Masaaki Kurosu
Ayako Hashizume (Eds.)

LNCS 15772

Human-Computer Interaction

Thematic Area, HCI 2025
Held as Part of the 27th HCI International Conference, HCII 2025
Gothenburg, Sweden, June 22–27, 2025
Proceedings, Part VII

Springer

Editors
Masaaki Kurosu
The Open University of Japan
Chiba, Japan

Ayako Hashizume
Hosei University
Tokyo, Japan

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-031-93981-5 ISBN 978-3-031-93982-2 (eBook)
https://doi.org/10.1007/978-3-031-93982-2

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Assembling Around Collective Experiences: Empowering Communities in Lisbon's Margins Through Expanded HCI and Digital Social Innovation

António Gorgel Pinto[1,2(✉)] and Paula Reaes Pinto[2]

[1] Faculdade de Design, Universidade Europeia, IADE, Tecnologia e Comunicação, UNIDCOM/IADE, Unidade de Investigação em Design e Comunicação, Lisbon, Portugal
antonio.gorgel@universidadeeuropeia.pt
[2] CHAIA, Centre for Art History and Artistic Research, Universidade de Évora, Évora, Portugal

Abstract. The paper focuses on the potential of participatory design, digital social innovation, and sustainable human-computer interaction to address urban issues, including gentrification, unsustainable tourism, and social exclusion. Acting in disenfranchised neighbourhoods of Lisbon, the showcased Estampa Colab project combines design ethnography, interaction design techniques, and community engagement to raise sociocultural opportunities and sustainable development. It creatively preserves local identity by blending storytelling, digital pattern creation, and local crafts. The project's participatory nature actively involves community members in collaboratively developing visual representations of their experiences, empowering them to act as agents of change within their communities. Estampa Colab operates a modular framework influenced by rhizomatic and assemblage thinking, enabling adaptation to local environments and scalability to other urban areas while maintaining cultural and socioeconomic distinctiveness. The iterative development of analogue and digital interactions—including silkscreen and sewing workshops, a co-creation tool for patterns, and an e-commerce-enabled website—emphasises inclusivity, usability, and community benefit. These tools promote collaboration and equitable resource allocation, advancing a post-growth framework that prioritises ecological sustainability and social equality over unrestrained economic growth. The project's outcomes correspond with critical HCI and post-growth principles, providing a replicable model for addressing systemic urban challenges while leveraging community resilience and sustainable practices.

Keywords: Digital Social Innovation · Participatory Design · Post-Growth Development · Community Empowerment

1 Overview and Key Questions

Lisbon's urban environment is facing serious issues in managing human activity, particularly due to mass tourism, the housing crisis affecting the lower and middle classes, poverty in peripheral neighbourhoods, and the adverse effects of neoliberal transnationalism [1]. The current distribution of residents and visitors is imbalanced, with excessive

M. Kurosu and A. Hashizume (Eds.): HCII 2025, LNCS 15772, pp. 349–364, 2025.
https://doi.org/10.1007/978-3-031-93982-2_23

pressure concentrated on cultural, historical, natural, and recreational attractions that often appeal to locals and tourists. These areas where there is a disproportionate amount of demand, rich in social, cultural, and economic opportunities, attract an unequal amount of attention, leaving other regions underutilised, usually the most vulnerable territories and communities. These issues are further aggravated by centralised power structures that frequently neglect the potential of initiatives led by the community.

The tourism sector considerably contributes to the city's unsustainable development by failing to account for the true societal and environmental impact of its actions. This carelessness is intensified by decision-makers who frequently disregard the principles of real-cost economics and the intrinsic value of natural capital and ecosystems to promote immediate financial benefits. This temporary mindset driven by profit prioritises rapid development over the sustainable future of the cities and communities.

Although some citizens and entities profit from these often impermanent gains, viewing this growth model as an opportunity for economic development, others see it as an oppressive condition that intensifies inequality and environmental degradation. Lots of people find themselves caught between these two standpoints, recognising the swift benefits while simultaneously suffering its consequences in the medium and long term, such as rising living costs, environmental degradation, and the erosion of local culture. This contradiction highlights the deep and conflicting impacts of deregulated tourism growth, stressing the urgent need for more sustainable and equitable approaches to urban development.

To ensure sustainable and holistic development in Lisbon and promote true democracy, it is crucial to create conditions for balanced social, cultural, environmental, and economic development across all urban areas, thus enhancing connectivity among local citizens and visitors. Among the answers to these hurdles are bottom-up initiatives using an expanded understanding of digital social innovation (DSI) to engage residents from Lisbon's disenfranchised neighbourhoods, which can be systematised and leveraged to enhance sociocultural and economic opportunities, create interconnections between different city users, and empower communities to value their own identities and sustainable practices.

A case study called Estampa Colab is being developed to tackle this drawback, namely a collaborative laboratory whose aim is to aid in transforming the lives of Lisbon residents from different disenfranchised neighbourhoods who meet regularly to share stories with one another. It is a space where cultures coexist, solidarity flourishes, and autonomy is leveraged, creating a living heritage for the coming generations.

The underlying research enquires into several crucial questions that address how community empowerment, sustainability, and urban cohesion are connected in Lisbon. It seeks to investigate the potential benefits of bottom-up initiatives that involve DSI and participatory art and design within disenfranchised neighbourhoods, attempting to understand how these efforts can transform local communities. It also looks at ways to organise these community projects to make sure they last and have a positive effect over time. Improving connection between locals and tourists is another essential requirement in order to provide fair access to opportunities. The research also considers ways to persuade decision-makers to put sustainability in the interests of future generations ahead of quick profits, seeking the fundamental components necessary to enable communities

to define their own identities and adopt sustainable practices. Also central is to consider whether the life stories of Lisbon's citizens living in disenfranchised neighbourhoods can be used to create visual representations that foment urban cohesion. Lastly, it pretends to evaluate how Estampa Colab's outputs contribute to preserving and boosting local identity amidst the pressures of globalisation and tourism massification.

Design, technology, and community participation enable Estampa Colab to answer urban problems and promote sustainability and inclusion. This research explores how cocreative processes and digital technologies may improve systemic change. Guided by this vision, the study poses the following questions:

How can digital social innovation encourage bottom-up, community-driven solutions to mitigate the adverse effects of gentrification and unsustainable tourism?

What role do participatory design and interaction design methodologies play in empowering disenfranchised communities in urban settings?

How can a sustainable HCI (human-computer interaction) framework contribute to advancing a post-growth agenda in urban tourism by promoting equitable visitor distribution and long-term sustainability?

What is the impact of specific digital tools, such as the pattern-creation tool and the project's website, on cultivating community engagement, cultural preservation, and economic empowerment?

2 Tourism as a Challenge for HCI in a Post-Growth Scenario

Modern HCI deals with complex global issues such as population growth, climate change, migratory flows, and other phenomena that hinder sustainable growth. This reality implies a reorientation of the discipline towards development and growth as interrelated but distinct concepts. Development means making things better by improving skills, complexity, or quality, which requires considering the expansion and increase of productivity, innovation, and the improvement of social and economic conditions. Growth, in contrast, depicts a process of quantitative expansion, often measured in terms of physical metrics like size, production, or financial sums [2].

The market and the idea of growth hold even greater importance than in past periods, often blurring more balanced approaches to development, and the tourism sector, an important source of employment and wealth, embodies this situation. In Portugal, the tourism sector achieved record growth in 2023, surpassing levels prior to the epidemic. With a population of approximately 10.5 million in 2022, the country welcomed 30 million visitors, of whom over 18 million were living abroad, which means a 19% increase compared to 2022 [3, 4]. Nevertheless, an economy heavily reliant on unsustainable tourism reflects the persistent dominance of neoliberal globalisation, characterised by an abiding belief in economic growth, progress at any cost, and partial policy measures.

The philosophies of degrowth and post-growth make it possible to address the unsustainable growth observed in contexts such as tourism, challenging the predominant models centred on growth and proposing alternatives for the development of society. Marxist critiques and poststructuralist analyses have profoundly influenced early ideas of degrowth by interrogating cultural assumptions underlying development, particularly the emphasis on growth. These criticisms evolved with the recognition that the

20th century also had significant restrictions, which led to the emergence of the concept of post-development, which suggests that development continues to be a dominant social force, even as its failings become increasingly evident. This idea connects with post-capitalism and post-growth theories, which challenge capitalism's hegemony and propose alternative economic practices like degrowth to shift focus away from growth's narrow economic perspective, aiming instead to redefine labour, care, and value in a society moving away from mere economic gain [2, 5].

In the sphere of tourism, the incessant use of technology to improve the spectrum of economic activity related to the attraction, accommodation, transportation, and satisfaction of the needs of tourists frequently promotes unsustainable practices, favouring immediate economic benefits over enduring harmony with the environment. Technologies such as AI-powered travel planning, predictive analytics for marketing, and the widespread use of social media platforms have unbalanced the relationship between the quantity of tourism and the quality of destinations, as they may not be prepared for an increased influx of people. By way of example, geotagging on social media platforms has caused overexposure of remote natural landmarks, leading to environmental damage and overcrowding, and travel and accommodation booking apps have exacerbated overtourism by helping people discover places that never had many visitors before, often resulting in disruption to local property markets and increased rental costs for residents. This technical enhancement, while remarkable, emphasises the need to incorporate sustainable practices in their design and implementation to mitigate the environmental and social consequences.

The concept of post-growth serves as a critical framework for such considerations, highlighting sustainability and equity while presenting tangible proposals for a more equitable and sustainable world. In this context, HCI has been criticised for exhibiting unbridled growth by relying on a development paradigm that is founded on the unending expansion of resources on a finite planet is unsustainable. At the same time, the IT field, inherently associated with the growth mindset, proves this criticism through its persistent pursuit of innovation, often characterised by a culture of disposability of devices and an obsession with disruption [6].

An efficient procedure is to develop technologies that focus on important values and objectives rather than just profit, supplanting the paradigm that perpetuates the belief in infinite economic growth with approaches that integrate ethical values and ecological realities. Consequently, the adoption of policies centred on degrowth within HCI becomes a crucial measure to mitigate its role in economic expansion and the intensification of global crises [6]. Degrowth represents, at its core, a critical evaluation of the growth paradigm, calling for the removal of economic thinking from public discourse and the rejection of economic growth as a societal objective, and aiming instead for emancipation from neoliberal oppression.

Degrowth proposes reducing the amount of economic activity, rather than just maintaining the current level, imagining a society that requires fewer natural resources and adopts alternative organisational and living structures. According to ecological economists, degrowth implies an equitable reduction in the scale of production and consumption, which translates into a reduction in the use of energy and raw materials [7]. Besides focusing on reduced quantity, degrowth also implies a society with a

lower metabolic rate and an alternative system capable of fulfilling more conscious purposes [8]. Despite being related, degrowth and post-growth have different philosophical foundations and areas of concern. To reduce environmental deterioration and social discrepancy, degrowth mainly encourages a conscious reduction in the use of resources and economic activity, demanding the need to reduce production and consumption in a balanced way, as well as challenging the fixation on GDP growth as a measure of society's progress. Based on a redefinition of society to move beyond the growth paradigm, post-growth, instead, proposes a qualitative transformation in which equity, well-being, and ecological balance are prioritised over growth as the main objectives, rather than simply reducing economic activity. Using creative frameworks for community life, labour, and governance, post-growth considers how societies might flourish without relying on constant material increase, offering workable alternatives like circular economies and cooperative ownership, among others, whereas degrowth, although relying on solid truths, frequently only criticises the current situation.

Post-growth thinking in HCI offers a strategy to broaden the sustainable development agenda, promoting critical analysis of research and design practices and their social, economic, and environmental consequences, being crucial to raising awareness of the impact of political economy on technological design. The democratisation of technologies has a very significant responsibility in this societal transformation, where organisations like fab labs and makerspaces exemplify how collaboration, sharing, and co-creation can facilitate access to multiple technologies. Locally, post-growth promotes small and independent economies; nationally, it advocates recognising human rights to natural resources; and globally, it emphasises equitable wealth and resource redistribution [6].

Tourism is a paradigmatic example in this respect, as it has an impact on multiple layers of society. A more balanced distribution of tourists in a city reduces overcrowding and the resulting strain on popular destinations, which can lead to environmental degradation, cultural erosion, and diminished local quality of life. This beneficial approach promotes a greater economic influx in the less popular areas of cities, fuelling a more sustainable tourism model, as well as protecting their most visited sites. The process of redistributing tourists in cities can be stimulated by HCI by developing technologies and systems that lead tourists to alternative attractions or create lively itineraries based on real-time data. Smart city applications, personalised tourism apps, and interactive digital platforms can help manage tourist flow, offer customised suggestions, and encourage visits during less busy times, alleviating pressure on iconic sites and also promoting the inclusion of underexplored regions in the tourist circuits. Post-growth development promotes the significant contribution of HCI in the implementation of sustainable urban practices, namely tourism, prioritising the quality of the experience over massification and configuring a more beneficial relationship between tourism, local communities, and the environment. However, digital technologies associated with profit and economic growth persist, often rejecting local ecological orientations and socio-environmental objectives, limiting the emergence of sustainable and equitable alternatives. The decentralisation of technological development to local contexts constitutes more environmentally and socially conscious design strategies [6].

Urban tourism has profound social, economic, and ecological impacts from unbalanced growth, requiring careful regulations to increase sustainability. For instance, while tourism promotes cultural exchange, it can also lead to overcrowding and erosion of local identity. A post-growth approach prioritises quality over quantity, better distribution of visitors, promoting local businesses, creating jobs, and reducing reliance on imports. Initiatives like Estampa Colab project, to be presented in the following section, address these issues by focusing on less impacted neighbourhoods to preserve their unique character, contributing to the mitigation of negative effects by promoting local production and circular economy practices supported by HCI.

Sustainable practices to protect the planet are urgently needed to regulate tourism by valuing quality over quantity. These practices also aim to encourage the development of technologies and policies that promote ecological balance, social equity, and long-term well-being.

3 Raising Urban Sustainability Through Digital Social Innovation

Social innovation denotes a collaborative endeavour to reconfigure and optimise existing resources to address urgent challenges affecting people's quality of life and general welfare of the community. Rooted in principles of economic, social, and environmental sustainability, social innovation emphasises a dual focus: it originates within society, addressing societal needs by leveraging existing resources in innovative ways, while also acting as a catalyst for transformative social change [9, 10].

In turn, digital social innovation is a way of collaboratively introducing new things or methods wherein makers, users, and communities working together use digital tools and technologies to co-create solutions and expertise addressing distinct societal needs [11]. It is important to emphasise the role of social networks and digital connectivity in accelerating and complementing traditional social innovation processes. This type of innovation enables projects that would be impossible without connected technologies, particularly the internet, thereby reshaping societal functions. Typically, these initiatives begin by identifying problems and co-developing solutions with the stakeholders involved, prioritising participants' unique needs, skills, and experiences, and creating new forms of collaboration and interaction within networked systems. Apart from introducing innovative solutions, digital social innovation also redefines the socio-economic and technical structures that underpin these changes [12].

In urban settings, digital social innovation is studied from multiple angles, from its technical contributions to its capacity for systemic transformation, stimulating inclusivity and active citizen engagement. Two prominent models within this framework are shared and circular cities: shared cities rely on digital platforms to optimise the utilisation of underused or excess urban assets, promoting more efficient and sustainable consumption; and circular cities harness technology to promote partnerships that challenge traditional, linear resource usage, aiming to extend resource longevity and reduce waste generation [13].

Digital social innovation solutions can significantly contribute to raising post-growth tourism in urban contexts by leveraging sustainable HCI to address challenges like gentrification and unsustainable tourism. These approaches emphasise community-building

around shared problems, encouraging collaboration, and promoting equitable outcomes. For instance, platforms such as Spotted by Locals[1] and The Worst Tours[2] connect tourists with authentic, locally recommended experiences, encouraging them to discover less-visited neighbourhoods, thereby distributing tourist flow more evenly and reducing pressure on overcrowded sights. Community-based solutions like Commonplace[3], a participatory urban planning platform, enable locals to share their opinions on urban issues related to tourism, ensuring their perspectives are integrated into policymaking. Additionally, platforms like Goodwings[4] promote sustainable travel by offsetting carbon emissions for bookings and connecting tourists with eco-friendly accommodations and transportation, as well as apps like Too Good to Go[5] can also support circular tourism economies by reducing food waste in collaboration with local restaurants, providing an additional layer of sustainability.

These examples highlight how digital social innovation can not only mitigate tourism's negative impacts but also contribute to broader post-growth goals by stimulating inclusivity, sustainability, and resilience in urban environments. By creating participatory ecosystems through digital means, HCI practitioners can enable cities to prioritise people and the planet, ensuring tourism becomes a driver for regeneration rather than exploitation.

Digital social innovation provides citizens with the essential resources, expertise, and competencies needed to play an active role in shaping the evolution of smart cities, challenging and redefining foundational aspects of smart city planning to ensure greater inclusivity. However, it is vital to ensure that such initiatives are community-driven and not taken over as instruments for political or technocratic agendas [13].

In urban environments, digital social innovation is fuelled by trends like open knowledge and open networks: open knowledge initiatives in the digital domain (like Commonplace) enable the identification and reporting of local issues, encourage citizen participation in urban governance, and facilitate collaborative public projects, promoting social inclusion, cultural preservation, and sustainability; open networks (like Spotted by Locals and The Worst Tours) facilitate sharing information and resources among individuals and groups, driving collective and personal enrichment across assorted contexts [13].

3.1 Empowering Lisbon's Communities with HCI and Creative Participation

Although strongly connected to digital platforms, digital social innovation also brings together face-to-face initiatives and offline interactions to effectively achieve its objectives. Workshops performed in person and other physical interactions are fundamental in addressing barriers such as limited digital literacy, favouring trust, understanding, and collaborative solution development, as well as broadening participation across varied social groups [13].

[1] https://www.spottedbylocals.com/.
[2] https://theworsttours.weebly.com/.
[3] https://www.commonplace.is/.
[4] https://portal.goodwings.com/.
[5] https://www.toogoodtogo.com/.

Digital social innovation integrates digital and physical domains, converting virtual engagements into concrete, meaningful solutions that address intricate societal issues, extending its purpose beyond simply digitising processes, and seeking to use digital advancements to serve innovative collaborations and build new capacities. At its core, digital social innovation seeks to democratise innovation, bringing up synergies among several stakeholders. This approach is particularly impactful in urban contexts, where concentrated social, technical, and cultural resources provide a fertile ground for driving meaningful change [13].

The Estampa Colab project is a case study of digital social innovation combining open knowledge and an open network that consists of in-person actions and face-to-face meetings. The initiative is part of a broader collaboration with the Aga Khan Foundation (AKF), an international charity focused on sustainable development in underdeveloped regions. Since 1967, the Foundation has worked in education, healthcare, economic development, and cultural preservation, emphasising community-led solutions and partnerships across Central and South Asia, the Middle East, Africa, and Europe.

In Portugal, the synergy between the AKF and Portuguese research centres has been central. This collaboration, in which the authors have been involved, began in 2017 with a series of participatory design initiatives involving disenfranchised communities on the outskirts of Lisbon, exemplifying the power of transdisciplinary methodologies and integrating participatory art and design, social innovation, and alternative economic strategies to bring up social and cultural sustainability within local communities. Central to these efforts is recognising and preserving craft techniques and cultural heritage, which cultivate a sense of belonging and identity among community members. It is a common ground among these partners, revealing their interest in artisanship as a more meaningful and sustainable approach to design, manufacturing, and consumption [14].

This participatory approach within the community challenges prevailing mindsets by promoting a more democratic society and represents a holistic strategy in art and design, opposing the conservative nature of large-scale social interventions by focusing on smaller, adaptable, and scalable projects. It is also its aim to effectively influence the dominant system through a gradual and transformative process, leading to significant social and cultural innovation that can shape public policies. The adoption of strategies resulting from innovative collaborations with residents is crucial to establish or rehabilitate connections between individuals and their environments [15].

The Estampa Colab project was launched in 2024 in central Lisbon and aims to continue this legacy, focusing on bottom-up initiatives and involving participatory design and HCI with residents of disenfranchised neighbourhoods, particularly in the Lisbon parishes of Marvila and Santa Clara. It also aims to increase economic and sociocultural opportunities and stimulate relationships between the city's different users and empower communities to shape their identities and sustainable practices. It intends to encourage decision-makers to prioritise long-term sustainability and recognise creativity as vital to democracy.

This transdisciplinary design methodology integrates social innovation and participatory methods to address the challenges of gentrification, unsustainable tourism, and social exclusion in Lisbon's peripheral neighbourhoods, unfolding through interconnected phases: (1) it begins with the collection of life stories using an ethnographic

and dialogical approach to understand the lived experiences of community members; (2) these narratives are then translated into representative images through participatory workshops, where community members collaborate with the design team to create and edit digital images; (3) building on these visual elements, a custom program developed in p5.js facilitates pattern experimentation, enabling an interactive exploration of digital design for social innovation (see Fig. 1); (4) the resulting patterns are transformed into screen-printed fabric through a partnership with a local association's screen-printing workshop, which actively involves neighbourhood youth in the creative process; (5) the printed fabric, combined with patchwork from reused materials, is used to produce tote bags in a sewing workshop held in collaboration with another local residents' association, engaging retired women in a hands-on, community-centred initiative (see Fig. 2); (6) finally, a website will promote the public cause, showcasing the project and allowing users to discover these less-visited neighbourhoods, as well as hosting the pattern creation tool and serving as an e-commerce space to benefit local participants economically. Noteworthy throughout the process is storytelling, which plays a decisive role in connecting the phases of the project, critically examining the relationship between gentrification, tourism, and social exclusion while highlighting inclusive solutions for better tourist distribution and socioeconomic empowerment.

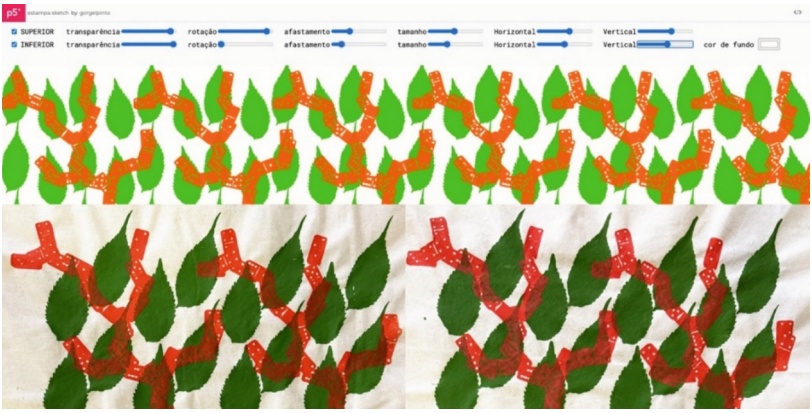

Fig. 1. Above: A p5.js program[6] developed to create patterns with participants, inspired by their local life stories. Below: The patterns brought to life through silkscreen printing.

By giving visibility to local life stories through participatory art and design practices and a digital social innovation framework, Estampa Colab seeks to preserve and invigorate local identity, strengthening urban cohesion. Digital social innovation emerges as a structural element in the project, where technology mediates collaboration, amplifies engagement, and scales the impact of local efforts. Situated within the sustainable HCI sphere, Estampa Colab demonstrates how technology can transcend its digital and instrumental role to become a transformative enabler of community resilience and systemic change. The integration of digital tools exemplifies the potential of sustainable HCI to

[6] Available at https://editor.p5js.org/gorgelpinto/full/OuM4dPE4o.

Fig. 2. Estampa Colab in Lisbon's Santa Clara parish. Left: Sewing and patchwork workshop. Right: Photography session with local participants.

balance technological development with social and environmental priorities, encouraging a post-growth agenda where innovation is directed toward meaningful, inclusive, and sustainable futures.

3.2 Using Assemblage Thinking Within a Design Iterative Process

The concept of assemblage represents the way the institutions, organisations, individuals, practices, and behaviours interact and influence one another within participatory projects that involve art, design, HCI, or other creative practices, leading to the formation and dissolution of territories. This process involves deterritorialisation, which opens new possibilities for assemblages, and territorialisation that inhibits these possibilities [16].

Deterritorialisation originated from the concept of rhizome, a metaphor for a plant that grows unpredictably and horizontally, unlike the hierarchical growth of a tree. Rhizomatic thinking resists rigid order, creating a freer, fluid, and borderless space. Deterritorialisation is essentially followed by reterritorialization as part of a rebalancing system. Each time the rhizome extends into new territory, the process repeats, transforming the rhizome in a flow that involves continuous reshaping through reciprocal effects [17].

Assemblages are created and dismantled across two dimensions. One dimension is the formation of territory on layers, which involves both the process of creating territory (territorialisation) and the process of undoing territory (deterritorialisation) on the Body without Organs (the changeable and fluid, powerful aggregate where they disassemble and their parts circulate). The second dimension is the articulation of symbols as a whole, transitioning between technology (substance, matter) and language (communication, intangible impacts) [16].

In line with this understanding, an assemblage of collective experiences such as the Estampa Colab, involving a coalition of institutions, artists, designers, and creative residents from disenfranchised neighbourhoods – through storytelling, silkscreen printing,

sewing, and HCI – represents a complex, robust, and heterogeneous whole. This assembly is meant to be a robust statement to local governance and the broader community, aiming to enhance the interaction of these distinctive components and generate new functions and more democratic realities.

Unlike traditional notions of structure, bottom-up initiatives like Estampa Colab – centred on participation and HCI to enhance citizenry and sociocultural and economic opportunities, bring up interconnections among locals and visitors, and empower communities to cultivate their own identities and sustainable practices – constituting a model of assemblage defined by fluidity, multiplicity, and the capacity for constant transformation. Rather than a fixed entity, this assemblage is an ongoing process, a vigorous arrangement of elements that can be reconfigured in countless ways, enabling creative and unexpected connections. Deleuze and Guattari's [17] concept challenges linear and hierarchical thinking, advocating for a rhizomatic approach that accentuates interconnectedness and the potential for change within systems. By valuing the context and the relationships between the nature of the entities that develop within it, assemblages create a greater understanding of natural, social, and cultural phenomena in contemporary thought.

The rhizomatic nature of the Estampa Colab creates opportunities for its potential scaling to other urban contexts while retaining its fluid and adaptive essence. Just as a rhizome grows horizontally, creating connections and spreading in unpredictable ways, the project's participatory actions and assemblies can extend from the specificities of the parishes of Marvila and Santa Clara to other urban contexts. By developing in local contexts – through design processes, ethnographic narratives and sustainable HCI practices – the project implements a modular structure capable of integrating new practices, elements, and stakeholders in different cities. This scalability is not about replicating a rigid model but about feeding a process of deterritorialisation and reterritorialization that allows for the creation of unique, locally rooted assemblages. An approach with these characteristics ensures that each iteration adapts to the specificities and socio-cultural needs of its new environment. The Estampa Colab's emphasis on digital social innovation also amplifies this scalability, as its digital platforms and tools enable knowledge sharing, collaborative experimentation, and collective learning across geographies. The project's rhizomatic approach makes it an example of how sustainable design and participatory HCI can catalyse systemic change while cultivating community resilience and interconnectedness in diverse urban settings.

Estampa Colab's research is exploratory, functioning as both a probe procedure and a method for producing further insights [18]. It is fundamentally a research-in-and-through-design approach that has evolved across multiple design activities, encompassing all phases of the project. This approach consists of iterative cycles in which designers combine multiple actions and generate several outputs, such as photography, videography, silk-screen printing, and prototyping, in tandem with the principles of design research, as it aims to produce insights into the design process by focusing on the fundamental project objectives and examining how the chosen methods and strategies might be improved or changed. It reflects research-through-design by involving designers in the systematic application and development of methods, guaranteeing that both the process and its results are shaped by this iterative commitment [19].

Since its inception in 2024, the project has undergone a complete cycle of design, prototyping, testing, literature review, reflection, and dissemination of different research phases to produce extensive data [20]. The website designed for the project's showcase and dissemination, including its concept, storytelling, the digital tool for pattern creation, and its outputs, as well as an archive of footage to document all the activities, is still in development, being the ultimate component to be tested.

A central pillar of the Estampa Colab project is its emphasis on design ethnography, which serves as both a methodology and a philosophy for engaging meaningfully with the realities of locals as a crucial initial step. Through this immersion, designers collect life stories, uncover cultural distinctions, and gain an intimate understanding of the community's values, struggles, and aspirations while also communicating through a two-way channel with the community in an educational approach. By prioritising the locals' perspectives, design ethnography goes further than surface-level research, allowing genuine dialogue and building trust within the community.

Design ethnography is inherently cyclical, consisting of iterative phases of observation, intervention, and reflection, where designers observe the social dynamics of the community, identify areas for meaningful change, introduce interventions, and then re-observe the outcomes to refine their understanding and approach [21]. The dynamic and adaptive nature of this process ensures that interventions meet the needs of the community rather than imposing solutions while also enabling adaptive strategies that develop in conjunction with the community, reflecting the powerful nature of its challenges and opportunities.

In the context of the project, design ethnography plays a vital role in informing participatory workshops, storytelling, and pattern creation, enabling the project to maintain a connection to local identity at the same time that encourages empowerment through a collaborative design practice. By integrating design ethnography into its methodology, the project exemplifies how design can bridge research and action, ensuring that solutions are culturally resonant, socially inclusive, and harmonised with the community's long-term aspirations. This approach stresses the importance of starting with empathy and observation, transforming these insights into sustainable and impactful design interventions [22].

The digital products developed within the Estampa Colab project, including the pattern-creation tool and the website, are guided by an interaction design methodology aimed at ensuring usability, accessibility, and relevance to the community's needs. The method begins with the (1) discover phase, wherein designers immerse themselves in the context by actively engaging with the community to achieve a solid understanding (design ethnography); (2) the define phase builds on insights obtained in the initial stage, enabling a reinterpretation of the design issues and a reframing of the main problem; (3) during the develop phase, multiple solutions to the design problem are produced, informed by multiple factors such as equivalent interaction solutions, insights from previous phases, and ideation sessions, emphasising collaborative design, where ideas are co-created with input from different types of users and stakeholders; (4) finally, the deliver phase focuses on evaluating these proposals on a small scale, refining viable options, and discarding less effective ones to arrive at improved, actionable solutions [23]. The implementation of the first prototypes of the tool was done using p5.js, allowing

iterative experimentation with various features and user interface designs. Likewise, the website, which was intended to showcase the project, promote the public cause, and function as an e-commerce platform, will be subjected to a heuristic evaluation [24] as well as rigorous user testing.

The integration of iterative testing and community involvement at every stage allows the interaction design methodology to relate digital products to the project's broader goals of generating inclusion, creativity, and sustainable development, representing an approach that emphasises the need for co-creation and people-centred design for creating digital tools that are not only functional but also deeply connected to the cultural and social fabric of the communities they serve.

4 Results and Discussion

The Estampa Colab project reveals how bringing together design ethnography, interface design, and participatory methods within a HCI framework can provide sustainable and socially innovative achievements. The proposed approach addresses the urgent need for post-growth perspectives in areas such as urban tourism, where unrestrained development frequently ends in environmental harm and injustices in society. By confronting these issues, the project establishes a compelling model for fomenting community resilience, sustainable practices, and cultural preservation, coinciding with post-growth principles and contributing to expanding the field of sustainable HCI.

The project's success opportunities rely on the effective use of design ethnography, which connects the understanding of community tendencies with the deployment of practical solutions. Through engaging with firsthand knowledge of residents, the design team obtained rich cultural insights, facilitating the co-creation of solutions that genuinely reverberate with the community, cultivating trust, comprehension, and genuine involvement in social innovation initiatives. The iterative nature of design ethnography in Estampa Colab also reflects the strong relationship of deterritorialisation and reterritorialization, where each phase of observation, intervention, and reflection reshapes the project's scope and objectives, consistent with a rhizomatic philosophy.

The interaction design methodology adopted in the development of digital products, incorporating the pattern-creation tool and the website, demonstrates the important role of iterative, people-centred approaches, including the relevant phases like ideation, prototyping, heuristic evaluation, and user testing, assuring that the products are useful and accessible across different user groups. Also relevant is the incorporation of community feedback in workshops, which emphasises the impact of co-creation in tackling complex societal challenges, as well as the planned testing of the website, which reflects a commitment to iterative refinement, ensuring its effectiveness in promoting the public cause, enhancing local economic opportunities, and amplifying the project's impact.

The project is conceptually grounded in assemblage thinking, highlighting fluidity, multiplicity, and interconnectedness throughout social systems. The collaboration between institutions, designers, and residents entails a vital assemblage that responds to the sociocultural unique characteristics of each location, enabling scalability to further urban areas, since the modular and rhizomatic framework of the project may incorporate other stakeholders, practices, and challenges.

The project's emphasis on digital social innovation is a critical contribution to sustainable HCI. By leveraging digital tools to facilitate collaboration, amplify community voices, and create economic opportunities, Estampa Colab demonstrates how technology can serve as a catalyst for equitable and inclusive development, matching with the fact that digital platforms should prioritise community-driven initiatives over profit-driven agendas. The digital products under development in this project, including the pattern-creation tool and the e-commerce-enabled website, illustrate how technology can balance innovation with ecological and social priorities, contributing to a post-growth agenda.

5 Conclusion

The Estampa Colab project demonstrates how participatory design and HCI can address critical urban challenges while fostering cultural preservation and sustainability. Starting with community collaboration and digital social innovation, the project enables disenfranchised neighbourhoods to co-create solutions to their unique contexts, thereby empowering residents to shape their identities and futures. This participatory approach, more than improving urban cohesiveness, redefines the link between technology and community, demonstrating how digital tools may be used to bring about systematic transformation.

The use of design ethnography and an iterative methodology ensures that its outputs are rooted in the lived experiences of residents. In particular, integrating storytelling, pattern creation, and crafts into a modular framework, Estampa Colab adapts to socio-cultural urban specificities, offering a scalable model for other cities facing similar challenges. This adaptability marks the relevance of assemblage thinking and the rhizomatic approach, emphasising fluidity, interconnection, and the potential for local solutions to inspire broader systemic transformation.

Estampa Colab questions the prevailing acceptance of uncontrolled growing, focusing on post-growth ideas, so supporting a sustainable and inclusive urban future as well as demonstrating the vital role of HCI to address global challenges, in particular how design, technology, and community participation can work together to generate consistent outcomes.

Acknowledgments. This work is financed by national funds through FCT–Fundação para a Ciência e a Tecnologia, I.P., under the Strategic Project with the references UIDB/00112/2020, UIDB/00711/2020.

References

1. Fuad-Luke, A.: Beautiful Strangeness Revisited. In: Bieling, T. (ed.) Design (&) Activism, pp. 173–187. Mimesis (2019)
2. Escobar, A.: Development, Critiques of. In: D'Alisa, G., Demaria, F., Kallis, G. (eds.), Degrowth. A vocabulary for a new era, pp. 29–32. Routledge (2015)
3. Instituto Nacional de Estatística: Estatísticas demográficas: 2022. INE (2023). https://www.ine.pt/xurl/pub/280978178

4. Burd Relvas, R.: Turismo ultrapassa níveis pré-pandemia e bate novos recordes. PÚBLICO (2024). https://www.publico.pt/2024/01/31/economia/noticia/turismo-ultrapassa-niveis-pre pandemia-bate-novos-recordes-2078761
5. Singh, N.M.: Environmental justice, degrowth, and post-capitalist futures. Ecol. Econ. **163**, 138–142 (2019). https://doi.org/10.1016/j.ecolecon.2019.05.014
6. Sharma, V., Kumar, N., Nardi, B.: Post-growth human-computer interaction. ACM Transactions on Computer-Human Interaction **31**(1), 1–37 (2023). https://doi.org/10.1145/3624981
7. Schneider, F., Kallis, G., Martínez-Alier, J.: Crisis or opportunity? Economic degrowth for social equity and ecological sustainability. J. Clean. Prod. **18**(6), 511–518 (2010). https://doi.org/10.1016/j.jclepro.2009.12.017
8. Kallis, G., Demaria, F., D'Alisa, G.: Introduction: degrowth. In: D'Alisa, G., Demaria, F., Kallis, G. (eds.) Degrowth. A vocabulary for a new era, pp. 29–32. Routledge (2015)
9. Mulgan, G., Tucker, S., Ali, R., Sanders, B.: Social Innovation: what it is, why it matters, how it can be accelerated. Young Foundation (2007). https://youngfoundation.b-cdn.net/wp-content/uploads/2012/10/Social-Innovation-what-it-is-why-it-matters-how-it-can-be-accelerated-March-2007.pdf?x55643
10. Mulgan, G.: Social Innovation: how societies find the power to change. Policy press (2019)
11. Bria, F., et al.: Growing a Digital Social Innovation Ecosystem for Europe. European Commission (2015)
12. Certomà, C.: Digital Social innovation: Spatial Imaginaries and Technological Resistances in Urban Governance. Springer Nature (2021)
13. Buyannemekh, B.: Digital social innovation in cities: a systematic literature review and a research Agenda. In: Proceedings of the 25th Annual International Conference on Digital Government Research (dg.o '24), pp. 116–132. Association for Computing Machinery, New York, NY, USA (2024). https://doi.org/10.1145/3657054.3657073
14. Hirscher, A.-L., Mazzarella, F., Fuad-Luke, A.: Socializing value creation through practices of making clothing differently: a case study of a makershop with diverse locals. Fash. Pract. **11**(1), 53–80 (2019). https://doi.org/10.1080/17569370.2019.1565377
15. Gorgel Pinto, A., Reaes Pinto, P.: Fostering the common: transformative socio-cultural innovation through co-creativity among citizens. In: Ming Kong, M., Monteiro, M.D.R., Pereira Neto, M.J. (eds.) Creating Through Mind and Emotions, pp. 307–312 (2022). https://doi.org/10.1201/9780429299070-40
16. Wise, J.M.: Assemblage. In: Stivale, C.J. (ed.) Gilles Deleuze. Key Concepts, 2nd ed., Vols. 91–102. Acumen Publishing (2011)
17. Deleuze, G., Guattari, F.: A thousand plateaus: Capitalism and schizophrenia (B. Massumi, Trans.). University of Minnesota Press (1987)
18. William, G.: What should we expect from research through design? In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '12), pp. 937–946. Association for Computing Machinery, New York, NY, USA (2012). https://doi.org/10.1145/2207676.2208538
19. Dalsgaard, P.: Research in and through design: an interaction design research approach. In: Proceedings of the 22nd Conference of the Computer-Human Interaction Special Interest Group of Australia on Computer-Human Interaction (OZCHI '10), pp. 200–203. Association for Computing Machinery, New York, NY, USA (2010). https://doi.org/10.1145/1952222.1952265
20. Gaver, W.W.: What should we expect from research through design? In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '12), pp. 937–946. Association for Computing Machinery, New York, NY, USA (2012). https://doi.org/10.1145/2207676.2208538

21. Müller, F.: Design Ethnography: Epistemology and Methodology. Springer Nature (2020)
22. Pink, S., Fors, V., Lanzeni, D., Duque, M., Sumartojo, S., Strengers, Y.: Design Ethnography: Research, Responsibilities, and Futures. Taylor & Francis (2022)
23. Rogers: Interaction Design: Beyond Human-Computer Interaction, Sixth Edition. Wiley (2023)
24. Nielsen, J.: The theory behind heuristic evaluations. Nielsen Norman Group (2023). https://www.nngroup.com/articles/how-to-conduct-a-heuristic-evaluation/theory-heuristic-evaluations/