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EDITORIAL

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The Urban Canvas: Spatial Computing in Planning, Analysing, and Representing the Cityscape

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Abstract

This thematic issue is dedicated to the memory of Heejung Kwon of Yonsei University. Her research, intellectual generosity, and the many enriching conversations over the years helped shape its vision. We challenged the contributors to consider how urban planning, a discipline long reliant on visual tools like maps, plans, and models, might evolve through spatial computing. While these traditional forms of representation have been effective for communicating and evaluating urban changes, they often limit people's ability to directly experience proposed environments. The articles in this issue show how spatial computing draws on a broad range of approaches, including: augmented, virtual, and mixed reality; digital twins; photogrammetry; situated visualisation; and audio-based experiences. Together, these approaches help bridge this gap by enabling immersive and participatory encounters with our lived environments. Spatial computing emerges as a set of practices that reconfigure relationships among planners, citizens, data, and place. It positions *space* not solely as an object of analysis, but as an interactive medium. Rather than focusing exclusively on technological development, the collection explores how digital and physical environments are becoming increasingly intertwined and its implications for how urban space is experienced, understood, and produced. The contributions reveal spatial computing as an evolving field whose significance lies as much in the questions it raises as in the tools it provides. Issues of access, governance, and representation run throughout the collection, highlighting the ways in which spatial media reshape the relationship between digital systems and urban life, opening new possibilities for the future of planning.

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digital futures; participatory urbanism; phygital city; public engagement; spatial computing; urban situated media

1. Remembering Heejung Kwon

This thematic issue is published in memory of Heejung Kwon of Yonsei University, our co-editor and colleague, who passed away before the issue she helped shape could appear in print. Heejung brought to this collection a combination of intellectual generosity and curiosity about the seams where the physical and the digital meet. She had a unique take on spatial computing, focused on 3D multi-user representations of place and space within interaction and design. We remember with gratitude the many conversations, collaborations, and exchanges we were fortunate to share with Heejung over the past 10 years and the work we did together on the proposal for this thematic issue. Heejung will be missed and we dedicate the issue to her memory.

2. Framing

Urban studies have long been a visual discipline. Maps, plans, renderings, and increasingly photorealistic digital models have been the medium through which planners test scenarios, monitor the performance of urban form, and hold conversations with the people who live in the places being designed. This reliance on visual representation has served the field well, but it has also bounded it. A drawing communicates and abstracts what a place is and what it might become, but it rarely lets a citizen stand inside a future that has not yet been built, feel its scale, or move through its uncertainty. The premise of this issue is that spatial computing is beginning to loosen that boundary between the physical and digital places. Through augmented, virtual, and mixed reality, through digital twins, photogrammetry, soundwalks, synthetic data, situated visualisation, and game engines repurposed as civic instruments, the city itself becomes a canvas: a surface onto which data, memories, and possible futures can be layered, inhabited, and contested.

Spatial computing reframes space as a medium rather than merely a subject. The growing accessibility of capture and display technologies, accelerated by companies such as Meta, Apple, Snap, and Niantic, together with advances in reality-capture methods, is democratising the production of immersive urban content. Similar to the way social media transformed content creation in the early 2000s, spatial computing is enabling a much broader community of users to create and share spatial content. Gaming frameworks already allow planners and citizens to engage with urban scenarios; spatial computing extends that capability into multi-sensory, layered, and contextualised environments that promote participation and enrich the design process. What interests us, and what unites the contributions gathered here, is less the novelty of the hardware than the question of what these tools do to the relationships between planners, citizens, data, and place. A new digital layer is rapidly becoming part of the urban fabric, visible to those with devices, invisible to those without, and that asymmetry is itself a planning problem. It creates opportunities, but also disparities when access to technology is constrained by cost, the expertise required to use it, or the technical jargon that surrounds it; it offers new ways of capturing everyday experiences, while also raising questions about whose experiences are represented, amplified, or hidden; it invites participation, while simultaneously foregrounding issues of ownership and control.

3. Contributions' Highlights

The articles that follow approach spatial computing from different positions, showing how digital systems are reshaping the ways urban environments are represented, experienced, and discussed. Rather than forming a single argument, they overlap and diverge, sketching the contours of a field still in formation, across disciplinary boundaries and through technologies that continue to evolve. Together, they present spatial computing not as a fixed set of tools, but as an evolving set of practices through which relations between people, data, and place are being reworked.

The impacts for the planning system are profound, yet the concepts the issue addresses are barely on the planners' radar, let alone legislated for in this newly emerging digital space. This is the central concern of "Spatial Computing and the Phygital City: Towards Digital Habitation" (Hudson-Smith, 2026), which proposes that the relationship between cities and digital technology is moving through a structured, three-stage transition. The first stage, the Smart City, is by now an established condition in which sensor networks and real-time analytics form the digital nervous system of urban life. The second, the Phygital City, is the condition currently emerging: one in which physical and digital layers are experienced simultaneously and inseparably within the lived environment. The third, Digital Habitation, is a speculative horizon in which physical geography ceases to be the primary frame of reference for work, commerce, and sociality. The article's central claim is a planning argument rather than a technological one. Naming the phygital phase matters, it contends, because planners and policymakers cannot govern a condition for which they lack adequate vocabulary, and the instruments fashioned for smart-city sensing are insufficient for the experiential and ethical complexities of phygital urbanism. The article treats this transition as a planning horizon requiring anticipatory governance rather than a technological inevitability, and that caution sets a useful tone for the issue as a whole.

If the phygital framing supplies the vocabulary for understanding hybrid urban conditions, "City as Canvas: Situating Digital Layers Across Urban Spaces" (Signorelli, 2026) offers a method for thinking about how digital layers can be situated within the city itself. It reframes the decline of Metaverse hype as an opportunity to focus on the digital traces, datasets, interfaces, and infrastructures already embedded in the urban environment. Drawing on two exploratory workshops, the article shows how situated visualisation can reconnect data, narratives, and environmental phenomena to the places from which they emerge, positioning the city not as a neutral surface for digital overlays, but as a contested environment where data, memory, infrastructure, and lived experience are continuously negotiated.

Where Signorelli (2026) focuses on digital layers in the present city, "Morecambe Area Gaming Environment (MAGE): An Applied Case Study for Coastal Futures and Adaptations" (Cureton et al., 2026) applies spatial computing to the challenge of coastal change. Flooding, sea-level rise, and long-term shoreline adaptation involve complex uncertainties that are difficult to communicate through conventional plans or reports. The article explores how game-based and interactive spatial tools can help communities engage with these futures more directly, testing possible interventions and understanding their consequences through situated and participatory forms of interaction. In doing so, it presents spatial computing as a way of making climate adaptation more tangible, allowing communities to enter the decision space of shoreline management rather than simply receive its conclusions.

"The Virtual Embodied Experience: Virtual Reality as a Medium for Computing, Analysing, and Representing the Cityscape" (LLabres-Valls, 2026) starts from the growing use of VR within professional frameworks for architectural visualisation and design communication. The article then asks whether this use has moved beyond representation towards more analytical forms of engagement. Through a systematic review across Scopus and CumInCAD, it shows that VR is well established as a medium for visualisation and communication, but that embodied interaction with spatial data remains limited. Its proposed concept of the virtual embodied experience therefore reframes VR not only as a display tool, but as a cognitive interface through which urban data might be experienced, explored, and interpreted.

The issue also turns to the question of how artificial urban environments can be built for testing, comparison, and experimentation. Synthetic cities are important because they allow researchers and practitioners to explore urban scenarios without relying only on costly, incomplete, or sensitive real-world data. "Creating Synthetic Road Networks Using Large Language Models: An Iterative Calibration Framework" (Kasiński & Szufel, 2026) extends this discussion by focusing on how LLMs can generate and calibrate road-network structures for virtual urban testbeds.

Sound expands this discussion by showing that spatial computing does not have to be primarily visual. "'Town Built From Fleeting Matter': Audiowalking San'ya's Hidden Histories as Practice-Led Spatial Inquiry" (Woite, 2026) uses a geolocated audiowalk in San'ya, Tokyo, to explore how audio can shape movement, attention, and interpretation while keeping participants grounded in the physical environment. By engaging hidden histories and marginalised spaces, the article shows how sound can make absence, memory, and contested urban narratives perceptible, broadening spatial computing beyond visual and model-based approaches.

Finally, "Within the Flows: Participatory 3D Scanning in Asian Techno-Industrial Hinterlands" (Müller, 2026) widens the issue's geography and its politics. Working at the peri-urban margins of Chennai and Hsinchu, sites bound together as hinterlands within global high-tech supply chains, the article proposes participatory photogrammetry as a lightweight, smartphone-based practice. The method generates embodied encounters within rapidly changing landscapes while producing digital fragments that can circulate across contexts and invite comparison. It is an important counterweight to the issue's other contributions, a reminder that spatial computing is not only a tool of the global-city centre but can be turned toward contested edges, multiplying viewpoints without smoothing real differences into a single narrative of progress.

4. Conclusions

Together, the articles show that spatial computing is not one method, but a set of emerging practices for connecting digital systems with urban life. These approaches open different ways to model, experience, interpret, and contest urban environments. Their significance lies not only in technical innovation, but also in how they are shaped by access, representation, maintenance, and the uneven conditions of urban life. It is with sadness that Heejung Kwon did not see this issue completed. The questions it raises about how we bridge the physical and the digital were questions she was asking herself when she proposed this issue. We hope the collection honours that contribution.

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Conflict of Interests

The authors declare no conflict of interests.

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Heejung Kwon (also known as Junie Kwon) was a lecturer and design researcher at Yonsei University in Seoul, South Korea. Her work bridged academic research and practical applications across human-computer interaction (HCI), digital media, and virtual environments.