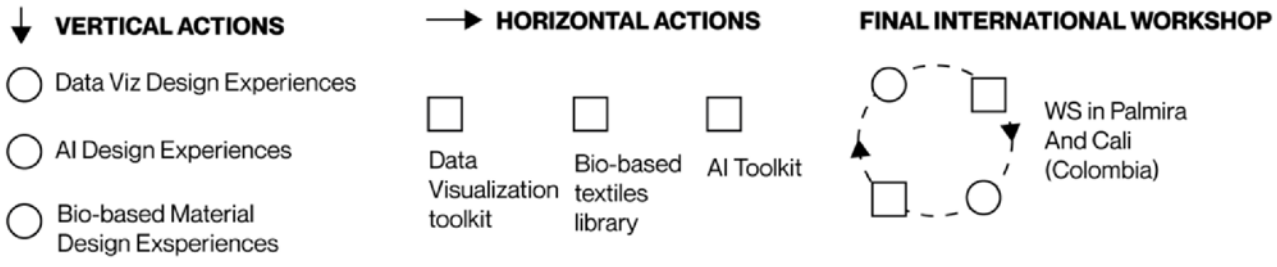

Figure 1. Application of the methodology in the FRONTIER project.

4.1 The Blended Experience

The preparatory phase involved designing an interaction process between research and teaching that would promote teaching/learning methods among transnational groups and with actors outside the academic world. The first phase of the project has been developed through the blended Design Experiences, hybrid laboratory teaching activities (conducted in person at the three campuses, interconnected online) from late February 2023 to April 2023 to familiarize students with cutting-edge technological innovations related to design on three key themes: Bio-creativity (knowledge and application of local circular materials), Dataviz (use of open tools and open data as an analysis methodology, transmittable and replicable across different disciplines), and Artificial Intelligence (using AI to unlock new value from existing data and relationships, enabling new product-service systems). The Design Experiences were led with an interdisciplinary approach (computer science, design, textile materials, and fashion) and provided students with the individual skills to address project topics, allowing them to conduct experimental initiatives using new open-source hardware and software tools. Additionally, during the Design Experiences, digital collaborative tools and blended teaching delivery methods were tested to facilitate collaboration among local and international groups.

In Italy, the project involved 5 professors and 20 students from bachelor's and master's Degree Courses of Design and Advanced Design of the University of Bologna, divided into 4 groups. Projects will be conducted with the participation of traditional craft realities of Italian context linked to textile traditions and materials (Turrini & Sbordone, 2020). Students created their own connections, participating to on-site visits, attending on-line meetings with experts, and collecting data and ideas according to their background and inspired by the traditions of their places of origin.

In Colombia, the "FRONTIER: Design Innovation and Traditional Craft" was developed by 21 undergraduate students and 10 professors from Industrial Design, belonging to the Facultad de Ingeniería y Administración, Universidad Nacional de Colombia, Sede Palmira. Seven teams were created, with a focus on the textile production of the Departamento del Cauca in Colombia, considering two references:

- The work developed by CODESPA with the "Enredarte con Identidad" Indigenous Women's Association (2024).
- The CORSEDA company (2023).

The Indigenous Women's Association "Enredarte con Identidad" is a collective of nearly 200 artisans who expertly handcraft bags and other items using locally sourced wool and fique. They employ traditional techniques including hand-dyeing, crochet,

and vertical loom weaving to create products, primarily handmade bags adorned with designs inspired by indigenous cosmology. To gather information, the students conducted three meetings and conversations with experts and indigenous artisans from the CODESPA Foundation, to identify specific characteristics of the community, and the social goals of the project, but also to delve into the production process, including raw material extraction, treatment, design, product creation, and knowledge transfer. The last meeting brought indigenous artisans to the university for a handson demonstration of weaving techniques. The artisans shared their expertise, showcased their products, and interacted with the students, providing invaluable insights into the intricate craftsmanship behind these unique pieces.

A visit was conducted to CORSEDA, an organization situated in the Department of Cauca, Colombia. This enterprise is comprised of approximately 200 families dedicated to the production of silk cocoons and handcrafted silk items. Their operations encompass the entire silk production process, from silkworm breeding to the sale of finished fabrics in both domestic and international markets. By incorporating the expertise of silk masters, they create unique pieces that distinguish themselves in terms of yarn type, color palette, texture, and overall appearance.

Participants documented the distinctive sounds, scents, colors, and flavors characteristic of the local environment.

At the end of this first phase, students divided into groups from their home universities submitted 11 projects in May '23, that took up the challenge to identify and map the factors influencing the traditional textile design production processes, in order to share the most innovative resources and transform them into new data and prototypes through the collective action of multidisciplinary and international teams. Through new tools and innovative approaches able to make these heritages more accessible, usable and interactive, information, stories, techniques, aesthetic canons, places, equipment, sounds and related materials have been interpreted, in the form of data, into nodes of new product or service chains and value components that interweave the physical and virtual worlds. The participants' projects were assessed by a committee from the 3 universities involved. Students from the winning projects were able to participate in international mobility.

4.2 The International Workshop in Palmira

The FRONTIER experience in Palmira-Colombia involved a collaborative effort with students and professors from the three universities. Approximately 35 individuals, including students, professors, and researchers, participated in this initiative. To facilitate the dynamic process, three groups were formed, each consisting of seven students from both Italy and Colombia. Professors and researchers from the three universities

worked together to develop the workshop and create a unified methodology and approach based on field diaries to document the region's characteristics, participatory activities with local stakeholders, and systemic maps to analyze the problem and develop relevant concepts.

Figure 2. Co-Anylisis activities.

In this context, the participants reflected on the interdependence of the factors characterizing a traditional production process, metaphorically viewed as an algorithm, and its potential representations in the form of data, discovering new relationships between the material and immaterial dimensions. The Palmira's experience allowed for the practical application of acquired skills in a region offering a wealth of innovation opportunities related to the subject of investigation: visits to museums, street tours, exploration of significant graphic production sites, and experiences of local flavors and sounds, topography and biodiversity in urban and rural areas were reported in field diaries to document sensory experiences (hearing, touch, sight, taste, and smell) at each location. Students participated in a series of design activities, including creating relationship maps to identify key factors and research questions, developing preliminary alternatives, and formulating a final proposal on three topics:

- Fighting the impact of artificial urbanization in the Boulevard del Río Cali area by mixing artificial and natural elements in this territory
- Accessible and inclusive interactions through sensory narratives between visitors and the Alameda Gallery?
- Use of natural materials in lantern printing to ensure the transmission of this tradition to future generations in Valle del Cauca

Several key factors contributed to the workshop's success, including effective communication, time management, and a positive, empathetic atmosphere. Communication throughout the workshop was smooth, utilizing multiple languages (Spanish, English, Italian, and Portuguese), as well as gestures and body language. This linguistic and nonverbal diversity greatly facilitated understanding and interaction among participants.
To complete the project, In October 2023, a delegation of students and faculty from Colombia participated in an exchange in Italy, attending the FRONTIER Finissage Workshop.

5. Frontier Results

The combination of these activities enabled the identification of new learning and training formats on an international scale, providing concrete experiences of the necessity to circulate science and knowledge beyond borders, in an interactive process of content integration, comparison of the involved realities, and identification of shared values.

The challenge posed by the action-research initiative from FRONTIER was to deconstruct the critical and defining socio-technical factors of traditional craftsmanship, assumed also as cultural heritage, in order to more easily identify its relationship with the innovative potential of emerging technologies. Craftsmanship represents a complex ecosystem, built upon a deep knowledge of workable materials and a mastery of its processes. However, artisan enterprises are structurally fragile due to several factors, including their size, operational capacity, ability to innovate, investment capabilities, and difficulty in mobilizing and leveraging external skills and knowledge.

One of the strengths of this approach lies in the potential to shape and anticipate future scenarios, positioning the valuable components of traditional craftsmanship within a rapidly evolving value chain.
This has certainly driven the design of intervention strategies aimed at integrating new technologies, a necessary step as this ecosystem continues to undergo profound transformation.

Additionally, the FRONTIER initiative facilitated the implementation of an open knowledge program (webinars, design experiences, intensive workshops, blended lessons, etc.), linked to the advancements achieved during the eighth International Forum of the Latin Network[2].

[2]https://www.forumdesignprocess.org/dgdw22/

The development of transdisciplinary educational programs based on the learning-by-doing approach through unconventional forms of teaching/learning in collaboration with actors outside the academic sphere was another significant achievement. This included the creation of physical and digital outputs of product-services capable of investigating the relationship between material culture and the humans who produce and/or consume it, within a multi-level innovation system, approaching the understanding of production processes through the application of open and online tools:

- A digital library of local biomaterials for textiles (FRONTIER Materials Library). This tool for the three countries promotes local resource processes on global actions.
- A portfolio of workflow tools for students to process and analyze data gathered during the research phase (AI and Dataviz toolkit), consisting of interactive cloud sheets to prototype algorithmic processes on their data through pre-set code, and tutorials for using commercially available online generative AI tools for processing texts, quantitative data, or images.

Enhancing collaboration between the academic and non-academic worlds resulted in the development of transversal skills in communication, sharing, and digitalization among students, as well as among the faculty and young researchers involved. Knowledge dissemination was further promoted through the organization of seminars open to public and private entities, a series of interviews conducted by UNAL television, and the exhibit of winning projects during the side event Bootcamp Design for Human and Planet Care organized in Bologna on October 12. This event was part of the Tenth Anniversary Celebrations of the Design Course at the University of Bologna, in collaboration with EIT KIC Culture & Creativity, which organized the C&C Days during the same period. The event featured the participation of international guests for a panel discussion.

6. Responsible and Advanced: Design for the Future

FRONTIER initiated a preliminary design effort among the various participating institutions to establish a common language, facilitating a collaborative approach to the complexities of responsibility, ethics, and gender, as well as the values inherent in traditional production processes. This approach particularly emphasizes human, cultural, and environmental components, and the rituals that render these processes unique.

The project's impact highlights how contemporary and future cultural flows, anticipated through scenarios developed using Advanced Design methods, influence how people live, act, and behave according to intersectional variables, which assume unexpected dimensions in transnational contexts. The collaborative process activated in both experiences was tied to design research and education pathways, exploring the capacity of design cultures to anticipate

shocks and support engagement and co-creation with diverse communities. This was achieved through interdisciplinary innovation, integrating social sciences, humanities, and cutting-edge technologies to address situated concerns from a global perspective and considering the value of anticipation for developing more sustainable, inclusive, and generative futures (Bosco et al., 2021; Zembylas et al., 2023).

Responsible innovation and education form a dynamic and interconnected duo, fostering transformative skills in students and supporting the adaptability of educational programs in facing the increasingly intricate challenges of sustainability and inclusion characteristic of contemporary times (Boehnert et al., 2022). This promotes an inter-, trans-, and multidisciplinary vision, where design constantly mediates between different forms of knowledge (Celaschi, 2008).

FRONTIER experimented with both online and on-site forms, emphasizing the collaborative and multi-stakeholder aspect underpinning responsible, inclusive, and sustainable innovation. This requires hybrid and flexible learning spaces to be integrated into the training of young designers. Creating a learning community comprising researchers, teachers, and students capitalizes on the collective intelligence of individuals from diverse backgrounds and cultures, adopting and testing various tools, and blending skills and competencies.

The Advanced Design approach supported these principles from a perspective of educational universality, stimulating its ability to embrace a global movement aimed at responsible, inclusive, and sustainable innovation. However, it also adapts to territorial specificities, enriching the process with new values and visions. This requires a design attitude capable of addressing the specific transformations of the contexts of application and establishing a permanent learning community.

References

Boehnert, J., Sinclair, M., & Dewberry, E. (2022). Sustainable and Responsible Design Education: Tensions in Transitions. Sustainability,14, 6397. https://doi.org/10.3390/su14116397

Bortolotto, C. (2010). Addio al territorio? Nuovi scenari del patrimonio culturale immateriale. LARES, 3, 355-373.

Bosco, A., Gasparotto, S., & Formia, E. (2021). Futured-Centred Design Education. Projects and Perspectives for Future Challenges. In A. Bosco & S. Gasparotto (Eds.), Updating Values. Perspectives on Design Education (pp.102-107). Quodlibet.

Calabrese, O. (1999). Il modello italiano. Le forme della creatività. Skira.

Cardozo Vasquez, J. J., Celaschi, F., Formia, E., Iñiguez Flores, R., León Morán, R. M., & Ramírez Triana, N. Y. (2019). Design & Territories: Emergencies and Conflicts at the Time of the Anthropocene, Strategic Design Research Journal, 12, 138-154.

Celaschi, F. (2016). Non industrial design: Contributi al discorso progettuale. Sossella.

Celaschi, F. (2008). Design come mediatore tra bisogni. In C.Germak (Ed.), L'uomo al centro del progetto (pp. 40-52). Allemandi.

Celaschi, F., Formia, E., Iñiguez Flores, R., & León Morán, R. (2019). Design Processes and Anticipation. In R. Poli (Ed.), Handbook of Anticipation, pp. 773–793. Springer International Publishing. hpps://doi.org/10.1007/978-3-319-91554-8_48

Celi, M. (2015). Advanced design cultures. Springer.

Formia, E., Gianfrate, V., & Succini, L. (Eds.) (2023). Design per l'Innovazione Responsabile. Guida per processi formativi in trasformazione. Franco Angeli.

Frayling, C. (2017). On craftsmanship. Oberon Books.

Gianfrate, V., Celaschi F., Licaj A., & Luca S., (2024). Soundscape and dataviz for traditional craft. Innovation by design. In C. Gambardella (Ed.), For Nature/With Nature: New Sustainable Design Scenarios (pp.196-214). Springer.

Gianfrate, V. (2024). Innovare la città dei servizi. Co-design responsabile, inclusivo, sostenibile. Allemandi.

Iñiguez Flores, R., Celaschi, F., Formia, E., & León Morán, R. M. (2019). The Extended Praxis of Design: Towards a Characterization of the Advanced Design Cultures, in The Design After. Cumulus Conference Proceedings 2019, 449–458.

Jakobsen, S.E., Fløysand, A., & Overton, J. (2019). Expanding the field of Responsible Research and Innovation (RRI) – from responsible research to responsible innovation. European Planning Studies, 27 (12), 2329-2343. DOI: 10.1080/09654313.2019.1667617

Llorach, P. (2021). Circular Design and Circular Material Design. In L. Clèries, V. Rognoli, S. Solanki, & P. Llorach (Eds.), Material Designers: Boosting talent towards circular economies (pp.1417). http://materialdesigners.org/book/

Sangüesa, R., & Guersenzvaig, A. (2019). AI as a Design Material: Dealing with new agencies. Temes de Disseny (35), 6–25.

Sennett, R. (2009). The Craftsman. Penguin.

Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. Research Policy, 42(9), 1568–1580. https://doi.org/10.1016/j.Respol.2013.05.008

Succini, L., Ascari, M., Formia, E. M., Gianfrate, V., & Zannoni, M. (2021). Design for Responsible Innovation. Social Impacts of Products and Services. PAD 21,(14),235 – 255.

Succini, L., & Ciravegna, E. (2022). Design and Responsible Innovation. Ethics and Caring as Keys to Addressing Contemporary Crises. Diid — Disegno Industriale Industrial Design, (77), 14, 24-36. https://doi.org/10.30682/diid7722b

Succini, L. (2023). Design per l'Innovazione Responsabile. In E. Formia, V. Gianfrate, & L. Succini (Eds.), Design per l'Innovazione Responsabile. Guida per processi formativi in trasformazione. FrancoAngeli. https://www.francoangeli.it/Libro/Design-per-l%E2%80%99InnovazioneResponsabile-Guida-per-processi-formativi-in-trasformazione?Id=28297

Turrini, D., & Sbordone, M. A. (2020). Designed & Made in Italy. Invarianti, transizioni, nuove mappe valoriali. Designed & Made in Italy, 9, 6–19.

Unesco, (2022). Basic Texts of the 2003 Convention for the Safeguarding of the Intangible Cultural Heritage. Unesco. https://ich.unesco.org/doc/src/2003_Convention_Basic_Texts-_2022_versionEN_.pdf

Villari, B. (2012). Design per il territorio: Un approccio community centred. FrancoAngeli.

Villari, B. (2018). Design e valore territoriale. Il progetto con, per e guidato dalle comunità. In M. Parente, & C. Sedini (Eds.), D4T. Design per i territori. Approcci, metodi, esperienze (pp. 63–74). ListLab.

Zembylas, M. (2023). A Decolonial Approach to AI in Higher Education Teaching and Learning: Strategies for Undoing the Ethics of Digital Neocolonialism. Learning, Media and Technology, 48(1), 25–37.

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A STUDY ON MODULAR CONCEPT DESIGN FOR STREET VENDOR MARKETS IN THE CONTEXT OF CONSUMPTION DOWNGRADING

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ABSTRACT | In the aftermath of the COVID-19, with the economy slowly recovering in a "W" shape due to complex factors and emergencies. "downgrading consumption" has become the most direct choice for people to cope with the challenges. Vendor bazaars provide an alternative public space satisfying a diverse and borderless consumer experience. However, vendor bazaars are seldom supported by policies; on the contrary, they tend to be vigorously evicted by the relevant authorities mainly due to their non-prescriptive nature, which affects the city's appearance and violates the city's street order. There is still a lack of research that can resolve the conflicts between consumers, vendors, and management in the context of consumer downgrading. There is a lack of a design intervention strategy to explore the model of rapid commercial erection actively.Taking Chengdu Shuyuan Street as a case study, this study uses qualitative methods such as participatory tracking method, street notes with quantitative research methods such as questionnaire surveys to obtain the current problematic status of the hawker bazaar, combined with the actor-network theory to systematize the analysis of actors in the hawker bazaar, and, finally, design a modular stall space that can be quickly constructed for assembling and disassembling, in order to meet the needs in the context of consumer downgrading and promote urban inclusiveness for vendors. This research creates a modular hawker bazaar design solution that can be replicated and scaled up to promote the application and practical research of hawking in other cities.

KEYWORDS | MARKET VENDORS, MODULARIZATION, ACTOR-NETWORK THEORY, CONCEPTUAL DESIGN

1. Introduction

"Under the severe impact of the epidemic on the global economy, per capita consumption in various countries has declined, and the trend of consumption downgrading is obvious" (Shi et al., 2023, p. 1). In China, after the state deregulated the ground stall economy to cope with the problem of employment pressure in the post-epidemic period, the governance of vendors has become a hotspot of urban development research. "In order to promote economic recovery and alleviate employment pressure, the State Council and local governments have issued and adjusted a series of policies, proposing to support multi-channel flexible employment and rationally set up a model for the management of vendors without fixed business premises" (Liu & Wang, 2023, p. 27). In this context, consumption downgrading is gradually becoming a trend, and vendors have become a direct choice for most people to cope with the challenges.

"Street vendors play an important role in urban economies, especially during economic downturns" (Bromley, 2000, p. 1). "Consumption downgrading has led to the revival of markets as affordable shopping destinations" (Berner et al., 2012, p. 382). "Consumption downgrading has changed consumer preferences for more affordable and accessible shopping options." (Prahalad & Hart, 2002, p. 54) In addition, its existence has positive implications for alleviating urban unemployment and poverty, promoting urban cultural diversity, and lowering the cost of living in cities (Cross, 2000; Huang et al., 2018; Chen & Carré,2020).

However, vendor bazaars are seldom supported and recognized by policies. Instead, they are often vigorously evicted by the relevant authorities, mainly due to their non-prescriptive nature, which affects the city's appearance and violates the city's street order. "Vendors often face challenges in terms of space, regulations, and competition" (Cross & Morales, 2007, p. 12). "In the case of vendor bazaars, the central issue is how to reconcile city managers with the conflicting demands of vendors and consumers" (Huang et al., 2012, p. 78).

There have been studies on the design and governance of vendors to carry out reform practices, to a certain extent, easing the intense spatial conflicts and social contradictions. However, in general, it is still based on the spatial game of passive acceptance, tolerance, and compromise, and it still lurks in the context of social crises and governance deficiencies. Research on clarifying the conflicts between consumers, vendors, and city managers in the context of fee degradation and proposing design strategies to explore the model of rapid commercial construction actively is still somewhat insufficient. Based on this, this paper adopts actor-network theory to analyze the difficulties and deficiencies of current governance and combines empirical cases to explore governance and design solutions for urban vendors, providing new ideas for improving governance efficiency and design planning.

Actor-network theory emphasizes the characteristics of heterogeneous actors and their agency, providing an innovative perspective for the study of vendor bazaars. In Actor-Network Theory, "an actor is defined as any individual or thing, both human and non-human, capable of triggering change. Its core characteristics are heterogeneity and agency, i.e., all actors, human and non-human, can impact other actors in the network. In this way, the interaction process between actors becomes the key to the network, and these interactions are achieved through translational mechanisms that promote the maximization of the interests of all parties" (Latour, 2005, p. 71). These characteristics provide a better theoretical basis and analytical tool for studying vendor bazaars.

The article examines the following questions (RQ1): How does actor-network theory explain the complex interactions of vendor bazaars? Moreover, (RQ2) How can modular design strategies solve the spatial problems currently faced by vendor bazaars?

The article adopts a combination of qualitative and quantitative research design to answer these questions and to explore their inherent contradictions, using the vendors on Shuyuan Street in Chengdu City as a case study. The design study consists of two phases. In the first stage of data receipt, 36 actors related to the hawker bazaar participated in the questionnaire survey. Participatory tracking and observation of Chengdu Shuyuan Street vendors were carried out to explore the potential commonalities behind them in depth based on a single case study. In the second stage of the design study, the actor-network theory was applied to sort out the contradictions among the consumers, city managers, and vendors. The modular design methodology was adopted, with the units being customized to provide the vendors with various choices and reorganization planning for the vendor bazaar.

The findings reveal the relationship of mutual constraints between the parties; the article's research proposes corresponding design strategies: 1. optimize stall design, 2. enhance consumer experience, and 3. promote

tripartite collaboration, which outputs design practice through a modular design approach. This study contributes to the hawker bazaar by (a) proposing a new approach that combines modular design with actor-network theory to provide a new perspective for urban research and design theory and (b) creating modular hawker bazaar design strategies that can be replicated and scaled-up to promote the application and practice of hawking in other cities.

This paper is divided into five parts; firstly, the article briefly introduces the theoretical background of actor-network theory. Secondly, the article reveals the study's findings from the data obtained from the qualitative research methodology, as well as the constraints and current situation of all stakeholders behind the vendor bazaar. Next, the article highlights the relevant design strategies and how the modular design approach can resolve their conflicts and promote the development of hawker bazaars in the context of consumption downgrading. Finally, the article details the shortcomings and contributions of the study.

2. Literature Review

This section mainly discusses the literature review related to actor-network theory and modularization, specifically adopting actor-network theory as the primary research theoretical basis to systematically analyze the internal analysis of the hawker bazaar, to explore the relationship and influence between its different actors, and at the same time selecting the modularization design methodology to reorganize the planning of the hawker bazaar, and the following is the review of the existing theories.

2.1 Actor-Network Theory

In the context of consumer downgrading, the study of the modular conceptual design of vendor bazaars is of great significance. In order to gain a deeper understanding of this area of research, this study will use Actor Network Theory (ANT) as a theoretical underpinning to explore the various types of actors and their interactions in hawker bazaars.ANT provides a unique perspective that can reveal how social and environmental factors work together to shape the operation and development of a bazaar by including both human and non-human actors in the same network.

In Reassembling the Social: An Introduction to Actor-Network Theory, Latour states that "society is not only made up of individual human beings, but also includes a variety of non-human factors such as technological, material, and natural phenomena". Phenomena. These non-human factors play an essential role in the social process. They should not be ignored" (Latour, 2005, p109). He emphasizes that "social structures are constructed through the process of interaction and translation between human and non-human actors". In this process, actors negotiate, adjust and redefine each other's roles and positions to form a solid network structure. John Law further develops

the theoretical framework of ANT in Actor-Network Theory and After. "Actor-network theory is not just about the relationships between objects and humans, but also about the dynamics and changes in those relationships". "Each node in the network (i.e., each actor) is active, and the form and function of the network are constantly changing " (Law, 1999, P20).

Given the relationship between vendor bazaars, consumers, and city managers and the influence of non-human actors such as the regulatory, institutional environment and the built environment on vendor bazaars. This paper utilizes actor-network theory, which can provide insight into the complex network structure of hawker bazaars and theoretical support for design. By focusing on the interactions of heterogeneous actors, the design of hawker bazaars can be better adapted to dynamic changes and enhance the vitality and sustainability of the bazaar. Therefore, actor-network theory provides a better perspective for analyzing and studying hawker bazaar research. The adaptability of actor-network theory to the study of hawker bazaars is reflected in four aspects:

First, actor-network theory aims to explore how heterogeneous networks of human and non-human entities are constructed and maintained. This breaks with the traditional sociological view of society as an inherent, static, orderly entity. Instead, society is viewed as a dynamic and ongoing process of connections between multiple elements (Latour, 2005, p. 7).

This view has important implications for designing vendor bazaars, which are a complex network of multiple heterogeneous human and nonhuman elements.

Secondly, as human actors, vendors, consumers, and city administrators play critical roles in vendor bazaars. Their interactions and transactions not only determine the economic activities of the bazaar but also influence the social culture of the bazaar. However, non-human actors (e.g., the design of stalls, digital payment systems, communication platforms, etc.) are equally important. Latour points out that "the agency of non-human actors cannot be ignored, and they can make a difference or have an impact that alters the behaviour of human actors" (Latour, 2005, p. 34).

Thirdly, the design of vendor bazaars needs to emphasize the interaction process between actors. These interactions include direct transactions between vendors and customers, the balance between vendors, coordination between vendors and management, and interaction between vendors and other influences. "By tracking these interactive processes, their dynamics can be better understood and provide valuable references for design" (Latour, 2005, p. 71).

Therefore, this study analyzes the vendor bazaar using actor-network theory. This theoretical framework not only helps to reveal the complex relationships in the operation of the bazaar but also can provide innovative ideas for design practice.

2.2 Modular Design

Modular design is a practical approach to solving contemporary urbanization problems. For example, in their book Refabricating Architecture, Kieran and Timberlake explore the potential of modular architecture, arguing that this approach can significantly shorten the building construction cycle, reduce costs, and improve the quality of buildings (Kieran & Timberlake, 2003, pp. 45- 49). By having prefabricated modules that do most of the construction work in a factory and are then assembled on-site, modular construction can reduce the impact on the on-site environment and provide greater building flexibility. It can provide flexible operating space for vendors to adjust the layout of their stalls according to market demand and individual needs. In addition, the modular design can facilitate cooperation and resource sharing among stallholders, enhancing the overall effectiveness and attractiveness of the bazaar. For example, Schneekloth and Shibley noted in their study that "modular design helps to create more inclusive and dynamic public spaces that enable a variety of stakeholders to work better together" (Schneekloth & Shibley, 2000, pp. 85-88). "Modular market structures offer solutions to spatial constraints in urban areas." (Davis, 2006, p. 29) "Modular stalls can be assembled and disassembled quickly, providing flexibility for street vendors." (Mehrotra, 2011, p.12) "Modular design provides a cost-effective solution for market infrastructure in urban environments." (Kieran & Timberlake, 2003, p. 29) "Modular design can enhance the inclusiveness and accessibility of markets in urban environments" (Deleuze & Guattari, 1987, p. 45). "In urban planning, modular approaches can address the challenges posed by the informal economy" (Roy, 2005, p. 147). "Modular design allows for flexibility and adaptability of urban spaces to the dynamic nature of markets" (Chen & Luo, 2018, p. 45).

The adaptive relationship between modular design and actor-network theory provides a new perspective to understanding complex systems and social phenomena. "Modular design emphasizes the flexibility of systems and fits with the concept of heterogeneous networks in ANT. Each module in a modular system can be seen as an independent actor that connects and interacts with each other through network relationships." (Langlois & Garzarelli, 2008) "The scalability of the modular design allows the system to add or subtract modules as needed, similar to the scalability of networks in ANT. By continually introducing new modules or actors, the system and network can continue to expand and evolve." (Yoo, Henfridsson, & Lyytinen, 2010) "Maintainability in modular design is closely related to network stability in ANT. Modular design makes it easier to identify and fix system problems and maintain the network's stability and continuity." (Pollock & Williams, 2008) By combining these two approaches, we can better analyze and design flexible, scalable and stable systems that reveal the network's interactions and relationships between human and non-

human actors. This not only helps to improve the effectiveness of design practice but also provides new perspectives on the study of vendor bazaars.

Therefore, the article uses modularization as the design method to design modular standard hawker space, to resolve the existing conflicts, to enhance the flexibility and adaptability of hawker bazaar, and to form a fast-constructing business model, to be more adaptable to the needs of the current business society.

3. Methodology

3.1 Research Methodology

This section is intended to enhance the understanding of the particular research area and to propose appropriate strategies for subsequent research. This study first uses a combination of qualitative and quantitative research methods, using Chengdu Shuyuan Street as a case study, with a survey period from April to July 2022. Qualitative methods such as the participatory tracking method, street notes, and semi-structured interviews were used to obtain the current status of the problem of current vendors. In-depth case studies of current vendors were conducted to obtain a more direct, complete, and comprehensive understanding of behavioural interactions and to obtain vendors' characteristics regarding their size, type, and space through on-site observation and recording during peak business hours.

Qualitative research provided detailed descriptions and complex background information for this study. Quantitative research was adopted by distributing 40 questionnaires to residents and consumers through questionnaire surveys, and 36 valid questionnaires were collected. Quantitative research provides objective and quantifiable data and patterns. The mixed research method allows for a more comprehensive understanding of the research phenomenon and enhances the depth and breadth of the study. This complementarity makes the findings more persuasive, provides richer insights for subsequent research, and enhances the validity and reliability of the study.

Second, the actor-network theory is applied to sort out the patterns of space use of the vendors in Shuyuan Street, the consumer behaviour and interaction between the vendors and the city administration, and the facilitating role of the digital payment system and the communication platform, to analyze the complex relationship among consumers, vendors and city administrators more comprehensively, to reveal how the human activities, the design practices and the social dynamics work together to form a complex interactive network, and to clarify the interests and obstacles of the actors in the process of constructing the network. The interests and obstacles of each actor in the network construction process are clarified. Finally, combining the modular design methodology proposes a conceptual design solution for the Chengdu Shuyuan Street Vendor Bazaar.

3.2 Research Analysis

The site is located in the Shuyuan Street area of Chengdu; the site has a large number of vendors, but there is currently no planning for vendors, and there is a more severe conflict between vendors and city managers within the entire site, making it difficult to strike a balance. The current site has the following characteristics:

· The site is located in the old city of Chengdu, with many residents and high traffic flow in the neighbourhood;

· The existing site already has a certain number of vendors congregating and appearing at fixed times of the day on a mobile basis;

· Vendors are mainly located in public spaces such as community public spaces, sidewalks, marketplaces, and entrances and exits of subway stations;

· T-Vendors mainly utilize urban fringes and grey spaces and often secure their survival by appropriating various types of public space;

· Easy to cause problems such as traffic congestion, crowd confusion, poor public order and sanitary environment.

· Vendors are mainly located in public spaces such as community public spaces, sidewalks, marketplaces, and entrances and exits of subway stations.

Figure 1. Current situation of vendors on Shuyuan Street.

The study found a high demand for vendors on Shuyuan Street, and residents visit the street from 12:002:00 pm to 5:00-10:00 pm. In the afternoon, most vendors rest or move around under the influence of the city administrators. In terms of the structure of goods sold, the main categories are food (55%), daily necessities (20%), and services (24%); in terms of the types of vendors, they can be broadly categorized into seasonal vendors, part-time vendors, and full-time vendors with a wide range of distribution areas.

Table 1. Vendor Type Chart.

Type of vendor	Description of activities	Type of vendor
Seasonal vendors	They are mainly migrant workers who work at home during the busy farming season and go to the city to set up stalls to increase their income during the non-busy farming season.	Seasonal vendors
part-time vendor	Low-income urban wage earners use off-duty hours or weekends to set up stalls and trade cheaply. They usually sell their goods at wholesale markets in cities and use night and morning markets. Part-time vendors also purchase their mobile vans for food and beverage sales.	part-time vendor
Dedicated vendors	Their work is relatively stable, mainly operating on a full-time, fixed-term basis and moving around at different times according to the needs of the people in the vicinity, which can generally be categorized into three time slots: morning, midday and evening.	Dedicated vendors

A more specific example: this study follows up on Auntie Wang, a sweetened fruit vendor in the venue, who epitomizes the many vendors in Chengdu, and thus a case study of her is universal and valuable. Auntie Wang, a resident of the Shuyuan community, aged 59, has been making sweetened fruits since she was laid off from her job, and the tools she needs to go out to the stalls are a wheelbarrow, horse zipper, umbrella, power supply, light bulb, thermos box, cooking utensils, and ingredients, etc. During the whole day's behavioural proceeding, there are a total of four kinds of behaviours involved, which are: preparing ingredients, going out to the stalls to look for stalls, setting up the stalls for sale, and closing the stalls for home, and in the process of selling, Auntie Wang, along with the different other actors and needed to change at any time.

Stage 1 is the preparation of ingredients, which is difficult to determine due to the vendor's inability to estimate the number of customers, resulting in the preparation of ingredients in a problematic quantity.

Stage 2, the stalls are looking for stalls. In this process, the location of the vendors changes with the flow of customers and the "surprise inspections" by city managers, resulting in the phenomenon of moving around and having no place to stay.

Stage 3, the most prominent part of the problem, in the process of finding a suitable location to settle down and set up a stall to sell, the vendor's constantly moving with the changes of other actors, and at the same time, the change of emotions from finding a location to breathe a sigh of relief, to the pleasure of selling, to the anxiety of being evicted by the city administrator, in this stage of the contradiction between the city administrator, the vendors and the consumers more and more prominent, and even many times In this stage, the conflict between the city manager, the vendor and

the consumer becomes more and more apparent, and there have even been many cases where the vendor has been expelled by the city manager in the middle of the food preparation process after the consumer has already paid for the food, thus forcing him to end his business, which is a kind of invisible harm to both the consumer and the vendor, while the city manager is only fulfilling his responsibility and work.

Stage 4, closing the stalls and going home, is also characterized by a greater degree of randomness, with vendors deciding whether to finish for the day or not as the flow of customers gradually diminishes. This shows the gradual increase in conflicts between vendors and city managers over time, and the mobile change of selling locations has become a daily routine for regular operators.

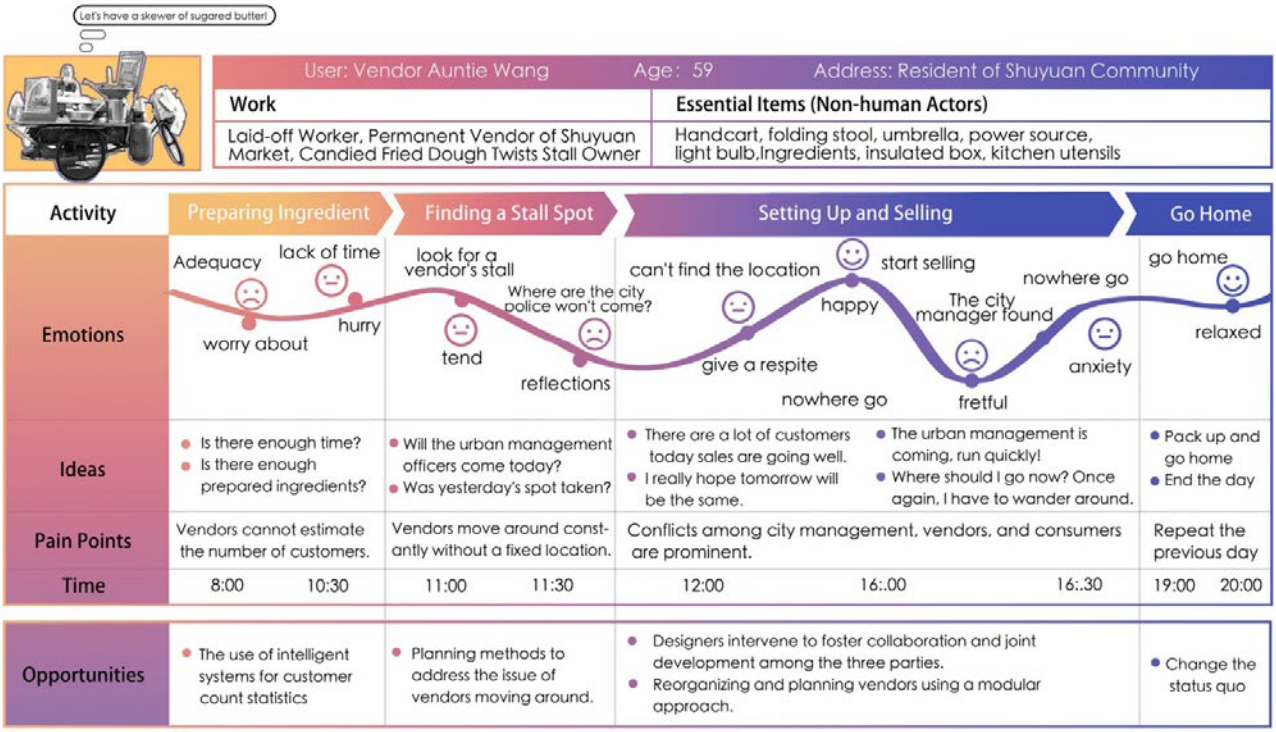

Figure 2. Journey map of vendors and users on Shuyuan Street.

In terms of the existing spatial distribution of vendors, on the one hand, vendors tend to be close to formal stores with consumers of the exact nature, enjoying the externality benefits of spatial proximity and sharing the market through price differences and product complementarities, e.g., cell phone sticker vendors have been selling in the vicinity of cell phone stores for a long time, and snack vendors are closer to the vicinity of the basement of the snack bar; on the other hand, vendors spontaneously form a particular scale of concentration, or On the other hand, vendors will spontaneously form a particular scale of concentration or distribution to attract consumers. New entrants can then identify the existing consumer market by entering the cluster.

The clustered vendors adopt differentiated marketing strategies, which will not lead to vicious competition with homogeneous products. At the same time, vendors are vigilant in observing and capturing the crowded consumer market, waiting for the opportunity to emerge at the city's boundary line, where they can capture the flow of people, avoid city administrators, and balance their interests.

4. Findings

The findings of this paper involve two main parts. In the first part, the actor-network theory is applied to reveal the contradictions and conflicts of existing hawker bazaars in the context of consumption downgrading, which are

1. the interaction between hawkers and the design space,
2. the relationship between hawkers and consumers,
3. the coordination between hawkers and city managers.

In the second part, the study reveals which design strategies can effectively dissolve the current problems and thus promote the development of hawker bazaars in consumer downgrading. The findings in this part include (1) optimizing stall design, (2) enhancing consumer experience, and (3) promoting tripartite collaboration. The main findings of each part will be described in detail below with specific pictures.

4.1 Images Network Of Actors In Vendor Bazaars In The Context Of Consumption Downgrading

The study analyzed the data of Chengdu Shuyuan Street and deeply combined it with actor-network theory to excavate and analyze the inner causes of its problems, and responded to the question of (RQ1) How does actor-network theory explain the complex interactions of the vendor bazaar? The following diagram of actor-network relationships is derived in response to the question.

Interaction problems between vendors and designed spaces

Vendors currently face limited space, resulting in stall designs that do not meet functional needs or affect the consumer experience. Existing vendors occupy many public transportation spaces, generating problems such as road congestion, affecting the regular use of sidewalks or driveways, and a lack of flexibility in design, with stall designs unable to adapt to changes in vendor needs, such as seasonal demand or business expansion. Moreover, This produces a large number of environmental health pollution problems; all kinds of pollution often in the vendors go away after still stay in place, and even more because of the fumes and other long-term pollution caused by the ground discolouration and other irreversible impacts affecting the appearance of the city.

Vendor-consumer relations

There is a mismatch between consumer needs, and vendors' design may not fully consider consumer needs and preferences, resulting in a poor shopping experience. Different vendors have different carts and use different physical facilities, most of which are freely designed and then processed by factories, resulting in various carts of various colours. This informality inadvertently destroys the image of the original formal presence of streets and stores. Some even use stronger colours or abrupt images to differentiate themselves from other merchants, attract customers, and increase recognition. The interactive design of the stalls is also too simple to attract consumers or enhance shopping convenience effectively.

Problems of coordination between vendors and urban managers

Urban management policies place excessive restrictions on the business activities of vendors, affecting their flexibility and ability to innovate. Existing management measures have not been adapted to vendors' actual needs and design, resulting in difficult or ineffective implementation.

Actor-network theory emphasizes that interactions between human and non-human actors constitute social phenomena. The actor-network theory used in the study of vendor bazaars first helps to identify the various types of actors, including non-human actors, key actors, and the shifting roles of actors in the process, which in most social science theories refers to vendors or consumers and city administrators, and that "effective management of a marketplace requires cooperation among vendors, consumers, and city authorities." (Bhowmik, 2005, p.2256) But the fact is that for vendor bazaars it is more than that. The business activities of vendors are not only influenced by human actors but also by conditions such as nonhuman actors. The actors of the vendor bazaar come first from vendors, consumers, city managers, residents, designers, and suppliers, who are the core subjects of the vendor bazaar, i.e., human actors. Secondly, feed, back systems, communication platforms, digital payment systems, weather and waste management, i.e. non-human actors. These heterogeneous actors interact with each other in complex ways, influencing and constraining each other. Therefore, to solve the current problems of vendors, systematic thinking should be used to intervene with the following actors in the network of actors in the hawker bazaar.

Table 2: Human and non-human actors in vendor markets

Human actors	act	non-human actor	act
stall-keeper	Responsible for preparing and selling merchandise.	Modular booths	Provide a platform for vendors to sell their wares and facilitate quick set-up and dismantling of stalls.
consumers	Purchase of goods or services provided by vendors.	feedback system	Collect and analyze feedback from vendors, consumers and other relevant parties to facilitate optimization of management measures.
city manager	Responsible for regulating and supervising the activities of vendors to ensure their legal compliance.	Communication platform	Establishment of communication channels between vendors, consumers and city managers to facilitate timely transmission of information.

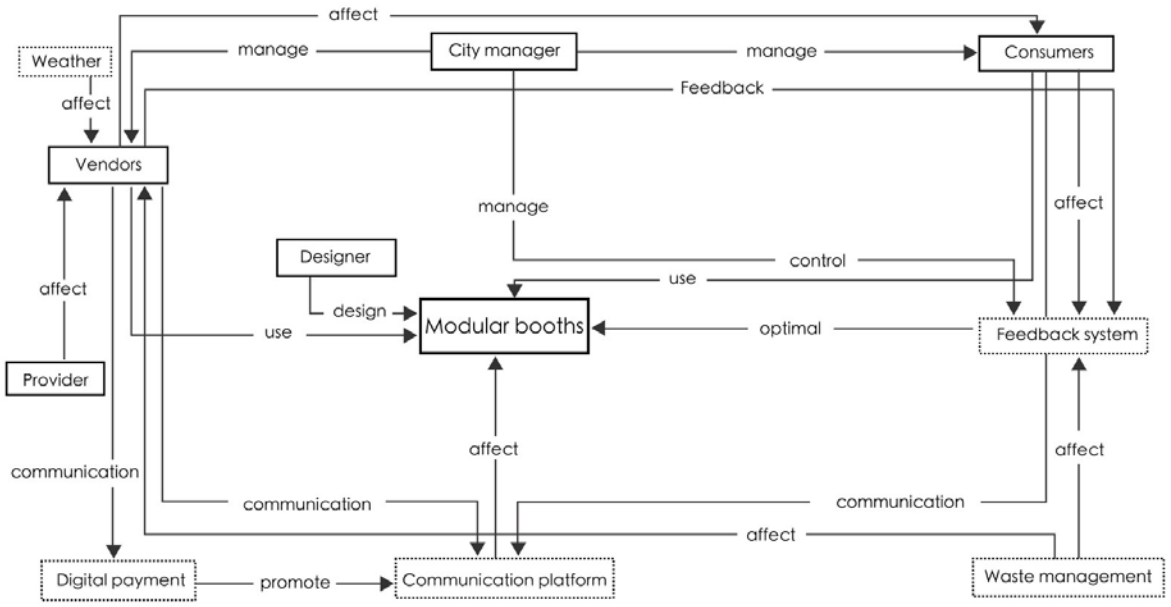

Figure 3. Map of the network of actors in vendor fairs

4.2 Modularized Vendor Concept Design

This section focuses on (RQ2) How can modular design strategies address the spatial problems currently faced by vendor bazaars? A response is provided. Existing actor-network theories have analyzed the relationship between stakeholders, so in terms of design practice, the physical space of the stalls is taken as the leading actor, and the contradictory relationship between different actors is gradually resolved to start from the planning and design of the stalls. Firstly, the capital attribute of the stall unit is weakened, and the use function of the stall is emphasized. Secondly, it is designed to be a more everyday and accessible commodity, reducing costs and creating more customizable modular spaces. The following design strategies were used to reorganize the planning of its vendor bazaar in terms of specific program design.

Optimize booth design

Research has been conducted that indicates that "modular market structures can be customized to meet the specific needs of different vendor types." (Brand, 1994, p.17). "The use of sustainable materials in modular designs can reduce the environmental impact of markets." (Lehmann, 2013, p.1). "Modular market designs can improve urban spaces' overall aesthetics and functionality" (Jacobs, 1961, p.29). This study again builds on the development of stall units that can be flexibly combined and adapted. This design allows vendors to adjust to actual needs, improving space utilization and functional suitability. A 3*3 m3 prefabricated unit block is used as the base module, on which more than ten deformations are carried out. Vendors can choose according to their needs or increase and decrease the modules according to the changes in demand; recyclable and environmentally friendly fibre-reinforced composites (FRPs) are chosen to reduce the impact on the environment and enhance the sustainability of the modularization. Stacking the modules up, flexible updating and fast flow, the apparent mould moment relationship can present a high degree of visual order, solving the problem of vendors disturbing the order and affecting the appearance of the city, looking upward for space, forming a large number of staggered platforms, allowing the building body to produce a novel sense of dislocation, and ordering the use of space in the order of the premise of a more diversified and flexible. Rapidly build recyclable temporary buildings to help vendors combine on-site when in use, easy to dismantle and assemble so that they can be used and moved more flexibly, and at the same time, solve the problems of damaging the city's image, leading to environmental pollution and security hazards.

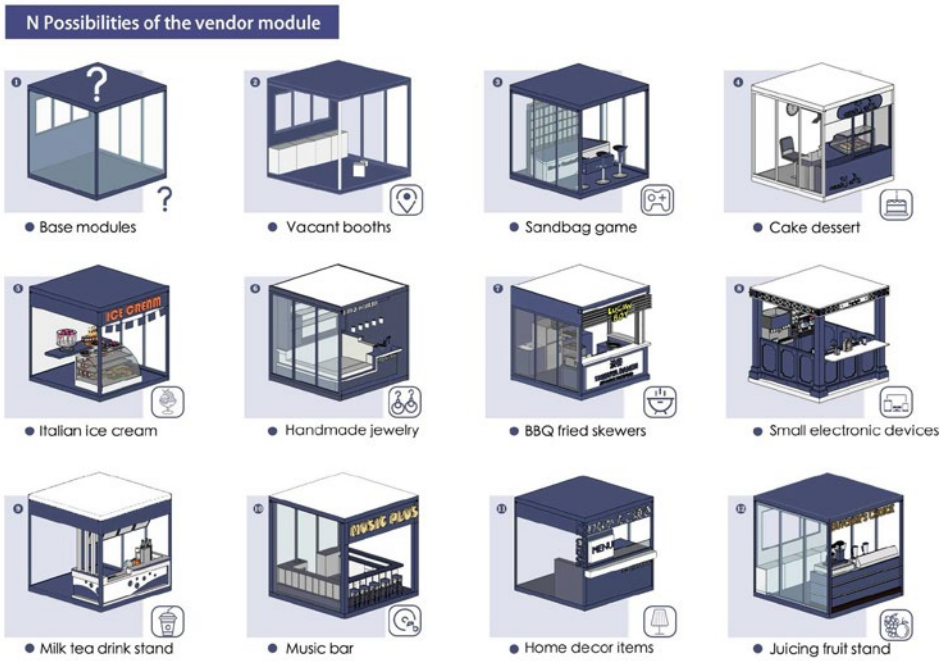

Figure 4. Vendor bazaar module module design

Enhance the consumer experience

The modular design can quickly gather more different types of vendor spaces to meet the diverse choices of contemporary people and design stall layouts and interactions that meet their needs, providing more support for consumption downgrading. On this basis, IoT technology is introduced to monitor and manage the use of vendors in real-time. With an intelligent system, vendors can book, adjust and maintain their stalls more efficiently, while the management can allocate resources and maintain order more efficiently. Transform the various negative impacts caused by the confusion and mobility of existing vendors. Design attractive, interactive elements to open up new experiences in the consumer scene.

Promoting triangular collaboration

Combined with the results of the analysis of actor-network theory, vendor bazaars, due to their unique attributes of complex systems, can establish communication platforms between vendors, consumers and city managers to facilitate information exchange and problem-solving. Track and assess the impact of feedback (actors) on design and management measures and make appropriate adjustments and optimizations. Establish a continuous improvement and innovation mechanism to encourage vendors and managers to develop new ideas and suggestions for improvement. Through this mechanism, the attractiveness and competitiveness of the market can be continuously enhanced. Organize regular

cultural activities and community involvement projects in the modular design space to attract more consumers and increase the flow of people to the market. These events could include musical performances, craft demonstrations and food festivals. In this way, they can be co-located to resolve the tensions and contradictory relationships between the three. To find a balanced and symbiotic path for vendors between top-down policies and bottom-up demands.

Figure 5. Conceptual design rendering of vendor market.

References

Akrich, M. (1992). The description of technical objects. In W. Bijker & J. Law (Eds.), Shaping technology/building society: studies in sociotechnical change (pp. 205-224). MIT Press.

Bromley, R. (2000). Street vending and public policy: A global review. International Journal of Sociology and Social Policy, 20(1/2), 1-28. https://doi.org/10.1057/ejdr.2011.61

Berner, E., Gomez, G., & Knorringa, P. (2012). "Helping a large number of people become a little less poor": the logic of survival entrepreneurs. European Journal of Development Research, 24, 382-396.
https://doi.org/10.1057/ejdr.2011.61

Brand, S. (1994). How Buildings Learn: What Happens After They are Built. Viking Press.

Bhowmik, S. K. (2005). Street vendors in Asia: A review. Economic and Political Weekly, 40(22/23), 2256-2264.

Cross, J. C. (2000). Street vendors, modernity and postmodernity: Conflict and compromise in the global economy. International Journal of Sociology and Social Policy, 20(1/2), 29-51. https://doi.org/10.1108/01443330010789106

Chen, M., & Carré, F. (2020). The Informal Economy Revisited: Examining the Past, Envisioning the Future. London and New York: Routledge. https://doi.org/10.4324/9781003087153

Chen, L., & Luo, Y. (2018). Flexibility in modular urban design. journal of Urban Planning and Development, 144(1), 45-56. https://doi.org/10.1061/(ASCE)UP.1943-5444.0000411

Cross, J. C., & Morales, A. (2007). Street Entrepreneurs: People, Place, and Politics in Local and Global Perspective. Routledge. https://doi.org/10.4324/9780203946764

Davis, M. (2006). Planet of Slums. Verso.

Deleuze, G., & Guattari, F. (1987). A Thousand Plateaus: Capitalism and Schizophrenia. University of Minnesota Press.

Huang, G. Z., Li, T. J., & Xue, D. S. (2012). 包容还是新的排斥: 城市流动摊贩空间引导效应与规划研究

[Inclusion or new exclusion: Spatial guidance effects and planning research of urban mobile vendors] . 规划师, 28(8) ,78 – 83 . [Planners]

Jane Jacobs. (2005). The Death and Life of America's Great Cities. Jin Hengshan (Translation). Nanjing: Translation Publishing House, 29-58.

Kieran, S., & Timberlake, J. (2003). Refabricating Architecture: How Manufacturing Methodologies are Poised to Transform Building Construction. McGraw-Hill.

Latour, B. (2005). Reassembling the social: An introduction to actor-network-theory. Oxford University Press. https://doi.org/10.1093/oso/9780199256051.001.0001

Law, J. (1999). Actor-network theory and after. In J. Law & J. Hassard (Eds.), Actor network theory and after (pp. 1-14). Blackwell/Sociological Review.

Liu, Q., & Wang, W. (2023).非正规经济视角下地摊 3.0 活动与城市空间互动机制研究[The interaction mechanism between street vendor activities and urban space from the perspective of informal economy].城市规划学刊(03),27-37. [Urban Planning Forum] doi:10.16361/j.upf.202303004

Lehmann, S. (2013). Low carbon districts: Mitigating the urban heat island with green roof infrastructure. City, Culture and Society, 4(1), 1-8. https://doi.org/10.1016/j.ccs.2013.02.002

Langlois, R. N., & Garzarelli, G. (2008). Of hackers and hairdressers: modularity and the organizational economics of open-source collaboration. industry and innovation, 15(2), 125-143. https://doi.org/10.1080/13662710801954565

Mol, A. (2002). The body is multiple: ontology in medical practice—Duke University Press. https://doi.org/10.1515/9780822384151

Mehrotra, R. (2011). Architecture in an Age of Accelerated Change: The Modular Imperative. Journal of Architectural Education, 65(2), 12-17. https://doi.org/10.1111/j.1531-314X.2011.01185.x

Pickering, A. (1995). The mangle of practice: time, agency, and science. University of Chicago Press.

Pollock, N., & Williams, R. (2008). Software and organizations: The biography of the enterprise-wide system or how SAP conquered the world. Routledge. https://doi.org/10.4324/9780203926735

Prahalad, C. K., & Hart, S. L. (2002). The fortune is at the bottom of the pyramid. Strategy+Business, 26, 54-67.

Roy, A. (2005). Urban informality: Toward an epistemology of planning. Journal of the American Planning Association, 71(2), 147-158. https://doi.org/10.1080/01944360508976689

Schneekloth, L. H., & Shibley, R. G. (2000). Placemaking: The Art and Practice of Building Communities (pp. 85-88). John Wiley & Sons.

Shi, L., Zhang, C., & Liu, N. (2023).突发公共卫生事件引致中国居民消费结构的新变化：逻辑机理与实证检 验[New Changes in Chinese Residents' Consumption Structure Induced by Public Health Emergencies: Logical Mechanism and Empirical Test]. 当代经济管理 (09), 1-12. [Contemporary Economic Management] doi:10.13253/j.cnki.ddjjgl.2023.09.001

Yoo, Y., Henfridsson, O., & Lyytinen, K. (2010). Research the new organizing logic of digital innovation: an agenda for information systems research. Information Systems Research, 21(4), 724-735. https://doi.org/10.1287/isre.1100.0322

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SUSTAINABLE CHOICES, FRESH APPROACHES: REDESIGNING MEAL KITS USING ACTIVITY THEORY

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ABSTRACT | "Cook and eat" meal kits from pre-packaged food delivery services provide exact portions of ingredients required for specific recipes, promoting sustainability by eliminating food waste in the cooking process. However, these services often overlook some of the current consumer behaviours associated with their use. This study aims to explore consumer behaviour regarding the use of meal kits in the Swedish context, with a particular focus on the sustainability of these behaviours. Applying activity theory as the theoretical framework, this study explores how consumers interact with meal kits during the ordering, cooking, storing and disposal and identifies potential areas for service and packaging improvement to promote sustainability. The methodology used includes a combination of qualitative survey (24 answers), in-depth interviews and observations with 4 households to gather data about consumer cooking practices and perceptions and self-reporting from 3 of the authors. Specifically, the study focuses on the operational layer of activity theory, analysing the routine actions and adjustments consumers make while interacting with meal kits, which directly and both consciously and unconsciously impact food waste and its sustainability. Considering the harmonies and tensions found between the consumer, the meal kit, including the recipe, the food, and the packaging, and the homemade meal, the findings show that while meal kits ease the cooking process and save time, they are perceived as having excessive packaging and do not completely eliminate food waste as promoted. Design suggestions include considering returnable packaging systems, offering ingredient replacement options, providing freezable and microwavable recipes, and including new cooking guidelines such as taste-testing steps. These changes can better align them with consumer needs, and potentially reduce the impact of consumer use, reducing food waste and increasing the sustainability perception of the system.

KEYWORDS | MEAL KITS, ACTIVITY THEORY, DESIGN FOR SUSTAINABLE BEHAVIOURS, FOOD WASTE, PACKAGING

1. Introduction

In recent years, meal kits have risen in popularity as a convenient and efficient way for individuals and families to prepare home-cooked meals without the hassle of grocery shopping. These pre-packaged food delivery services provide consumers with exact portions of ingredients required for specific recipes, thereby promoting sustainability by potentially eliminating food waste in the cooking process (Sharda et al., 2024). Companies such as HelloFresh, Marley Spoon, or Linas Matkasse follow this trend, offering diverse menus and easy-to-follow recipes that provide for a variety of dietary preferences and cooking skills (HelloFresh, n.d.; Linas Matkasse, n.d.; Marley Spoon, n.d.) Consumers can choose from many options that change from week to week, including vegetarian, traditional diet, and low-calorie meals, among others, suitable for both lunch and dinner. These meal kits also present different difficulty levels, allowing consumers to select recipes based on their cooking experience and the amount of time they have available. For example, the service HelloFresh offers "Rigatoni with Goat's Cheese" as an easy and vegetarian option or "Oven-Roasted BBQ Chicken" as a medium-difficulty option for a traditional diet (HelloFresh, n.d.).

We can identify four main categories of meal kits available today in the market, presenting them into four types: cook-and-eat, heat-and-eat, ready-to-eat, (Global Market Insights, 2023) and nutritional meal replacements. The "cook and eat" kits include raw ingredients and recipes for consumers to make meals from scratch. The "heat and eat" kits include pre-cooked ingredients that require only minor heating before consumption. "Ready to eat" kits provide fully prepared meals that can be consumed immediately. Lastly, meal replacements, which come in powdered or liquid form, offer a quick alternative to traditional meals, with a focus on nutritional content and meal replacement. This study focuses on "cook and eat" meal kits, which require the preparation of meals using raw ingredients provided in specific portions. Figure 1 presents the four types of meal kits just described.

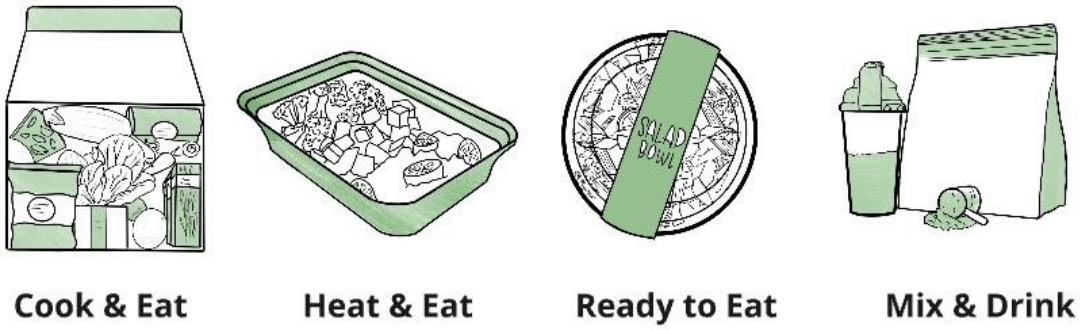

Figure 1 Type of meal kits

However, while "cook and eat" meal kits offer several advantages, including convenience and the reduction of food waste (Cho et al., 2020), they also introduce new sustainability challenges. For example, the significant amount of packaging required to keep ingredients fresh and separate can lead to increased waste if not properly managed. Additionally, the unflexible structure of pre-determined ingredients may not align with all consumers' eating habits or cooking styles, leading to food waste despite the intention of meal kits to minimise it. Thus, understanding the full impact of meal kits on sustainability requires a comprehensive analysis of consumer behaviours and perceptions associated with their use.

Activity theory, a framework originally developed by Soviet psychologists Vygotsky and Leont'ev, offers a valuable lens for examining these behaviours. Activity theory focuses on the interaction between individuals and their environment, emphasising the tools and community involved in any given activity (Leont'ev & Hall, 1978; Vygotsky, 1978). By applying this framework to the context of meal kits, we can gain insights into how consumers interact with these services during different stages such as ordering, cooking, storing, and disposal. This theoretical approach helps identify contradictions and harmonies within these interactions that may contribute to sustainable or unsustainable practices, guiding design strategies to develop functionality and user engagement towards sustainable outcomes (Chu et al., 2021).

Building on this, this study looks into consumer behaviour regarding "cook and eat" meal kits in Sweden, with a particular focus on sustainability. Using activity theory, we look into consumers' routine actions, both consciously and unconsciously, and their impact on food waste and sustainability, making use of a mixed-methods approach, including qualitative surveys, in-depth interviews, and observations, to identify areas for improvement in service and packaging. The goal is to provide new recommendations for meal kit services that will better align with sustainable consumption patterns.

2. Methodology

To uncover the unsustainable behaviours behind the "cook and eat" meal kits, the lens of activity theory is used. This framework allows us to understand the motives behind the use of meal kits, the goals that users aim to achieve, and the conditions and routines that influence their use. By employing a combination of surveys, observations, interviews, and self-reporting, we seek to capture insights into the different levels of activity theory as they relate to meal kit usage.

For this study, we used four different methods to gather comprehensive data. A qualitative survey was conducted among both users and non-users of meal kits. The objective was to understand the motives behind the decision to include meal kits in their grocery shopping routines. The survey gathered data from 12 users and 12 nonusers on their perceptions of sustainability, food waste, and the user-friendliness of meal kits. The questions were designed to uncover conscious behaviours and preferences. Through the survey, participants were also asked if they would be willing to take part in cooking observations for the next phase of data collection.

Observations of the meal kit used were carried out with four households recruited from the survey. During these sessions, we monitored the participants' actions from planning to cooking and storing or eating the food. This method provided insights into the operational layer of activity theory, focusing on routine procedures and the conditions under which these actions are performed. Following the observations, in-depth interviews were conducted with the participants right after the use of the meal kit, to look deeper into their goals and conscious decisions regarding the use of meal kits. These interviews helped to capture the participants' immediate reflections on the cooking process and their overall perceptions of the service.

The authors also engaged in self-reporting by using the meal kits themselves. This approach provided firsthand experience and insights into the different stages of meal kit usage, from ordering to cooking. Self-reporting helped to identify any potential biases or unique insights that might not be captured through observation alone.

The data collected from surveys, observations, and interviews were analysed qualitatively (Hashim & Jones, 2014). An affinity diagram was used to compile and categorise the data, highlighting common themes, tensions, and harmonies. This process facilitated understanding the participant's experiences and the identification of areas for potential improvement in meal kit services. The study was conducted within a Swedish context, involving consumers with varying diets (traditional diet, vegetarian, and with allergies) and household compositions, predominantly single or two-person

households. The group of consumers who agree on participating aligns with the current common household types most likely to use meal kits (Schoenbauer, 2019), as these services are particularly popular among single individuals and small households due to their convenience (Choi et al., 2023). Additionally, the diverse dietary preferences of participants reflect current diet trends (Global Market Insights, 2023), ensuring a more realistic spectrum of preferences.

3. Activity Theory Framework

For this study, activity theory is applied as a theoretical framework to better analyse the behaviours associated with meal kit services. Activity theory provides an approach to understanding human behaviour by breaking it down into a hierarchical structure of activity, action, and operation. The methods selected for this study align with these levels, enabling a detailed examination of the motivations, goals, and conditions that shape consumer interactions with meal kits.

Activity theory involves subjects, objects, and artefacts, together with the rules, community and division of labour, for this study we will be analysing the relation between the three first elements. The subject refers to the individual or group who performed an action. In this context, the subjects are the consumers using meal kits. The object is the goal or purpose that the subject aims to achieve, such as preparing a meal with minimal food waste. The artefact or tool is the means through which the activity is performed, which in this case includes the meal kits themselves, along with any associated packaging, instructions and online app or website. (Kaptelinin, 2024)

To analyse the different layers of activity theory and find the improvements within "cook and eat" meal kit alternatives, we focus on uncovering the tensions or contradictions. Tensions and contradictions are conflicts within the activity system that can hinder the achievement of the object (Engeström, 2015). They are relevant for identifying opportunities for improvement.

For this study, we reveal secondary and tertiary contradictions, focusing particularly on the secondary type. The four types of contradictions (Engeström, 2015) are:

1. Primary Contradictions:
These occur within each component of the activity system, such as within the subject or the artefact.

2. Secondary Contradictions:
These arise between components of the activity system, such as between the subject and the artefact or between the object and the community.

3. Tertiary Contradictions:
These occur when a culturally more advanced form of the activity is introduced into the current activity system.

4. Quaternary Contradictions:
These emerge between the central activity and its neighbouring activities.

Additionally, the study examines the harmonies within the system, which are the aspects users perceive as positive and that function well within the service. Understanding these harmonies helps in retaining effective elements while addressing the tensions.

This study also focuses on the improvement of the artefact within this system. Through the lens of activity theory, the cognitive evaluation and the potential for behaviour change in neighbouring activities are also discussed, as a result of using these services.

By applying activity theory to consumer behaviour with "cook and eat" meal kits, we aim to understand how consumers interact with the service at different stages. The activity level helps us identify the overarching motivations, such as convenience and sustainability. The action level allows us to explore specific goals, like following a recipe or reducing food waste. The operation level focuses on the habitual practices and conditions under which these actions are performed, such as cooking techniques and storage methods.

We collect data through surveys, observations, interviews, and self-reporting to gain insight about consumers' conscious and unconscious routines, allowing us to identify and classify specific tensions and harmonies within the meal kit service. This classification helps us to redesign and reduce secondary contradictions, such as resolving tensions between sustainability goals and packaging or maintaining harmonies like the convenience of pre-portioned ingredients, better aligning the service with user needs and environmental objectives.

4. Findings and Analysis

4.1 Findings from the Methods

Survey Results

The survey conducted among both users and non-users of "cook and eat" meal kits aimed to understand the motives behind the decision to include meal kits in their grocery shopping routines, their perceptions of sustainability and food waste, and the user-friendliness of meal kits. Most respondents highlighted the convenience of using meal kits, noting time savings and the ease of having pre-measured ingredients as significant advantages, aligning with the results of other studies (Moir, 2021; Shin et al., 2024). Users generally felt that meal kits helped reduce food waste because they provided exact portions needed for recipes. Additionally, meal kits were appreciated for introducing new recipes and adding variety to users' diets. Some users felt that meal kits encouraged healthier eating habits by providing balanced meals with fresh ingredients, and they enjoyed the simplified meal planning process as they did not have to think about what to cook each day.

However, there were significant tensions identified. A major concern among users was the excessive packaging associated with meal kits, which contradicted their sustainability

goals. When asked if the meal kits were considered a more sustainable option, one of the users pointed out in the survey:

"Hard to say. It is good that I don't waste food but bad that everything is packed in individual packaging and the door delivery (increased transportation needs)."

Some respondents found meal kits to be expensive compared to traditional grocery shopping. Users also noted a lack of flexibility in meal kits, as they could not easily substitute or skip ingredients without creating waste. Additionally, some users felt that the meal options became repetitive over time, reducing their interest in the service and the only option of delivering is not perceived as a sustainable option in the service.

Observations and Interviews

Observations were carried out with four households using meal kits, monitoring participants' actions from planning to cooking and storing the food. Following the observations, in-depth interviews were conducted to delve deeper into their goals and conscious decisions regarding the use of meal kits. Participants generally found the meal kits easy to use, with clear instructions that made the cooking process straightforward. Some participants perceived the service to ease the planning process. The quality of the ingredients was often highlighted, with users feeling that they were getting fresh and high-quality products. Users appreciated the time efficiency of meal kits, noting that they could prepare meals more quickly than if they had to measure and prepare all ingredients themselves.

Despite these positive aspects, several tensions were identified. Some participants found that the instructions could be unclear particularly when indicating different quantities in the recipe, leading to mistakes or inefficiencies during cooking.

Additionally, participants felt that they were completely trusting the recipe without any taste recommendations along the steps, making it hard to judge if the flavour was as expected. There were mixed feelings about portion sizes; some found them too large, leading to leftovers, while others found them insufficient. Issues were perceived with the storage of ingredients and their freshness, particularly if the kits were not used immediately upon delivery. Occasionally, users found that certain ingredients did not meet their quality expectations or wondered about the source of the products. Even with pre-measured ingredients, some users ended up with waste from components they did not use fully or did not prefer. Lastly, it was perceived that some recipes were more complex than anticipated, requiring more time and effort than expected.

Self-Reporting

The authors also engaged in self-reporting by using "cook and eat" meal kits themselves. This approach provided firsthand experience

and insights into the different stages of meal kit usage, from ordering to cooking. The self-reporting confirmed that the meal kits provided a comprehensive service that covered all aspects of meal preparation, from ingredient delivery to cooking instructions. The meals prepared were generally satisfying in terms of taste and variety, matching the expectations from the meal kit service. Authors noted that using meal kits introduced them to new ingredients and cooking techniques they had not previously used.

However, some tensions were identified. There were logistical issues with delivery times and conditions, which could affect the freshness and quality of the ingredients. Managing and disposing of the packaging materials was seen as overpacked, and the need for them was questioned. Additionally, there were occasional mismatches between the expected and actual contents of the kits, such as missing ingredients or incorrect quantities. When not selecting your order for the next week, the order will be selected automatically, leading to recipes that might not match the user's diet or food not planned to get delivered.

4.2 Analyses of the findings through Activity theory

Contradictions in the traditional grocery shopping

Traditional grocery shopping involves several tensions that motivate consumers to seek alternatives like meal kits. To prepare a fresh homemade meal, individuals require cooking skills, which many may lack, leading to repetitive meal choices and limited culinary variety. According to Hill and Maddock (2018), the lack of time and cooking skills can lead consumers to opt for convenience foods, which often discourage cooking from scratch and can result in a society lacking in food preparation skills (Hill & Maddock, 2018). Additionally, purchasing ingredients in larger quantities often results in food waste, as consumers struggle to use up all the items before they spoil. Another significant tension is the desire to try new recipes and ingredients without ending up with leftover ingredients that they don't know how to use in future meals. Meal kits can provide a structured approach to cooking, reducing the cognitive load associated with meal planning and preparation (Hill & Maddock, 2018). These tensions push consumers towards meal kits, which offer pre-measured ingredients and easy-to-follow recipes, potentially reducing food waste and making the cooking process more accessible, offering a meal plan, creative cooking experience, help in the cooking process, and quick and easy solutions, main attitudes among meal kit buyers according to Numerator Psychographics data (Schoenbauer, 2019).

Considering the interaction between the subject, the goal which in this case might be to have a fresh homemade meal, and the instrument, in this case, the system of traditional grocery shopping, is represented in Figure 2 the tensions that can lead the subject to try a new grocery system.

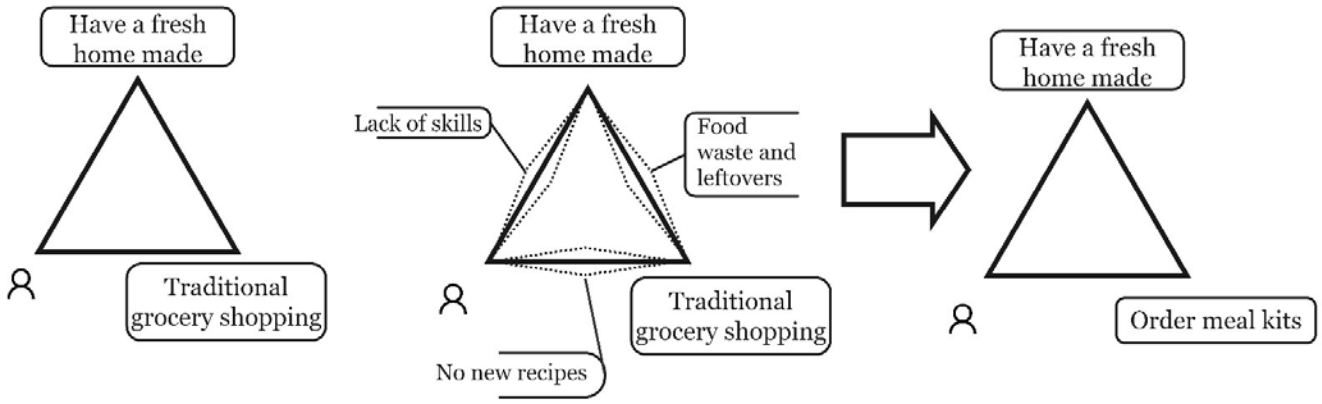

Figure 2 Tensions within traditional grocery shopping

Tertiary contradictions between systems

While meal kits offer a solution to these tensions within traditional grocery shopping by providing pre-measured ingredients and easy-to-follow recipes, they introduce their own set of contradictions. Traditional grocery shopping is generally cheaper, whereas meal kits, despite being more convenient, come at a higher cost. This creates a tertiary contradiction where consumers must balance the cost-effectiveness of traditional grocery shopping with the convenience offered by meal kits. This tension can lead to a combination of routines from both systems, promoting new behaviours. These tertiary contradictions are represented in Figure 3.

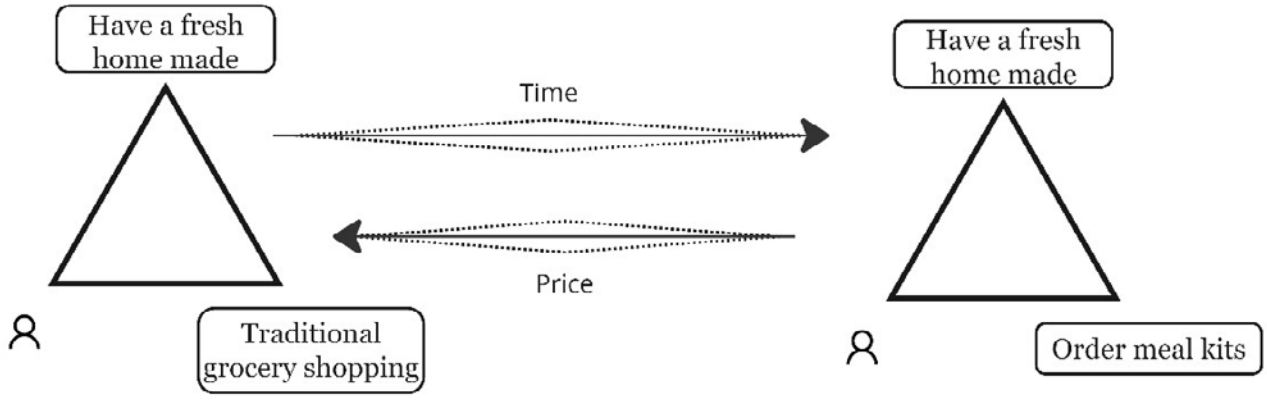

Figure 3 Tensions between traditional grocery shopping and meal kits

Considering the internalisation and externalisation principles of activity theory, consumers can internalise new knowledge about ingredients and recipes by incorporating meal kits. They then apply this knowledge when grocery shopping, potentially buying only the quantities needed and reducing waste. The variety of recipes tried through meal kits also could enable consumers to remember and retry these recipes, using ingredients more efficiently. Research indicates that meal kits can promote healthy dietary behaviours by improving cooking skills and confidence (Fraser et al., 2024), which can be translated into long-term use to more efficient and less wasteful traditional grocery shopping practices.

Additionally, after an internalisation process through the use of meal kits, consumers might no longer require them if we consider the tensions of cooking skills, recipe variety and food waste. By buying products in the exact quantities needed, learning through the use of the meal kits and avoiding food waste and unnecessary extra food, they might transition and depend on other types of systems, such as packaging-free systems. Therefore, meal kits could be used as a transition, helping consumers internalise quantities, products, and new recipes while allowing more flexibility in cooking. This could lead to more efficient grocery shopping and the potential use of packaging-free grocery systems, where consumers can reuse or return packaging and buy food products in bulk quantities, adjusting themselves the amount of ingredients they need in their households. However, the combination of the use of both ways of grocery shopping is outside the scope of this study and it has not been studied with the participants.

Tensions and harmonies within meal kits

The operational layer in activity theory focuses on the routine actions and conditions under which these actions are performed. In the context of meal kits, this layer includes the practical aspects of cooking skills, trying new recipes, and avoiding food waste and leftovers. Each of these objectives involves interacting with specific artefacts: meal kit recipes, meal kit food, and meal kit packaging.

Figure 3 illustrates the operational layer in activity theory for meal kits, showing the transition from traditional cooking to potential improvements. Initially, traditional grocery shopping and home cooking are associated with issues such as a lack of skills, the absence of new recipes, and food waste. The introduction of meal kits presented in the new approaches aims to address these issues by providing fresh home-cooked meals, improving cooking skills, introducing new recipes, and reducing food waste through pre-measured ingredients, bringing their own sets of harmonies and tensions.

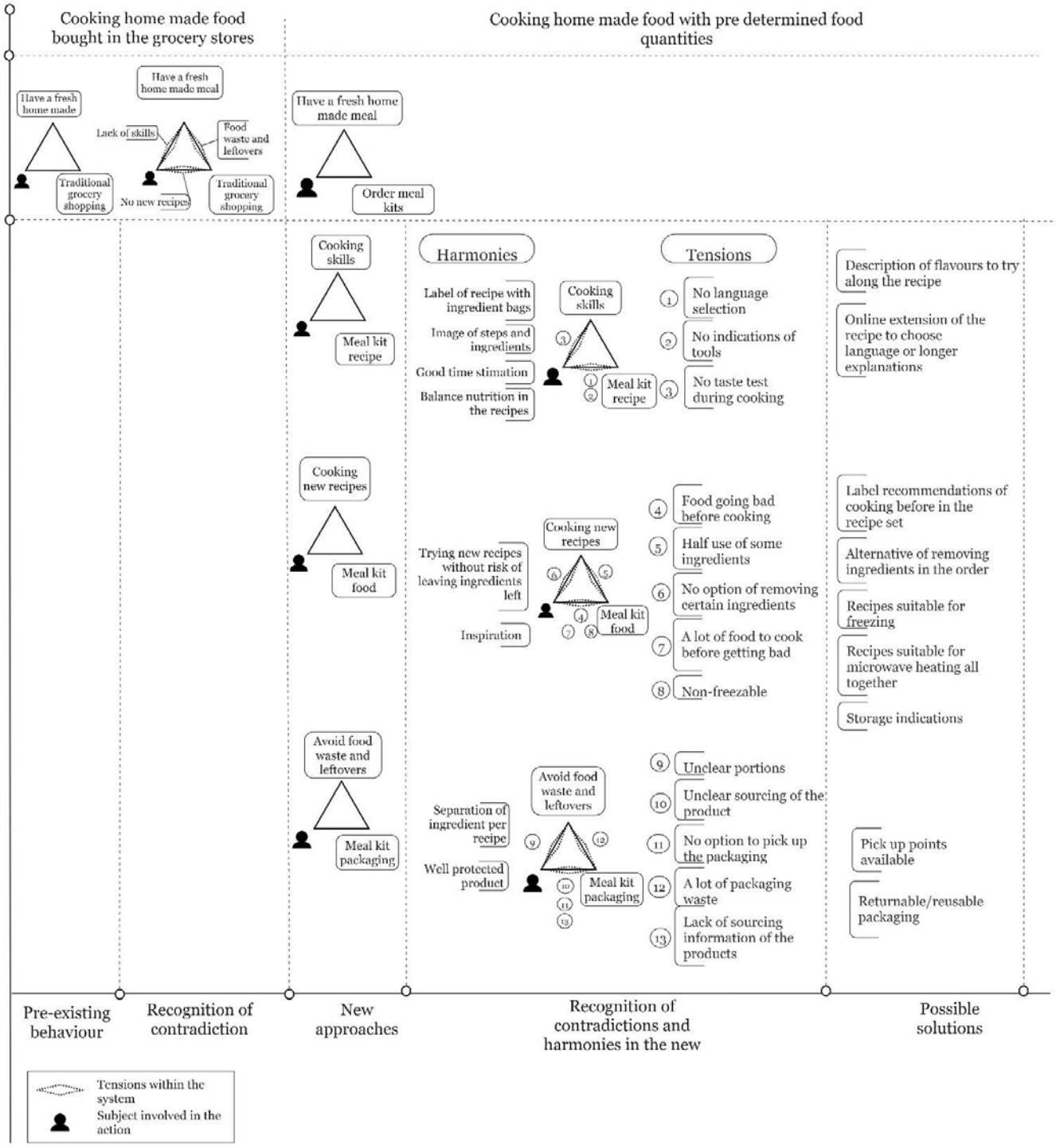

Figure 4 Layer analyses of the meal kit use

Cooking Skills

The artefact of meal kit recipes is important when developing cooking skills in this service. Users benefit from clear labelling of recipes with corresponding ingredient bags, which helps them easily identify what they need for each step. Additionally, the use of images for steps and ingredients provides visual guidance, making the cooking process more intuitive. Good time estimation within the recipes allows users to manage their time effectively while cooking, and balanced nutrition ensures that they are preparing healthy meals. However, there are several tensions present. The lack of language selection options limits accessibility for non-native speakers, and the absence of indications for necessary tools can confuse preparation. Furthermore, the lack of indications to conduct taste tests during cooking might lead to meals not meeting taste expectations.

Cooking New Recipes

When it comes to cooking new recipes, meal kit food serves as the key artefact. Meal kits inspire by offering new recipes that users might not have tried otherwise, encouraging culinary exploration and reducing waste by using exact quantities needed. This harmonises with the users' desire to try new dishes without the risk of leftover ingredients. However, there are significant tensions. Ingredients might go bad before they are used, leading to food waste. Additionally, some ingredients are only partially used, leaving users with half portions that are difficult to incorporate into other meals. The limited options for substituting or removing ingredients that users will not use in their recipe due to food restrictions or preferences are perceived as restrictive, and non-freezable recipes limit the ability to store leftovers for future use or to cook every recipe at the same time to avoid fresh food to get bad.

Avoiding Food Waste and Leftovers Ingredients

The artefact of meal kit packaging is relevant to the goal of avoiding food waste and managing leftovers. Separation of ingredients per recipe helps in organising and using ingredients efficiently, while well-protected products ensure that ingredients remain fresh until they are used. Despite these harmonies, excessive packaging is perceived during the observations as excessive waste. Portions can sometimes be unclear, leading to either insufficient or excess food. The sourcing of products can be unclear, raising concerns about sustainability and quality. Additionally, the lack of options for picking up is presented as inconvenient for some of the participants.

4.3 Proposed Solutions

To address these tensions, several potential solutions can be considered. Improving cooking skills through meal kit recipes, including language selection options and clear indications of necessary tools can enhance accessibility and ease of use. Providing tastetesting guidelines during cooking can help ensure that meals meet users' taste expectations.

For cooking new recipes with meal kit food, offering ingredient substitution options and recipes that can be frozen for later use can increase flexibility and reduce waste. Ensuring ingredients are fresh and appropriately portioned in all cases can also help minimise food waste. Showing indications of which recipe to cook first depending on the food's current condition could allow consumers to prioritise meal recipes which can get bad sooner and indications on storing for both after and before cooking would ensure better food handling.

To avoid food waste and manage leftovers with meal kit packaging, using returnable packaging can reduce the amount of packaging waste. This implementation could be used as an internalisation process for consumers to later on apply these routines to new habits making use of other types of packaging-free systems. According to recent research, shifting away from plastic packaging is challenging and requires significant changes within the value chain, but experts suggest that returnable packaging presents a feasible alternative to meal kit services (Sharda et al., 2024). Clear labelling of portion sizes and transparent sourcing information can help users make more informed decisions. Additionally, implementing a system for packaging pickup and using just one type of packaging material to facilitate recycling can further promote sustainable routines. Indications of storage before and after cooking could also ensure that food has lasted longer if needed.

By addressing these tensions and implementing these solutions, meal kit services can better align with consumer needs and sustainability goals, providing a more balanced and effective solution to the combination of grocery shopping and cooking challenges.

5. Discussion and conclusions

Meal kit services offer an alternative that allows for a reduction in food waste at different phases of the cooking process. By providing pre-measured ingredients and easy-to-follow recipes, they help users manage portions more effectively and reduce the likelihood of unused food going to waste. (Shin et al., 2024) However, while these services address some of the tensions found in traditional grocery shopping, they also introduce new tensions, particularly within the operational layer of meal kit usage.

The proposed solutions to address the tensions in the operational layer, such as language selection, tool indications, and taste testing guidelines, aim to improve user experience and the overall effectiveness of meal kits. Similarly, offering ingredient substitution options and recipes suitable for freezing can provide users with greater flexibility and reduce food waste. Implementing returnable packaging, easing recyclability, providing clear labelling of portion sizes and sourcing information are also other steps towards making meal kits more sustainable.

However, these modifications could potentially introduce quaternary contradictions within the production and logistics phase before the food reaches consumers. For instance, the implementation of returnable packaging may disrupt existing supply chains, bringing in more variety of packaging to the logistics. To understand the practicality of these proposed changes, it is necessary to analyse their impact on the current logistics systems. This involves evaluating how these solutions might affect existing harmonies and identifying any new tensions that may arise in the order preparation. Some other changes which might create this contradiction are the personalisation of meals, such as removing elements, the assessment of which recipe should be cooked first when food is not labelled with expiration dates or the implementation of returnable packaging.

To ensure the possibility of implementing these solutions, it is important to find a balance between maintaining current operational harmonies and removing the presented tensions. This might involve redesigning supply chains to accommodate more personalised recipes and developing new logistics strategies to handle the return of packaging or the assessment of the food.

Another important area to explore is the realistic context of combining meal kit usage with traditional grocery shopping. This hybrid approach can offer a more sustainable and cost-effective solution, balancing the strengths of both systems. Understanding how these two modes of grocery shopping interact can provide insights into new behavioural patterns and identify potential areas for improvement. For instance, consumers might use meal kits to learn about portion control and new recipes, and then apply this knowledge to traditional grocery shopping, further reducing food waste and enhancing meal planning efficiency.

By exploring the combination of meal kits and traditional grocery shopping, it is possible to identify synergies that can lead to more sustainable consumption practices. This involves examining how users adapt their routines when integrating both systems and assessing the long-term impact on their shopping and cooking behaviours, anticipating new possible services into the picture as packaging-free grocery alternatives. Following recent categorisation, if packaging-free alternatives are considered in "cook and eat" meal kits, these could fall into the category of businessowned packaging, picked up at home by the company, bringing new sustainability questions to the current packaging-free classification (Jiménez Romanillos et al., 2024), but easing consumers to transition to other types of packaging-free options, such as refill or repurpose choices. This move could also encourage consumers to a broader adoption of packaging-free alternatives in other areas of consumption, and promote new practices.

References

Cho, M., Bonn, M. A., Moon, S., & Chang, H. (Sean). (2020). Home chef meal kits: Product attributes, perceived value and repurchasing intentions the moderating effects of household configuration. Journal of Hospitality and Tourism Management, 45, 192–202. https://doi.org/10.1016/j.jhtm.2020.08.011

Choi, J., Lee, Y. M., & Jeon, H. (2023). Values of meal kit delivery services: A segmentbased approach. Journal of Foodservice Business Research, 0(0), 1–24. https://doi.org/10.1080/15378020.2023.2222646

Chu, W., Glad, W., & Wever, R. (2021). A meta-synthesis of the use of activity theory in design for sustainable behaviour. Design Science, 7, e17. https://doi.org/10.1017/dsj.2021.17

Engeström, Y. (2015). Learning by expanding: An activity-theoretical approach to developmental research (Second edition). Cambridge University Press.

Fraser, K., Johnson, B. J., Love, P., Spence, A., Laws, R., & Campbell, K. J. (2024). Mapping the behaviour change potential of meal kits to positively influence parental food literacy. Public Health Nutrition, 27(1), e16. https://doi.org/10.1017/S136898002300263X

Global Market Insights. (2023, October). Meal Kit Market Size, Share & Trend Analysis Report ID: GMI6842. Global Market Insights Inc. https://www.gminsights.com/industry-analysis/meal-kit-market

Hashim, N., & Jones, M. (2014). Activity Theory: A framework for qualitative analysis. Faculty of Commerce - Papers.

HelloFresh. (n.d.). HelloFresh. HelloFresh. Retrieved May 28, 2024, from https://www.hellofresh.se/_next/data/7.98.5303/landingpages/about/homepage.json

Hill, B., & Maddock, S. (2018). (No) time to cook: Promoting mealkits to the time-poor consumer (pp. 241–253). Elsevier. https://doi.org/10.1016/B978-0-08-102037- 1.00016-5

Jiménez Romanillos, E., Williams, H., & Wever, R. (2024). Unpacking Behaviours: A Literature Study and Research Agenda on Consumer Behaviour in PackagingFree Systems. Packaging Technology and Science, n/a(n/a). https://doi.org/10.1002/pts.2825

Kaptelinin, V. (2024). Activity Theory. Interaction Design Foundation—IxDF. https://www.interaction-design.org/literature/book/the-encyclopedia-of-humancomputer-interaction-2nd-ed

Leont'ev, A. N., & Hall, M. J. (1978). Activity, consciousness, and personality. https://www.semanticscholar.org/paper/Activity%2C-consciousness%2C-andpersonality-Leont%E2%80%99ev-Hall/846dcce4ea934d56c452cc2ae6a118f916d8902b

Linas Matkasse. (n.d.). Retrieved May 28, 2024, from https://www.linasmatkasse.se/, https://www.linasmatkasse.se/

Marley Spoon. (n.d.). Marley Spoon. Retrieved May 28, 2024, from https://marleyspoon.com/

Moir, J. (2021). Making a meal of it: International Academic Conference on Management, Economics and Marketing. Proceedings of IAC in Vienna 2021, 71–77.

Schoenbauer, A. (2019). Meal Kit Market: The Whos and Whys Behind Meal Kit Buys. Numerator. https://www.numerator.com/resources/blog/whos-and-whysbehind-meal-kit-buys/

Sharda, N., Krampe, C., & Ingenbleek, P. T. M. (2024). HelloFresh: Transitioning to a plastic-free future? International Food and Agribusiness Management Review, 27(2), 378–396. https://doi.org/10.22434/ifamr2023.0068

Shin, H., Jeon, J., & (Lena) Jeong, E. (2024). Investigating consumers' perceived benefits and risks of meal-kit delivery service. International Journal of Hospitality Management, 119, 103715. https://doi.org/10.1016/j.ijhm.2024.103715

Vygotsky, L. S. (1978). Mind in Society: Development of Higher Psychological Processes. Harvard University Press. https://doi.org/10.2307/j.ctvjf9vz4

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RESEARCH ON DAILY SPATIAL PRACTICES IN TRADITIONAL CHINESE VILLAGES: A CASE STUDY OF FUJIAN TULOU VILLAGES

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ABSTRACT | In 2008, the Fujian Tulou was officially inscribed on the World Heritage List, becoming China's 36th World Heritage site. Since then, as a form of residential and daily life architecture, the Tulou has been maintained to a certain extent under protection and unified planning. However, the daily "spatial practices" of Tulou residents in their living spaces reveal that the existing spatial planning fails to fully meet the diverse needs of its users. This phenomenon warrants in-depth investigation. This study is based on the theory of everyday life practices by French scholar Michel de Certeau. Through field investigations and documentation, it examines the traditional villages of the Tulou in Yongding District, Fujian Province, China. The research focuses on analyzing how Tulou residents adapt and modify their daily living spaces to meet their needs under top-down spatial restrictions and management planning. The findings show that faced with the top-down spatial restrictions set by government authorities and designers, Tulou residents exhibit high flexibility and creativity. They engage in a series of bottom-up spatial practices to adapt and optimize their living environment. These adaptive design strategies include: Spatial Morphology Expansion: Extending and renovating the exterior and courtyards of the Tulou to create additional usable space. Spatial Function Integration: Merging multiple functions within a single space to better utilize limited resources. Spatial Production Methods: Creating new spaces that meet modern needs by replicating successful spatial models and integrating different functions. The study concludes that the practical wisdom of Tulou residents in their daily living spaces can be transformed into valuable design resources. This also provides a basis for higher-level planners to modify design recommendations, addressing the shortcomings of standardized planning. This research offers a new perspective on the spatial practices of traditional villages.

KEYWORDS | SPATIAL PRACTICES, TRADITIONAL VILLAGES, FUJIAN TULOU, PRODUCTION OF SPACE

1. Introduction

Over the past 40 years of urbanization in China, villages have long been regarded as subordinate to cities and have not received sufficient attention. To change this perception of urban-rural relations and narrow the urban-rural gap, the Ministry of Housing and Urban-Rural Development of China began leading the selection of "Traditional Chinese Villages" in 2012. A series of policies and funding initiatives were subsequently introduced to curb the decline of traditional villages (Ministry of Housing & Urban-Rural Development of the PRC, 2012). In 2018, the Chinese government introduced the "Rural Revitalization Strategy Plan," marking the beginning of a development era driven by both rural revitalization and new urbanization (Central People's Government of the PRC, 2018). With the implementation of this policy, an increasing number of traditional villages have not only emphasized the protection and inheritance of cultural heritage but have also gradually shifted their development focus to industrial prosperity and ecological livability.

Endowed with heritage values and emotional significance as "places carrying traditional culture" and "homesickness spots," the rural tourism industry has become a priority choice for many traditional villages (An, et al., 2022). Simultaneously, tourism development has brought a new wave of spatial development, design, utilization, and transformation. Power and capital entities continuously attract resources, technologies, and other elements into rural areas, while also introducing phenomena such as planning and constructive destruction, unfair distribution of interests, and spatial alienation, including the displacement of spatial subjects (Cao, et al, 2018). In this process, the role of villagers is noteworthy. Lefebvre and de Certeau emphasize that ordinary people and daily life, seemingly mundane, can drive the production of space through implicit or explicit forms of resistance (Sun & Zhou, 2014).

Against this backdrop, this study selects Hongkeng Village in Yongding District, Longyan City, Fujian Province—a representative Hakka village—as the research subject. Using an

empirical approach, the study explores how residents, through their daily lives, resist the spatial representations manipulated by the government and capital entities, thereby fostering corresponding spatial practices and demonstrating the creativity of daily life. It is hoped that this research will provide a flexible planning design basis for higher-level planners.

2. Theoretical Foundation

2.1 Interpretation of Spatial Operations: The Theory of the Production of Space

In 1970, Henri Lefebvre proposed the theory of the production of space, emphasizing that "space is produced through purposeful social practice" and is a product of social relations, focusing on the reproduction of implicit social relations. This theory applies to exploring complex factors such as the operations of power and capital and the transformation of social relations during the transition of traditional villages (Duan et al., 2023). Lefebvre classified space into three types: "Physical Space"—tangible and measurable; "Mental Space"—constructed by thoughts, consciousness, and ideas; and "Social Space"—formed by social factors such as relationships, social organization, and power structures.

Lefebvre later developed these three concepts into the "trialectics of spatiality," positing that space is constituted by "spatial practice," "representations of space," and "representational spaces." This framework provides an analytical tool for understanding space production and reproduction at different levels. In traditional villages, spatial practice reflects human material practices and their outcomes, forming external physical space composed of the village's layout, buildings, and public facilities. Representations of space refer to the abstract space created by planners and engineers, who convert knowledge into a reflection of production relations and order. This space is envisioned, outlined, and constructed, with ideology being re-coded, translated, and received. Representational spaces are the lived spaces, tied to the complexity and uncertainty of daily life, encompassing residents' experiences. These spaces are constrained by representations but, due to diverse individual needs, often require adjustments and adaptations (Lefebvre, 2014).

The theory elucidates the dialectical analysis of the three types of space, where design, domination, and resistance are constantly in play. This continuous generation of contradictions drives the evolution of daily practices among villagers, shaping and reconstructing their living spaces.

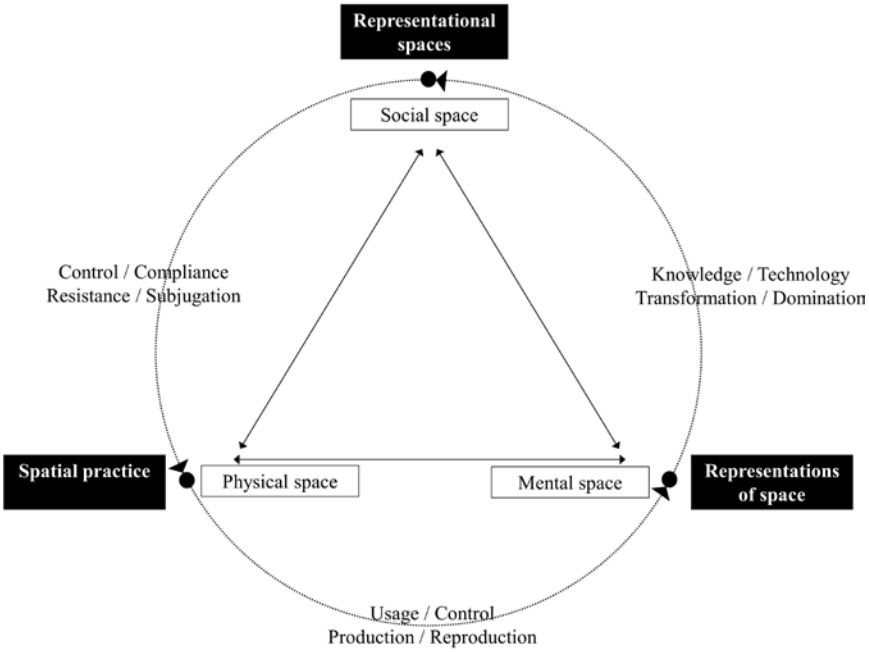

Figure 1. Theoretical Framework of the Production of Space (Source: Drawn by authors)

2.2 Weapons of the Weak: Individual Daily Life Practices

Lefebvre's "trialectics of spatiality" provides a macro-level explanation of the mechanisms and practices of spatial operations, serving as a practical tool for spatial analysis. In line with Lefebvre's discussion on the resistance inherent in representational spaces, contemporary French sociologist Michel de Certeau offers a micro-level perspective by elucidating the specific behavioral strategies of space users, which forms the basis of this study's viewpoint. De Certeau posits that, in the face of alienation brought about by dominant discourses such as capital and political power, the weapons of ordinary individuals, as the weaker party, are embedded in the seemingly insignificant, mundane practices of everyday life (Certeau, 1984).

De Certeau identifies four main aspects of individual daily life practices. First is resistance: ordinary people employ "tactics" as indirect methods within the dominant's space, seeking opportunities for minor yet clever resistance to counter top-down forces and ideologies (strategies). Second is spatial practices: the public engages in creative production through fluid and informal practices, transforming the symbolic and institutionalized spaces provided by ruling elites into alternative forms. Third is making do: the resistance of the weak is not radical revolution or complete overthrow but minor resistance through recombining, modifying, and utilizing products, forming a flexible network that counters the dominant

economic order. Fourth is silent production: consumers engage in creative secondary production through selection, rewriting, and subversion, bestowing new meanings to texts and products and forming unique cultural production methods (Certeau, 1984).

The theories of Lefebvre and de Certeau highlight the rich creativity and spatial shaping ability of ordinary people, who drive the production of space through implicit and explicit forms of resistance. In tourism-oriented villages, villagers use their daily life creativity to reinterpret and rewrite the "representations of space" designed by the government and capital, ultimately constructing the "representational spaces" of traditional villages (Qin & Leung, 2021).

3. Overview of the Case Study Site and Research Methods

This study selects Hongkeng Village in Yongding District, Longyan City, Fujian Province as the case study site. The village is located in the southwestern region of Fujian Province, surrounded by mountains on the east, west, and north sides, with Liulian Village to the south. The village is built along both banks of the Hongchuan River in a north-south direction, forming a strip layout. Due to its elongated shape, the village is customarily divided into two parts, Upper Village (the northern village) and Lower Village (the southern village), with the Lin Family Ancestral Hall as the central point. The village entrance is on the south side. Formed during the Ming Dynasty, Hongkeng Village is home to many well-preserved Tulou buildings, representing a typical Hakka Tulou village. After being listed as a World Heritage Site in 2008, Hongkeng Village adopted a development model that combines heritage protection with tourism development, leading to rapid growth in the tourism industry (Liu, 2022). Concurrently, the village has faced issues such as residential spaces being converted into commercial spaces and challenges in preserving authenticity, leading to subtle changes in villagers' sentiments (Yan, 2015). Therefore, selecting Hongkeng Village as a case study for examining villagers' daily life practices is quite representative.

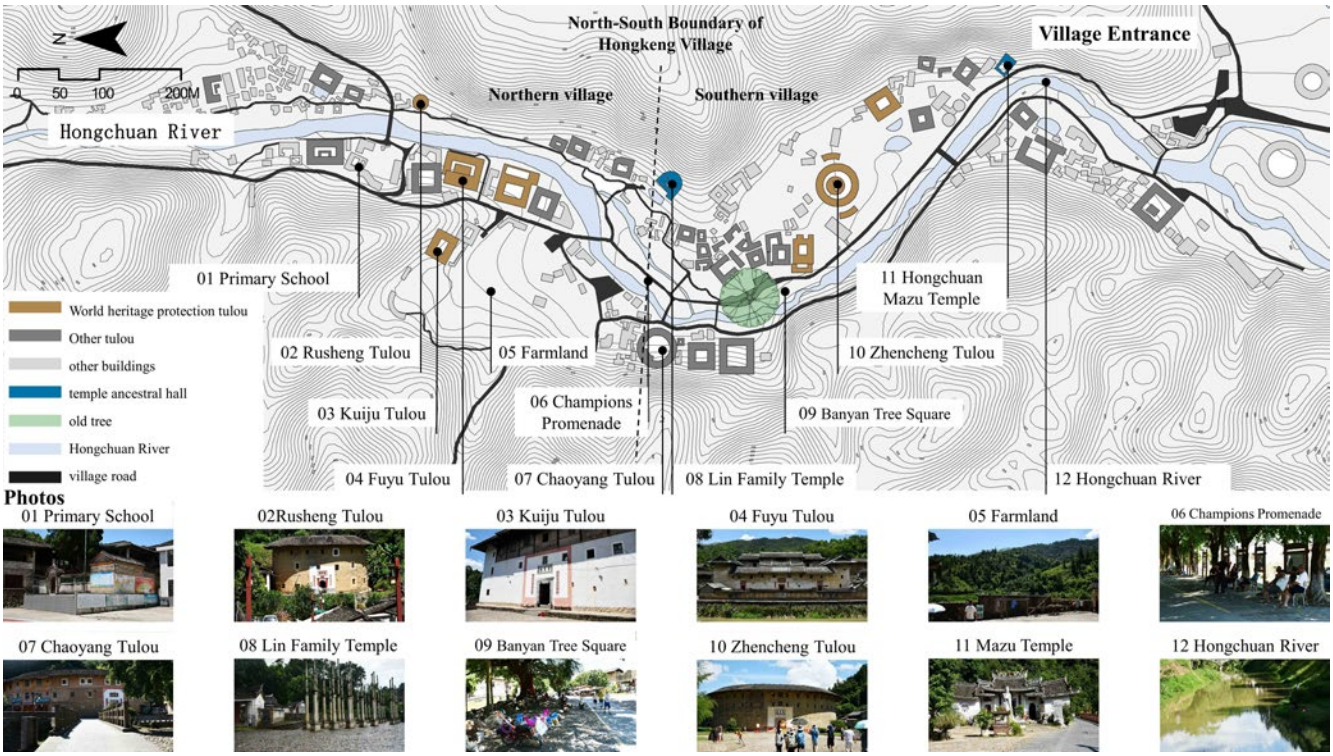

Figure 2 Plan and Current Overview of Hongkeng Village (Source: Drawn by authors)

The most famous structures in Hongkeng Village are the Tulou cluster, represented by the "Prince of Tulou," Zhencheng Building. Zhencheng Building is a four-story circular Tulou, currently housing around 40 residents. The entire ground floor has been converted into retail shops, and daily performances take place outside, making it a "front-stage space" in the eyes of the villagers. Fuyu Building, a courtyard-style Tulou, has had portions of its interior converted into a hotel and restaurant to meet tourism demands. Hongchuan Tianhou Temple, located at the village entrance, serves as an important site for villagers to worship Mazu during the Lunar New Year, while the Lin Family Ancestral Hall at the village center is the venue for ancestral worship, holding the collective memory of the villagers. Banyan Tree Square, also located at the village center, is the most popular gathering place for villagers, often used for resting and socializing.

Today, many of the Tulou buildings in Hongkeng Village are listed as cultural heritage sites. Although these buildings still serve as residential units, their renovation and modification require strict approval, and construction activities throughout the village are subject to stringent regulations and limitations. It can be said that the current state of Hongkeng Village is a product of top-down governance, with phenomena in its daily spatial practices aligning with de Certeau's theory of everyday life practices. Driven by their own developmental needs, villagers consciously engage in adaptive or resistant daily spatial practices, grounded in their own requirements and the limited spatial resources available.

This study conducted two field visits to Hongkeng Village in August 2022 and December 2023. Through non-participant observation and interviews, it gathered information on the distribution of Tulou, farmland, public spaces, and tourism facilities, as well as the living conditions of the residents. Adopting the "thick description" method, the research analyzed the village's daily spatial practices from two perspectives: "top-down constraints" and "bottom-up adaptations," revealing the underlying logic of villagers' daily lives.

4. Top-Down Spatial Shaping

4.1 Definition of Village Environmental Style

Tourism development is closely integrated with management and conservation efforts. To protect and reutilize these architectural heritages, the Yongding government in Fujian Province has delineated a World Cultural Heritage core protection area, a buffer zone, and key protected individual buildings. Based on these architectural heritages, they have designed tourist routes, and the areas along these routes have undergone comprehensive environmental renovation. Traditional agricultural production has been largely abandoned: only a small piece of farmland near Kuiju Building is preserved for tourism promotion, while the rest has been converted into construction or landscaped green spaces. Chickens and ducks are no longer raised inside the Tulou, sacrificing some conveniences of daily life. For example, the vegetable garden in front of Zhencheng Building, once used by villagers for production, has been transformed into an open square with a pebble-paved surface. This large, empty square not only accentuates the majestic image of Zhencheng Building but also facilitates daily performances such as "Tulou Drum Beating" and "Hakka Music."

Figure 3: New Waterwheel and Open Square (Source: Photo by authors)

Additionally, bamboo groves and ponds have been installed on one side of the square, transforming the ordinary, life-oriented village scene into a "beautiful village" that aligns with the aesthetic values of tourist landscapes. To restore the ancient charm of the village, self-built houses are encouraged to be painted in uniform colors. The exterior wall finishing materials are either yellow face bricks or paint, and exposed components of steel-structured canopies are painted with wood-like finishes to maintain harmony with the overall village atmosphere. The government and capital, as dominant forces, have engaged in the production of space over the original village space, realizing their envisioned "representation of space" for a "heritage tourism site." This management extends into subsequent administrative efforts. For instance, while non-protected buildings within the heritage site are allowed to be renovated or rebuilt in their original form, traditional craftsmanship and materials must be used. Their appearance, size, color, and height must be consistent with the protected buildings, with a height limit of four stories or 12 meters.

4.2 Relocation of Residential Space

The development of tourism has brought benefits to the villagers but also created a series of problems, with housing issues being foremost. According to the "Fujian Province Traditional Architectural Style Protection Regulations" and the "Yongding District Hukeng Town Hukeng Village, Hongkeng Village, Liulian Village Village Plan (2021-2035)," to protect the authenticity and integrity of the World Cultural Heritage site, no new housing construction projects are allowed in the core protection area of Hongkeng Village except for necessary municipal infrastructure (Standing Committee of the Fujian Provincial People's Congress, 2021). This makes residential space within the village very limited. Some villagers choose to continue living in the Tulou where their ancestors have long resided. For Tulou that are not cultural relics, they can improve living conditions by adding necessary spaces (such as kitchens and bathrooms) in the central courtyard. However, for protected buildings like Zhencheng Building, villagers have to live within the limited space available. Other villagers choose to live outside the village and convert the ground floor of the Tulou in Hongkeng Village into small shops or tea rooms, operating during the day and returning to rest outside the village at night. In such cases, the concept of the Tulou as "home" is gradually being diluted.

To address this issue, the Yongding government has planned an area outside the village as a new settlement to accommodate villagers facing residential shortages in Hongkeng Village. However, this plan is generally not accepted by the local villagers for two main reasons: first, living outside the scenic area means they cannot directly benefit from the tourism activities, and villagers are likely to be marginalized by tourism companies, unable to participate in tourism development and thus losing vested interests. Second, daily commuting between inside and outside the scenic area brings

many inconveniences, such as transportation and ticketing, which increases living costs for villagers who depend on tourists. Therefore, local residents are reluctant to relocate outside the scenic area, making the housing issue a challenge for both residents and tourism development companies.

4.3 Non-Homogeneous Development of Village Space

Hongkeng Village is spread along both banks of the Hongchuan River in a north-south direction, forming a narrow, elongated plan. Local villagers customarily divide the village into Upper Village and Lower Village, with the Lin Family Ancestral Hall as the central point. This was originally a geographical division, but the intervention of the tourism industry has created a division in consumption space. Due to the designated tourist routes within the village, Hongkeng Village has gradually formed a core area (main scenic area), a secondary core area (secondary scenic area), and a marginal area (Upper Village with minimal tourism development).

Tourism development within the village primarily expands from Zhencheng Building as the core towards both ends. The area around Zhencheng Building is rich in tourism facilities, including high-end homestays, a Tulou bookstore, a Hakka brewing culture museum, and a series of street stalls. The Banyan Tree Square north of Zhencheng Building is not only a place for tourists to enjoy the water but also a core public space for villagers to gather, rest, and sell goods.

With the combined efforts of the government, capital, and tourists, Zhencheng Building and its surrounding Tulou buildings have become the consumption core space of the village, rich in facilities and bustling with people. In contrast, the Upper Village north of the Lin Family Ancestral Hall has not seen significant changes in its internal form, infrastructure, or ecological environment since the early stages of tourism development. The Upper Village receives few tourists due to two main reasons: first, it lacks historically significant Tulou with high viewing value, making it less attractive to tourists; second, tourists have limited time, and reaching the Upper Village from the southern village entrance requires considerable time and effort. As a result, it has become a "marginal area" in tourism development, with only a few villagers participating in tourism activities, while most engage in external labor or agricultural production. Compared to the Lower Village, the Upper Village has few tourism facilities, and public facilities for villagers, such as pavilions and corridors, are also relatively scarce.

The serene pastoral landscape of the Upper Village contrasts sharply with the bustling scenes of tourists, villagers' greetings, guides' explanations, and various performances in front of Zhencheng Building in the Lower Village. Upper Village villagers, unable to benefit from tourism, face construction restrictions and express dissatisfaction with this phenomenon. The spatial division caused by tourism has disrupted the originally harmonious and unified atmosphere of Hongkeng Village.

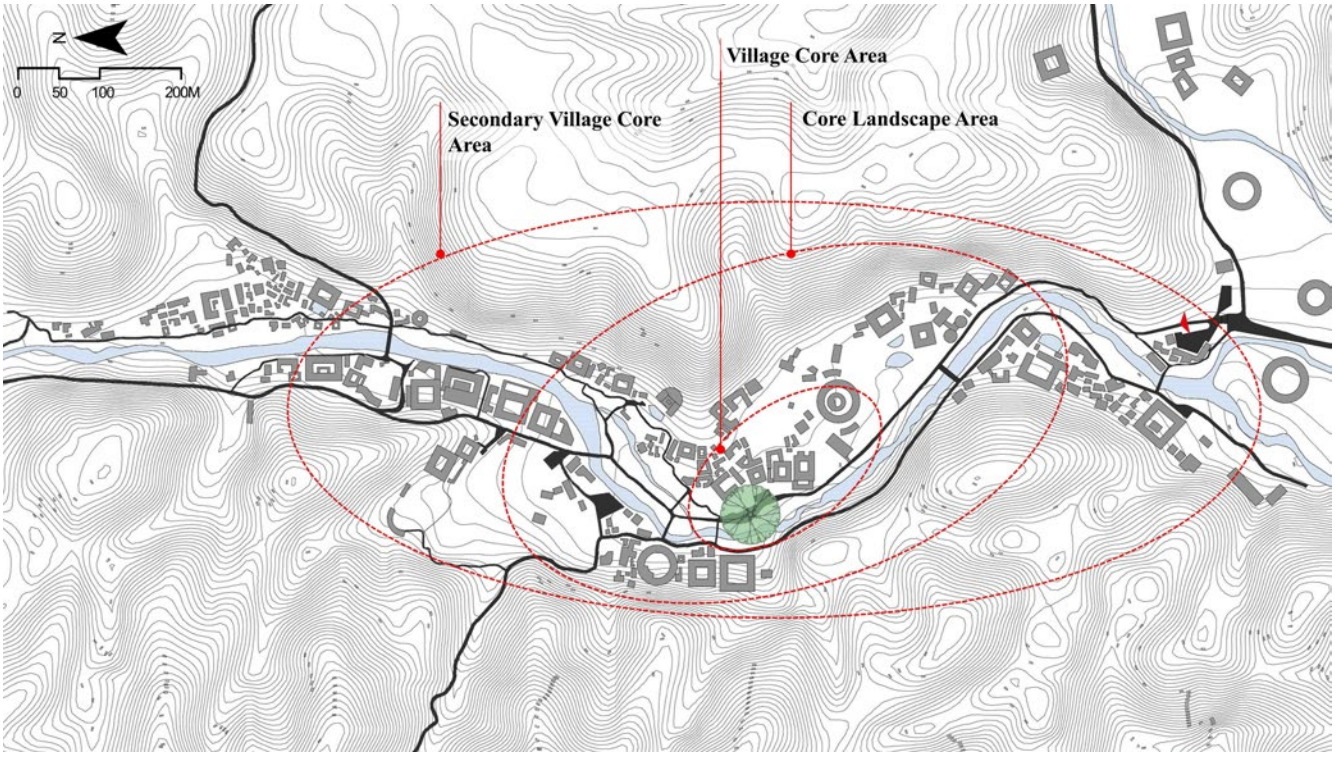

Figure 4: Non-Homogeneous Development of Village Space (Source: Drawn by authors)

5. Bottom-Up Daily Life Practices

5.1 Cooperation and Participation

In Yongding Tulou, the cultural self-awareness of villagers is reflected in their renewed understanding of Tulou culture and changes in their behavior. Villagers have come to realize that Tulou culture is not only a part of their daily customs but also a means of livelihood. This shift in awareness has motivated them to actively participate in the spatial production of landscape symbols. Specifically, some villagers have transitioned from farmers to full-time or part-time performers in live cultural shows about Tulou. Many female villagers have obtained tour guide certifications and become full-time guides, contributing to the shaping of Hongkeng Village's "front-stage space."

Additionally, villagers have responded to government initiatives by maintaining the architectural features of the Tulou, renovating facilities, and transforming them into homestays. Houses along the main street have been converted into restaurants, small shops, and specialty stores to increase household income. The tobacco industry in Hongkeng Village has a long history, with several shops still selling homemade tobacco and demonstrating traditional tobacco-making techniques to tourists. In their daily lives, villagers actively engage in cultural construction through their physical actions, which involve not only preserving traditional architectural features but also learning and applying tourism-related skills. Those directly involved in the tourism industry participate by providing goods and services, while others gradually adapt to new lifestyles and production habits through indirect exposure.

Figure 5: Villagers Participating in Cultural Performances and Spatial Expansion (Source: Photo by authors)

5.2 Transformation of Spatial Functions

1. Embedding

Embedding new functions within existing spaces, such as business functions, is the most common form of spatial conformity. For example, the Banyan Tree Square opposite Fuxing Building, which features a 600-year-old banyan tree considered sacred by the local Hakka people. Beneath the tree is a small temple dedicated to the Earth God, frequently visited by villagers for worship. This originally singular worship space is also the most popular resting spot for villagers in summer, where they cool off and chat. Due to its prime location along the tourist route, it also serves as a site where elderly residents of Fuxing Building set up small stalls to sell local delicacies. The embedding of leisure and sales functions has transformed this site from a place of worship into the village's most popular spot.

2. Coexistence

Faced with the strategic discipline of capital and power under tourism industry intervention, some villagers do not resist but adopt a "making do" approach. They avoid direct confrontation but remain within the space, using covert production to subtly infiltrate their differences. Coexistence is a behavioral pattern that emerges when the planning party's spatial use and the villagers' needs do not conflict, with both parties using the same space at different times. Despite large-scale chicken and duck farming no longer being permitted in Hongkeng Village, ducks can still be seen in the Upper Village's river. Conversations with villagers reveal that this is partly because their Tulou are not protected buildings and thus face fewer restrictions, and partly because the area is relatively remote and less frequented by tourists, allowing them to avoid busy tourist periods.

3. Derivation

Spatial derivation aligns with de Certeau's concept of "silent production," referring to newly created spatial functions and activities due to industrial intervention. Villagers do not just passively accept changes; they creatively engage in "secondary production" through selection, rewriting, and subversion. This silent production occurs quietly in daily life. For example, the open space at the south entrance of Hongkeng Village, after being modified by villagers with soft lighting and beautiful water features, has gradually become a popular spot for collective dancing. This once forgotten, desolate place has been revitalized into a lively gathering spot, demonstrating how regulated industrial space and villagers' daily practices jointly create new places.

Figure 6: Tulou Characteristic Elements and Banyan Tree Square (Source: Photo by authors)

5.3 Expansion of Spatial Form

1. Expansion for Functional Needs

The most direct spatial reproduction by villagers is evident in their modifications to the Tulou, which can be categorized into three major types. First are modifications driven by functional needs. Many Tulou buildings make use of courtyard space to construct auxiliary rooms, such as kitchens and bathrooms, or expand existing structures based on practical requirements. Second are modifications for commercial purposes. Many Tulou buildings have been transformed into homestays or shops, with some residents hanging shop signs outside to attract tourists. To increase natural light, some villagers have added new windows or modified existing ones. Finally, there are modifications utilizing existing conditions. In cases where parts of old Tulou have deteriorated, villagers use the remaining earthen walls as a foundation for new buildings. This approach not only reduces construction costs but also preserves traces of the Tulou's historical character.

2. Creating New Landmarks

To avoid the homogenization of Tulou landscapes, residents of each Tulou strive to uncover unique features and form distinct cultural landmarks. For example, Yucheng Building has undergone a series of meticulous modifications, successfully transforming into the "Fragrant Wine House," a landmark showcasing Hakka rice wine culture. Outside the building, a group of sculptures vividly depicts the traditional winemaking process, while inside, the focal point is the arrangement of large wine jars, creating a strong visual impact and reinforcing the winemaking theme. The ground floor has been specially designated as a winemaking workshop, including functional spaces such as a "rice steaming room" and a "fermentation room," providing visitors with the opportunity to observe and experience traditional winemaking techniques. Red lanterns not only provide illumination but also add a festive atmosphere, aligning with tourists' expectations of local culture. The preservation and renewal of Yucheng Building follows a strategy of "small-scale modifications with strong cultural emphasis," ensuring that the building's historical and cultural value is sustained within modern tourism development. This practice of local representation through subtle adjustments and cultural integration demonstrates the creativity of Hongkeng villagers in resisting the homogenization of space.

6. Discussion

6.1 From Structured to Lived Space: The Redefinition of Village Centers

Before the intervention of the tourism industry, the spatial structure of Hongkeng Village was centered around the ancestral hall. The Lin Family Ancestral Hall, located at the village's core, served as a site for ancestral worship and important ceremonies, reflecting the strong clan culture and community cohesion. However, with the advent of tourism, the village's spatial structure underwent significant changes. Zhencheng Building and Banyan Tree Square gradually replaced the ancestral hall as the new focal points of the village. This shift not only represents a physical reconfiguration of space but also signals a deeper transformation in economic activities and social relations, as the villagers' daily lives have shifted from being primarily centered on clan-based activities to those driven by economic pursuits. Zhencheng Building, with its unique historical and architectural value, has become a symbol of tourism in Hongkeng Village, attracting large numbers of visitors. Meanwhile, Banyan Tree Square, with its natural environment and accessibility, has become the main gathering place for both villagers and tourists.

While the ancestral hall continues to fulfill its traditional clan functions, its social role has weakened; it is no longer the primary space for villagers' daily interactions and decision-making, but rather a symbolic reminder of history and culture. The reconfiguration of

Hongkeng Village's center reveals a shift in lifestyle and the repositioning of spatial priorities driven by economic forces.

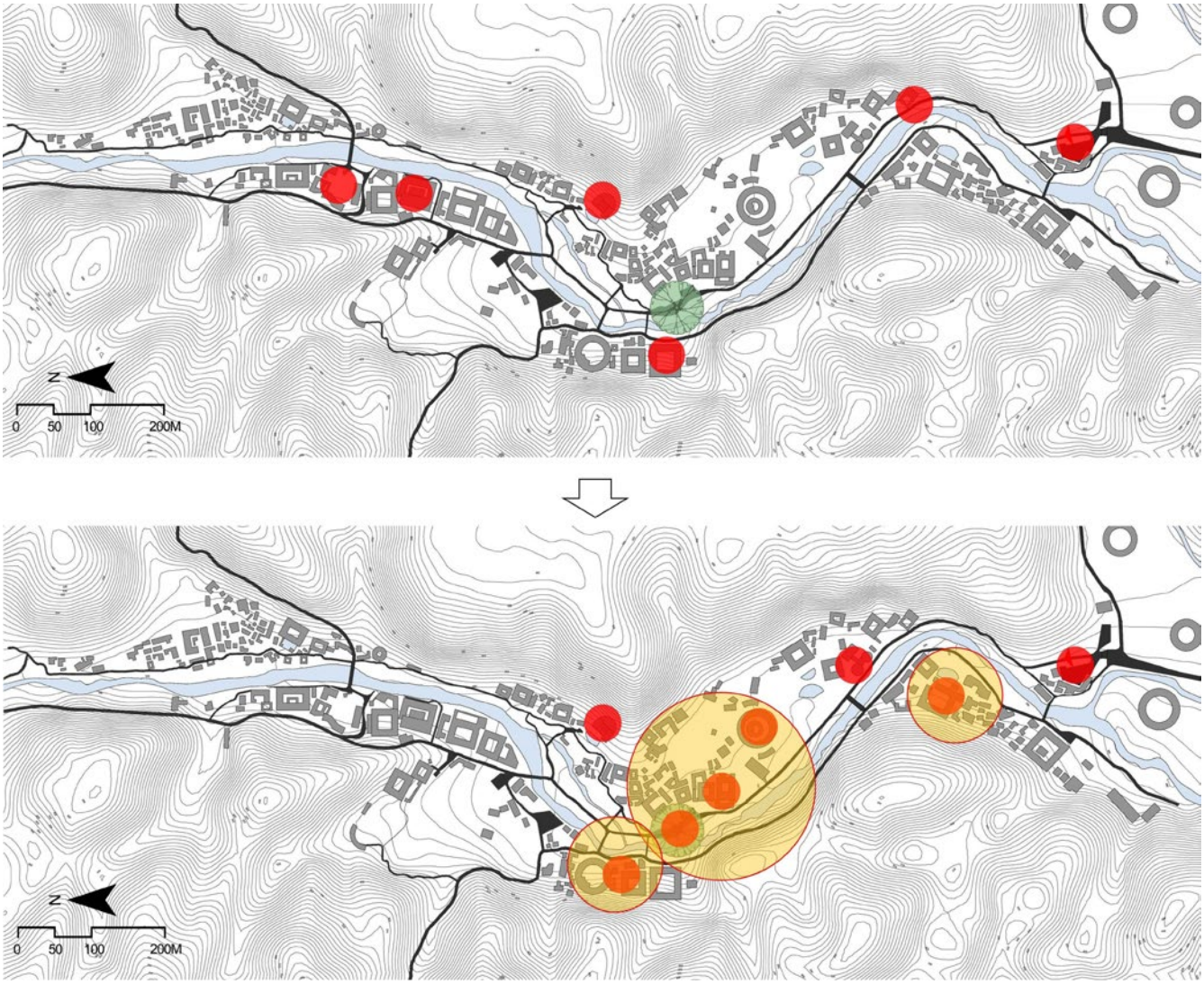

Figure 7: Reconstruction of Village Spatial Order (Source: Drawn by authors)

In rural development, what resonates with people are the traces of time and the authenticity of daily life. Therefore, in tourism development, planners should focus on restoring the essence of everyday life by fostering emotional connections and creating lived landscapes. These landscapes should not only meet the practical needs of villagers but also combine functionality with aesthetic appeal, deeply integrating everyday living spaces with tourism spaces. This approach can enhance cultural appeal and achieve a balance between cultural preservation and economic benefits. Additionally, improving the quality of public spaces is crucial. The case of Hongkeng Village demonstrates that public spaces should serve multiple functions, catering to both villagers

and tourists. Planners should emphasize the integration of natural and cultural elements, optimizing existing resources such as ancient trees and streams, improving pathways and rest areas, and ultimately enhancing the quality of life for villagers while providing visitors with an authentic rural experience.

6.2 The Scenic Transformation of Villages and the Alienation of Vernacular Architecture

With the rise of tourism, the architecture and spaces in Hongkeng Village have increasingly taken on a scenic, tourist-oriented character, detached from their original social context. In response to tourist demands, both the government and the market have introduced decorative elements unrelated to the village's traditional life, such as red lanterns and imitation ancient waterwheels. These additions have gradually transformed the core areas of the village into standardized tourist attractions, with the large open square in front of Zhencheng Building serving as a typical example of this scenic transformation. This approach to spatial development has directly influenced the villagers' architectural practices and perceptions.

Following the success of the "Duluo" homestay model, many villagers began to imitate these designs, hoping to attract tourists by modifying their Tulou. However, this imitation has led to the alienation of vernacular architecture, resulting in spaces that are increasingly symbolic and homogenized. One prominent example is the widespread adoption of the "wooden house" style. Some homestays have incorporated traditional wooden elements from the Tulou, particularly in the flooring and wall decor, in an attempt to create a personalized aesthetic. However, excessive imitation and replication have caused many Tulou in Hongkeng Village to lose their original vernacular characteristics, resulting in a uniform "wooden house" style that lacks architectural diversity. This homogenization and symbolic design erode the cultural richness of the village, making it difficult for visitors to experience authentic local culture. Meanwhile, the cultural depth of the area is being gradually diminished by the forces of commercialization. Over-reliance on symbolic design not only threatens the integrity of cultural heritage but also allows market forces to replace traditional lifestyles and cultural practices.

In response, the government should shift from being the primary driver to acting as a facilitator, establishing diverse design guidelines that encourage villagers to incorporate local architectural styles and culture into their homestays and commercial buildings, avoiding blind imitation. By providing professional guidance, the government can support villagers in innovating while preserving local characteristics. Additionally, it is crucial to promote education and cultural awareness, guiding tourism operators and visitors to respect local culture, reducing superficial design trends, and maintaining the cultural depth and uniqueness of vernacular architecture.

6.3 The Decline and Persistence of Family and Religious Spaces

Nearly every Tulou in Yongding has a Guanyin Hall, located on the central axis directly facing the main entrance, where families pray for peace. To this day, residents continue to conduct worship rituals on the first and fifteenth days of the lunar month. Historically, the Guanyin Hall served as a dedicated space solely for religious practices, without merging with other functional spaces. However, with the rise of mixed residential and commercial lifestyles, the religious function of these spaces has increasingly merged with everyday activities. For example, the Guanyin Hall in Kuiju Building now serves as a storage area and has been furnished with tea tables and benches, transforming it into a space for relaxation and entertaining guests. Similarly, the Guanyin Hall in Yucheng Building incorporates elements of alcohol culture into its decor, reflecting a trend towards commercialization. Despite these changes, the villagers of Hongkeng remain steadfast in their traditions. While the significance of religious spaces has diminished, they remain a crucial part of village life. Even as these spaces are compressed and integrated with daily activities, losing their independence and centrality, they are preserved, reflecting the deep-rooted ancestor worship and the villagers' "unconscious resistance" to the pressures of commercialization.

In addition to the transformation of religious spaces, intimate family spaces within the Tulou are also shrinking. Driven by economic interests, portions of residential spaces have been converted into homestays, where tourists occupy the main areas of the house, while villagers, as service providers, retreat to secondary spaces. This shift results in a phenomenon where "self-use space" gives way to "other-use space." For instance, the side courtyard of Zhencheng Building, originally a space for family relaxation, has now been repurposed into a tea-serving area for guests, significantly reducing family interactions. The Tulou, once a vital living space for familial and social connections, offered residents a sense of belonging. However, this concept of "home" is gradually fading as the Tulou becomes a commercialized space.

The preservation of religious and family spaces remains crucial for maintaining residents' sense of identity. To address these challenges, village administrators can revive traditional rituals through cultural or festive activities, allowing these spaces to regain their significance in daily village life. Furthermore, villagers can be encouraged to integrate family culture into tourism services. For example, involving tourists in traditional family activities, such as making local specialties, can provide an authentic Tulou experience for visitors and prevent the erosion of the concept of "home."

Figure 8: Integration of Religious Space with Other Functions (Source: Photo by authors)

7. Conclusion

This paper uses Hongkeng Village in Yongding District, Fujian Province, as a case study to explore the daily spatial practices of villagers under the context of tourism development. Through a top-down approach, the government and capital forces have shaped the envisioned space of Hongkeng Village by enhancing infrastructure and defining architectural styles. While these measures have increased the village's appeal to tourists, they have also led to spatial segregation within the village. In response to external spatial planning, villagers have demonstrated a variety of coping strategies in their daily lives. Through career shifts, they actively participate in tourism development. By embedding, coexisting, and deriving new functions for old spaces, they have expanded spatial forms and avoided homogenized production, showcasing their adaptability and innovation in the face of modernization and tourism.

The intervention of the tourism industry has significantly altered the spatial structure of Hongkeng Village, with the village center shifting from the ancestral hall to public spaces, reflecting a transition from order to everyday life. However, the homogenization and symbolic transformation of homestays by villagers have weakened the local culture of Hongkeng. Additionally, within the Tulou, self-use spaces have been replaced by spaces for others, leading to the decline of both

family and religious spaces. To address these issues, planners should first establish a more inclusive framework that avoids imposing external subjective preferences on the village's development process and instead prioritize villagers' spatial needs and lifestyles to create public spaces that align with residents' daily lives. Additionally, village administrators should promote diverse design standards and cultural education, encouraging the preservation of local architectural features and preventing excessive commercialization. At the same time, cultural identity should be strengthened by reviving traditional rituals and everyday cultural activities, enhancing villagers' sense of belonging and connection to local culture, and fostering a win-win development between culture and economy.

References

Certeau, M. D. (1984). The practice of everyday life. University of California Press.

Lefebvre, H. (2014). The production of space. Routledge.

Qin, R. J., & Leung, H. H. (2021). Becoming a traditional village: Heritage protection and livelihood transformation of a Chinese village. Sustainability, 13(4), 2331. https://doi.org/10.3390/su13042331

Yan, H. (2015). World Heritage as discourse: Knowledge, discipline and dissonance in Fujian Tulou sites. International Journal of Heritage Studies, 21(1), 65-80. https://doi.org/10.1080/13527258.2014.894930

Liu, Y., Wang, Y., Dupre, K., & McIlwaine, C. (2022). The impacts of world cultural heritage site desig nation and heritage tourism on community livelihoods: A Chinese case study. Tourism Manageme nt Perspectives, 43, 100994. https://doi.org/10.1016/j.tmp.2022.100994

An, C. Y., Zhai, Z. Y., & Li, T. S. (2022). Representation and discourse power of traditional village spa ce based on the text analysis. Scientia Geographica Sinica, 42(4), 702-710. DOI: 10.13249/j. cnki.sgs. 2022.04.015. (in Chinese)

Cao, Z. K., Wu, X. G., Mu, X. Y., et al. (2018). Spatial distribution characteristics of rural tourism attra ctions in Nanjing and its influencing factors. Acta Agriculturae Jiangxi, 30(08), 136-143. DOI: 10.193 86/j.cnki.jxnyxb.2018.08.28. (in Chinese)

Duan, D. G., Zeng, X. T., & Li, G. M. Z. (2023). The research on the spatial transformation of urban fr inge villages based on the theory of spatial production: Baolong Village in Chang'an District as an e xample demonstrated. Journal of Human Settlements in West China, 38(5), 9-16. DOI: 10.13791/j.c nki.hsfwest.20230502. (in Chinese)

Fujian Provincial People's Congress Standing Committee. (2021, June 9). Fujian Province Traditiona l Architectural Style Protection Regulations. Retrieved July 30, 2024, from https://www.fj.gov.cn/zw gk/flfg/dfxfg/202106/t20210610_5618498.htm

Sun, J. X., & Zhou, Y. (2014). Study on the reproduction of space of tourism community from the pe rspective of everyday life: Based on theories of Lefebvre and De Certeau. Acta Geographica Sinica, 69(10), 1575-1589. (in Chinese)

Central People's Government of the People's Republic of China. (2018, February 4). Opinions of th e CPC Central Committee and the State Council on Implementing the Rural Revitalization Strategy. Retrieved July 30, 2024, from http://www.gov.cn/zhengce/2018-02/04/content_5263807.htm

Ministry of Housing and Urban-Rural Development of the People's Republic of China. (2012, Dece mber 19). Notice on Publishing the First Batch of Villages Listed in the Directory of Traditional Chin ese Villages by the Ministry of Housing and Urban-Rural Development, Ministry of Culture, and Mi nistry of Finance. Retrieved July 30, 2024, from https://www.mohurd.gov.cn/gongkai/zhengce/zhen gcefilelib/201212/20121219_212340.html

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EXTENDING THE LIFECYCLE OF DESIGNED PRODUCTS FOR SUSTAINABLE DEVELOPMENT: INSIGHTS FROM ZISHA TEAPOT

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ABSTRACT | Against the backdrop of diverse global consumer demand and intensified market competition, products are rapidly updated and iterated to maintain competitive advantages, offering consumers more choices. However, this also results in design homogenization, quality degradation, and shortened product lifecycles. The "Zisha" from China can provide valuable insights for solving this problem. As the foremost of China's four famous potteries, its representative product, the Zisha teapot, has a history of over 600 years. It combines practical functions with design features that integrate poetry, calligraphy and painting, making it widely appreciated worldwide. This paper employs interdisciplinary research, historical deduction, and field studies to explore why the Zisha teapot has remained popular despite limitations of time, space, and cultures, and extracts useful elements for modern product design. Research indicates three key lessons in the sustainable development of Zisha teapots: First, selecting materials with local characteristics and using handmade production processes can impart geo-cultural features to the product and inject personalization and human elements.

Second, expanding from the practical and aesthetics functions to interactive features ensures it meet users' actual needs, and integrates social and interactive features aligned with users' lifestyles, which increases product use frequency through multi-dimensional value creation. The third and most important strategy involves cross-border collaboration with the art world, uniting creativity to imbue products with uniting creativity cultural connotations and contemporary aesthetics. This approach aims to establish spiritual resonance and emotional engagement with users, ultimately achieving sustainable product development. This research begins by reflecting on historical experience and contemporary theory, providing a multi-dimensional practical path and scientific framework for extending the life cycle and sustainable development in modern product design.

KEYWORDS | ZISHA POTTERY, ZISHA TEAPOT, SUSTAINABLE DESIGN, PRODUCT LIFECYCLE, CROSS-BORDER COLLABORATION, EMOTIONAL CONNECTION

1. Introduction

In today's rapidly evolving market, shorter product lifecycles has become commonplace(Cooper, 2010; Koenig, 2023). The main reasons for this include rapid technological iteration, fierce market competition and changing consumer needs(van der Laan & Aurisicchio, 2019; Yamamoto & Murakami, 2021). Statistics show that over 1.5 billion smartphones are sold annually around the globe(Statista, 2024), but they are very often replaced before they are broken, with an average replacement cycle of less than two years(Cordella, Alfieri, & Sanfelix Forner, 2020). In China, the average lifespan of mobile phones has decreased from three to five years in 2015 to 2.2 years in 2018(Hou, 2022). In addition, it has become more common to buy new TVs instead of repairing old ones, reducing the average lifespan of TVs to just over seven years and accelerating the pace of replacements(Wieser & Tröger, 2015). Similarly, the actual lifetime of washing machines has fallen below the average consumer expectation of 12.5 years(Boyano et al., 2017). Additionally, the European Environment Agency (EEA) reports that the average actual lifespan of products like smartphones, TVs, washing machines, and vacuum cleaners is at least 2.3 years shorter than their designed or expected lifespan(European Environmental Agency, 2020). This trend of shorter product lifecycles not only leads to excessive resource consumption and environmental pollution but also poses challenges for enterprises in terms or cost control and market stability. Therefore, extending product lifecycle has become an urgent issue.

Existing research on extending product life cycles focuses on two main aspects: First, extending product life cycles through technological and design innovation to ensure that products are more durable and easier to upgrade and maintain. Specifically, designing modular products using durable materials and structures makes them easy to replace and upgrade, thereby maintaining the highest utility and value of products, components and materials(Agrawal, Atasu, & Ülkü, 2016; Bakker, Wang, Huisman, & Den Hollander, 2014). A design that facilitates maintenance and has rich spare parts supply can also significantly improve product repairability and

service life(Vonplon, 2020; Wilhelm, 2012). Clothing brands such as Patagonia, Eileen Fisher, and Filson promote recycling fashion by encouraging consumers to buy high-quality clothing that can be repaired rather than replaced. They point out that repairing clothes can create an emotional attachment, thereby extending the life of the clothing(Diddi & Yan, 2019). These methods have merits to reduce waste generation by extending the product's physical or functional service life, and contribute to resource conservation and environmental protection due to the design with ease of repair and upgrade. However, these innovations often require high R&D costs and technical investment, and are more challenging in design and production.

Secondly, promote product recycling and remanufacturing through recycling business models. The product service system (PSS) (Olesen, 2016) and collaborative consumption model in the recycling economy improve product utilization through sharing and leasing, which reduces the new materials demand and waste generation(Nußholz, 2017; Tukker, 2015). For example, the performance economy proposed by Stahel et al. decouples resource consumption from economic growth and creates more jobs through a fully service-based society(Cooper, 2010). Additionally, integrating reverse logistics into traditional supply chains allows companies to efficiently recycle end-of-life products, making them available for reuse and recycling, thereby optimizing profit potential through product (or material) value retention(Masi, Day, & Godsell, 2017). However, shifting from traditional sales model to a service model requires significant operational and managerial adjustments, which can be challenging. Meanwhile, some consumers, particularly in the B2C market, may be reluctant to adopt collaborative consumption or service models.

Existing research on extending product lifecycles focuses on technology and design innovation as well as business model innovation. These studies start from product design, product use, and reuse, and propose diverse and practical solutions to reduce resource waste and promote sustainable development. However, many researches face challenges in technology, cost, and consumer and market acceptance in practical applications, indicating room for further solutions.

We find that most current research focuses on drawing practical experience from modern products, lacking analysis of historical cases, and full utilization of historical experience as a guide in modern design and practice. The Zisha teapot from Yixing, China, is an example with an exceptionally long lifecycle. With a history spanning over six hundred years, it has seen its rise and fall, but has never ceased to exist, demonstrating its remarkable vitality. The Zisha teapots have been exported to Japan, Southeast Asia, Europe, and other regions, and has become a model for pottery design, production, and culture, demonstrating their unique charm across time, space, and cultures.

As such, this paper focuses on the design history of Chinese Zisha pottery and systematically discusses the reasons for its success in maintaining a long product life cycle from multiple perspectives of material selection, process changes, design concepts, and cultural value. Combined with modern product design and lifecycle management theories, this paper analyzes the scientific nature and originality of Zisha pottery design, and summarizes ideas and methods that can be used for reference to provide substantive guidance and support for the modern product sustainable development.

2. Overview: The Essential Features of Zisha Teapots

Zisha pottery is one of the most famous pottery varieties in China (Figure 1), and is known as the foremost of the four famous Chinese potteries(Y. Dong, 2018). It comes from Yixing City, China. With its unique material technology, functional use, and cultural connotation, it has become a collectible and luxury item with distinct artistic and cultural value. Zisha pottery is unglazed pottery made from clay with high iron and manganese content, which is unique in Yixing(Qu, 2015). It is made using a unique swatting cylinder or clay sheet inlay technique, before being fired in a kiln of over 1000 degrees Celsius(Wu & Shi, 2006). The production process has been selected as one of China's first batch of national intangible cultural heritage. Its outstanding product, the Zisha teapot, has superior breathability, is not easy to burn hands, resists scale deposit, remains fresh overnight, and gradually absorbs the aroma of tea during long-term use, making it an excellent tea device. Moreover, it has good plasticity to be painted, written on, carved, or engraved, so that people can incorporate poetry, calligraphy, and seals from traditional Chinese art into the pot. Zisha teapot has become an important representative of Chinese culture and art.

Figure 1. Teapot incised with floral design and verses, Guangxu period, Qing Dynasty (Geng, 2010)

The Zisha pottery can be traced back over 7000 years to the Neolithic Age when Yixing residents began making rough daily pottery such as sand-containing gray pottery. From the Song Dynasty (960-1279), Yixing potters discovered and utilized the unique local Zisha clay ore to create the famed Zisha pottery(Editorial Committee of Cultural Relics, 1984), with the Zisha teapot being the most influential. During the Ming (1368-1644) and Qing (1644-1911) Dynasties, the popularization of tea-making methods, changes in the craftsman system, and the participation of literati led to the great improvement in the Zisha teapot making craft, featuring continuous artistry and culture improvements. It was appreciated by literatis and dignitaries, and entered the court and

royal family as a tribute. Highly and widely praised, Zisha teapot enjoyed the reputation of "the best tea set in the world"(Lin, 1992). Its image often appears in ancient paintings, demonstrating its popularity (Figure 2).

Since the late Ming Dynasty, the Zisha teapot has been exported for about 400 years, becoming an important reference model for ceramics production in the Netherlands, Germany, and the United Kingdom. During the time, Portuguese merchants introduced Zisha teapots to Europe, where they became known as China's "red porcelain" and quickly gained popularity among European consumers. In the 1760s, British aristocrats began using Yixing Zisha teapots(Petttigrew, 2001). According to Dutch East India Company records, about 1635 pieces of Zisha teapots arrived in Amsterdam in 1680. By the late 17th century, Zisha teapots, along with tea, became fashionable items in aristocratic households. By the end of the Edo Period (1600-1867), it was introduced to Japan and quickly became a staple of the Japanese tea ceremony(Huang, 2007). Japanese tea practitioners pride themselves in using Yixing Zisha teapot utensils and have collaborated with Zisha clay artists in making teapots, which promoted the aesthetic trend of Japanese Zisha teapot culture. During the Republic of China, Zisha teapots customized according to the customs of various countries were sold to the United States, Britain, Germany, France, Italy, Thailand, and the Philippines (Figure 3). A small number of them were sold to Latin American countries like Mexico and Peru, showcasing its long history and global popularity.

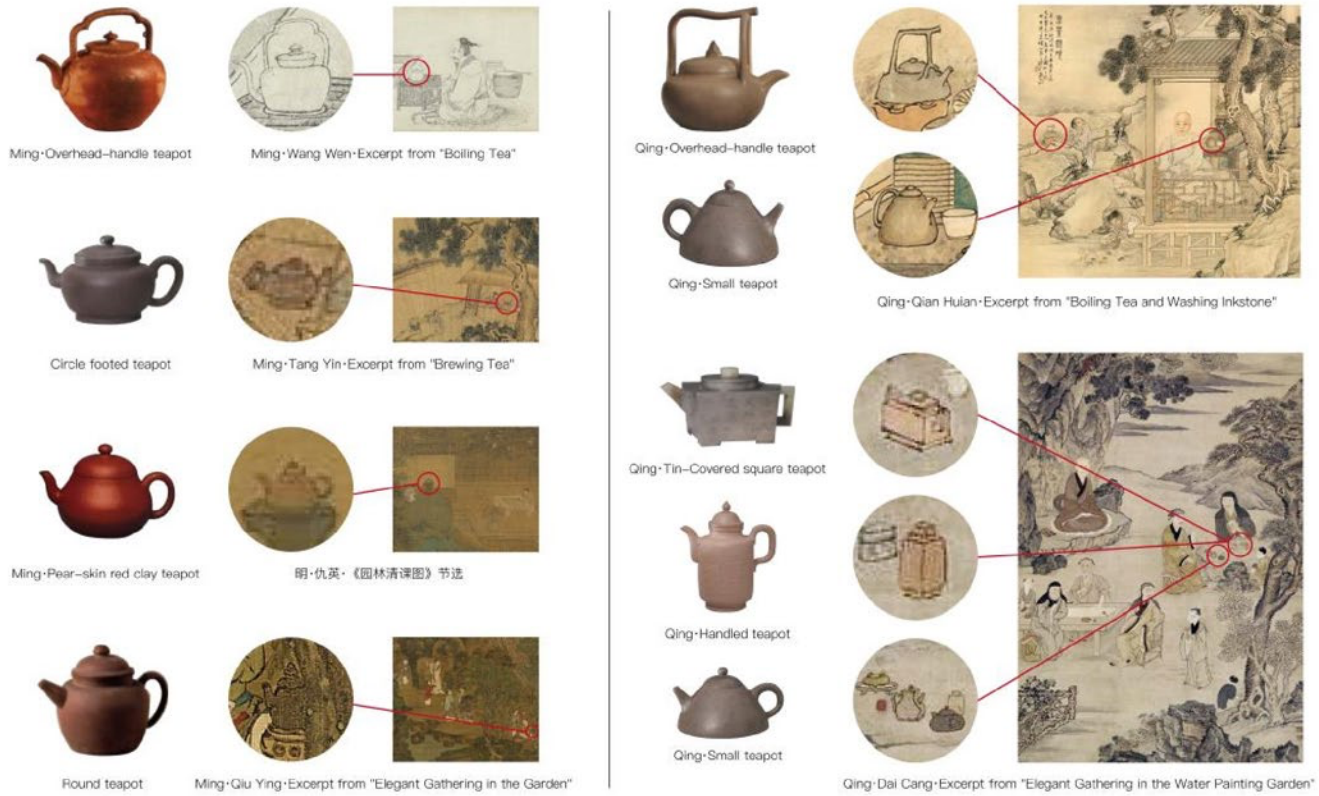

Figure 2. Zisha teapots in ancient paintings

Figure 3. Unknown, Zisha teapot Exported to Europe. Purchased from Brown, accessioned in 1853. Handformed in Yixing. V&A collection. (V&A collection)

Nowadays, with the economic development, the rapid pace of life, and people's increasing attention to spiritual well-being, Zisha teapot appears more timeless and exudes new vitality. Despite industrialization and marketization changes, Yixing Zisha teapot has consistently adhered to traditional handmade methods while continuously innovating design concepts. This pursuit of high-quality products has kept it vibrant in modern society and on the international stage, and deeply valued and sought after by Zisha teapot enthusiasts worldwide.

3. Exploration: The Reason for Zisha Teapot's Longevity Enduring popularity

The enduring popularity of Zisha teapots is closely linked to the uniqueness of the materials, the craftsmanship of the production, the functional practicality, and the profound cultural significance. This section will delve into these factors to comprehensively explore the reasons behind its popularity in more than six-hundred-year history.

3.1 Unique Zisha Clay from the Yixing

Materials determine the basic characteristics and development potential of products, and Zisha clay is a prerequisite for the success of Zisha clay art(Zhang, 2017). The acquisition of Zisha clay is fundamentally linked to its surrounding ecological environment. Yixing, with its long history of pottery making, has seen local artisans gradually master the properties of various clay types through years of practical experience and innovative experimentation in crafting everyday ceramics. During this process, these artisans identified Zisha clay, which possesses unique physical and chemical properties. They discovered that the finest Zisha clay originates from the mountains near Dingshu Town in Yixing (Figure 4).

Zisha clay possesses multiple excellent characteristics, and teapots crafted from Zisha clay are more capable of preserving the fragrance of tea during tea making. It is this unique, regionspecific clay that has brought fame to Zisha teapots. First and foremost, Zisha clay possesses excellent permeability. Research shows that the surface of Zisha pottery has many tiny pores, with a porosity over 11%(Sun & Ruan, 1993). From material perspective, this is due to the granular structure of Yixing Zisha clay mud ore. After sintering, a dual pore structure forms inside the Zisha clay body, providing good breathability to retain the tea fragrance. Second, Zisha clay material resists sudden heat changes and has low heat conduction. Therefore, when boiling water is poured into the Zisha teapot in winter, it has no risk of cracking, and has good insulation to stay cool to the touch(Zhao & Zhou, 1998). Moreover, with long-term use, the surface texture of the teapot becomes warmer and smoother, allowing consumers to experience its gradual transformation, which further enhances the enjoyment of daily life.

All in all, the reputation of Zisha teapots is inseparable from the craftsmen's emphasis on exploring and utilizing regional materials. Zisha clay material has strong regional attributes, and high-quality Zisha clay products cannot be made outside Yixing City. This regional specificity ensures product scarcity in the market, making it more valuable, so that consumers cherish them more to indirectly extend their service life.

Figure 4. Distribution Map of Zisha Clay Mining Area

3.2 Handicraft-centered Zisha processing

The uniqueness of Zisha teapots is also rooted in their purely handmade craftsmanship. The entire process, from the preparation of Zisha clay raw materials, the production of individual components to the final shaping, relies heavily on handcrafting. The Yixing potters believe that only hand-made Zisha teapots can reflect the pot makers' thoughts and emotions, and have vitality, humanistic atmosphere, and the delicate beauty of hand-imprinted marks. The preparation of Zisha clay involves a series of meticulous steps, including manual selection of materials, sun drying, impurity removal, crushing, sieving, water mixing, kneading, and aging, all of which are carried out by hand. Zisha teapots are typically composed of several basic components, with clay sheets being one of the fundamental elements. the precision of hand control over the clay is pushed to its limits. When creating clay sheets, the process begins by using fingers to round the corners of a square clay block. Then, one hand holds a tool to forcefully strike the clay into a flat disc, while the other hand's thumb and middle finger grip the center of the disc, rotating it on a workbench to ensure that the edges become compact and smooth, thereby preventing cracks during further processing (Xu, 2017; Yang, 2013). Throughout this process, both hands must coordinate effectively; with each strike, the disc must be rotated, ensuring that the angle of rotation and the force applied are consistent, resulting in a flat and even clay sheet. Additionally, the number of strikes must be carefully controlled, as too many or too few will fail to achieve the desired outcome.

Judging from the forming techniques of Zisha teapot, hands play a crucial role in these processes. Taking the most distinctive mud sheet-making technology in the Zisha clay process as an example, handcrafting experience and skill are essential. This forming technology is based on the local pottery beat forming technique (Figure 5). The craftsman use one hand to support the interior of the vessel to control its shape, while the other hand presses and taps the exterior with a paddle. This coordinated technique shapes the vessel into various forms. During tapping, the craftsman must carefully balance the support strength of the hand and the impact force of the paddle, requiring both precision and control. Additionally, the craftsman must maintain the vessel's steady rotation to ensure stability through inertia. Although Yixing Zisha teapot once attempted to follow the trend of industrialization by adopting mechanized and mass production methods, these efforts ultimately failed to achieve the refined quality of traditional handcrafted techniques. Moreover, they struggled to preserve the original cultural significance and artistic essence inherent in Zisha teapot. Clearly, craftsmanship is crucial in achieving the teapot's unique quality and is a key factor in its long-term popularity.

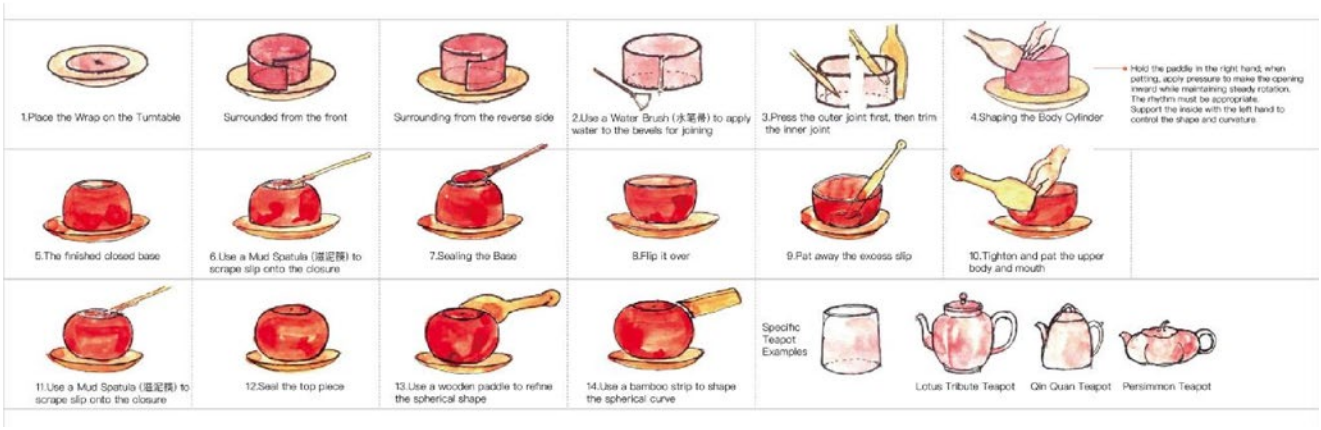

Figure 5. Diagram of the Beat Forming Technique of Zisha Teapots (Xu, 2017)

3.3 Expanding from Practical Tea Tasting to Aesthetic and Interactive Functions

The popularity of Zisha teapots is inseparable from their practical use, aesthetics, and interactive functions. The practicality of Zisha teapots can be observed from their shape design. Each component designed for practicality constitutes a complete Zisha teapot. As a tea appliance, the Zisha teapot's shape design is constrained by its function. Specifically, the Zisha teapot's shape must facilitate the handling, water pouring from the spout, filling water between the mouth and lid, and adding and removing tea leaves during brewing (Figure 6). The teapot is composed of the body, lid, lid button, handle, spout,etc. (Figure 7) Each component serves a distinct function, while collectively contributing to a harmonious and cohesive design. For instance (Yang, 2013), the filter holes at the spout have been continuously optimized to address practical challenges. Early singlehole designs frequently caused tea leaves to block the spout or enter the cup. The introduction of multi-hole sieve-like designs effectively resolved this issue. However, in smaller teapots, the limited space between the body and the spout can cause expanded tea leaves to block the sieve holes. To address this, artisans developed hemispherical ball-shaped holes, increasing the spout's surface area and further improving the tea brewing experience.

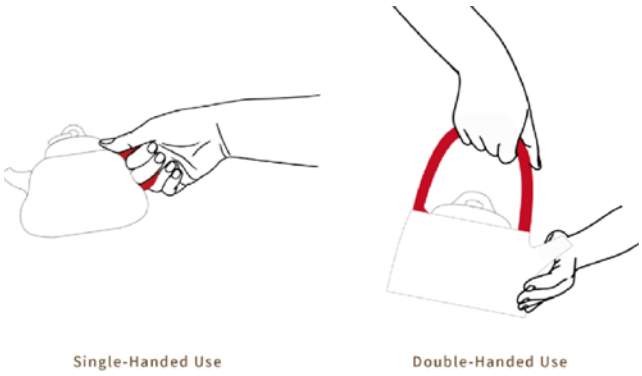

Figure 6. Diagram of the Handle Usage for Zisha Teapots (He, 2018)

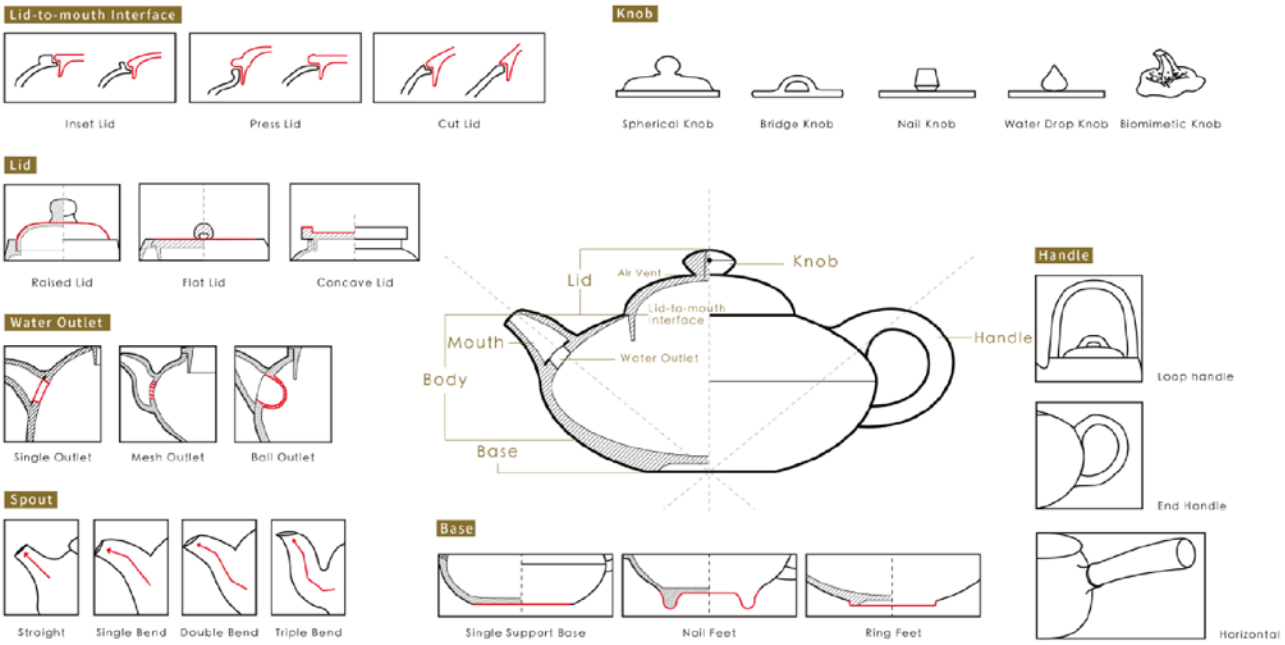

Figure 7. Diagram of the Structure of Zisha Teapots

Secondly, while focusing on the practical shape design, Zisha pottery makers also comprehensively considered aesthetic factors to enhance the visual appeal of Yixing tea sets. In crafting traditional round and square Zisha teapots, emphasis is placed on clarity of form and well-proportioned structure. In contrast, Zisha teapots inspired by natural organic shapes or ancient artifacts, known as "floral wares," adopt more creative design approaches. Some teapots ingeniously transform elements like plant vines and branches into functional components such as spouts or handles. Others mimic the forms of ancient bronze vessels, incorporating features like shoulders and feet to evoke the solemnity and ceremonial significance of ritual objects. As such, the teapot design clarifies the practicality as the basis and aesthetics as an important auxiliary. It not only offers exceptional practicality in daily use but also appeals to individuals unfamiliar with tea utensils, thanks to its distinctive aesthetic charm and cultural significance. It can be said that the shift from a focus on utility to a balance between functionality and beauty is a key factor in the teapot's enduring appeal and continued evolution.

Finally, the teapot has strong interactive functions, which is primarily reflected in its social attributes. People often meet friends with tea, discuss philosophy, exchange feelings, and appreciate arts, so using teapot enhances interaction and connection. Historically, literatis often combined tea drinking with other elegant and leisurely activities, such as banquets, exhibitions, and tea tastings in bookrooms and teahouses. Nowadays, the use of Zisha pots adds

fun and ritual to modern life. People exchange experiences in tea making and pot appreciation through tea parties, enhances their emotional connections through participation and sharing.

3.4 Tea Culture and Value Empowerment of literati Culture

The widespread influence of Zisha pottery relies not only on its excellent quality but also on China's long-standing tea culture and literati culture (Figure 8). From the perspective of tea culture, Yixing Zisha teapots, as a uniquely Chinese tea-brewing vessel, have a design and development closely intertwined with the evolution of tea culture. Since the Tang and Song dynasties, tea gradually became a daily beverage, and tea appreciation emerged as an important activity, reflecting refined taste. As tea drinking gained popularity, the selection of teaware became a symbol of personal cultivation and aesthetic sensibility, which in turn stimulated the diversification of ceramic and porcelain teaware. By the mid-Ming dynasty, Yixing Zisha teapots gained widespread recognition, a trend linked to the expansion of tea cultivation and the transformation of tea-drinking practices.

Yixing, the birthplace of Zisha teapots, was renowned for its production of Yangxian tea as early as the Tang dynasty. The Tang poet Lu Tong vividly praised the tea's exceptional quality in his poem "Running Brush to Thank Councilor Meng for Sending New Tea," where he wrote, "Even the emperor should taste Yangxian tea, and no other plants dare bloom before it." (Peng, Chen, & Zhou, 2021) The flourishing tea culture not only advanced the practice of tea drinking but also inspired local potters to innovate teapot designs tailored to the needs of tea preparation. By the Ming dynasty, the founding emperor Zhu Yuanzhang considered the production of compressed tea cakes (tuancha) too labor-intensive and costly, leading to a shift toward the simpler production of loose-leaf tea. This change transformed tea-drinking practices from the "whisking" method to directly steeping tea leaves in boiling water. Zisha teapots, with their excellent breathability and water absorption, became the ideal vessels for this new method, allowing tea leaves to fully release their natural aroma. Consequently, Zisha teapots have remained popular from the Ming dynasty to the present day.

Figure 8. Diagram of the Relationship between Zisha Teapots, Tea Culture, and Literati Culture

From the perspective of literati culture, the cultural achievements and aesthetic tastes of ancient Chinese artists represented by the literati group have significantly enhanced the decorative and cultural aspects of the teapot. During the Ming and Qing dynasties, literati not only formed an indirect connection with Yixing Zisha teapots by praising them, but also collaborated with artisans to engrave their favorite poems and writings on the teapots, thus participating directly in their creation. For example, the Ru Ding teapot co-created by literati Chen Mansheng and craftsman Yang Pengnian features poems: "The milk spring is full of snow, and it shines on my cheeks." It describes tea soup gushing out like stalactite spring water, penetrating the heart. This verse not only describes the freshness and sweetness of tea but also conveys the joy of drinking it, inspiring poetic sentiment and a love for tea, as well as the pursuit of beauty. Moreover, on another teapot engraved with the phrase "I love my ding, strong food and strong drink," the verse is inscribed in running script on the teapot's surface, with certain strokes thickened, especially those of simpler characters. This variation in stroke thickness gives the surface a more rhythmic aesthetic (Figure 9) (He, 2018). When using such a teapot, the user can simultaneously appreciate its visual form and recite the inscribed verse, generating boundless imagination and reflection through the combined enjoyment of sight and sound.

Figure 9. Analysis Diagram of Running Script Poetry on Zisha Teapots: Example of Inscription on Chen Mansheng and Yang Pengnian's Ru Ding Teapot(He, 2018)

Since the mid to late Ming Dynasty, the decoration of teapots has gradually expanded from texts to paintings. Chinese painting, as an important decorative theme, enhances the unique artistic characteristics and cultural connotation of the teapot. For example, the overhead-handle calabash teapot by Chen Mansheng and Yang Pengnian features a Taihu Lake stone drawing (Figure 10). Using landscape painting techniques, the spatial sense of Taihu Lake stone is outlined with thick and thin lines, and the texture and structural transitions are expressed with "dry brush technique"(He, 2018), showing the natural beauty of Taihu Lake stone and the literati's aesthetic interest in natural landscapes. It can be said that the intervention of literatis, represented by Chen Mansheng, has provided a deep two-way interpretation of the teapot, poetry, and painting (Figure 11), and introduced new expressions in art form and cultural inheritance. The teapot is not just a daily appliance but also an art form, serving as a medium for literatis to express their emotions and feelings. Conversely, this cross-disciplinary collaboration has allowed teapot design to intersect and merge with Chinese poetry, calligraphy, painting, and other arts, transforming it into a medium for expressing the aesthetics, cultural psychology, and aesthetic concepts of the era. This cultural charm, condensed from traditional Chinese art, gives it an enduring spiritual appeal.

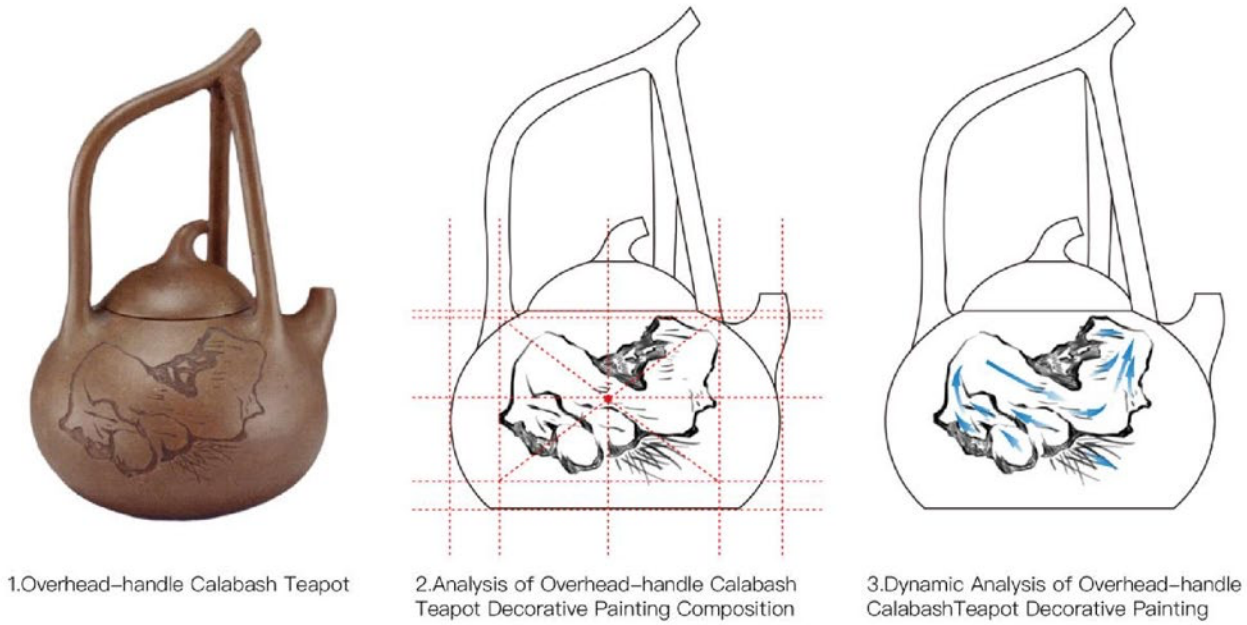

Figure 10. Analysis Diagram of the Painted Decoration on Chen Mansheng and Yang Pengnian's overheadhandle calabash Teapot(He, 2018)

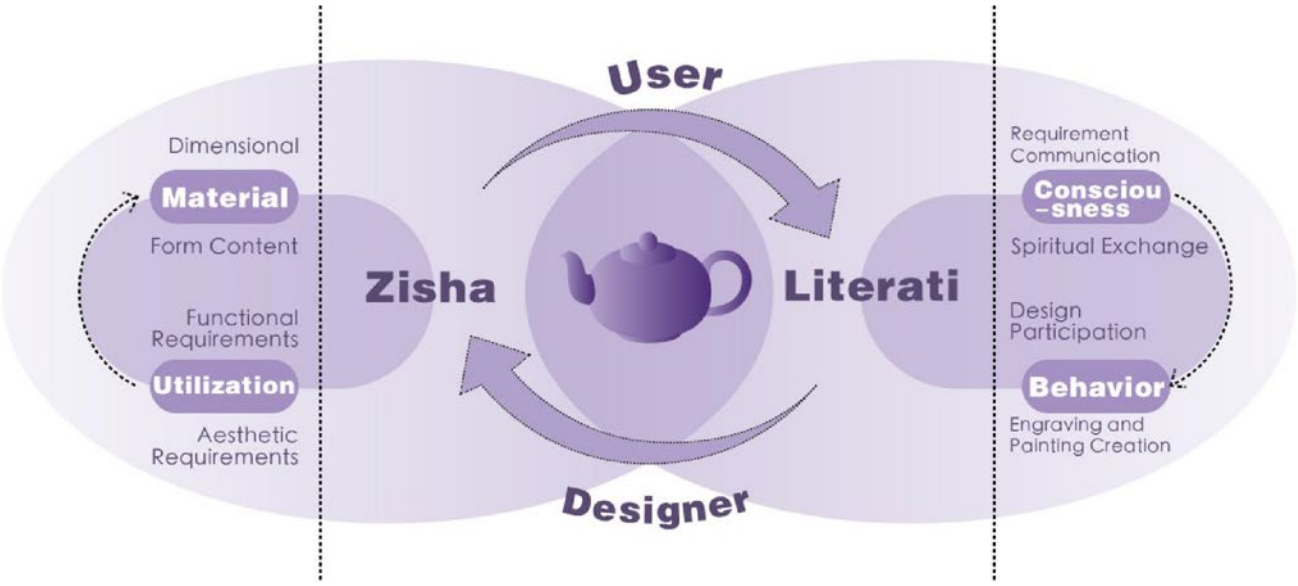

Figure 11. Diagram of the Role of Literati in the Creation of Zisha Teapots

4. Insights: Exploring Multi-dimensional Methods in Product Lifespan Extension

Focusing on the reasons behind the long lifecycle of China's Zisha teapot, this paper conducts a comparative analysis and discussion using modern product design and lifecycle management theories, as well as relevant practical cases. It aims to interpret successful cases of traditional Chinese creations using contemporary and international design languages, to better apply historical experience to modern product design. This paper discusses the design concept of Zisha teapot and its application in modern product design across three categories and six aspects: materials and craftsmanship (locality, handicraft), functions and their extensions (practicality, interactivity), and culture and emotion (culture, emotion) (Figure 12).

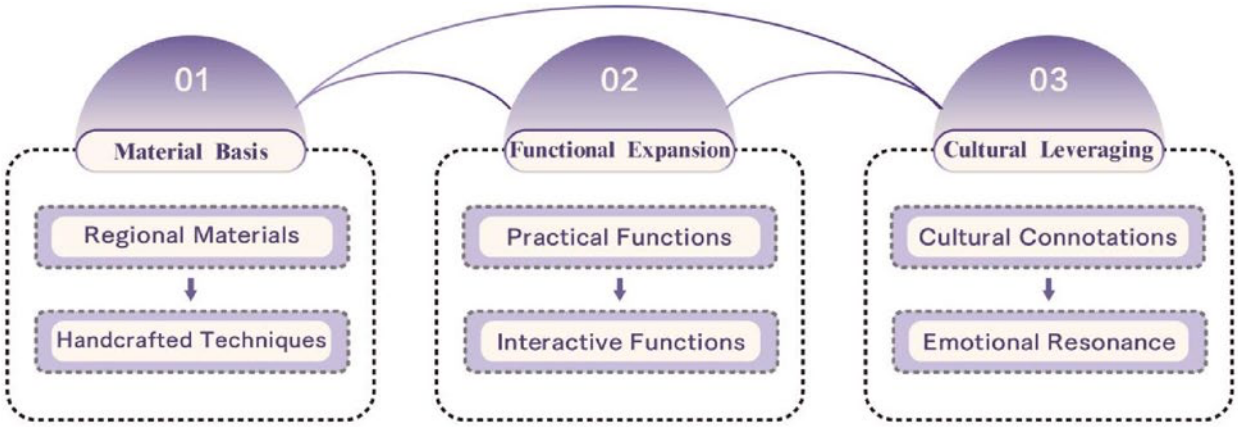

Figure 12. Diagram of the Refined Design Concepts of Zisha Teapots

4.1 Local Materials and Handmade Craftsmanship

1) Regional: Unique Expression of Local Materials

Local materials refer to those obtained within a specific geographical area, emphasizing their local characteristics and cultural background. Local product designs often showcase the unique charm of combining local personalities and customs with specific natural conditions and cultural environments(Hu, 2007). Zisha teapots utilize the unique Zisha clay found in Yixing City, Jiangsu Province. This material possesses local cultural characteristics, natural adaptability, and resource sustainability. On one hand, it can reduce production costs, energy consumption and pollution by minimizing transportation and processing, and supports local economic development, and the inheritance of traditional crafts and cultural heritage. On the other hand, unique regional materials can give products natural advantages over similar products from other regions. Take Zisha teapots as an example. When discussing Zisha teapot, Yixing is inevitably mentioned. Using Yixing's local Zisha clay is almost a baseline in the marketing of Zisha teapots(Zhou, 2017). Local elements are embedded in products, and this geo-cultural advantage strengthens consumer recognition and loyalty to the brand(Qian & Zhu, 2011).

The traditional Chinese design concept of adapting to local conditions emphasizes selecting locally suitable materials for design and manufacturing based on the natural conditions and resource characteristics of different regions, aiming to achieve harmonious coexistence between humans and nature. Ecological design and Sense of Place Design theories in modern product design also emphasize using local materials. It encourages designers to utilize local resources and cultural elements to create products with unique local characteristics, thereby enhancing their cultural value and market appeal. For example, traditional Japanese washi paper emphasizes using natural materials such as mulberry bark ark and tree bark from Mino City, Gifu Prefecture. Traditional Chinese rice paper emphasizes using sandalwood bark and sand field straw from Jingxian, Anhui Province. Swiss watch manufacturers also emphasize high-quality movements and unique designs originated from Switzerland. These practices highlight the uniqueness and superiority of the materials' origins, enhancing the products' geographical, cultural and historical value.

2) Handicraft: the Continuation of Craftsman Spirit

Handicraft refers to the process of making through manual craftsmanship, which relies on the skills and experience of craftsmen rather than standardized machine production. It differs from modern mass production theories. Lean Manufacturing pursues efficient and low-cost standardized production, while handicraft production focuses on personalization and high value added. Handmade craftsmanship is unique,

with distinct textures and details, often following the concept of excellence to produce high-quality products. For example, Italy has a long history of handmade leather goods. Traditional handicrafts produce high-quality and uniquely designed leather goods with high market value. Additionally, handmade products often incorporate the unique aesthetic and artistic expressions of craftsmen, possessing strong historical and cultural value. As Li Yanzu said, "Handicraft skills are an unforgettable and painstaking cultural accumulation. They are based on the practice of countless workers and rooted in the cultural and artistic will of the entire nation, involve the processing and transformation of objects, and represent the mental journey of the entire nation."(Li, 2009) In a postmodern society full of hightech products, craftsmanship, through its emphasis on skill and the creative process, fulfills the human need for emotional connection, meaning, and individual expression. It effectively harmonizes the relationship between technological advancement and the spiritual, psychological, and emotional needs of humanity.

4.2 Expanding from Practical Functions to Interactive Experiences

1) Practicality: Core of Functionality and Efficiency

Practicality is the most fundamental aspect of a product that ensures its long-lasting appeal. In the early stages of creation, any artifact was made for utility. Over time, it has evolved from solving everyday problems and providing greater functionality to incorporating aesthetic value. In ancient China, products related to the national economy and people's livelihood were always the mainstream in design. These designs maintained a concept that prioritized people, emphasized functionality, and upheld humanitarianism(Y. Dong, 2018). Regardless of their design, Zisha teapots consistently maintain excellent tea-brewing functionality and remain connected to daily life, thus avoiding being purely ornamental or becoming useless, which ensures its continued vitality. In modern product design theory, practicality also holds an important position. User-Centered Design emphasizes that the design process should center on user needs, ensuring that product design focuses on practicality and user experience. Functionalism further advocates that design must first meet functional requirements, as form follows function. Therefore, we recommend that designers place practicality at the core of product design, ensuring that their products can truly solve users' problems through an in-depth understanding of user needs and usage scenarios, thereby extending the product's service life.

2) Interactivity: Key to Engagement and Experience

Interactivity enhances user experience and interest in product design by improving interactions between objects, people, and others. The interactivity of Zisha teapot is mainly reflected in the tea culture extended by its tea-drinking function, which enhances

interactions between people and objects, as well as among individuals. During use and tasting, users share their experiences with others through tea ceremonies and tasting activities, conveying profound culture and emotions (Figure 13). This transforms the teapot from a mere tea-drinking tool into a medium for cultural exchange and emotional transmission. Collaborative design emphasizes user collaboration and interaction in product design, while interactive design enhances the social interaction and collaboration experience among users. Modern design can enrich the social and interactive nature of products by incorporating multi- dimensional interactive functions. For example, Nintendo's Switch game console allows users to play alone or interact with friends and family, enhancing communication and connection between people and objects, and among individuals.

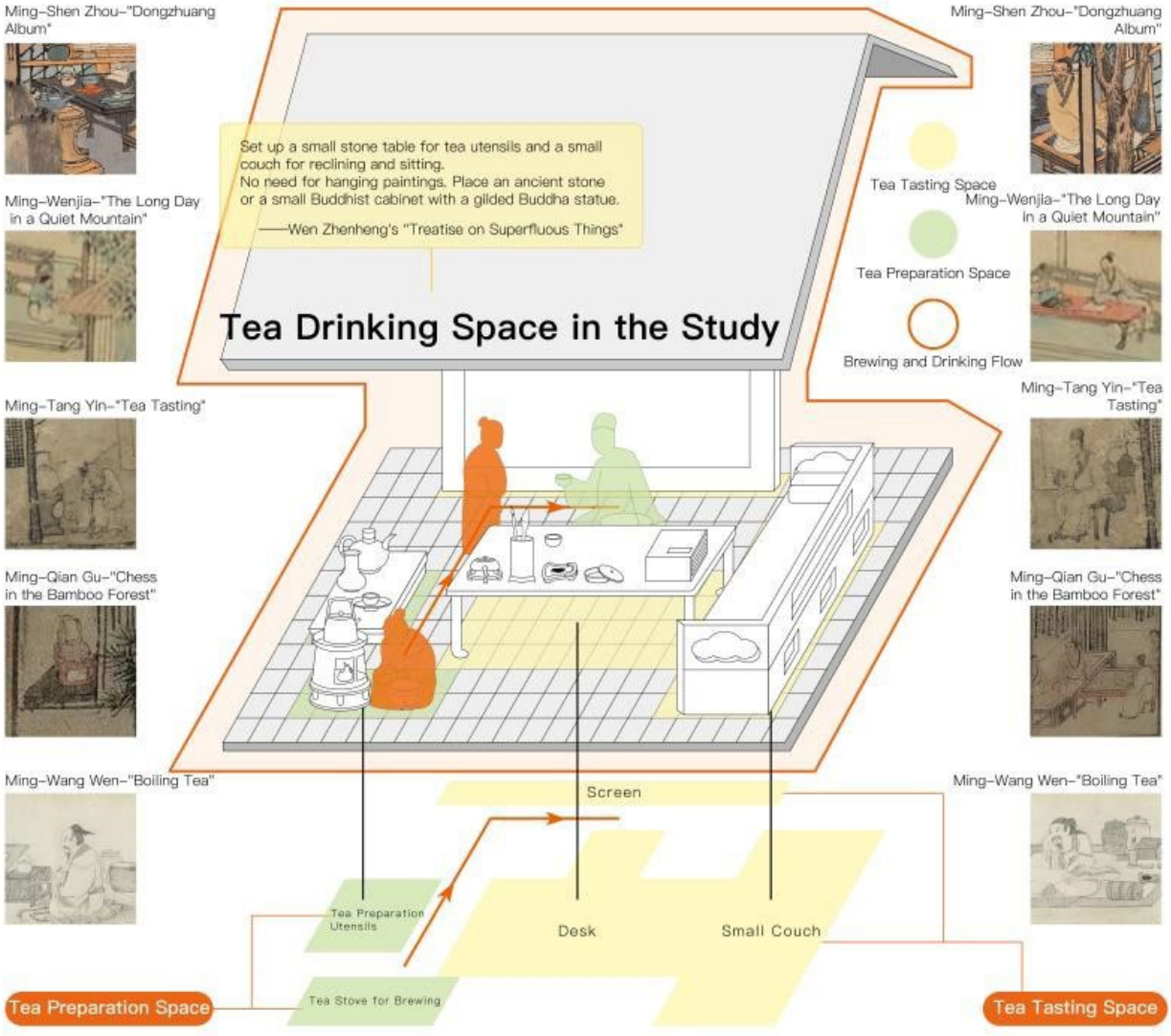

Figure 13. Diagram of the tea drinking space in painting

4.3 Riding the Cultural Empowerment and Emotional Resonance

Culture reflects the connotation and artistic value of a product in design. By integrating specific cultural backgrounds, historical heritage, and artistic expression, it enhances the product's unique charm and market value. By incorporating the Chinese tea culture and fine arts represented by literatis, Zisha teapots gain profound cultural heritage and artistic value, which not only stimulates users' emotional resonance but also enhances their experience.

Brand Culture theory emphasizes that a brand's uniqueness and market appeal can be enhanced by incorporating specific cultural elements. It is an efficient way to empower the brand by seizing cultural elements, giving the brand unique symbolic meaning, leveraging these elements' connotations, making the brand superior to its competitors, and aligning with the target consumer group's awareness(Ye, 2020). Every nation, ethnicity, and region possesses its own unique cultural symbols and cognitive associations, such as the dragon and panda in China, the Statue of Liberty and Uncle Sam in the United States, and the pyramids and Sphinx in Egypt. These cultural symbols can empower brands by enhancing their cultural significance, thereby increasing their market competitiveness. For example, Maserati adopts the trident of Poseidon from Greek mythology as its emblem, symbolizing power and prestige, while Marlboro uses the image of the Western cowboy to embody its brand's "masculinity." (Ye, 2020)

Similarly, the design of Yixing Zisha teapots leverages China's rich cultural heritage to enhance their market recognition and enduring appeal.

Modern product design can enhance the artistic value, cultural connotation, and even collection value of products by incorporating specific cultural elements or collaborating with the art world. It should be noted that if the reference to culture remains at the surface level, such as merely using patterns from a certain culture, it is essentially superficial. When Japanese graphic designer Kazu Nagai was inspecting art design in China, he said: "Japanese design was once influenced by Chinese religious paintings, patterns, and animal motifs. However, Japanese designers refined it by adding decorative changes and symbolic values, elevating them to a mature and aesthetic level rather than applying them mechanically." In the early stages of modern Japanese design, designers combined Japanese aesthetics refined from Chinese culture with Cassandre's posters, Bauhaus theory, and later American advertising and editorial design skills, forming the foundation of modern Japanese graphic design. (Li, 2009) In modern product design, the key to successfully leveraging culture lies in thoroughly understanding the intangible, symbolic, and spiritual dimensions behind it. This allows designers to imbue traditional art and culture with effective, innovative forms of expression, while also infusing products with profound vitality.

In addition, the charm of culture and art also lies in their ability to touch people's innermost emotions. Artistic forms such as music, dance, and painting convey feelings through various mediums, transcending time and cultural boundaries to resonate with audiences. For example, Chinese opera and American jazz, with their unique vocal styles and melodies, evoke powerful emotional responses. Similarly, Argentine tango and Austrian Viennese waltz convey complex emotions and energy through movement and gestures. Likewise, Chinese ink painting and European oil painting, using techniques such as color, line, and composition, express rich emotional layers and artistic moods. In consumer experiences, people seek more than just material fulfillment—they also desire emotional resonance. When a product is infused with positive emotions, it bridges the emotional gap between the consumer and the product, fostering cultural identification and influencing purchasing behavior(Lu & An, 2017). Therefore, in modern product design, it is also crucial to focus on addressing the emotional needs of individuals. By integrating emotional elements such as specific symbols, colors, and materials, designers can achieve cultural expression that stimulates deeper emotional responses(S. Dong, Wang, Xu, Wu, & Yin, 2011), thereby contributing to the sustainable development of products.

It is worth further discussing that the sustainability of Yixing Zisha teapot is attributed to its simplicity in material selection, traditional craftsmanship, and its expansion in functionality and cultural significance. However, directly applying this historical experience to the design of modern electronic products, such as televisions, computers, and smartphones, presents significant challenges. Modern electronics are composed of various complex materials, including rare metals, plastics, glass, and multiple chemicals. These materials consume substantial energy during manufacturing and are often difficult to recycle or degrade at the end of their life cycle. Nevertheless, despite the differences in material use and waste management, the design principles of Zisha teapot can still provide valuable insights for the sustainable design of modern electronics. For instance, designing interactive electronic products can enhance users' social connections and interactive experiences, while culturally resonant designs can evoke emotional engagement, thereby extending the product's lifespan. Additionally, exploring more environmentally friendly material alternatives and improving product reparability can also help mitigate the environmental impact of electronic waste.

Furthermore, the rich sustainable design concepts embodied in Zisha teapot are not only applicable to product design within the context of Chinese culture but also have the potential for broader application in other cultural and contextual settings. Firstly, compared to other highquality handicrafts across different cultures, the design principles of Zisha teapot possess a certain universality. For example, Japanese tea utensils, like Zisha teapot, emphasize the essence of materials, exquisite craftsmanship, and the emotional

bond between users and objects. This dual focus on product functionality and cultural significance makes the design philosophy of Zisha teapot replicable in a cross-cultural context. Moreover, the sustainability principles in material selection and craftsmanship of Zisha teapot offer valuable references for product design in other cultural contexts. The use of natural materials and meticulous craftsmanship in Zisha teapot resonates with Scandinavian design, particularly in the application of minimalism and natural materials. Similarly, the slow fashion movement can draw inspiration from Zisha teapot's emphasis on material durability and emotional value to develop clothing and accessories that align with sustainable development principles. These cross-cultural applications demonstrate that Zisha teapot is not only a representative of Chinese culture but also a significant reference in global sustainable design. By integrating its design principles with product development in other cultural contexts, we can promote broader sustainable design practices and foster global cultural exchange and technological innovation.

5. Conclusion

This paper aims to extract useful elements from China's iconic long-life product, the Zisha teapot, and analyze the feasibility of their application in modern product design to help extend product lifecycles. This multi-dimensional research not only inherits traditional wisdom but also actively explores and practices future product design strategies. Although Yixing Zisha teapot has been explored in cultural and historical studies, integrating it with contemporary design theory and examining its cross-cultural adaptability on a global scale is the unique contribution of this research. Research shows that the uniqueness of Zisha teapot in materials and processing, functional and aesthetic expansion, and culture and emotions is key to their sustainable development over several hundred years. These characteristics offer important insights for developing products with extended lifecycles. First, the local nature of materials can reduce production costs and impart geo-cultural characteristics to the product. Applying numerous handicrafts in the production process injects personalization and human elements into products, mitigating the monotony and indifference of standardized products. Second, all designs must be based on practical functions, and then add aesthetics to ensure the product meets consumer needs. Meanwhile, creating diverse usage scenarios and increasing the product's social attributes and interactivity during use will enhance product usage frequency, thereby creating multidimensional value. The third and most critical factor is injecting cultural elements into the product through cross-border collaboration, giving it profound cultural heritage and artistic value. This stimulates users' spiritual resonance and optimizes their use experience. In addition, the charm of culture lies in its ability to touch people's innermost emotions. Cultural expression through specific symbols, colors,

materials, and designs stimulates deeper emotional reactions, establishes a bond between products and users, enhances psychological attachment, and contributes to sustainable development. The significance of this research lies in creatively drawing inspiration from tradition and seeking solutions to current design dilemmas. More importantly, systematically analyzing successful historical cases constructs a multi-dimensional scientific framework, providing dual references for the sustainable development of contemporary product design from historical experience and realistic theory.

References

Agrawal, V. V., Atasu, A., & Ülkü, S. (2016). Modular upgradability in consumer electronics: Economic and environmental implications. Journal of Industrial Ecology, 20(5), 1018-1024. doi:org/10.1111/jiec.12360.

Bakker, C., Wang, F., Huisman, J., & Den Hollander, M. (2014). Products that go round: exploring product life extension through design. Journal of cleaner Production, 69, 10-16. doi:org/10.1016/j.jclepro.2014.01.028.

Boyano, A., Cordella, M., Espinosa, N., Villanueva, A., Graulich, K., Rüdenauer, I., Stamminger, R. (2017).
Ecodesign and Energy Label for Household Washing machines and washer dryers. Luxembourg: Publications Office of the European Union. doi:10.2760/029939, JRC109033.

Cooper, T. (2010). Longer lasting products: Alternatives to the throwaway society: Gower Publishing, Ltd. doi:org/10.4324/9781315592930.

Cordella, M., Alfieri, F., & Sanfelix Forner, J. V. (2020). Guidance for the assessment of material efficiency: Application to smartphones. Luxembourg: Publications Office of the European Union. doi:10.2760/037522, JRC116106.

Diddi, S., & Yan, R.-N. (2019). Consumer perceptions related to clothing repair and community mending events: A circular economy perspective. Sustainability, 11(19), 5306. doi:org/10.3390/su11195306.

Dong, S., Wang, X., Xu, S., Wu, G., & Yin, H. (2011). The development and evaluation of Chinese digital science and technology museum. Journal of cultural heritage, 12(1), 111-115. doi:org/10.1016/j.culher.2010.10.003.

Dong, Y. (2018). Aesthetic perspectives on the craftsmanship and development trends of Yixing Zisha Pottery. Arts Criticism, 12(6), 157-163. doi:10.16364/j.cnki.cn11-4907/j.2018.06.025.

Editorial Committee of Cultural Relics. (1984). Collection of Survey and Excavation Reports on Ancient Chinese Kiln Sites: Cultural Relics Press. ISBN:11068·1304.

European Environmental Agency. (2020). Europe's consumption in a circular economy: the benefits of longer-lasting electronics. Retrieved from Brussels,Belgium: https://www.eea.europa.eu/publications/europe2019s-consumption-in-a-circular/benefits-of-longerlasting-electronics.

Geng, B. (2010). The Complete Collection of Treasures of the Palace Museum: Purple Sandy Ware Shanghai: Shanghai Scientific & Technical Publishers. ISBN: 9787532388042.

He, Z. (2018). A Study of Literati Creation in Qing Dynasty: A Case Study of Mansheng Kettle. (Master).
Jiangnan University.

Hou, L. (2022). How long have you been using your phone? Survey: The average lifespan of mobile phones in China is about 2 years. China Daily. Retrieved from https://www.163.com/dy/article/HI9M7O750530SFP3.html.

Hu, F. (2007). On the Designing Idea of Chinese Ancient Objects. Hundred School In Art, 40(4). doi:10.3969/j.issn.1003-9104.2007.04.037.

Huang, Y. (2007). Legacy from Japan - Yixing Teapots Exported to Japan from the Collection of Peiji Xuan. Xin Bei: Ying Ji Tang Ren Craft Press.

Koenig, S. (2023, February 03, 2023). Product Lifecycles Shrinking. i3. Retrieved from https://www.cta.tech/Resources/i3-Magazine/i3-Issues/2023/January-February/Product-LifecyclesShrinking.

Li, Y. (2009). Introduction to Art and Design. Wuhan: Hubei Fine Arts Press. ISBN: 9787539425849.

Lin, G. (1992). Tao Bao Portrait Song. Taoyuan: Tea Study and Literature Press.

Lu, Y., & An, W. (2017). The Application of Emotional Semantics in Design. West Leather, 39(20), 120. https://www.cnki.com.cn/Article/CJFDTotal-XBPG201720096.htm.

Masi, D., Day, S., & Godsell, J. (2017). Supply chain configurations in the circular economy: A systematic literature review. Sustainability, 9(9), 1602. doi:org/10.3390/su9091602.

Nußholz, J. L. (2017). Circular business models: Defining a concept and framing an emerging research field. Sustainability, 9(10), 1810. doi:org/10.3390/su9101810.

Olesen, A. R. (2016). For the sake of technology? The role of technology views in funding and designing digital museum communication. Museum management and curatorship, 31(3), 283-298. doi:10.1080/09647775.2016.1163643.

Peng, D., Chen, S., & Zhou, L. (2021). The Complete Tang Poems, Volume 2, Essential Edition. Xi'an: Shaanxi People's Publishing House. ISBN: 9787224142754.

Petttigrew, J. (2001). A Social History of Tea. London: National Trust. ISBN: 070780289X, 9780707802893.

Qian, L., & Zhu, H. (2011). Locality and Heritage: The Geographic Branding and Evolution of Yixing Zisha Culture. Scientia Geographica Sinica, 31(10). doi:10.13249/j.cnki.sgs.2011.10.002.

Qu, H. (2015). Cognitive Study of "Zisha Pottery". Jiangsu Ceramics, 48(3), 9-12. doi:10.16860/j.cnki.321251/tq.2015.03.012.

Statista. (2024). Global smartphone sales to end users 2007-2023. Retrieved from https://www.statista.com/statistics/263437/global-smartphone-sales-to-end-users-since-2007/. Retrieved July 18, 2024 https://www.statista.com/statistics/263437/global-smartphone-sales-to-endusers-since-2007/.

Sun, J., & Ruan, M. (1993). Microstructure of Yixing Zisha Pottery and the Permeability of Zisha Ware. China Ceramics, 66(4), 21-25. doi:10.16521/j.cnki.issn.1001-9642.1993.04.003.

Tukker, A. (2015). Product services for a resource-efficient and circular economy–a review. Journal of cleaner Production, 97, 76-91. doi:org/10.1016/j.jclepro.2013.11.049.

van der Laan, A. Z., & Aurisicchio, M. (2019). Archetypical consumer roles in closing the loops of resource flows for Fast-Moving Consumer Goods. Journal of cleaner Production, 236, 117475. doi:org/10.1016/j.jclepro.2019.06.306.

V&A collection. Yixing stoneware teapot. Retrieved from https://collections.vam.ac.uk/item/O115612/yixing-stoneware-teapot-teapot-unknown/.

Vonplon, D. (2020). Konsumentenschutzer wollen die Reparatur retten. Neue Zürcher Zeitung. Retrieved from https://www.nzz.ch/schweiz/reparieren-soll-sich- wieder-lohnen-ld.1532659

Wieser, H., & Tröger, N. (2015). Die Nutzungsdauer und Obsoleszenz von Gebrauchsgütern im Zeitalter der Beschleunigung: Eine empirische Untersuchung in österreichischen Haushalten. Wien: Kammer für Arbeiter und Angestellte für Wien. ISBN: 978-3-7063-0563-1.

Wilhelm, W. B. (2012). Encouraging sustainable consumption through product lifetime extension: The case of mobile phones. International Journal of Business and Social Science, 3(3). https://ijbssnet.com/journals/Vol_3_No_3_February_2012/2.pdf.

Wu, Y., & Shi, S. (2006). Discussing the Evolution of Yixing Zisha Teapots from Early Zisha Ware. Southeast Culture, 40(4), 94-96. https://d.wanfangdata.com.cn/periodical/ChpNaW5lclBlcmlvZGljYWxDSEkyMDIyMDkwORINZG53aDIw MDYwNDAxNhoIYm1iaXNueng%3D.

Xu, X. (2017). Traditional Craftsmanship of Yixing Zisha. Shanghai: Shanghai Painting and Calligraphy Press. ISBN: 9787547915493.

Yamamoto, H., & Murakami, S. (2021). Product obsolescence and its relationship with product lifetime: An empirical case study of consumer appliances in Japan. Resources, Conservation and Recycling, 174, 105798. doi:org/10.1016/j.resconrec.2021.105798.

Yang, Z. (2013). History and Mordern Chinese Porcelain's Art Zisha Pottery. Harbin: Heilongjiang Art Publishing House. ISBN:9787531838999.

Ye, M. (2020). Is Your Brand Symbol Unique? China Marketing, 31(02). https://kns.cnki.net/kcms2/article/abstract?v=8XtZWovJaIQZMO7J5rPPEx-0Y5rWdwgmyLOl_jkegH4Z6J3flzhUpoSZc2b5SElHyktmuUX8HRqUP6n_-812O3TT2fiv-MYnHidfVlnjGDNWbFa1fRn22fcikKOmGHF-BC7xq5 2jbkHZpp7DLCsOVJyHncAz8OPb7SnMtZYTcKtSKs_YrL6Ed7ctj0U4FKcUNj6_7Iyz5VrvBypSrdZ4u7NFKQndkhm6SXXtBVfAfs=&uniplatform=NZKPT&language=CHS.

Zhang, X. (2017). Syncretism of Skill and Morality: On the Creation of Red Stoneware. ZHUANGSHI, 167(8). doi:10.16272/j.cnki.cn11-1392/j.2017.08.007.

Zhao, K., & Zhou, J. (1998). History of Science and Technology in China (Chemistry Volume). Beijing: Science Press. ISBN: 9787030061591.

Zhou, Z. (2017). Find Way in Pottery Capital, Seek Truth of Red Stoneware: Thinking about Cultural Inheritance and Industrial Development of Red Stoneware in Yixing. ZHUANGSHI, 67(8), 12-21. doi:10.16272/j.cnki.cn11-1392/j.2017.08.004.

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“DESIGNED BY WOMEN (DPM): APPROACHES FOR A HISTORICAL, NON-SEXIST, AND CO-CREATIVE STUDY ON PIONEERING WOMEN DESIGNERS IN CHILE”

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ABSTRACT | Publications on the trajectories of designers, whether biographies, micro-stories, or side notes, have articulated and enriched multiple histories of design in the Southern Cone. However, these histories reveal a persistent pattern: in the case of Chile, most published works primarily focus on male designers. This bias accentuates gender differences and perpetuates patriarchal power dynamics. The presence of women designers has been only partially addressed in local histories of design and applied arts or in the disciplinary training at university design schools. To address this gender imbalance in the construction of a comprehensive history of women designers who paved the way and created new paths within the national scene, the research project “Designed by Women: Pioneers of Design in Chile” (DpM) was undertaken. The project’s objective is to highlight the trajectories of women who contributed to the professionalization of design—from both professional and academic perspectives—during its formative phase. The study incorporates research methods from design, history, and anthropology. In this article, we emphasize the theoretical framework and discussion that shaped the DpM project rather than presenting its concrete results as a replicable methodology. The proposal, in its documentary phase, introduces the concept of the “pioneer” and methodologically characterizes a non-sexist perspective, which is a necessary approach for studying women who forged the design profession in Chile within a system where positions of power were predominantly held by men (in universities, design offices, design publications,

design event organizations, etc.). In the exploration phase of the project, we examined the trajectory of the distinguished designer Ximena Ulibarri—who is still professionally active—to co-construct her pioneering journey from a non-sexist perspective. Methodologically, through reflection during the research process, we tested a prospecting approach that distances itself from dominant androcentrism by incorporating a gender perspective. The research resulted in an initial systematization of experiences, enabling the replication of this process to explore the trajectories of other female designers. This approach is not intended to commodify a historically subaltern identity, but to challenge the traditional and objectivist canons used to construct the history of design. The aim is to fully recognize women's relevance in the professionalization of design and to contribute to the generation of transformative knowledge.

KEYWORDS | GENDER AND DESIGN, NON-SEXIST RESEARCH, PARTICIPATORY RESEARCH, LOGICS OF POWER, SYSTEMATIZATION OF EXPERIENCES

1. Introduction
[STYLE: _P/RoD Heading 1]

Within the framework of the project "Designed by Women: Pioneers of Design in Chile" (DpM), which aims to highlight the trajectories of local design pioneers through documentary, exploratory, and project-based research, a preliminary study is being developed on Ximena Ulibarri, one of the women who helped forge the design profession in Chile within an overwhelmingly male-dominated power system. Approaching this from a non-androcentric perspective, the project has produced a methodological tool as its first outcome, with results published on https://disenadopormujeres.cl. The purpose of this article is to outline the methodological and theoretical framework used for the systematization of experiences and the coconstruction of the career, work, and thought of the prominent national designer Ximena Ulibarri, recognized as a pioneer of the discipline and an active professional designer. This is particularly significant as it positions the pioneering designer as an active agent in the gathering of information and the interpretation of her own history. In this way, her professional trajectory is historicized, situating her within various contexts and historical moments in the non-linear manner characteristic of personal memories.

In this proposal, rather than presenting concrete results, we offer a discussion and a potential methodology— considering its feasibility—for investigating the work and trajectory of a woman designer from the Southern Cone, potentially applicable beyond these borders. This research framework seeks to transcend the purely structuralist or positivist dimension of history, which is often expressed through different structures (material, social, economic, mental) "within which individuals could be perceived... framed in more or less homogeneous groups, where personal profiles and characteristics are completely blurred" (Morales, 2005, p. 76). Thus, the aim is to distance ourselves from modern and objectivist canons in the construction of a history of design pioneers, with the goal of contributing to the generation of transformative knowledge within the

discipline and profession, beginning with the initial question: How can the practices and discourses used in research processes subvert androcentric narratives in the memory of design?

2. Theoretical Perspectives.

2.1 On the Notion of "Pioneer": Toward a Visibility of Female Designers

The concept of pioneer, from a general historical perspective, originates from the French term pionnier (12th century) and, as it transitions into modernity, it acquires the meaning of initiator. This notion also takes on various bifurcations depending on its subject and context: from a group of animal or plant organisms that begins the colonization of a new territory; a person or collective that starts to explore or exploit something unknown (Todorov, 1982); an individual capable of seeing potential opportunities and making the most of them; someone who does something that has never been done before, marking a before and after; to an agent participating in the formation and expansion of something.

In historiographical terms, the concept of "pioneer," in the masculine form, became canonical with Nikolaus Pevsner's book Pioneers of Modern Design (1936), which is often considered the first publication on the history of design in the Western world. This text has been critiqued by subsequent generations of design researchers for, among other things, its teleological construction of a modern design narrative led by "heroes" rather than "heroines." However, it must be understood within the historical and social context in which it was written. From a broader perspective, in the major Euro-American publications on the history of design that followed (Banham, 1960; Ferebee, 1971; Heskett, 1980; Lucie-Smith, 1983; Meggs, 1983; De Fusco, 1985; Sparke, 1987; Satué, 1988; Bürdek, 1991; Forty, 1995; Campi, 2007, Eskilson, 2007; Jury, 2012; Margolin, 2017, etc.), women occupy a less prominent role. Nevertheless, as this type of research advances, their presence becomes more significant (Breuer and Meer, 2012; Drucker and McVarish, 2020; Herder, 2015; Kirkham, 2000, etc.). A noteworthy and controversial aspect is that in recent studies written by female designers (Kirkham, 2000; Menéndez, 2021), there is an insistence on the thesis that the women who contributed to the construction of modern design worked solely for well-known male figures with their own studios (e.g., Lilly Reich, Charlotte Perriand, Cini Boeri, and Franca Helg in the offices of Ludwig Mies van der Rohe, Le Corbusier, Marco Zanuso, and Franco Albini). However, we find it important to highlight that, in DpM, this historiographical claim does not apply literally: it was not until the implementation of the neoliberal model in Chile that leadership positions in professional design teams began to be increasingly occupied by men.

On the other hand, in constructing narratives about trajectories in the historiographic field of design, "women are excluded from historical references on the industry simply because these narratives are often written by and about men" (Connory, 2020).

Consequently, women's contributions are undervalued due to the variables of "success" and "significant contribution" present in design histories, which align with the production and work of male pioneers and their broader dissemination for the teleological formation of the canon. Authors like Buckley (2020) argue that the omissions of women, both in the past and present, are systematically ignored, and these silences are not accidental but rather the direct consequence of specific historiographic methods. Although her thesis might be debatable, as the historiography of design did not deliberately aim to exclude women designers, her interpretation makes sense by challenging those research methods that involve the selection, classification, and prioritization of certain categories of design and designers, styles and movements, and modes of production, which bias the presence of women.

Against the "historical invisibility of the character," beyond their gender, the issue of biographical constructions arises. Although we are in a different time from the events we study, which allows us to know some (but only some) of their potential outcomes, our present remains an open horizon to various possible futures. To some extent, a purely biographical recognition or visibility of a pioneer—who may also resist being designated as a "pioneer"—can detract from the ontological, epistemological, and methodological priority of social structures—extra-individual entities—based on a scheme of "objective" determinations (Revel, 2015). While biographical constructions can contribute, they present obvious limitations. The creation of a list of authors, whether men or women, may constitute an obsolete epistemology as it does not facilitate the understanding of the deeper forces and stereotypes that underpin cultural systems limiting women's access to the design profession (Beuer and Meer, 2012). Gorman (2003) argues that filling lists with women excluded from the design chronicle is erroneous; instead, he proposes eradicating the pervasive classism, sexism, and racism in the global design field since enumerating heroines, rather than challenging the canon, confirms it by establishing hierarchies. As López Carmona suggests, "the attitude of most feminists has been to recognize or reincorporate the biographies of women who have played an important role in the history of design into the historical narrative" (2016, p. 3). Although challenging, with DpM we strive to distance ourselves from the modern-patriarchal canon that compels us to focus on certain achievements typically monopolized by men, such as leadership positions, company directorships, mentions in publications, guild awards, and so forth. If we were to adopt these dominant—and inherently binarist—criteria through a process of 'reverse engineering,' we would inevitably reproduce a male-dominated history of design, shaped by a male-defined construction and taxonomy.

The question of who qualifies as a "pioneer" within the various domains or specializations of Design is open to debate (Luna Rodríguez, 2019). From a non-sexist perspective, DpM proposes certain criteria that should be considered to address the historical invisibility of women designers: a) Women who pursued the early stages of a design career in Chile, who identify as designers but not necessarily as pioneers, using the term as an "adjective"; b) Women who contributed in various ways to the formation of design as a modern profession; c) Women whose work subtly influenced and shaped the discipline of Design in Chile through their professional practice and within the fragile academic environment; and d) Professionals who created a body of work distinct from the visual arts and advertising.

2.2 Historizing Gender Imbalances and the Pioneering of Design

According to García Parada (2020) in her research Maestras del diseño gráfico en Chile, addressing design from a gender perspective does not necessarily entail establishing a strict demarcation between two domains: design oriented towards market needs and practices focused on social responsibility, often understood in a binary framework, with the former considered masculine and the latter feminine. Instead, the work of early cohorts of Chilean professional female designers sought to achieve a certain discursive and practical transversality—balancing private and social demands with the need to cater to a new type of "urgent" client who drove the neoliberal economy in Chile during the transition from the 1970s to the 1980s—often without the time or possibility for adequate reflection. The neoliberal structure, dominant to this day, aggressively promoted consumerism and the development of financial and commercial services, prompting reflection on those who become visible and the agencies and practices that remain less recognized in the design field. However, from a feminine and care-oriented perspective, as we observed in interviews with members of design groups predominantly composed of women—such as Publicidad UC, Paula, and INTEC—these designers promoted working conditions and environments that constituted the profession, even while responding to the exponential increase in demand for professional design services as part of the new market requirements.

During the development of the still-dominant neoliberal and patriarchal system, the environments created by women pioneers of design in Chile came under pressure due to new business structures and logics. While the demand for design solidified their presence in companies, institutions, and universities, it did not prevent positions of relevance and power from being predominantly occupied by their male counterparts. When occupations gain prestige, as we observed in the case of design in Chile from the 1960s to the 1990s, men tend to colonize them. This occurred with the imposition of the neoliberal model in Chile, a scenario where the productive trajectory, the quality of work, and the progress of each designer operated in contexts localized and overseen by social

institutions: competitions, universities, companies, sponsorship systems, and so on (Lupton and Tobias, 2021). Additionally, the multiplicity of roles between the public and private spheres has been another determining factor. For those women who forged their paths during the early stages of the design profession, establishing their own independent professional businesses was, in fact, almost a heroic act. This was especially true if the profession was accompanied by conventional social and cultural roles: being a wife, mother, and caretaker of the household (Guida, 2020). However, as observed in our research, the logics that prevailed in the early design studios led by women allowed for the coexistence of roles within structures that could be described as more horizontal and cooperative rather than vertical and competitive, qualities that are often recognized in feminism as differences between patriarchal and matriarchal logics (Harding, 1987; Kirkwood, 2001; García Dauder and Ruiz Trejo, 2021).

Researching and historicizing the pioneers who established the design profession in Latin America is a complex task. When the focus is on the work of women designers, design has often been mischaracterized— for instance, as illustration or interior decoration—and not fully recognized as an autonomous profession with its own distinct field of knowledge. Anyway, more challenging were the efforts of women designers who refused to confine themselves to reproductive labor. However, during the 1980s and 1990s, when design and visual arts intersected with postmodern sensibilities and poststructuralism (Álvarez and Neira, 2020; Pelta, 2004; Poynor, 2003; Walby, 2002), new and more flexible discourses emerged, challenging monolithic approaches such as psychoanalysis, Marxism, or structuralism (Anderson, 2006). In this context, female historians began publishing previously unknown material about active women in the creative fields, challenging the prevailing selection and quality criteria in art, architecture, and design by offering more pluralistic perspectives (Sellers, 2018). Belatedly, the Western world has begun to acknowledge the professional trajectories of some women who made significant contributions to the field of design in the 20th century. Though, this recognition often lacks a historically situated, non-sexist perspective that critically examines the role of women. While biographical accounts and analyses of their work are valuable contributions, they are insufficient to fully explain the development of these trajectories, as previously mentioned.

The historiography of Chilean design still recognizes a clear imbalance between the publications of male and female monographs regarding the construction of narratives, experiences, and trajectories of design academics and professionals. The latter—those about women—are scarce, which is even more paradoxical given that women have been the majority in university classrooms in the discipline (Vargas and Rodríguez, 2019; Vidal, 2022). This is evident in the higher number of enrollments in design schools, where many pioneers who pursued academic or professional careers, or both,

Figure 1. Sample covers of monographic books about national designers or proto-designers, all men, 21st century. Source: Pedro Álvarez archive.

were trained. This paradox reveals that design has been rapidly acquiring greater symbolic value and, consequently, increasing influence in organizations and positions of power. When men from bourgeois families begin to study design, it indicates that the discipline is moving away from a position of "symbolic deprivation" (Jaffe-Dax, 2024).

2.3 A Non-Sexist Perspective for Making Female Design Pioneers Visible

The DpM research perspective is grounded in the premise that all knowledge is produced in a situated manner, meaning it is shaped by the context and subjectivity of the producer (Haraway, 1995; Harding, 1987). In line with feminist epistemology, we hold that the gender of the researcher influences research practices (Buenahora, 2016) and propose the feminist viewpoint as an alternative for generating significant and transformative knowledge for women and their contexts (Arango Marín & Cardona González, 2023; Blazquez, Flores & Ríos, 2012).

Following Harding (1987), one of the pioneers of gender-conscious research, feminist methodologies aim to incorporate women as empirical and theoretical resources, have a political

purpose of transforming women's reality, and place researchers on an equal critical footing with the people studied. Additionally, they focus on questioning binary categorizations (Preciado, 2022)—such as the division between subjects who research and objects of research—seeking active collaboration between researchers and those researched (Biglia, 2014). This approach also promotes women's access to knowledge, alongside a critical reflection on their role in the social fabric, without being limited to highlighting aspects considered important by men (Harding, 1987; Blazquez, Flores & Ríos, 2012). Thus, it questions the hegemonic hierarchy that places roles, practices, and social positions historically assigned to masculinity at the top of the social pyramid, challenging patriarchal myths about female 'passivity' in history (Kirkwood, 2001).

By distancing ourselves from the androcentric biases that still shape part of History—those that render stories invisible—we incorporate a gender perspective as a starting point to understand the worlds and environments in which these pioneers have situated themselves. But a non-sexist approach is not synonym of a feminist approach. While both address sexist and androcentric biases (Bartra, 2012), feminist research must also be explicit in its political stance and commit to advancing gender equity. Margrit Eichler argues that, unlike non-sexist research, feminist research focuses on improving the condition of women. Both the gender approach and the feminist viewpoint allow us to observe and describe the world from perspectives that highlight power inequalities and inequities. The non-sexist approach seeks to eliminate gender biases, while the feminist perspective aims to recover the history of marginalized groups of women (Kirkwood, 2021). However, in this case, it is not obvious to claim that the first generations of professional designers trained in Chile were particularly marginalized women, as most came from bourgeois or middle-class families. From this position, they accessed university education, confirming their belonging to the classes with access to elite professional training and practice.

Political commitment is a distinctive feature of feminist methodologies, which imposes on any research that proposes this inscription to be explicit in applying its principles at all stages of the work (Maffia, 2012). While a non-sexist approach does not require its practitioners to have as explicit a political commitment as the feminist one, in investigative terms, feminism and non-sexism, as situated approaches, take a critical distance from the canonical epistemology and methodologies of modern science. The latter, in its practice, hides its political interests under the pretense of possessing supposed neutrality, camouflaging its political practices of power production with the notion of objective knowledge. Situated research seeks to expose and question the existing —yet concealed— power relations and interests that favor certain investigative agendas.

In practice, the feminist and non-sexist situated approach in research is defined and recognized by its discourse but legitimized by its daily practices; that is, how research tools are applied, how the team is organized, how its sensitivity addresses gender inequalities, and its commitment to reducing the identified inequities. While it is not obvious to assert that there are inherently feminist or non-sexist research instruments, the careful and conscious realization of the inequities in semi-structured interviews and oral histories has been privileged in the social sciences that participate in this perspective (Bartra, 2012). Consequently, the relationship between researchers and the researched develops differently due to a certain awareness of historical sex-gender relations, which constitutes the type of mediation each inquiry instrument deploys, how it is conducted, the findings obtained, and the willingness to return the research results to the communities worked with for their empowerment.

This approach responds to its democratic vocation. Situated, feminist, and non-sexist research actions return data, results, and findings to the communities involved in the research, as facilitating access to knowledge has been one of its central concerns (Kirkwood, 2021). Its commitment to social transformation entails an effort to make the knowledge derived from the research experience available to enrich and contribute to the autonomy of those who made the research possible, thereby promoting the critical capacity of the displaced in intellectual, political, and affective dimensions (García Dauder and Ruiz Trejo, 2021). It is important to note that situated research questions traditional forms of communicating results, as the modern scientific conviction of producing objective knowledge imposes it using expert and distant language (Bartra, 2012), which favors the marginalization and subjugation of non-experts. Feminism and non-sexism agree that the objective and subjective, the rational and emotional, can coexist and enrich each other within a clear, critical, straightforward, personal, and compelling discourse.

Recently, design historiography has aimed to identify the causes that exclude women from the canonical narrative of the discipline. This effort has helped reveal and address the evident imbalance between research, exhibitions, and publications about male and female designers. However, the omission of women compels us to rethink the logic and methods of data collection, narrative construction, and the use of categories and variables that operate when documenting the disciplinary present of design and writing its histories.

The development of the project materializes the assumption that the historical narrative is itself an object that can be designed, thereby rejecting the hegemony that objective knowledge, claimed by a particular discipline or method, has over how history should be constructed. We establish this criterion to foster a dialogue among investigative modalities from different disciplines, aiming to construct ways of understanding and

narrating history that are pertinent to the studied context and to recover the memories and trajectories of pioneers whose work and influence have been undervalued (Miquel Mallol Esquefa, 2019).

3. Methodological Approach to the Subject of Study

3.1 Applying a Non-Sexist Perspective

Although this project does not necessarily articulate itself as a form of "resistant female subjectivity" (Schraut and Paletschek, 2008), it does align with studies on the underrepresentation of women in various fields of design (Buckley, 1986 and 2020; Meer, 2012; Gorman, 2001). Cheryl Buckley, recognized as an "academic pioneer," highlighted this issue in her work "Made in Patriarchy: Toward a Feminist Analysis of Women and Design" (1986).

The historical dimension of the pioneer (past, present, and future) addressed in DpM focuses on the analysis of the autobiography, professional trajectory, and technical record of Ximena Ulibarri' work. We understand DpM research as co-creative, due Ulibarri actively participated in the analysis of her own biography and production. This involves a historiographic review of the

PRIMARY SOURCES			SECONDARY SOURCES
ORAL SOURCES	**VISUAL SOURCES**	**WRITTEN SOURCES**	**DIGITAL SOURCES**
Pioneer designer (actors related to her career)	**Photographic records of the period:** Personal dimension	**Writings/manuscripts of the designer**	**Netnography work:** presence of the pioneer in online media, websites, blogs, digital social networks, etc.
Family circle of the designer	**Photographs of the designer's work and projects:** from sketches to commissions and finished works.	**Printed bibliographic material on the designer** (articles, interviews, written columns, awards, prizes, etc.).	
Colleagues and teachers during her university education	**Photographs of teaching activities:** Academic dimension		
Professional and academic peers			
Bosses and collaborators			
Students			

Figure 2. Diagram of the use of primary and secondary sources for documenting the work and trajectory of the pioneer designer. Source: own elaboration.

designer and her ways of doing and thinking through oral sources (interviews, conversations) and evidence found in printed and digital documents, both primary and secondary (bibliography, netnography, and archival work). This includes records of graphics, products or services, as well as images related to her private sphere, professional development, and/or academic trajectory. It is important to emphasize here that the research integrates significant historical moments (key events) and chronological temporal arcs (e.g., years or decades) based on both plausible

and subjective events of the past (the pioneer's trajectory), present (the current situation of the pioneer), and future (the pioneer's projections, for instance, her legacy). Thus, the non-sexist aspects —which intersect with historical ones— are evident in the construction and application of a qualitative data interpretation, approaching the process critically to avoid sexist and androcentric biases. This approach is mindful of the fact that power structures and gender norms can influence how data is collected, analyzed, and interpreted.

In line with the previously described perspective, the project sought to identify the various key actors and communities that should be considered, promoting their active participation in the construction of the research narrative. This initial phase materialized during the investigative process through activities in which the participants could influence the research process and the preliminary approach of the team. The research addresses a phenomenon where personal and political, organizational and productive dimensions intersect, based on research in and through design (Findeli et al. 2008), but also as action research (Fals Borda 1988; Colmenares, 2012), from a non-sexist interpretative matrix, as a possible way to approach and make visible the trajectories of the pioneering women in design.

We, as researchers, intertwined two perspectives: the biographical (experiences of the pioneers) and the contextual (events that occurred in Chile as experienced by the subjects). Integrating these two approaches interweaves the qualities and circumstances of these designers' trajectories, employing a methodological approach that acknowledges research as inherently political. This approach allows us to address issues such as the concerns and beliefs of the subjects under study, their affections and emotions, as well as their actions and rituals (Mollenhauer, Hormazábal, & Molina, 2018).

Within the typologies of "case" studies, we find those that focus on a particular fact or subject (Santamaría and Lecuona López, 2016). Regarding the type of subject, a single case can be considered as a person, a family, or a group. As Ottenberger (2001) states, the "single case design" originates from action research as a dual experience between researcher and researched subjects, allowing for testing general hypotheses that can be used or referred to particular cases. These interactions between researcher and researched subjects naturally enrich the investigation by presenting differences and subjectivities; but, if systematically analyzed, these differences can facilitate the detection of certain patterns. Furthermore, the application of horizontal investigative work in conjunction with the pioneer allows for a more comprehensive understanding of their trajectory and affections from a situated perspective. In the context of this research, we employed a multimethod investigative strategy that integrates qualitative and participatory methods, typical of ethnography, historical analysis, and design research. Specifically, the methods

included oral history interviews, which facilitated a deep exploration of the lived experiences of Ximena Ulibarri, and visual elicitation techniques, which allowed participants to engage with and reflect upon their professional and personal histories through visual media. We also utilized documentary analysis, where both primary and secondary sources, including archival materials, publications, and personal documents, were systematically reviewed. Furthermore, ethnography and autoethnography played a critical role in intertwining the researcher's reflexivity with the subject's own reflections, ensuring that the research process remained co-creative and non-hierarchical. These methods were essential in contextualizing Ulibarri's work within broader disciplinary, political, and social frameworks, thereby offering a situated understanding of her contributions to Chilean design.

Figure 3. Instances of research with the pioneer (case study), other pioneers and academics, feminists, and historians. Source: own elaboration.

In line with the project's purpose, we categorized design pioneers in Chile using a non-sexist methodological approach, aiming to broaden perspectives and challenge modern, objectivist research paradigms. We considered the fundamental qualities of the design profession, as defined by its goals, practices, and values (Ashforth et al., 2008). However, due to the gender

biases that dominate the Chilean design field, it was not possible to select a designer based solely on her awards, publications, media appearances, and similar indicators. As previously mentioned, we used four criteria to recognize a woman as a Pioneer of Design: Is she an emerging designer from the early stages of the design profession in Chile? Is she a key figure in articulating design practice in Chile? Has she produced a body of work that significantly contributed to the development of Chilean design? Does her work leave a distinct legacy for Chilean design? These questions allowed us to introduce analytical categories into our method that unequivocally identify Ximena Ulibarri as a pioneer and position her as a reference for new generations. Moreover, we sought to validate this recognition through accounts provided by communities of professionals, educators, colleagues, peers, students, and family members, thereby legitimizing her trajectory as a pioneer due to her impact on the field.

This investigative effort aims to highlight the work and agency of the pioneer Ximena Ulibarri. It proposes her as the subject of study through an ethnographic and methodological approach to recognize and make visible other design pioneers in Chile. This scalable project establishes guidelines to avoid gender biases, as it "leads us to develop the research process somewhat differently, starting with the formulation of different questions about issues that, in general, are not considered relevant by other researchers" (Bartra, 2012, p. 73). Under this approach, it becomes crucial to recognize how and where we position our own subjectivity, acknowledging the impossibility of achieving a neutral stance on the subject and its controversies. In this sense, knowledge production can be understood as a political act, requiring us to position ourselves consciously and responsibly (Biglia, 2014). Thus, during the projective research and through critical reflection on the investigative and interpretative process, DpM develops a research method that gradually distances itself from androcentric research, building its autonomy during the research process itself.

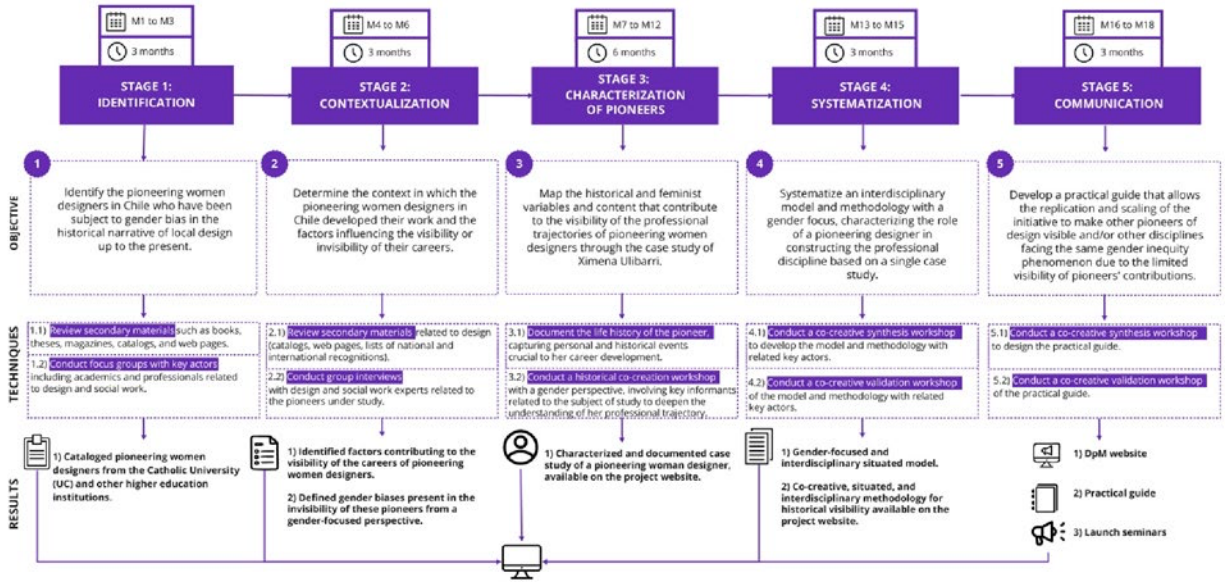

Figure 4. Descriptive Scheme of the Five Stages Constituting the DpM Research.

The critical approach of the DpM project aims to identify the power relations and asymmetries underlying the phenomenon studied. It seeks to critically interrogate the relationship between the research team, the instruments, and the individuals involved in the investigation, without pretending to consider the project as something "completely closed." Therefore, at each stage of the project, the findings are reviewed with the aim of iterating the information gathered with the pioneer and keeping the expectations and particularities of the research experience alive.

The co-creative aspects present in the DpM model are addressed through the review and analysis of bibliographic sources and the collection of visual material carried out during various research activities in the field (interviews, visual elicitations, conversations, group meetings, etc.). These activities were conducted either virtually or in person with various actors, taking into account the pioneer and the researchers, as well as all participants in these inquiry processes (feminist academics, design historians, professional colleagues, academic peers, team members, family members, students, and design pioneers in Chile).

4. CONCLUSIONS

Facing the perception of a gender imbalance in the recognition and inclusion of pioneering female designers in historical and disciplinary publications in Chile, DpM, Designed by Women: Pioneers of Design in Chile, positions itself as a project aimed at making their trajectories visible. It targets both the academic world and a broader audience to generate transformative knowledge about pioneering women designers in the Southern Cone. Additionally, specific dimensions have been identified to consider in creating a method and/or investigative process that proposes alternatives to the traditional and objectivist canons of constructing histories of designers who paved the way. This proposal suggests historical approaches, work stages, methods, and ethnographic inquiries that, according to the authors, are necessary to explore these pioneers' trajectories and construct their history in a shared, informed, and horizontal manner.

Although the purpose of this article is not to present the concrete results of the case study of designer Ximena Ulibarri—available at https://disenadopormujeres.cl—it aims to discuss how her case study highlights the need to incorporate non-sexist criteria in researching pioneering women designers to advance the generation of transformative knowledge for themselves and their contexts. In this sense, it is crucial to emphasize that the interest in studying these professional women implies re-situating the historical

perspective of design at both continental and local levels. This goes beyond the trajectories of European or American designers (all white) who were the first to be examined or become references in global design history books, documentaries, or design magazine articles (e.g., Casey, Eames, Greiman, Grey, Kare, Kruger, Lupton, Pierrand, Reich, Scher). However, the focus here is not on finding a female identity or identities in design but rather on understanding the diverse perspectives in practice while also recognizing the trajectories of women who contributed to the disciplinary and professional construction under conditions of lesser likelihood of recognition.

It has been essential to attempt to understand how, despite a high enrollment of women in technical and professional design schools compared to their male peers—at least in the context of Chile—their presence in design histories has been less prominent. This correlates with their influence in power territories (such as leadership positions in design schools, research centers, and related institutions), although this phenomenon has been gradually changing in recent times. It has also been observable how pioneering women designers "established schools" within sometimes rigid Bauhaus curricula or rebelled against certain programmatic assumptions such as "interior decoration" or "industrial design." They proposed alternative paths, such as integrating objects into environments do not separate from them or clarifying that graphic design was also industrial and therefore difficult to separate in a binary manner, against categories defined and naturalized by male architects or designers.

During our research, we recognized that the pioneers shape the field of design by organizing into work teams based on logics and modes of relationship historically associated with women, such as mutual care, a certain horizontality, and the practical consideration of the affective fabric, among others. This observation allows us to affirm that, in its formation, the professional design field in Chile is organized based on logics and practices that can be described as matriarchal. It has been within these constructions of plural and flexible design histories, without falling into relativism, that this investigative and methodological proposal has sought to generate some approaches to address this ongoing problem. Finally, it should be mentioned that the mere exercise of writing about the trajectory of a pioneer will not succeed in reversing the invisibility of women's work. However, providing an investigative experience and methodological approach that can be scaled constitutes a contribution that allows for reflection during the action and interpretation outside of the action (Findeli & Coste, 2008).

BIBLIOGRAPHY

Álvarez, P. y Neira, A. (2020). Formas imposibles: expresión y tecnología del diseño gráfico posmoderno en Chile (1985-2000), en Devalle, Verónica y Marina Garone (eds.), Diseño latinoamericano: diez miradas a una historia en construcción. Bogotá: Editorial UTADEO.

Anderson, P. (2006). Los orígenes de la posmodernidad. Madrid: Anagrama.

Arango Marín, M., y Cardona González, M. (2023). Narraciones de mujer sobre la casa rururbana de Riosucio (Caldas): experiencias de otras maneras del diseño desde un proceso de investigación creación. Kepes, 20(27), 319–351. https://revistasojs.ucaldas.edu.co/index.php/kepes/article/view/8045

Ashforth, B. E., Harrison, S. H., & Corley, K. G. (2008). Identification in Organizations: An Examination of Four Fundamental Questions. Journal of Management, 34(3), pp. 325–374. https://doi.org/10.1177/0149206308316059

Banham, R. (1960, 1985). Teoría y diseño en la era de la máquina. Madrid: Paidós.

Bartra, E. (2012). Acerca de la investigación y la metodología feminista, en Blazquez, N., Flores, F. y Ríos, m. (coords). Investigación feminista: Epistemología metodología y representaciones sociales. Ciudad de México: Universidad Nacional Autónoma de México, pp. 67-78.

Biglia, B. (2014). Avances, dilemas y retos de las epistemología sfeministas en la investigación social, en I.

Mendia, M. Luxán, Legarreta, M. Guzmán, G., Zirion, I. y Azpiazu, J., Otras formas de (re) reconocer. Reflexiones, herramientas y aplicacionesdesde la investigación feminista. SIMREF.

Blazquez, N, Flores, F. y Ríos, M. (2012). Introducción, en N. Blazquez, N., Flores, F. y Ríos, M. (coords). Investigación feminista: Epistemología metodología y representaciones sociales. Ciudad de México: Universidad Nacional Autónoma de México, pp. 11-20.

Breuer, G. y Meer, J. (2012). Women in Graphic Design 1890-2012. Berlin: Jovis.

Buckley, C. (2020). Made in Patriarchy II: Researching (or Re-Searching) Women and Design. Design Issues, 36 (1), 19–29. https://doi.org/10.1162/desi_a_00572

Buenahora, G. (2016). Escribir para no ser silenciadas: Mujeres, literatura y epistemología feminista en Lecturas críticas en investigación feminista, en Blazquez, N. y Castañeda, M. (coords.) Colección Alternativas. Ciudad de México: Universidad Nacional Autónoma de México.

Bürdek, B. (1991, 1994). Historia, teoría y práctica del diseño industrial. Barcelona: Editorial Gustavo Gili.

Campi, I. (2007). La idea y la materia: El diseño de productos en sus orígenes. Barcelona: Editorial Gustavo Gili.

Connory, J. (2020). Processes that cause invisibility for women in Australian graphic design. In Boess, S., Cheung, M. and Cain, R. (eds.), Synergy-DRS International Conference 2020. https://doi.org/10.21606/drs.2020.135

De Fusco, R. (1985, 2002). Historia del diseño. Barcelona: Santa & Cole Publicaciones.

Drucker, J. y McVarish, E. (2002). Una historia del diseño gráfico. Buenos Aires: Ampersand.

Ferebee, A. (1971). A History of Design from the Victorian Era to the Present. New York: Van Nostrand Reinhold Company.

Fernández García, A. et alii (eds.), MoMoWo. 100 works in 100 years. European Women in Architecture and Design, 1918-2018, Turín: France Steele Institute of Art History, 2016.

Findeli, A., et al. (2008). Research through design and transdisciplinarity: a tentative contribution to the methodology of design research. FOCUSED: current design research projects and methods. Swiss Design Network, pp. 67- 91.

Frayling, C. (1993). Research in art and design. Royal College of Art Research Papers, 1(1), pp. 1-5.

García Dauder, D. y Ruiz Trejo, M. (2021). Un viaje por las emociones en procesos de investigación feminista. Empiria, Revista de metodología de ciencias sociales, (50), pp. 21–41. https://doi.org/10.5944/empiria.50.2021.30370

Gorman, C. (2003). The Industrial Design Reader. New York: Alworth Press.

Guida, F. (2020). Beyond Professional Stereotypes. Women Pioneers in the Golden Age of Italian Graphic Design. Milano: PAD, Pages on Arts and Design, Politecnico di Milano.

Haraway, D. (1995). Ciencia, cyborgs y mujeres. La reinvención de la naturaleza. Valencia: Ediciones Cátedra.

Harding, S. (1987). ¿Existe un método feminista? (G. Bernal trad.). Indiana Press University.

Herder, J. (2015). Women Pioneers: Swedish Design in Between the Wars. Nationalmuseum.

Heskett, J. (1980, 1985). Breve historia del diseño industrial. Barcelona: Ediciones del Serbal.

Jaffe-Dax, H. (2024). When Less Is More: The Semiotic Privilege of Status Downplay. Symbolic Interaction, 47(2), 200-225.

Jury, D. (2012). Graphic Design Before Graphic Designers: The Printer as Designer and Craftsman: 1700-1914. London: Thames & Hudson.

Kirkhan, P. (ed.) (2000). Women Designers in the USA, 1900-2000: Diversity and Difference. New York: Yale University Press.

Kirkwood, J. (2021). Preguntas que hicieron movimiento. Escritos feministas, 1979-1985. Santiago: Editorial Banda Propia.

López-Leon, R. and Macias, E. (2020). Enhancing design strategy through visual mapping: the strategy map. Design Research, Vol. 18, Nos. 1/2, pp. 96–111.

Lucie-Smith, E. (1983). A History of Industrial Design. New York: Van Nostrand Reinhold Company.

Luna Rodríguez, S. A. (2019). La influencia del género en la formación de los diseñadores industriales. Kepes, 16(20), 609–638. https://doi.org/10.17151/kepes.2019.16.20.22

Lupton, E. y Tobias, J. (2021). Extra Bold: A Feminist, Inclusive, Anti-racist, Nonbinary Field Guide for Graphic Designers. Princeton Architectural Press.

Maffia, D. (2012). Género y políticas públicas en ciencia y tecnología, en Blazquez, N., Flores, F. y Ríos, M. (coords). Investigación feminista: Epistemología metodología y representaciones sociales. Ciudad de México: Universidad Nacional Autónoma de México, pp. 139-154.

Mallol Esquefa, M. (2019). Para las investigaciones teóricas en el diseño: aprendiendo del pensamiento feminista. Kepes, 16(20), pp. 577–607. https://doi.org/10.17151/kepes.2019.16.20.21

Margolin, V. (2017). World History of Design. London: Bloomsbury.

Meggs, P. (1983). History of Graphic Design. New York: Van Nostrand Reinhold Company.

Menéndez Martínez, Alicia (2021). El papel de la mujer en el diseño del siglo XXI. Oviedo: Ediciones de la Universidad de Oviedo.

Mollenhauer, K., Hormazábal, J. y Molina, M. (2018). Creación de valor turístico en territorios urbanos mediante MESO. Revista DIS (1), pp. 48-54. http://revistadis.unnoba.edu.ar/?page_id=123

Morales Moya, Antonio (2005). "La historia con personas", en Hernández Sandioca, Elena y Langa, Alicia (es). Sobre la historia política actual. Entre política y cultura. Madrid: Abada Editores, 2005.

Muratovski, G. (2016). Research for designers. A guide to methods and Practice. London: SAGE Publications.

Ottenberger, A. (2000). El estudio de casos en la investigación social. Santiago: Ediciones Universidad Tecnológica Metropolitana.

Pelta, Raquel (2004). Diseñar hoy: temas contemporáneos de diseño gráfico. Barcelona: Paidós.

Pevsner, N. (1936, 2003). Pioneros del diseño moderno: de William Moris a Walter Gropius. Buenos Aires: Ediciones Infinito.

Preciado, P. B. (2022). Dysphoria mundi. Grasset.

Poynor, Rick (2003). No More Rules : Graphic Design and Postmodernism. London: Laurence King Publishing.

Revel, Jacques (dir.) (2015). Juegos de escalas. Experiencias de microanálisis. Buenos Aires: San Martín, unsam Edita.

Santamaría Aguirre, J., y Lecuona López, M. (2016). Propuesta de plan de investigación en el área de diseño basada en el método de estudio de casos. Kepes, 13(13), pp. 233–264. https://doi.org/10.17151/kepes.2016.13.13.11

Satué, E. (1988). El diseño gráfico: desde los orígenes hasta nuestros días. Madrid: Alianza Editorial.

Sellers, L. (2018). Women Design: Pioneers in architecture, industrial, graphic and digital design from the twentieth century to the present day. Frances Lincoln Adult.

Schraut, S. y Paletschek, S. (eds.) (2008). The Gender of Memory: Cultures of Remembrance in Nineteenth- and Twentieth-Century Europe. Frankfurt: Campus.

Sparke, P. (1987, 2010). Diseño y cultura una introducción. Barcelona: Editorial Gustavo Gili.

Stern, M. (1962). We the women: Career firsts of Nineteenth-century America, Virginia: Schulte Publishing Company.

Todorov, T. (1982). La conquista de América. El problema del otro. Buenos Aires: Siglo XXI Editores.

Vargas Callegari, R., & Rodríguez Torrent, J. C. (2019). Profesionalización del Diseño en Chile, una sinfonía en cuatro movimientos. RChD: Creación Y Pensamiento, 4(6).

Vidal, J. (2022). Encontrar el ella: Codiseñando una memoria feminista del Diseño. Santiago: autoedición.

Walby, S. (2002). ¿Pos-posmodernismo? Teorización de la complejidad social. en Barrett, M. Phillips, A. (comp.). Desestabilizar la teoría. Debates feministas contemporáneos. México, D.F.: Paidós / Universidad Autónoma de México, pp. 45-6.

“CO-CREATION AND DESIGN OF TOOLS FOR CULTURAL MEDIATIONS IN ART MUSEUM OF CIUDAD JUÁREZ”

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ABSTRACT | Today´s museums, rather than simply keepers of artifacts, should be spaces for exploration, education and inspiration. As centers of knowledge and culture they must be accessible to all and encourage both formal and informal learning. Mediation in museums, especially in contemporary art, which is often exclusionary in its complexity, seeks to make exhibitions more accessible and relevant, breaking down barriers between art and audience to facilitate deeper and more participatory understanding. This paper is about considering opportunities to design meaningful experiences that go beyond the content of exhibitions, integrating activities that enhance the visitor experience. Although the Museo de Arte de Ciudad Juárez (MACJ), the only one of the National Institute of Fine Arts and Literature in the north of México, has adapted and opened to the public in recent years, its access and relevance remain limited, facing challenges such as low attendance, limited dissemination and few public resources. This project has revealed opportunities to improve mediation and access through interactive and playful activities in this museum, such as exploring the exhibitions, experimenting, creating in concordance with the art works and learning, all of which encourage greater participation and connection with the community. Experience design and co-creation as a means of transforming visitor interaction could be tools to enhance the visitor’s experience.

KEYWORDS | DESIGN, MUSEUM, MEDIATION, EXPERIENCE, CO-CREATION

1. Education and mediation in museums

Museums, as places to safeguard culture, history, science and art, are now much more than places that preserve and display artifacts. A museum allows people to explore collections for inspiration, learning and fun. It is an institution that collects, protects, and makes objects, artifacts, and specimens accessible, which it holds in trust for society (Association of Museums in EVE Museums and Innovation, 2018). Miremont (2017) explains that museums are today a fundamental piece for the transmission of ideas and stage of the modern concept of cultural entertainment, they are part of the living knowledge of a society and institutions of culture at the service of a community. To complete this goal museums must have their doors open to everyone:

"Museums themselves have recognised [sic] that in order to be considered a valid and active participant in their society, they must be accessible to all, of real use by giving value in terms of providing resources for intellectual refreshment and debate and spaces for contemplation and inspiration". (Woollard, 2004, p. 106)

The museum functions are preservation, acquisition, conservation and collection management but also research and communication (Reinwardt Academie in Desvallées and Mairesse, 2010). Research and communication are intimately related to the exhibition as much as to education, one of its primary functions since museums are places for learning, because they allow people to develop skills and build knowledge in various spaces and moments throughout their lives (Lebrún, 2015).

Following Lewis (2004) "museums have an important duty to develop their educational role and attract wider audiences from the community, locality, or group they serve. Interaction with the constituent community and promotion of their heritage is an integral part of the educational role of the museum" (p. 11). Therefore, education in the museum aims to promote experiences in a formal environment in connection with educational institutions or specific academic projects, but also from non-formal education.

Museum mediation (Castellanos-Pineda et al, 2021; Arriaga, 2019; Alderoqui, 2020; Morales, 2015, Desvallées and Mairesse, 2010; Santacana, 2006) stems from its communicative and educational vocations. Mediating implies breaking the hierarchies that are usually associated with art and museums to make exhibitions more accessible to more people, and proposing activities that support the encounter with the works from different versions. It is a transmission effort that uses different channels and implies a communicative turn; with it, bridges, connections and accompaniments are established through the design of practical, critical and transformative media and activities that contribute to the democratization of culture.

In the contemporary art museography, these strategies also try to break the separation, both physical and intellectual, that is made of artistic and heritage objects with respect to their context (Sabido, 2015). In art museums, especially contemporary art museums, the resources and elements of mediation become fundamental when what is exhibited is experimental or conceptual since it entails an exercise of reflection beyond the obvious.

One of the great paradoxes of 20th century art has been precisely that the rupture with figurative and traditional art, which was proposed from a democratization and de-aesthetization of art, later became an exercise of exclusion. According to Giovine (2015) the works of conceptual art emphasized the epistemological turn in function of art that had already been initiated by the deaesthetization, the anti-art and the rupture, and made evident a new relationship with the spectator, who could not limit himself only to observe nor to relate aesthetically to the work -in a concrete way- but to relate to it by way of the intellect -in an abstract way-.

In this sense, mediation strategies should consider the dimensions of presence and event of the museum as a device for the consideration of the subjects and the ways of exercising knowledge, of knowing the world and, through this knowledge, formulating ideas about social reality (Sabido, 2015). The questions generated by much of today's art are not easy to answer, which is why museums have a fundamental role in mediation as guides to their visitors, but not only to explain it but also to provide access to the rich discussion of the artist with his media and discourse. In a context where the contemporary art museum is concerned with change in art (Debbaut, 1985 in Millet, 2018, p. 18), it is an opportunity for mediation to deal with the dynamic perspectives that art must manifest itself.

2. Experience design and co-creation as tools for mediation

Mediation is not a generalized exercise for any museum, it does not happen in a void, it is imperative to know the audiences. Planning experiences implies identifying the contexts from which visitors come or could come, it also considers access to their ideas, needs, perspectives and expectations, it is to consider

not only in the reception but in the experience of interpretation. Therefore, it depends not only on the content or the media, but on the visitor: on his appropriation as a subject constructor of the experience, linked to the vital and social baggage that he brings with them (Castellanos-Pineda et al, 2021, p. 611).

Visitor participation in museums is an area of conflict and ambiguity about how visitors become part of the museum (Alderoqui, 2015). In a 1967 seminar held in New York with different museum directors and curators in which Harley Parker and Marshall McLuhan participated, were put on the table radical ideas for traditional museums. In words of Alderoqui (2015) they talk about: open museums at night, take some artifacts out of their display cases and create immersive showcases for visitors; museographic devices to touch, scale reproductions, immersive spaces, modulation of lighting to force visitor involvement, visitors as co-producers and co-creators, rooms for children, the design of meaningful experiences in personal and identity terms, a sense of humor, the recreation of sensory environments to mount the artifacts of the collections that could reveal how they had been produced and used, nonverbal rooms, without signs, the deployment of imagination, of multiple languages, tactile, olfactory and acoustic spaces, and nonlinear exhibitions.

After fifty years, how much of this can be said to have happened in museums around the world is a difficult question to answer. In Mexico, great science museums have been created for children, interactive museums such as the economics museum in Mexico City (MIDE), or virtual visits, but some of the museums of history, culture and art financed with public funds are perhaps still far from generating mediations of that level. What do we see is a great opportunity to understand their role as constructors of meaning and educational recreational elements. "Museum collections reflect the cultural and natural heritage of the communities from which they have been derived. As such they have a character beyond that of ordinary property which may include strong affinities with national, regional, local, ethnic, religious or political identity. It is important therefore that museum policy is responsive to this" (Lewis, 2004, p. 12).

When it comes to experiences, design is a fundamental tool given that as an activity it studies access to new interactions with spaces, objects and messages (Campi, 2020; González de Cossío and Morales, 2015; Norman, 2006). As Buchanan (1995) explains: "design is an essential element of a new philosophy of culture directed toward the empowerment of individuals in exploring the diverse and common qualities of comunity experience" (Introduction, p. XVII). Through design, ideas are visualized since it is a projective and prescriptive activity (Lawson, 2006). It is a strategic and methodological activity whose solutions are based on studies of environments, users and recipients to identify needs and opportunities for improvement in different aspects of the development of

individuals, society and territories. The formal properties of an object or product are the result of the study of needs, so it must be done from a responsible perspective with the physical and social environment, always considering people and their realities.

"Human responses to the everyday things of the world are complex, determined by a wide variety of factors. Some of these are outside the person, controlled by designer and manufacturer, or by advertising and such things as brand image. And some come from within, from your own, private experiences" (Norman, 2004, p. 65). Experience design seeks to develop an ideal relationship and interactions between a user and an object. As Norman (2012) explains, objects are containers of experiences and emotions, they recall pleasant and comforting moments and by association have an important personal meaning for their users. But in addition, the object as a unit of material culture, is a temporal mediator, a communicator of the basic elements of a society (Melgar and De Los Reyes, 2019, p. 124).

"User experience design is the creation and synchronization of elements that affect users´experience with a particular company, with the intent of influencing their perceptions and behavior" (Unger & Chandler, 2012, p. 3). And it is an empathic approach of "research, conceptualization, design and development of a vast array of user-centric objects and experience" (Chapman, 2005, p. 94). It is therefore interesting to think about this perspective to understand how a museum configures its space, how it presents its exhibitions and, above all, how it designs routes and builds tools to communicate with its users.

According to Marc Hassenzahl (2010) "experiencing is the stream of feelings and thoughts we have while being conscious—a continuous commentary on the current state of affairs… sights and sounds… motives and actions, all closely knitted together and stored in memory, labeled, relived and communicated to others" (p.1). For Diller, Shedroff y Rhea (2006), there is an "essential human need for meaning" (p.3), that's why is important to "understand the role that meaning plays in people´s lives, how products and services can evoke meaning" (p.4), in other words meaningful experiences modify the user's sense of purpose and significance. Users relate to designed objects in ways that go far beyond their practical function generating a process of affectivity, but this affectivity depends on cultural variability, experience, education and individual differences (Norman, 2012, p.54).

Co-creation as a process of mutual value creation between an entity and its users, generates an active form of coexistence and interaction between them (Alves dos Santos et al, 2018; De Koning et al, 2016; Sanders and Stappers, 2008; Prahalad and Ramaswamy, 2004). Instead of a simple giveand-take it is about having non-passive recipients and contact that ceases to be transactional and becomes an experience. Co-creation is a collaboration that guides the design process,

involves dialogue, access to information about the actors, understanding the benefits of the process and transparency in the development of the actions in which they are involved.

As Busciantella-Ricci and Scataglini (2024) state in their overview, designers cannot "escape from interacting in a (co-)design process" (p. 8) because we collaborate, converse, share goals and carry out practices with different actors, and because in our work creativity is no longer exclusive to us or to a single moment of the design process. In this sense co-design is also "a mechanism for empowering people, namely a mechanism for taking control over their own futures by developing their own ideas, knowledge and skills" (Zamenopoulos & Alexiou, 2018 in Busciantella-Ricci and Scataglini, 2024, p. 9). If design in general already is co-design when works hand in hand with people, participatory design is even more so; is an approach that focuses on considering people's experiences and visions, but also the roles and relationships they might assume during the processes, in other words how they get involved in the generation of new ideas and in the transformation that a design process always implies. This is the foundation of what is understood as a human-centered, user-centered design.

Similarly, Sanders y Stappers explains in Designing to Co-Designing to Collective Dreaming (2014) that:
"Designers and design researchers are exploring the creation of tools that non-designers can use to channel their own creativity. In co-design, designers use the ideas generated by others as sources of inspiration and innovation. Designers are becoming part of teams responsible for the generation, analysis, and interpretation of the "data": the artifacts and models that result from the co-designing process. Design professionals are learning the skills needed to act as facilitators of the collective creativity of others". (2014, p. 19)

Their work shows the evolution over time of the concept of people's participation in the design activity, if at the beginning design was for consumers, and today design is made with users, in the future design will be done by people as a collective activity. Among its various conclusions, we highlight that "everyone can be involved in designing and gains relevant learning experiences throughout their education to enable their participation" (Sanders and Stappers, 2014, p. 33).

Experience design, user-centered design, participatory design and museum mediation concurs in a central element: taking people into account in the processes to generate meaningful products or services. As the experts explain "museums should not abdicate its responsibility as cultural institutions but need to coexist diversity of voices, because when this happens in the context of an exhibition enrichment of both museums and public occurs" (Alderoqui, 2015, Abstract, p. 30). That is why we see co-creation as a key element to implement in the design of tools for people to live and understand what the museum can give them and in turn the museum feeds back and generates another type of work, collaborating with those

who see it from other points of view.
Since the emphasis is rarely placed on the visitor subject, on the types of experiences that he/she constructs during his/her visit, on the manifestations of pleasure or of aesthetic gaze or historical understanding (Schmilchuk, 2012), thinking about mediation resources in the museum under the perspective of experience design and co-creation could contribute to produce museographic, informative, communication and dissemination resources that are indispensable to favor the mobilization of preconceptions and leave open the possibility of learning (Schmilchuk, 2012). According to this background, museums can be mediators of emotions, sensations and memories (Melgar and De Los Reyes, 2019), which allows establishing that through the design of experiences and co-creation, objects could contribute to the exercise of memory, learning and recreation in the hands of the public and other actors interested in educational and cultural development.

3. Mediation at the Museo de Arte de Ciudad Juárez

In Mexico, museums are fundamental spaces of its history and identity, but they are still inaccessible or distant for most of the population, distant not only geographically, but also in terms of absence as a cultural and recreational option. Like so many other institutions transplanted from the Old World, the museum in the American Continent is created as a cultural establishment in which conceptual-operational models are extended aimed at developing and disseminating specialized knowledge from objects and collections (Rico, 2018, p. 54). However, that knowledge has not always been at the service of all, even though the museum has changed and has opened its doors it is still an option for leisure, entertainment and education for few people.

There are many reasons why in our country there is still little population that approaches museums and of course it also depends on each region and its recreational options, but we cannot deny that repeatedly museums built as repositories of the great creations of the human spirit continue to play an important role in perpetuating coloniality, highlighting certain subjectivities and knowledge while invisibilizing others, perpetuating hegemonic narratives and worldviews (Guzmán, 2021).

In Ciudad Juarez there is a really reduced offer of museums compared to the size of its population, which exceeds 1.5 million inhabitants, so the Art Museum of Ciudad Juarez, the only museum of the National Institute of Fine Arts and Literature of Mexico (INBAL) that is in the northern region of the country, is an important museum in a city that has few cultural sites. This Museum was built in 1963, as part of the National Frontier Program (PRONAF). It was opened to the public in 1964 to the creation of cultural and entertainment centers along the entire border strip between Mexico and the United States (MACJ, Antecedentes, 2024). It is a museum with three exhibition

spaces, one of them characteristic for being a circular room, the others are part of a half-moon, they have two smaller areas of flexible use as a warehouse or to offer workshops. They do not have a permanent collection, they always receive from INBAL or propose the exhibitions themselves, which usually last three months, although there are shorter ones. Approximately nine people make up the management group: director, administrator, promotion and diffusion coordinator, exhibition and special activities coordinator, educational services coordinator, design and image coordinator, assistant, custodians and assembly, although not all of them are full time.

3.1 Methodology

This proposal is part of the research project Museum as a cultural space and access to knowledge. Strategies of mediation and new experiences in the Museo de Arte de Ciudad Juárez (INBAL) funding by UACJ through the call for Research Projects with Social Impact (PIISO). The methodological strategy is approached from a qualitative perspective, the inquiry action is dynamic between the facts and their interpretation (Hernández, 2014). The emphasis is placed on the study of reality and on the respect and fidelity to the perspective of the actors involved in that reality (Sautu, 2005). According to Tesch's classification (Miles and Huberman, 1994; Sautu, 2005) this work falls into the category of studies focused on the search for and social construction of patterns or regularities, and systems of social categorization, since among the theoretical-methodological approaches it covers are the various types of ethnographic studies, grounded theory and emancipatory and participatory studies -action research-.

This paper presents part of the first stage of the project, which consists of a diagnosis of the museum and the exploration of its existing audiences. For this purpose, a survey, open interviews, observation and active participation in museum events were carried out to identify the museum's audiences and the first possibilities for mediation and creation with users.

In March 2024 we began to work with MACJ to understand the dynamics of communication that it maintains with its public, to recognize their ways of working and later to propose, with them, elements of mediation. We have realized that MACJ already has a captured public, belonging to people interested in art and culture, but also to schools, especially elementary schools, or associations for those who make guided visits. Visitors who come on their own to the museum during its regular hours are not many, in the first survey conducted within the museum called Tell us about your experience in the Museo de Arte de Ciudad Juárez conducted during the month of May 2024 to sixty people, we realized that although the museum is recognized as an exhibition space, as well as protection and dissemination of artistic heritage, there are few people who come to the openings (17. 5% almost always, 1.8% always) and to the exhibitions (24.6% almost always, 5.3% always), and even fewer people attend other activities

offered by the museum such as workshops, conferences, guided tours, courses, concerts or events. In general, about 30% of the respondents recognize that they hardly ever go to MACJ and that when they go it is because they receive information about the exhibition or event. Respondents consult little the museum's Instagram and Facebook pages, the Tik tok and the museum's website are more successful. On the other hand, if we talk about the level of satisfaction, most recognize that they have had a good experience in the museum and that it has been thanks to the artists and work they appreciate, as much as to the building itself valued as an architectural piece of good design.

In addition to its exhibitions, MACJ offers the community guided tours, talks, dialogue tables, activations and workshops, and opens its doors to small concerts. It has a person in charge of Educational Services and some activities of its public program are framed in programs of the INBAL such as Night of Museums or A museum for you, or those of the Secretaría de Cultura, as it was in pandemic the program Contigo en la distancia, cultura desde casa from which arose Diálogos de la Frontera from MACJ. They also propose actions on special dates such as Children's Day, the museum's anniversary or the month of pride for sexual diversity, to name a few. Several of these activities are part of the public program that is scheduled every month with the authorization of INBAL and is disseminated through social networks. As a contemporary art museum, it is faced with exhibiting work that may be visually and conceptually difficult to understand for the common public, so it seeks other means of interaction with its audiences and strives to be a voice for art in the crossborder cultural context.

Although visitors to MACJ are professionally attended, we found that few visitors come to the museum or are aware of its networks. In the experience of the museum director, the number of people who visits an exhibition or attend an opening is directly related to the theme of the exhibition or the recognition of the artist. But it also contributes to the fact that on several occasions the dissemination of activities is not launched with time in advance given the type of management required to be part of INBAL, that the public budget is limited and that for the moment there is no board or association in charge of raising other funds. This, together with the fact that most citizens do not consider museums as a common space for recreation, opens the opportunity to think of spaces for co-creation and design of experiences that connect and communicate citizens with the museum for an enhancement of its cultural and educational work.

The first mediation proposals were generated from here, considering that the activities should offer a space for dialogue beyond the presentation and explanation of the art works presented. The tools of mediation make it possible to attend to an incipient process of co-creation that the MACJ could consider for its next activities. The early

stage of the research does not allowed to say if effectively we had address social change yet, but it has certainly broadened the MACJ administrators possibilities.

3.2 Tools for mediation

It is important that state-funded museums put in the foreground: "the needs and expectations of their visitors up to the top of their agenda [because] even if admission is free they wish to be assured that the time and effort they put into a visit will be rewarded through being entertained, learning something new and feeling welcome and comfortable in the surroundings" (Woollard, 2004, p. 106). As experts explain collections are at the service of the museum and the museum is at the service of the community (Miremont, 2017). With this in mind, we find opportunity to engage with the museum understanding that the exhibitions themselves are a great communication tool between the museum and its audiences because, as Miremont (2017) explains, the object alone, isolated, cannot express the research done around it, it needs to be presented in a context, in a communicational system attractive and tailored to the public every time it is presented. Therefore, our idea is to mediate through the contents that their exhibitions have; taking as a subject the same theme that the artistic pieces explore is a way to get the contents across in a different way, since as we saw above the audiences are diverse, not only in terms of age, but of interests, knowledge and skills.

Form and materials used by the artists to represent their themes and generate meanings is another opportunity to interact with the public in a different way. An example is the first activity we proposed and tested with a group of university students who took a guided tour of the museum. The objective was to explore the exhibition looking for specific materials, an exercise inspired by Bingo of the Museum of Modern Art, NY, USA. MoMA (2024). The exhibition at MACJ was a border biennial, meaning that there were very different pieces technically since it brought together several artists. Visitors were asked to use a worksheet called Exploring the Border Biennial with photographs containing parts of the art works, one side of which indicated what type of material they were looking for, such as wood, plastic, fabric, thread, cement or metal, e.g. They had to look among the pieces in the exhibition to find which work that photograph belonged to. This is a different way of looking at the pieces again; looking through the works also allows to pay attention to details, to find the diversity of media an artist has, to recognize the language of the materials, their consistency, malleability, durability, etc.

Two other exhibitions were inaugurated in May, Terrenos by José Villalobos, who presented photography, installation and video from which he speaks of the social and cultural dynamics of rural communities in northwestern Chihuahua, in contexts such as migration, their relationship with gender and land ownership in northern contexts (MACJ, Special Planner, May 2024). And Sentido

Paisaje by César de la Riva, who presents abstract pictorial art work, representations of the landscapes of various towns he visited in the region to create his pieces, which he describes in the titles of his paintings. As can be seen, both artists have the state of Chihuahua as their background.

The first activity that was designed was within the framework of the Night of Museums, which implies opening the doors one Wednesday a month after the usual schedule to offer a different program to the public. Usually this event proposes talks, conferences, concerts and welcomes adult audiences. On this occasion we proposed a playful exercise, an activity entitled Palabras y sonidos del estado grande in which we invited people of all ages to participate in the elaboration of poems through the guided tour of the museum and from two songs that speak of
Chihuahua. The activity began visiting and carefully observing the pieces by José Villalobos and César de la Riva, so visitors can reflect in what they saw, felt, and wondered about the pieces, and then to put those ideas in order in a special way by carrying out a poetic activity inspired by one of the works of art, whichever one they chose.

The public was given a pencil and an activity sheet that invited them to go through the exhibition rooms, choose a work that had caught their attention, and gather a series of words that would later help them to construct a poem. After this activity, a talk was given by anthropologist Francisco Lara Padilla about the different regions of the state, emphasizing its geography and the different cultures that have inhabited it. Then it was time for the collective work, the mariachi Canto a mi tierra from the UACJ was invited to sing Corrido de Chihuahua and Viva Chihuahua live, two songs that speak of the state, its customs and roots. Afterwards, we invited people to create collective poems, the words that make up these two musical pieces were made available to the users in the form of Magnetic Poetry -a creative writing exercise that consists of loose words on magnets that are then combined to generate new phrases and rhythms-, with the variety that they would be placed on displays. One of the most exciting parts was the reading aloud of the constructed texts. This event was attended by more than thirty people, including children, young people and adults, an important figure for the usual numbers (Figure 1).

Figure 1. Activitie in Noche de museos, Palabras y sonidos del estado grade.

In May 2024, a workshop was held with preschool and elementary school teachers to introduce them to some ideas about the museum and a work kit was used, which in itself is an element of mediation and co-creation because it allows them to learn about other experiences through a playful vision. "The play aspect of co-creation also serves to emphasise 'creation'. Just as play provides the freedom to do things differently on each occasion, so creation does not start with a preconceived end point. The very idea of creating suggests the importance of process" (Ind and Coates, 2013, p. 90-91). The assembly of a landscape with shapes and figures previously cut out allowed them to put together collages that had an important meaning for each of them, making them think of places they have traveled in the region. The letter they wrote to the museum about the degree course they are taking at the Centro Chihuahuense de Estudios de Posgrado, also related to the research project, shows that they are working on including it as part of their formal educational activities.

The fact is that "the educational services offered in the museums generate relationships with educative institutions. These services must be performed by a transdisciplinary team, which possess specific knowledge about the psychological characteristics of the visitor with regard to his/her behavior and learning processes in the exposition, motivations, and interests through a coherent, efficient and effective communication" (Lebrún, 2015, Abstract, p. 26). When museums do not have such large teams to help understand the characteristics of so many diverse visitors, listening to the voice of the docents can help generate more efficient mediation processes that will ultimately lead to co-creation, which is a process that "allows the creation of a design space that lets expert and non-expert designers collaborate" (Busciantella-Ricci and Scataglini, 2024, p. 12).

Finally, based on the artwork of César de la Riva, a permanent mediation is proposed for the last month of his exhibition. This exercise was built in some way as a logical consequence of the previous exercises, which were: exploring the museum to see the works from a different, more playful perspective, interacting with the themes that are exhibited, inviting visitors to participate with their opinions, to create based on the subjects that are offered to them, investigating how to teach and learn from the museum. The mediation took place in the space where the exhibition is located; installed on a couple of tables arranged in the museum, the activity began with the exploration of the art works of César de la Riva, to recognize some of the regions to which his paintings refer. The instruction was to compare the images given to them on a sheet of paper with the paintings, and to collect the name of the work that has the title of the place represented by the artist. Once this was done, they used one of the two wood puzzles of the state of Chihuahua to locate the regions and learn some details of the geography, culture and customs of the municipalities of Chihuahua. The last exercise invited the participants to create their own landscape; they were provided with a series of materials such as cardboard, paper and colored stickers, as well as glue and scissors (Figure 2).

Figure 2. Permanent mediation based in César de la Riva´s exhibition Sentido Paisaje.

This activity allowed each participant to show their work in the museum and to be part of the exhibition on a temporary basis. As Alderoqui (2015) mentions, the objective is the recognition of the reciprocal relationship between society and the museum, which demands a creative use of the collections: to stop being exclusively a "treasure to protect" to become a truly collective resource (2015). Results for both the museum and for us as researchers were very important, they opened up possibilities for the future, the evidence indicates that people were able to come to the activity on their own and execute their exercises with autonomy, but more importantly to broaden the vision of the other mission of the museum, not only to offer artistic works to see, but to help the public to interact with them, to dialogue through mediation. Even though the artist or the mediators are not present, by being in the museum and interacting with the work to make this exercise of self-creation, an exercise of co-creation took place in an incipient way. Co-creation and participation are basic strategies of co-design and help to democratize the processes, in this case, public participation in a space reserved only for artists.

Co-design is considered a "primary strategy for participation, co-creation and democracy in innovation" (Busciantella-Ricci and Scataglini, 2024, p. 1). And it should not be forgotten that the complex society that we currently form "is pushing for using creativity and collaborative practices as collective resources for sharing knowledge, activating co-creation processes and provoking systems changes (Jones 2018; Eckhardt et al. 2021 en Busciantella-Ricci and Scataglini, 2024, p. 9). Therefore, it is relevant that the museum offers more and more spaces to be not only a "thermometer" of society, but also a "microphone" for it and above all spaces for personal and collective creative expression.

To conclude, we would like to stress the importance of museums knowing their audiences and measuring the footprint of their public programs, we agree with the experts that a permanent study of people's needs is necessary, contemplating the socioeconomic and cultural reality and finding and using the appropriate instruments and forms of measurement with the purpose of knowing if the efforts cause the desired impact. Museums must also exist to reconcile and bring people with different ways of understanding life closer together (Roitman, 2019). As researchers, we are grateful that the museum managers allow us to accompany them and that they themselves consider new options as part of our intervention. This summer 2024 they opened a series of talks with emerging artists and offered a series of workshops for children ranging from painting and recycling to poetry and physical exercise within the program Un museo para ti; although the number of beneficiaries is still low, it helps to make visible that the museum has a permanent public program. On the other hand, we have seen an interest in inviting visitors to join their networks through posters in the museum itself and an increase in the museum's publications about its events.

Conclusion

The reflections and exercises presented here are part of a project that aims to design strategies and mediation resources to contribute to the formation of new audiences and participation in the dialogue about the city from the perspective of culture and art. In its first stage, as we saw in this work, it aims to make a diagnosis to understand how Museo de Arte de Ciudad Juárez works and how it is received by its users. At the same time, it generates the first tools to work with audiences and identify resources, means and possible ideas for mediation. It has been an important learning experience that would not have been possible without the openness that the museum has had with us, and we believe that this also helps managers to remember that the experiences of their audiences can be very significant.

Co-creation is an exercise used in many types of companies and instances, museums could benefit from its procedures to generate dialogues between them and artists, the community, associations and educational institutions. The design of different activities is allowing the museum's already captured audiences and perhaps some new ones, to live new experiences, MACJ is an architectural space of great aesthetic value, being in it is already an enjoyment, but if in addition we can not only appreciate the works, but have access to reflection on its contents, to the opinion or to the same action, the experience becomes something extraordinary.

After the diagnosis, we intend to start proposing more permanent activities that will contribute to this communication for the benefit of all. Although monthly activities are planned and workshops, visits and forums are offered, an opportunity is perceived in the search for feedback from users, in the dissemination of events and in the capture of new audiences. All the experiences gathered so far allow us to think of new challenges for the MACJ and its possibilities to generate spaces for design and co-creation that contribute to having a more diverse audience and, of course, a larger one, so that all its efforts and planning have an impact on more people.

To understand how MACJ works, how the exchange relationship with its visitors is, and how they experience the museum, we have implemented qualitative and quantitative instruments. The general analysis indicates that the way in which the museum works has intense periods of planning that then lighten with the day to day of the exhibition, it would be ideal to implement exercises of experience design and participation that allow the museum to listen to the user to be able to take a step forward.

Results obtained so far open positive possibilities for the future, both for the museum and for us as researchers. The evidence indicates that the people who experienced the permanent exercise were able to come to the activity on their own and execute their exercises with autonomy. With this, the museum opened its doors to validate the work and at the same time helped us to

start an exercise to observe it calmly, to learn something from it, to appreciate it beyond its aesthetic appearance, in short, to live it in a different way.

Museum works according to the exhibitions it receives, sometimes they are of recognized artists, others of emerging artists, or even of other disciplinary areas such as architecture, but all of them are a source of inspiration to put on the table different themes, the border, ecology, geography, violence, culture, etc. As a public institution, MACJ has the responsibility to disseminate knowledge in a coherent way and seeking that all the contents can be well assimilated and discussed, it is not an easy task. What we propose is to consider design as a generator of new valuable experiences for its visitors, to foresee its qualities as an engine of change and to help consolidate the museum as an inclusive, participatory and coexistence space relevant to society, which in turn contributes to a better understanding of art and the interaction between creations and their audiences.

References

Alderoqui, S. (2015). El museo de los visitantes. Museologia & Interdisciplinaridade, 4(7), 30-42. https://doi.org/10.26512/museologia.v4i7.16771

Alderoqui, S. (2020, October 23). Mesa 3: La experiencia museal en entornos virtuales y digitales. Facultad de Comunicación UNC. Córdova, Argentina. Retrieved June 19, 2024, from https://www.youtube.com/watch?v=OmphQElCXJI

Buchanan, R. (1995). Rhetoric, Humanism, and Design. In R. Buchanan y V. Margolin, Discovering Design. Explorations in Design Studies. Chicago: The University of Chicago Press.

Busciantella-Ricci, D. and Scataglini, S. (2024). Research through co-design. Design Science, 10(e3), DOI: 10.1017/dsj.2023.35

Campi, I. (2020). ¿Qué es el diseño? España: Gustavo Gili.

Castellanos-Pineda, P., Massarani, L. Vieira de Abreu, W., Alvaro M., Norberto-Rocha J., Singer-Sochet, S. y Sánchez, E. (2021). La figura del mediador en la relación entre el museo y el público: estudio de caso del MIDE de México. Arte, Individuo y Sociedad, 34, (2), 609-626, https://doi.org/10.5209/aris.74644

Chapman, J. (2005). Emotionally Durable Design: Objects, Experiences and Empathy. Londres: Earthscan. https://doi.org/10.4324/9781315738802

de Koning, J., Crul, M., & Wever, R. (2016). Models of co-creation. In N. Morelli, A. de Götzen, & F. Grani (Eds.), Service Design Geographies: Proceedings of the ServDes.2016 Conference (125 ed., pp. 266278). Article 22 (Linköping Electronic Conference Proceedings; No. 125). Linköping University Electronic Press.

Desvallées, A. y Mairesse, F. (2010). Conceptos claves de museología. Francia: Colin-ICOM. Retrieved October 5, 2023, from https://icom.museum/wpcontent/uploads/2022/02/Conceptos_claves_ES.pdf

Diller, Shedroff y Rhea (2006). Making meaning. How successful businesses deliver meaningful customer experiences. Berkeley: New Riders.

EVE Museos e Innovación (2018). Museos, Centros de Interpretación y de Visitantes. Una Nueva era para Nuestros Museos. Retrieved October 9, 2023, from https://evemuseografia.com/2018/01/03/museos-centros-de-interpretacion-y-de-visitantes/

Giovine, M. (2015). Paradojas del arte contemporáneo. La paradoja en el discurso. Tópicos del Seminario, (34), 155-171. Retrieved October 9, 2023, from http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1665120020150002000008&lng=es&tlng=es.

Hassenzahl, M. (2010). Experience Design: Technology for All the Right Reasons. EUA: Morgan y Claypool. https://doi.org/10.1007/978-3-031-02191-6

Hernández, R., Fernández, C. y Baptista, P. (2014). Metodología de la investigación. México: McGraw Hill.

Ind, N. and Coates, N. (2013), "The meanings of co-creation", European Business Review, 25 (1), pp. 86-95. https://doi.org/10.1108/09555341311287754

Lebrún, A. (2015). La educación formal, no formal e informal: una tarea pendiente en los museos del Perú. Consensus, 20(2), 25–40. https://doi.org/10.33539/consensus.2015.v20n2.405

Lawson, B. (2006). How Designers Think. The design process demystified. USA: Elsevier, Architectural Press.

Lewis, G. (2004). The Role of Museums and the Professional Code of Ethics in Running a Museum: A Practical Handbook. International Council of Museums (ICOM), UNESCO. Retrieved June 27, 2024, from https://unesdoc.unesco.org/ark:/48223/pf0000141067?posInSet=3&queryId=35ee11dcd043-43c4-a0e9-49c75b0cdc79

MACJ (2024). Antecedentes del Museo de Arte de Ciudad Juárez. Retrieved June 27, 2024, from https://museodeartejuarez.inba.gob.mx/antecedentes.html

Melgar, M. y De Los Reyes, J. (2019). De los objetos al museo. Experiencias educativas emotivas y creativas. Contextos de educación, 20 (25), 122-137. Retrieved October 9, 2023, from http://www2.hum.unrc.edu.ar/ojs/index.php/contextos/article/view/770

Miles, M. y Huberman, A. (1994). Qualitative Data Analysis. Thousand Oaks: Sage Publications.

Millet, C. (2018). El arte contemporáneo. Buenos Aires: La Marca Editora.

Miremont, G. (2017). Seminario Museografía práctica. Departamento de Artes, Facultad de Filosofía y Letras, Universidad de Buenos Aires. Retrieved October 2, 2023, from http://dspace5.filo.uba.ar/bitstream/handle/filodigital/10244/uba_ffyl_p_2017_art_seminarios_museografía%20práctica.pdf?sequence=1&isAllowed=y

Morales, L. (2015). La mediación cultural del museo. En L. Morales (Ed.), Tendencias de la Museología en América Latina. Articulaciones, horizontes, diseminaciones (pp. 120-132). México: ENCRyM-INAH. Retrieved June 7, 2024, https://revistas.inah.gob.mx/index.php/digitales/article/view/6068

Norman, D. (2012). El diseño emocional. Por qué nos gustan (o no) los objetos cotidianos. Barcelona: Paidós.
_____ (2006). La psicología de los objetos cotidianos. España: Nerea.

_____ (2004). Emotional Design. Why We Love (or Hate) Everyday Things. New York: Basic books.

Rico, L. F. (2018). El museo en la UNAM (México). Arquetipos, procesos y nuevos compromisos. Cuadernos De Arte De La Universidad De Granada, 49, 53–68. https://doi.org/10.30827/caug.v49i0.8145

Prahalad, C. K., & Ramaswamy, V. (2004). Co-creating unique value with customers. Strategy & leadership, 32(3), 4-9. DOI 10.1108/10878570410699249

Roitman, D. (2019). El museo como instrumento educativo hacía la diversidad: la experiencia del Museo Judío de Chile. Cuadernos Judaicos, (36), 135–152. https://doi.org/10.5354/0718-8749.2019.55873

Sabido, A. (2015). Museología - presencia – dispositivo. In L.G. Morales (Ed.), Tendencias de la Museología en América Latina. Articulaciones, horizontes, diseminaciones (pp. 164-176). México: ENCRyM-INAH.

Santacana, J. (2006). Bases para una museografía didáctica en los museos de arte. Enseñanza de las Ciencias Sociales, 5, 125-133. Retrieved October 2, 2023, from http://www.ub.edu/histodidactica/images/documentos/pdf/bases_museografia_didactica_muse os_arte.pdf

Sautu, R. (2005). Todo es teoría. Objetivos y métodos de investigación. Argentina: Lurniere.

Schmilchuk, G. (2012). Públicos de museos, agentes de consumo y sujetos de experiencia. Alteridades, 22(44), 23-40.

Unger, R. y Chandler, C. (2012). A project guide to UX Design for user experience designers in the field or in the making. Berkeley: New Riders.

Woollard (2004). Caring for the Visitor in Running a Museum: A Practical Handbook. International Council of Museums (ICOM), UNESCO. Retrieved June 27, 2024 from https://unesdoc.unesco.org/ark:/48223/pf0000141067?posInSet=3&queryId=35ee11dc-d043-43c4-a0e9-49c75b0cdc79

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