BUILT FORM

Artificial Intelligence and City-Making: The Potential for New Synthesis

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Abstract

Since urban morphology was first established as theories and methods in the 1950s and 1960s, architects and planners have sought to apply it to urban regeneration. The Italian school of urban morphology led Aldo Rossi to develop a typological approach to city-making in the late 1960s. Giancarlo De Carlo built on urban morphology's methods of analysis and sought to the community participation it called for in his work in the 1970s through the 1990s. De Carlo, a founder of Team X, hoped to use urban morphology to transform urban regeneration, demonstrating this possibility in projects at Urbino and Genoa, and establishing the International Laboratory of Architecture and Urban Design (ILAUD) as a vehicle for making this happen. Despite these efforts, urban morphology proved difficult to apply in the real world of urban regeneration. In the 1990s, Space Syntax emerged as an offshoot of the British school of urban morphology, focusing on urban analyses of cities that could be carried out using data analytics. In 2003 and 20l5, respectively, urban acupuncture and tactical urbanism were put forward as ways to simplify urban morphology's methods and focus on interventions at different scales as the medium of its application. Today, artificial intelligence (AI) has the potential to make urban morphology actionable and transform urban regeneration, as De Carlo hoped. This article reviews this history and offers a prognosis.

Introduction

Urban morphology's two most important schools—British and Italian—sought to pay systematic attention to cities' deeper contexts as a sound basis for urban regeneration. The Italian school, of which La Sapienza University of Rome is a leading center, built its teaching and research programs around urban morphology's methods of analysis, including building typological studies. The Italian school soon attracted the attention of prominent Italian architects. These first-generation pioneers included Aldo Rossi, who made his own contribution to its theories by focusing on typological analysis. (Rossi, 1984) His contemporary, Giancarlo De Carlo, sought to

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apply it to urban regeneration projects. His decade-long work in Urbino, discussed below, is a particularly good example of a comprehensive attempt to make urban morphology actionable and, in the process, transform urban regeneration itself. His efforts, while contributing to urban morphology's methods, fell short of proving its usefulness under real-world conditions.

In the late 1990s, the ability of Geographical Information Systems (GIS) to connect geographic and typological with socio-economic data led some urban morphologists to believe that this could produce the data needed to make city-making a real-time process (Moudon, 1997, pp. 9-10). This in turn would make urban morphology actionable. GIS does generate data that cities use to track trends in local 'micro-economies,' for example, but it did not produce the larger transformation Moudon and others saw in it.

This led a second generation of architects and planners to propose to simplify urban morphology, refocus it on intervention projects, and tie it pragmatically to urban regeneration. Starting in 2003, Jaime Lerner in Brazil, and Mike Lydon and Anthony Garcia in the USA, made complementary efforts to shift the focus to intervention at different scales, aware of context but not foregrounding it. In roughly the same period, Bill Hillier in the UK developed Space Syntax, an extension of the English school, using graph theory and mapping to analyze the complexity of cities at different scales.

This article first recounts these efforts to apply urban morphology to urban regeneration, and then discusses the potential of AI to realize these goals without losing urban morphology's unique ability to include qualitative as well as quantitative factors influencing the urbanity and vitality of city-making.

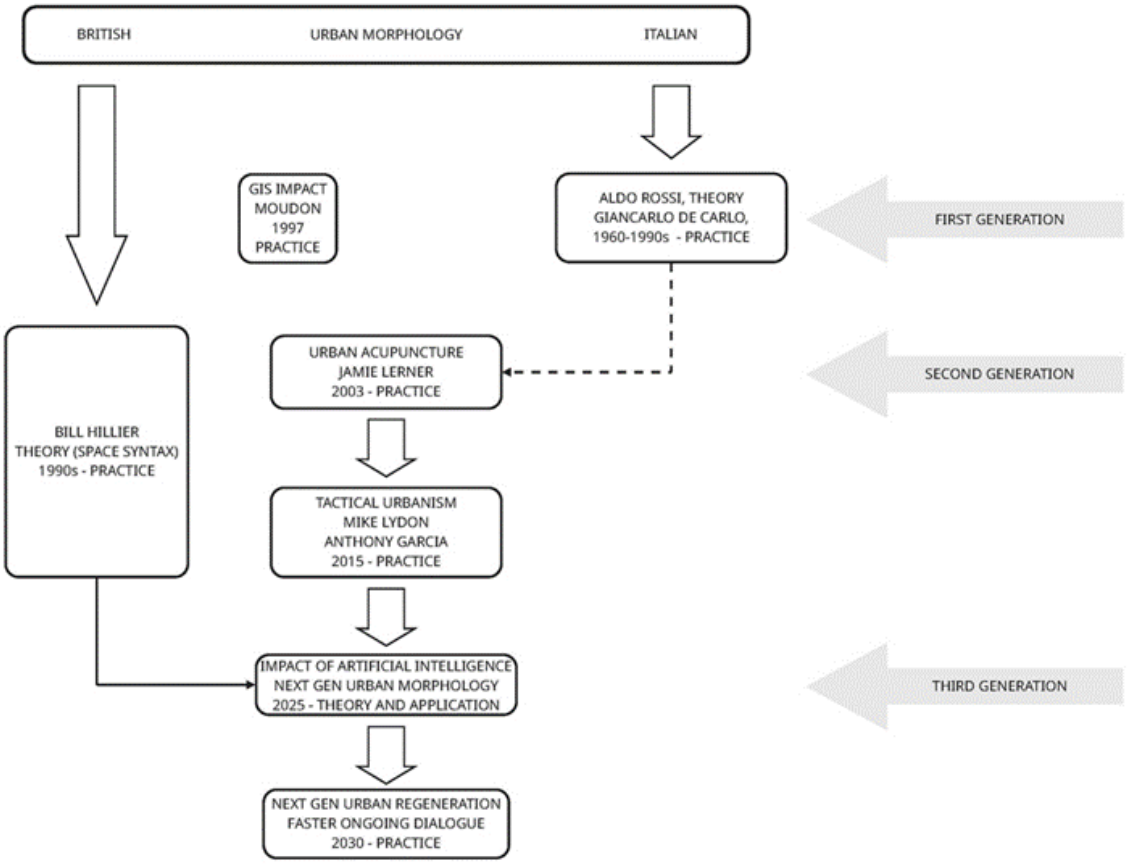

Figure 1. Urban morphology's evolution as theory and practice (Authors, 2025)

Giancarlo De Carlo's ILAUD approach

Giancarlo De Carlo, a practicing architect-planner as well as an urban theorist, made a concerted attempt to define methods for 'reading' the city at different scales and finding ways to engage the community as participants in urban regeneration. In a postscript to a 1991 ILAUD publication, Reading and Design of the Physical Environment, De Carlo describes his long involvement with Urbino, the city and the university, initially to revive its historic center through adaptive reuse and selective redevelopment. This effort secured its future, he says, but the rest of Urbino and its environs remained at risk, so he was asked to make a new plan that considered the whole territory's future without placing himself at the heart of it as 'regenerator-in-chief.' The Summer Workshop he convened reflected the need to guide these activities without directing them and provide a framework that specifies the 'big moves' at the regional level while providing a comparable one at the level of districts or villages and their neighborhoods (De Carlo, 1991, pp. 43-44).

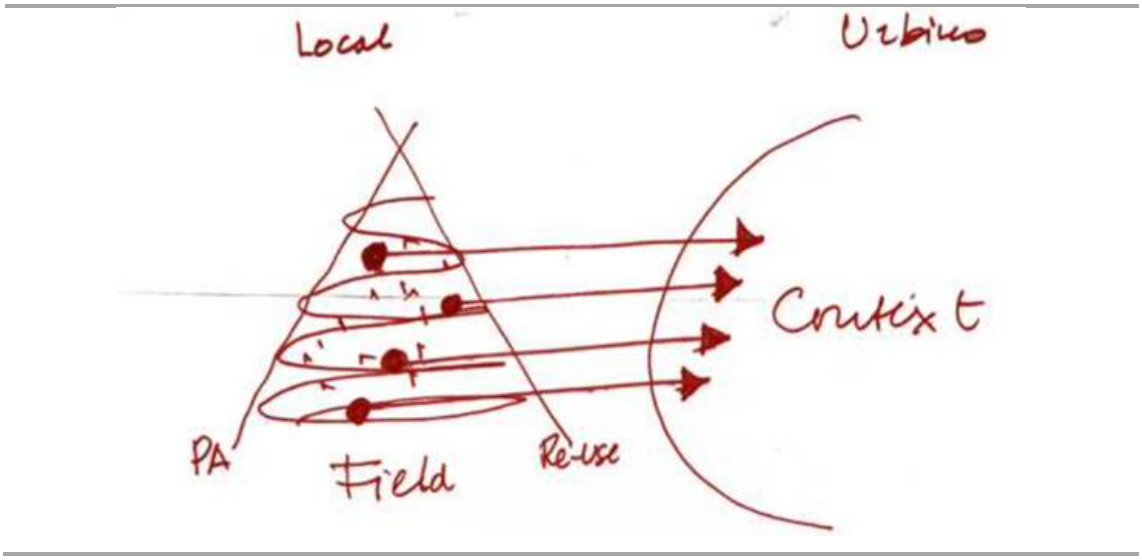

Figure 2. De Carlo's diagram of local actions influencing a city's broader context. (Moucheront, 2018)

Marianna Charitonidou discusses De Carlo's efforts to build local community participation into his projects at length. In De Carlo's 'The Architecture of Participation,' she writes, he argued that participation would change urban regeneration so that its 'different phases merge and the operation cease to be linear, one-way, and self-sufficient.' The role of the user is continuous, from initiation to production to inhabitation. As he elaborates, 'Participation breaks [the] hierarchy between the operation's various stages and moments, and brings them all back to the same logic: the problematic logic of the 'project.' The program, the assignment of resources, and the choice of site become hypotheses that must be tested, and even be radically changed if they prove to have inappropriate or undesirable consequences' (Charitonidou, 2021, pp. 987-988).

The Nuovo Villaggio Matteotti project in Terni exemplifies De Carlo's initial approach to participation. He and his team, including a sociologist and an architectural historian, brought together 1,800 future inhabitants of the new village. They opened the dialogue with an exhibition intended to expose these users to 'models' (prototypes or precedents) from outside Italy, to break the market's hold on their imagination. They then worked with users to define the project's design principles (Charitonidou, 2021, pp. 988-992).

Charitonidou contrasts De Carlo's work in Terni with his work in Urbino, arguing that the latter is based on ‘an idealized understanding of the needs of the inhabitants,’ while in the former ‘the whole design strategy was structured around the idea of bringing in the opinions of the inhabitants in the first place.’ Yet at Terni, she adds, ‘despite his intention to take into account their opinions, he insisted on trying to convince them that the idea of maintaining the identity of 'a low-rise, high-density, low-rise village' was the best solution.’ He ‘was convinced that the capacity of architectural artefacts to transform a place depends on their capacity to discover a genetic code’ (Charitonidou, 2021, pp. 994-995). De Carlo was reacting to post-war modernism, which he saw as ‘too simple and unsophisticated compared with the complexity of reality.’ Its ‘form follows function’ credo became a dogma that privileged architects over those who live in and with it. They give it meaning, and the design process should be altered ‘to give it life as they see it’ (Charitonidou, 2021, pp. 985-996).

The ILAUD Summer Workshops, organized by De Carlo and collaborators like Paolo Ceccarelli in Italy and Donlyn Lyndon in the USA, produced case studies of a wide range of ‘urban conditions’ at different scales. These are potentially valuable in considering urban morphology from a methodological standpoint (De Carlo, 1991, pp. 54, 64, 104, 117).

The second generation: Jaime Lerner

In his foreword to Jaime Lerner's 2003/2014 book *Urban acupuncture*, Danish city planner Jan Gehl writes that ‘without an understanding of people and politics, planning is merely a technocratic tool. (Lerner, 2014, p. xiii) In contrast, urban acupuncture is ‘an approach to city planning designed to make things happen’ (Lerner, 2014, p. xiv). Lerner was an architect-planner who served as Mayor of Curitiba, Brazil, and then as Governor of Brazil's Paraná State. He also taught abroad, notably at U.C. Berkeley, and traveled extensively in Latin America, East Asia, and Western Europe. Urban acupuncture reflects these experiences. A passion for planning and politics,’ Gehl writes, led him to describe an approach to urban regeneration that is observational and anecdotal, and yet manages to convey its principles and methods (Lerner, 2014, p. xiii).

Urban acupuncture has affinities with Christopher Alexander's ‘pattern language.’ Like De Carlo, Lerner sees each city as having characteristic patterns, often visible across its history as responses to terrain, climate, culture, and other factors. Discovering such patterns and applying them in urban regeneration is part of his approach, which ties it to urban morphology. In summarizing his approach, Lerner points to the individual's experience of a city as one starting point. This person is empowered as an active participant in the city's constant transformation, and the solidarity of such participants is in the real engine of a process that supports the city's vitality and sustainability (Lerner, 2014, p. 65). In his view, the city is a political body whose elected leaders, the politicians, serve the people by prompting the process, intervening to secure, for example, the movement people and goods need without sparking car-centricity or harming resilience. Cities help local communities to articulate visions or scenarios of urban transformation and then organize small-scale, rapid interventions to show what they look like, testing concepts so they can be refined and extended or discarded.

The second generation: Mike Lydon and Anthony Garcia

Lydon and Garcia's *Tactical urbanism* (Lydon & Garcia, 2015) provides a methodology for small-scale urban intervention and case studies primarily drawn from U.S. and Canadian cities. and points to historic precedents such as world fairs and expositions, which envisioned a different future for cities and their buildings. Lydon and Garcia's starting point is Design Thinking's five-part method. These parts are not necessarily sequential, they argue. but they imply a circular process with an implied feedback loop (see Figure 3).

Tactical urbanism views locally based interventions through a project lens, elaborating on the Design Thinking model to address them as pilots that demonstrate concepts and invite community use, feedback, and adjustment. This is in keeping with Lerner's sense of urban interventions needing to prioritize speed of implementation and ease of modification. Lydon and Garcia are strong on methods and documentation, but they are only interested in the history of a place if it suggests ways to build on what exists. That a place is the outcome of an evolutionary process, as urban morphology posits, does not appear to concern them.

Figure 3. Lydon and Garcia's diagrams of their methodology. (Lydon & Garcia, 2015, pp. 173, 200)

Lydon and Garcia share Lerner's sense that community participation is best engaged by the rapid interventions that demonstrate the intended changes. Lerner gives more credit to local democracy as a vehicle for local involvement and to politicians' ability to intuit local priorities as they put their own forward. He also views cities and regions as best equipped to set higher-level priorities that shape local growth. Lydon and Garcia emphasize locally initiated action as the best way to prod cities to notice and respond. There are projects only the public sector can initiate, finance, implement, and run, they agree, but Lerner argues that even these projects can often be implemented quickly and then expanded or upgraded (see Figure 4).

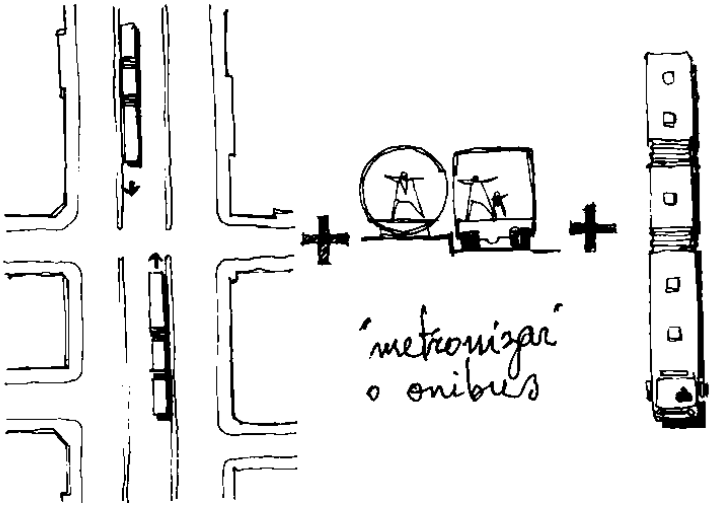

Figure 4. Jaime Lerner's sketch of Curitiba's pioneering bus rapid transit (BRT) system. (Lerner, 2014, pp. 135-136)

The second generation: Bill Hillier

Bill Hillier's Space Syntax began with his understanding and appreciation of London's 'organized complexity.' That it grew as a series of connected villages was a source of its vitality. Modern town planning, he saw, simplified things in the name of efficiency. The methods planners used to assess them were correspondingly reductive, missing their richness (Hillier, 2009). Space syntax maps cities at different scales to identify patterns conducive to 'sustainability,' which Hillier defined as livability and prosperity. He used machine learning to speed analysis, but he noted that he measured 'spatial relationships and not place identify, which means that [it cannot interpret} built form and meaning' (Hillier, 2009, p. K01.5). Yet the analyses space syntax makes can pinpoint the disruptions in the urban fabric that post-war governments inflicted on their cities. Dr. Francesca Froy uses it to analyze Manchester and Sheffield, both of which contended with deindustrialization by tearing down older buildings, many of them well-suited to small-scale manufacturing and tech startups, clearing large parts of entire districts to make room for industrial and warehousing 'parks' that robbed both cities of their walkability and the clustering of trades that spurs innovation and local employment. Space syntax maps these connections and quickly shows if a district has lost them. It can also show from remnants of the past what healthy connectivity looks like (Froy, 2025).

Urban morphology's quandary and opportunity

As this brief history shows, serious efforts to make urban morphology actionable have sought to simplify it and shift the focus from large-scale interventions of the kind De Carlo made in Genoa and Urbino, addressing every scale and initiated by cities and universities—to others that, even when they were systemic, involved what we now call 'rapid prototyping' to show what's possible and build support for a larger rollout. Lydon and Garcia see this as local activism; Lerner sees it city politics, with interventions sparking debate. He also assumes a local knowledge that is more or less shared by locals and their elected representatives.

Urban morphology seeks a deeper understanding of context that can be shared with the different actors in urban regeneration. Its methods are holistic with respect to space and time, climate and terrain, and other factors. This is its virtue and its quandary. It begs the question, 'What do we need to know to regenerate our cities responsibly?' As an academic discipline, urban morphology's schools predefine what to consider and incorporate its findings in teaching and research. De Carlo adapted its methods to ever-shorter timeframes. Lerner took for granted that urban communities understand their context well enough to participate in its ongoing evolution. Lerner saw cities as organisms, and he and De Carlo both emphasized how regeneration can heal them or make them more resilient in the face of new challenges.

Urban morphology acknowledges the unfolding nature of human settlements, of course, but it looks for whatever frames this unfolding and asks how, owing to growth and other pressures, these patterns are disrupted. This interest in urban form and pattern as framing elements for urban regeneration can be seen in the work of John Habraken and his followers at TU Eindhoven and MIT. It led Moudon and others to found the International Seminar on Urban Form—ISUF—as a vehicle for discussion and research on urban morphology.

In 1997, Anne Vernez Moudon pointed to GIS as a possible way urban morphology could become more actionable (Moudon, 1997, pp. 9-10). GIS data is mainly used by experts who analyze its implications for the near future—neighborhood growth or stagnation, for example. But the concurrent trend is to make cities more transparent to ordinary users by providing online substitutes for local knowledge and direct observation.

Some cities make 'urban data' readily available to all comers, but in general the data are fragmented, with multiple 'keepers,' and a lack of consistency across the sources. Such data form the surface layer of a city's evolution. Urban morphology wants to understand the underlying

strata, with reason, but it has lacked the means to do so at the pace and with the accessibility that city-making requires. AI could change this.

The third generation: AI's potential to make urban morphology actionable

AI emerged from antecedents like Smart Cities, mass surveillance, robotics, and autonomous vehicles, while data analytics emerged from probability and statistics. Commentators on their urban applications highlight their limitations, drawbacks, and dangers. Both can already be found in the dystopian toolkits of regimes focused on internal security and the repression of political and self-expression (Cugurullo *et al*, 2024, pp. 361-389). Despite this, we believe that AI, paired with data analytics, can make urban morphology relevant to urban regeneration, shifting it from transactional debates on projects to ongoing dialogues about places in which the participants are on an equal footing. Cities and local communities will still experience what Horst Rittel called 'a symmetry of ignorance' about others' priorities and the nature and relevance of the context, but they will reduce it by a shared understanding within a process that all parties expect to be transparent and accessible (Protzen & Harris, 2010, p. 148).

Four aspects of urban regeneration are particularly ripe for the use of AI as a heuristic. First, understanding a city or a place's deeper context: Urban regeneration benefits from reliable background knowledge pf a city or a place's evolution. If properly trained and managed, AI can be a 'community memory' for these histories and their visual documentation as maps, etc., accessible to all participants, answering their queries in layperson's terms, and, ideally, exportable to any current planning process, to understand changes in form, pattern, density, coverage, resilience, complexity, and other factors raised by a given intervention.

Second, incorporating 'urban data': GIS already tracks a huge amount of data pertinent to urban regeneration, and AI in tandem with computational data analytics makes it faster to integrate and analyze this data, and then make its implications more widely available, with a similar concern for community as opposed to expert access. This is not to question the need for expertise in interpreting data, but to test to what extent AI can be trained to do this reliably, report its findings, and, ideally, also make them exportable to any current planning process.

Third, supporting intervention: AI can 'picture' urban interventions, rapidly generate and evaluate options against different criteria, and support area plans, for example, that consider the future and work through a consensus about rezoning, new planning and design guidelines, etc., to guide by-right redevelopment. By serving as a 'co-intelligence' for the process, AI can turn it into an ongoing and interactive dialogue (Mollick, 2024).

Fourth, supporting local engagement: An explicit goal of urban morphology, shared by the pioneers who sought to make it actionable, is to level the playfield so urban regeneration is less of a top-down diktat to locals, but also less of a bottom-up diktat that stops it in its tracks because it proceeds case-by-case rather than by consensus that clears a path for it. Part of the support AI can provide is to track and summarize, with their permission, the discourse of community groups that discuss their districts and neighborhoods in general, and potential interventions that impact them in specific. These groups are typically voluntary and ephemeral, but AI can be a collective memory for this, too, ensuring that the 'argument,' as Rittel called it, continues (Protzen & Harris, 2010).

In their book on technological innovation, John Seely Brown and Paul Duguid argue that it takes a generation for such innovations to take hold fully (Brown & Duguid, 2022). While Steve Jobs famously imagined the connected system of mass consumer offerings to which his portable hardware would serve as a portal, it was the crowdsourcing of those devices, especially the iPhone, that expanded exponentially on Jobs' vision, completely transforming established industries and practices in the process. We're midway into this transformation, of which AI and computational data analytics are only the latest part. Urban regeneration, which has largely

resisted the changes to which urban morphology and its champions pointed three generations ago, is ripe for change.

We believe that AI's proliferation and applications will exceed what is currently imagined, because humans are making use of them at a scale that ensures constant experimentation on the user end, and constant modifications, refinements, and breakthroughs on the maker end to leverage what emerges. That word 'maker' is likely to be a human/AI combo. Thanks to these innovations, we're all makers now. The future of urban regeneration will be crowdsourced, and urban morphology will be part of it, to its benefit.

Disclosure Statement

The authors report there are no competing interests to declare.

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