Designing Hybrid Spaces

ENVISIONING PLURAL ECOSYSTEMS AND SOCIO-CULTURAL PRACTICES FOR REGENERATIVE URBAN FUTURES

Edited by
Laura Galluzzo and Salvatore Di Dio

FrancoAngeli
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PART 4

Digital Tools for New Models of Participation

19. Metaverse and Co-design for Social Innovation: design reflections

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ABSTRACT

The chapter analyses the use of the metaverse as an environment for co-design practices oriented towards social innovation, focusing on methodological, technical and participatory implications. Through reflections and the analysis of the OSMOSI experimental project, implemented on the Spatial.io platform where the activities involved heterogeneous actors in moments of exploration, dialogue and co-creation on two urban public spaces, the authors show how immersive environments can facilitate collaborative paths even in conditions of limited physical accessibility. Opportunities emerged related to avatar-mediated participation, traceability of project contents and experimentation with new forms of engagement. However, critical issues related to technological barriers, platform fragmentation and digital inequalities also emerge. The metaverse is thus configured as a complex design space that requires new skills and an active role of the designer as facilitator.

19.1 Introduction

The metaverse is emerging as a four-dimensional, multi-user, persistent, and navigable digital environment where users cooperate via virtual self-representations and co-inhabit purpose-designed spaces. It is an immersive 3D virtual world in which users interact as avatars, blending real and virtual experiences (Stephenson, 1992; Davis *et al*., 2009; Hamurcu, 2022; Weinberger, 2022), engaging with digital artefacts and other users in real time (Weinberger, 2022; Dwivedi *et al*., 2022).

In recent years, its application has expanded beyond entertainment and simulation to include participatory design, local governance, public services, and the socio-cultural valorisation of territories. The metaverse is thus a socio-technical system capable of transforming interaction and collaboration (Zhou *et al*., 2024; Davis *et al*., 2009). This raises new questions about how co-design processes may be translated or reimagined within immersive virtual environments. Rather than merely a technological medium, the metaverse constitutes a socio-technical space that reshapes collective interaction, negotiation, and representation (Davis, 2009; Rehm *et al*., 2015; Zhou *et al*., 2024).

This chapter reflects on the use of the metaverse as a co-design platform for social innovation from the exploration of emerging approaches, methods, practices and experimentation within the OSMOSI research-action project.

19.2 Scientific Background

Co-design has been established as collaborative approach to innovation within socio-technical contexts since the late 1970s. Its roots lie in Scandinavian participatory design, where workers were actively engaged in developing workplace technologies (Bødker *et al*., 2000). Over time, this approach has evolved and adapted across sectors, extending into urban planning, public services, healthcare, education, and social innovation (Britton, 2017; Antonini, 2021). In design for social innovation, co-design is a well-established methodology for

actively involving citizens, users, and stakeholders in decision-making and creative processes (Manzini, 2015; Evans & Terrey, 2016; Deserti *et al*., 2019). Co-design offers an open and relational approach to generating innovative solutions to complex social challenges (Britton, 2017). Its iterative process (understanding, ideating, prototyping, and testing) supports co-creation from conception to implementation (Deserti *et al*., 2019), playing a pivotal role in building trust, acquiring knowledge, and addressing user needs over time (Evans & Terrey, 2016).

Incorporating the metaverse into design discourse coincides with the growing diffusion of immersive digital platforms, multi-user virtual environments, and extended reality interfaces. The metaverse constitutes a computational space that introduces entirely new operational conditions for participatory design. Within this context, traditional interaction methods, such as in-person workshops, focus groups, and physical co-creation, must be adapted, reinvented, or replaced. Several unique characteristics of these environments drive scholarly interest in co-design within the metaverse:

- eliminating spatial and temporal constraints enables collaboration among geographically dispersed participants (Kim, 2025)
- using avatars and spatial representations allows for new modes of expression unconstrained by the physical limitations of the body or built environment, thereby influencing user behaviour and interaction (Davis *et al*., 2009);
- integrating digital tools opens complex and articulated opportunities for interaction and shared production.

A notable example of metaverse's use is the experience of the creators of Grand Theft Hamlet (2024), who staged Shakespeare's Hamlet within the video game Grand Theft Auto Online during the COVID-19 lockdown. This project illustrates how, under restrictive social conditions, virtual environments can become vital spaces for continuing professional and creative activities, protecting the right to expression, and fostering community-building. This capacity of the metaverse to offer resilient alternatives to physical participation is especially valuable for co-design initiatives focused on urban and public interest projects. Where physical, health-related, or logistical barriers hinder attendance, metaverse-based software and structured processes can provide targeted solutions. The follow table (Ta-

ble 1) outlines physical participation constraints in urban and public co-design processes, potential application areas, and the software platforms supporting such activities. In this context, metaverse ex-

Table 1.
Responses to Physical Participation in Urban and Public Co-Design.

Condition Limiting Physical Participation	Co-design of Public Spaces	Co-design of Public Services	Co-design of Public Buildings
Health emergencies / Mobility restrictions (e.g. pandemics, lockdowns)	Ideation, shared layout visualization, flow simulation	User journey mapping, role-playing of service scenarios, virtual focus groups	3D visualization of projects, interior layout co-design, shared selection of finishes/ furnishings
	Suggested Software: Mozilla Hubs, Spatial.io, Coderblock, Minecraft (Education Edition)	Suggested Software: Roblox, Second Life, GTA Online (for specific scenarios), generic social VR platforms	Suggested Software: Mozilla Hubs, Spatial.io, SketchUp with VR viewers, The Wild
Great geographical distances / Prohibitive travel costs	Remote participatory workshops, virtual exploration of proposals	Co-creation of service concepts, usability testing via avatars, distributed feedback collection	Collaborative design reviews, immersive presentations to remote stakeholders
	Suggested Software: Spatial.io, VRChat (with custom worlds), Coderblock, Twinmotion (for immersive presentations)	Suggested Software: Microsoft Mesh, Engage VR, FrameVR	Suggested Software: Arkio, Gravity Sketch, Shapespark
Physical disabilities / Temporary or permanent mobility limitations	Participation in virtual site visits, facilitated accessibility	Expression of needs and preferences in controlled and accessible environments	Accessibility evaluation of projects, feedback on inclusive solutions
	Suggested Software: Desktop-accessible platforms (e.g. Mozilla Hubs), 360° virtual tours	Suggested Software: Customizable platforms with simplified interfaces, Second Life	Suggested Software: Platforms with simplified navigation and customizable avatars, The Wild (with accessibility focus)
Conflicting work/family commitments with fixed schedules (asynchrony)	Asynchronous contributions on 3D models, virtual idea boards	Thematic discussion forums in virtual environments, deferred feedback collection	Annotations on 3D models, asynchronous voting on design options
	Suggested Software: Conceptboard/Miro, Spatial. io (with persistent notes), Coderblock	Suggested Software: Persistent forum/messaging platforms (e.g. Discord integrated with VR worlds)	Suggested Software: Trimble Connect (with VR viewer), Bimsync Arena
Unsafe contexts / Physical inaccessibility to certain areas	Safe exploration and participatory mapping of digital twin areas	Simulation of critical scenarios for emergency or public safety services	Virtual inspection of unsafe or condemned buildings, remote planning of interventions
	Suggested Software: Google Earth VR, platforms supporting 3D scans/ photogrammetry imports	Suggested Software: Dedicated simulation platforms, Roblox (with advanced scripting)	Suggested Software: Matterport, platforms supporting point cloud models

periences are configured as true social laboratories, where technologies are not merely support tools, but constituent elements of the project experience. The functionalities of the technologies employed in the metaverse – communication, virtualisation, interaction and socialisation tools – are not merely supportive, but actively shape the collaborative environment. For example, participants create and modify objects in real time, enabling immediate feedback and new ways of conveying complex ideas (Owens *et al*., 2011), a key aspect of co-design in immersive environments. A further element that emerges is methodological hybridity: co-design practices in the metaverse are often based on combinations of digital tools (video conferencing, online whiteboards, 3D models) and relational strategies (structured workshops, ethnographic sessions, role-playing). This convergence between tool and process requires a new design literacy, which concerns technical skills and the ability to build trust, inclusion and dialogue in non-physical environments.

19.3 Metaversal Approaches to Co-Design

A significant variety of approaches to co-design within the metaverse can be synthesised and organised around these principal dimensions:

19.3.1 Fields of Application

Within co-design for social innovation, metaverse's adoption involves the citizens and stakeholders' engagement in shared decision-making processes, the fostering of immersive experiences, and the promotion of collaboration and inclusion across diverse user groups. Several emerging application domains offer a dynamic snapshot of the field:

- Public space: metaverse-based participatory urban design experiments leverage platforms and digital tools to involve citizens in collaborative activities related to real urban scenarios (Ng *et al*., 2024a; Ng *et al*., 2024b).
- Public services: co-creation of services within the metaverse reconfigures traditional service design elements by enabling contextual control, sensory perception via avatars, virtual resources, and real-time data-driven processes (Jeffery, 2023).

- cultural heritage: co-design within the metaverse can engage local communities in the virtual reconstruction and storytelling of place-based identities (Martins *et al*., 2022).
- community building: customised virtual environments can support urban regeneration and community development (Abramov *et al*., 2024).
- education and training: virtual reality-based co-design of product-service systems at the university level fosters collaboration between students, educators, and industry stakeholders (Mourtzis *et al*., 2023).

19.3.2 Technologies and Platforms Employed

Virtual environments can support design actions and natural communication styles, potentially reducing time and costs in multidisciplinary group work (Mengoni, 2009).

Collaborative design within metaverse's settings involves various systems and technologies, such as:

- immersive virtual reality systems that integrate communication and collaboration tools during co-design sessions (Roupé *et al*., 2020);
- digital tools for collaborative spatial design, which incorporate advanced visualisation systems and motion tracking to improve spatial communication among designers (Zaman *et al*., 2015);
- custom-built virtual environments designed to address specific problems and provide personalised interaction spaces;
- supportive digital tools embedded within virtual environments to stimulate collaboration, socialisation, and 3D modelling.

This heterogeneity reflects an ecosystem without a dominant standard, but rather a multiplicity of approaches tailored to design hybrid contexts.

19.3.3 Stakeholder Engagement Modalities

A central component of participatory design is how stakeholders engage in decision-making and creative processes. In the metaverse, these modalities are significantly transformed: the virtual, asynchronous, and immersive nature of these environments reshapes the timeframes, spaces, and forms of interaction. The notion of partic-

ipation acquires new meanings: presence is mediated by avatars, interaction occurs through multimodal languages, and technical and cultural factors shape access.

Understanding how stakeholders are involved in metaversal co-design processes thus requires inquiry into which groups are engaged, how, with what tools, and under what relational and structural conditions. Engagement strategies become an integral part of the design process itself, directly impacting the process's inclusivity, outcomes, and legitimacy.

Mere presence in a virtual environment does not ensure meaningful participation since feedback mechanisms and cross-media translation tools are essential. Moreover, managing virtual identities and avatars can significantly affect participants' perception of their voice in the process. Stakeholders' engagement in the metaverse may involve a range of practices, including intergenerational participation (Ng *et al*., 2024b), ethnographic approaches, Martins *et al*., 2022), technology-mediated co-design (Kohler *et al*., 2011; Dorta *et al*., 2019), asynchronous planning (Fanzini *et al*., 2015), structured facilitation by combining synchronous and asynchronous elements within a guided methodology.

19.3.4 Design Frameworks

The challenges posed by the use of the metaverse as a platform for co-design emphasise the importance of developing flexible structures that can be adapted to the specificities of the context, users and desired outcomes. Ng (*et al*., 2024a) offer an articulated framework outlining a structured participatory process within virtual environments. Their process takes place in a virtual reality platform (Mozilla Hubs), integrating collaboration tools (Miro and Zoom), and comprises six stages: tour (participants exploration of the virtual space), discussion (guided sessions for collective exchange and reflection), evaluation (shared assessment of emerging ideas), definition (identification of design priorities), action (proposal of concrete actions), show and tell (public presentation of results).

This model supports transparent processes, fostering user participation and ensuring a structured documentation of design results. While this model (and others in general) offers valuable opportunities

to improve engagement and understanding of the space, it also faces challenges related to technology, inclusiveness and user competence, factors that need to be addressed to enable a more widespread and practical application in shared design processes.

19.4 Co-designing in the metaverse: OSMOSI project

As part of the OSMOSI action-research project, an experimental co-design activity was conducted within the metaverse – *OSMOSI Digital Area* – using the Spatial.io platform as an immersive environment to explore and discuss the possible use scenarios of two urban public spaces: Open Casello in Milan and the former Convent of Crociferi in Palermo. The activity involved users with heterogeneous backgrounds (activists, students, cultural operators, citizens) and was divided into a multi-phase design process, aimed at collecting perceptions, needs and visions through collaborative and exploratory methods.

The virtual environment was prepared by:

- the insertion of an accurate three-dimensional representations of the two spaces;
- the placement of learning elements for the use of the space (instructional video, information and directional signage);
- the positioning of portals capable of transporting users from the metaverse to the chosen collaborative tools (Miro).

The process began with an introductory phase of technical and conceptual onboarding, in which participants were guided in the use of the platform and the objectives of the path were presented. Subsequently, an exploratory phase followed: users, in the form of avatars, freely visited the two virtual environments. During this phase, information panels were positioned that served as catalysts for individual and collective reflection.

In the dialogic phase, participants took part in moments of comparison within the virtual space, where mediators stimulated users with reflections on accessibility, cultural functions and social use of the spaces. The discussions took place in real time, with voice support and

chat integrated into the digital platform. This was followed by a co-creation phase: participants used the portals to travel from the metaverse to the collaborative platforms where two-dimensional maps of the spaces awaited them. Using annotation tools, users then entered keywords and design proposals relating to the environments visited in the metaverse, thus creating spatial maps of possible future uses.

The process concluded with a subsequent restitution phase in which users were able to enter the space asynchronously to further reflect (and at their own pace) on the analysed spaces.

Overall, more than 350 visits have been recorded by the Spatial platform on the *OSMOSI Digital Area* (data retrieved on June 16th, 2025), during the first two live events 19 participants were actively engaged and they have shared their feedback, insights and proposals in more than 16 sticky notes on Miro's maps.
These activities highlighted how the metaverse can become an intermediate space between co-design and social activation, facilitating a form of participation that is graphically accessible and methodologically reproducible.

19.5 Advantages and potential criticalities

The integration of co-design practices within a meta-verse elicits a number of multifaceted reflections on an individual and collective level. One of the most significant effects is the increased involvement of participants: immersive virtual environments, combined with playful dynamics and symbolic representations, can stimulate more active and motivated participation (Dorta, 2019).

In addition to involvement, the generation of tangible project content becomes equally important. Participants should be encouraged to leave traces in virtual spaces, create cognitive maps and produce digital narratives. This productive dimension is not only symbolic: the co-created materials serve as decision support tools, as communication elements between stakeholders and as operational bases for the application of solutions in the real world. The value of these results lies in their dual nature: they are both the tangible result of the co-design process and a reinforcement of the participants' commitment. The co-presence

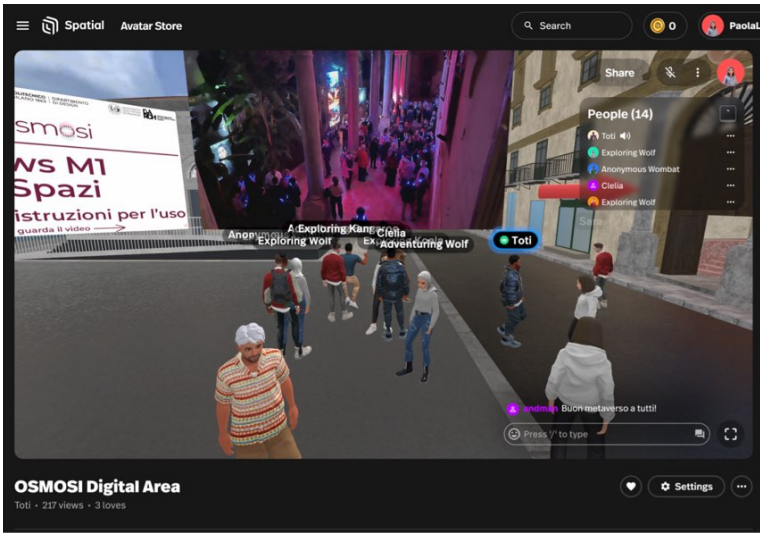

Figure 1.
OSMOSI Digital Area.

in virtual spaces, combined with the sharing of spatial and narrative experiences, facilitates the development of collaborative relationships between heterogeneous actors. Moreover, there is the development of new competences of participants, including digital skills, communication skills, collaborative attitudes and creative tools (Romero, 2016).

However, several structural challenges affect the effectiveness, inclusiveness and sustainability of metaverse-based co-design projects (Chowdhury *et al*., 2023). According to Gupta (*et al*., 2024), these challenges can be grouped into three categories:

- technological (concerns related to privacy and access to infrastructure);
- organisational (issues related to integration, feasibility and standardisation);
- environmental (factors related to user behaviour, psychological responses and trust in metaverse systems).

Among these, technological barriers are particularly critical. Access to immersive platforms requires basic digital skills and compatible devices, resources that are not equally available among different social groups. The elderly, people with low digital literacy or those from marginalised backgrounds may find it difficult to navigate 3D environments or complex interfaces. This may exclude the very voices that participatory design aims to empower.

A further critical issue is the fragmentation of the metaverse ecosystem, with platforms adopting proprietary standards, non-uniform interfaces and incompatible formats. This fragmentation hinders content migration, limits the scalability of solutions and complicates integration between different environments within broader design processes. This results in a structural barrier, which reduces operational efficiency and undermines the long-term sustainability of co-design initiatives. Furthermore, it creates a dependency on technical experts, limiting replicability in resource-limited contexts.

19.6. Discussion and conclusion

The research group's reflections on experimenting with the metaverse as a space for co-design raise numerous methodological, technological, social and epistemological questions. Despite its touted potential for accessibility and openness, effective participation in the metaverse still heavily depends on material infrastructures and digital competencies. For future co-design in the metaverse, we recommend focusing on the role of the designer and design as a bridge between different dimensions and disciplines. In this context, the presence of designers as expert facilitators becomes essential to transform technological potential into genuinely shared design processes. Another emerging tension concerns the continuity of co-design processes: there is a risk that such initiatives remain confined to short-term experiments or pilot phases with limited resources, resulting in fragmented experiences, interrupted participation, and weak capitalisation of results over time. While adopting design frameworks can help structure and coordinate these processes, they do not resolve the issue of sustainability.

Creating stable design communities demands governance tools, accessible documentation, persistent environments, and moments for collective reflection and return. In this sense, metaverse-based design must move beyond the experimental phase and integrate with the actual life cycles of organisations and communities. Moreover, the form and function of interfaces play a decisive role in the success of participatory processes: the complexity of 3D environments, the

need for dedicated hardware, system compatibility, and the steep learning curves of specific platforms directly affect inclusivity and the effectiveness of participation. Therefore, the presence of a mediator is crucial to orient participants within the environment and to enable them to contribute meaningfully and understand the process.
Finally, co-design in the metaverse cannot be considered a mere digital transposition of analogue methodologies. Virtual worlds introduce new ways of relating, addressing problems and generating solutions. Interaction through avatars in 3D environments with virtual interaction radically alters the nature of user participation. Design in the metaverse becomes performative, scenic, and spatially situated, as anchored in the virtual as in the real. This necessitates the development of participatory experience design that accounts for the cognitive, perceptual, and relational transformations induced by immersive environments. The exploration of the metaverse as a platform for co-design represents an emerging frontier in the field of design for social innovation. Its areas of application are expanding due to the metaverse's ability to enable unconventional interactions, make local narratives visible and support collaborative construction of solutions. Virtual platforms offer a variety of operational configurations responding to different needs, but all must converge towards a common goal: making co-design processes accessible, transparent and understandable. In this sense, design takes on a transformative function: it creates the conditions for interaction, shapes the rules of participation, makes actors visible and distributes tasks and responsibilities. The role of the designer thus expands, becoming a mediator between worlds and a director of complex design activities and the future of co-design in the metaverse will depend on the ability of designers to integrate creative thinking with technical skills.

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This volume investigates the potential of Socio-Cultural Hybrid Spaces as engines of urban regeneration, democratic participation, and cultural innovation. Emerging at the intersection of cultural production, social experimentation, and territorial transformation, these spaces challenge conventional boundaries between public and private, temporary and permanent, physical and digital. Through four main sections, the book develops a critical and impactful perspective on the functions, design and interdisciplinary approaches, and transformative potential of Socio-Cultural Hybrid Spaces. From their evolving role as plural ecosystems to their capacity to generate declinations of public value; from cultural and participatory practices that reclaim and reimagine the commons to the opportunities and challenges introduced by digital technologies; it offers a multifaceted lens on *hybrid practices* in contemporary urban and territorial contexts. By weaving together theoretical perspectives, empirical research, and case studies, this book provides critical reflections by and for scholars, practitioners, and institutions. How can cultural initiatives generate new alliances between institutions and communities? What forms of participation can strengthen the democratic role of public space? And what challenges arise in connecting physical and virtual dimensions for collective engagement?

FrancoAngeli
La passione per le conoscenze