PlanAIr. Planning and Artificial Intelligence in Urban Research

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Drawing on James Lovelock's concept of the Novacene, this editorial for the PlanAIr thematic issue frames the contemporary city as the primary crucible in which the alliance among human intelligence, artificial intelligence (AI), and ecological systems is negotiated. It argues that the current dominant paradigm of "Urban AI"—largely confined to data-driven optimization and "weak AI"—is insufficient for addressing the socio-ecological and cognitive complexities of the Anthropocene. Building on this analysis, the

Forty years of Gaia

In the 1970s James Lovelock's Gaia (Lovelock, 1972; 1979) revolutionized our understanding of Earth, presenting it as a self-regulating, living organism – a system capable of maintaining the conditions necessary for life. Today, Lovelock challenges us to confront a new geological and philosophical frontier: the expression Novacene marks an era in which intelligent machines, born of human ingenuity, begin to surpass our control (Lovelock, 2019). The Novacene is not merely a continuation of the Anthropocene; it is a radical departure, defined by the rapid acceleration of "reasoning" technologies and the necessity of using computers to design other computers. Unlike dystopian narratives of machine supremacy, Lovelock envisions a future grounded in alliance: between humans and living beings, the natural and the artificial, social intelligence and artificial intelligence. This alliance, he argues, is not only possible but essential for the survival and flourishing of Gaia, the living Earth.

Cities as Crucibles of the Novacene

The city, as the most complex artifact of the Anthropocene, stands at

editorial introduces the special issue PlanAIr to investigate the "epistemic turn" in urban planning and to explore how AI necessitates a rethinking grounded in urban ontology, concept-driven governance models, and hybrid design methodologies. This collection of interdisciplinary contributions takes a first step toward bridging the gap between data-driven approaches and cognitive reasoning, moving beyond the efficiency narratives of the smart city.

The editorial contends that, with a generative, hybrid, and ontology-aware AI, we can shift from exploiting AI as a tool for management to engaging AI as a partner in co-creating inclusive, transparent, and resilient urban futures.

the heart of this transition. Cities are more than physical spaces; they are dynamic, combinatorial machines, as Ash Amin and Nigel Thrift describe in Seeing Like a City (Amin, Thrift, 2017). They are generative systems, shaped by socio-ecological and sociotechnical networks that connect humans and non-humans, producing both social and artificial intelligence. In the Novacene, cities become the primary sites where the relationship between humanity, technology, and the planet can be negotiated, contested, and reimagined.

Cities are the inheritance of the Anthropocene and the protagonists of the Novacene. They are hubs of creativity and transformation, as well as laboratories for experimentation and co-production. As assemblages of technologies, infrastructures, institutions, and bodies, cities embody the "moorings and motilities" that define urban life. They are where the potential of AI meets the realities of human experience—where algorithms shape traffic flows, energy grids, and social interactions, but also where the ethical, political, and ecological implications of these technologies are most acutely felt.

The rise of "urban AI", as articulated by Michael Batty (2007; 2013), reflects this intersection. Urban AI seeks to simulate and replicate the complexity of human thought, yet its current manifestations are largely confined to "weak AI": systems designed for specific, instrumental tasks, such as predicting traffic patterns or optimizing resource allocation. While these applications offer undeniable benefits, they barely scratch the surface of what AI could achieve in urban contexts. The dominant focus on optimization risks reducing cities to efficient machines, rather than vibrant, equitable, and adaptive ecosystems.

Beyond Optimization: Toward a Generative Urban AI

The potential of AI in cities extends far beyond efficiency. Batty's framework – cognitive, data-driven, and hybrid approaches – provides a useful taxonomy for understanding the diverse aims and applications of urban AI. The cognitive approach, rooted in models of human reasoning, offers a path toward AI that can engage with the nuanced, often irrational dimensions of urban life. The data-driven approach, while powerful, must be critically examined for its biases, limitations, and unintended consequences. The hybrid approach, which integrates both, may hold the greatest promise for developing AI systems that are not only intelligent but also responsive to the ethical and ecological complexities of urban environments.

Yet, the integration of AI into urban life raises profound questions: How can we ensure that these technologies serve the public good, rather than exacerbating inequality or eroding democracy? How can we harness AI not just to manage cities, but to imagine and create better ones? And how can we design urban AI systems that are transparent, fair, sustainable for and accountable to the communities and the ecologies they affect?

A Call for Critical and Creative Engagement

This thematic issue invites to ponder and explore the possibilities and challenges of urban AI in the Novacene, seeking contributions that move beyond technical optimization to address the broader implications of AI for urban design, governance, and social justice. We encouraged submissions that:

- Interrogate the alliance between humans, machines, and Gaia, asking how cities can foster symbiotic relationships that support both technological innovation and ecological sustainability;
- Examine the ethical and political dimensions of urban AI, including issues of fairness, transparency, and democratic participation;
- Propose new frameworks for classifying and applying AI in urban contexts, with an emphasis on generative, rather than merely predictive, uses of technology;
- Imagine alternative urban futures, where AI is not a tool of control but a partner in co-creation, enabling cities to become more inclusive, resilient, and creative.

The Novacene is not a distant possibility – it is unfolding now, in the algorithms that govern our cities, the infrastructures that shape our lives, and the choices we make as a society. The question is not whether we will enter this new epoch, but how we will shape it.

Reflecting on Artificial Intelligence and the Future of Urban Planning: the contributions in PlanAIr thematic issue

The intersection of urban planning and artificial intelligence (AI) is rapidly reshaping

how we understand, conceive, design, govern, manage and experience cities. The papers in the PlanAIr thematic issue bring together a diverse set of perspectives that critically examine the opportunities, challenges, and epistemological shifts prompted by the integration of AI into urban planning practice and reveal AI's transformative potential across diverse urban challenges – from service accessibility and mobility to the spatial and social impacts of digital infrastructure.

At the heart of this transformation lies the ontological and epistemological turn in urban planning, as explored by Stefano Borgo and Camilla Perrone. Their contribution underscores the need for structured knowledge frameworks – ontologies – that can harmonize the vast, heterogeneous data streams now available, enabling more coherent and intelligent decision-making in urban contexts.

Luca Gaeta invites us to reconsider the very nature of urban AI through the lens of media theory, drawing on Marshall McLuhan's humanistic legacy. Gaeta argues for a broader understanding of collective intelligence, one that embraces sociotechnical systems and moves beyond narrow, efficiency-driven narratives of the smart city.

Giulia Guadagnoli addresses the polarized reactions – anxiety and enthusiasm – that AI often provokes in planning circles. By tracing the roots of contemporary AI optimism to positivist traditions and showcasing post-positivist alternatives, Guadagnoli advocates for a shared pluralist approach in inter-disciplinary collaboration between like-minded planners and computer scientists toward responsible and inclusive AI applications.

Domenico Camarda situates the potential of AI within the broader evolution of planning theory and practice. He highlights the tension between traditional top-down models and the need for adaptive, multi-agent, and knowledge-based approaches, especially in an era marked by uncertainty and complexity. His analysis of generative AI and applied ontologies reveals both the promise and the pitfalls of these technologies, emphasizing the importance of participatory processes and equitable outcomes.

Alessia Calafiore's paper bridges the divide between theory-driven and data-driven approaches in urban planning. Through a critical examination of small-area composite indicators and classifications, she demonstrates the complementary value of both paradigms, while cautioning against technocratic and decontextualized applications. Her call for reflexivity, situated knowledge, and openness resonates with the broader drive to integrate AI tools with human judgement and local context.

Paolo Nesi, Chiara Garau, and Paola Zamperlin focus on the potentiality of data-driven approaches presenting a compelling case for the use of digital twins and AI in urban

decision-making. Their discussion of the Snap4City platform illustrates how virtual replicas of cities, powered by real-time data and advanced AI models, can enhance responsiveness, resilience, and long-term strategic planning, ultimately improving the quality of urban life.

Francesco Berni and Andrea Bartolini investigate how AI can innovate service planning within the framework of the 15-minute city, using Milan as a case study. They argue that data-driven approaches are essential to overcoming the limitations of traditional urban standards, especially in contexts where public debate and private transformations intersect.

Asma Mehan shifts the focus to mobility infrastructure, examining how Urban AI systems –through real-time decision-making and infrastructure coordination – can enhance efficiency and resilience. Through U.S. case studies, Mehan demonstrates that the legitimacy of these systems hinges on integrating equity, transparency, and participatory governance, positioning Urban AI as a cornerstone of just and inclusive cities.

Cristiana Mattioli and Alice Franchina address the territorial impacts of the burgeoning data economy, with a focus on Italy's emerging role in the European data center landscape. Their analysis underscores the urgent need for clear regulations and informed decision-making to manage the physical, governance, and socioeconomic implications of these critical infrastructures.

Claudio Saragosa and Maddalena Rossi offer a critical reflection on the relationship between AI, power, and urban space. Drawing on Foucault and Han, they challenge dystopian narratives and technocratic visions, advocating instead for AI as a tool to recognize and enhance territorial heritage. Their proposal for a "right to the city" in the AI era emphasizes the integration of physical and digital dimensions to support collective well-being.

Finally, Iacopo Zetti and Biagio Martino present a case study on AI in urban design, comparing algorithmic and traditional approaches. Their findings highlight AI's strengths in rapid environmental simulation and layout generation, while stressing the irreplaceable role of human designers in interpreting urban complexity and embedding social values into spatial solutions.

Together, these papers offer a rich tapestry of insights, challenging readers to consider, beside the technical capabilities of data-driven AI, the modelling advantages of cognitive AI in terms of ethical, theoretical, and participatory dimensions. As cities continue to evolve, the integration of AI into urban planning demands a nuanced, interdisciplinary dialogue – one that this special issue aims to foster.

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