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Revisiting Jane Jacobs's Urban Complexity in Global Sustainability City Discourse

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Abstract

Since the 1990s, a recurrent trope of the 'global sustainable city' has emerged in popular and professional discussions of globalization, sustainable development and urban innovation. Published in commercial publications and grey literature on policy, design and global trends, the trope is also articulated in a genre of trade books by urban consultants and in public showcases that project the city as a socially, economically and environmentally beneficial entity – a sustainable complex system that is even promoted to be humanity's best hope for solving the global ecological problems of the twenty-first century. This article traces how urbanist Jane Jacobs's notion of urban complexity becomes an allusive reference in examples of popular global sustainability discourse that present the city as an evolutionary self-organizing entity of systemic networks and physical flows. It examines urban economist Edward Glaeser's *Triumph of the City: How Our Greatest Invention Makes Us Richer, Smarter, and Greener* (2011), urbanist Leo Hollis's *Cities Are Good for You: The Genius of the Metropolis* (2013) and urban

strategist Jeb Brugmann's *Welcome to the Urban Revolution* (2009), as well as the smart building showcase of engineering multinational conglomerate Siemens, The Crystal. The article demonstrates how the trope of urban complexity is mobilized to project the city as a generic scalable entity of creativity and energy efficiency. It becomes the basis of an infrastructural imaginary of neoliberal innovation that supports entrepreneurial and 'smart-eco' agendas of urban design and governance that promise – but have yet to deliver – planetary ecological amelioration.

Keywords: global sustainable city; urban complexity; Jane Jacobs; metabolic urbanism; The Crystal; urban innovation; eco-cities; smart cities; neoliberal urban imaginary; planetary solution

Introduction

Produced and circulated by an international research–industrial complex that includes urban designers, architects and planners, urban policy think tanks, international press, multinational conglomerates, United Nations agencies and urban consultants, the trope of the ‘global sustainable city’ has been promoted in various contemporary professional and trade publications and platforms since the 1990s. Framing global urbanization as a phenomenon of planetary ecological scale, humanity as historically becoming an ‘urban species’ or ‘homo urbanus’, and the city as the genus of civilization, arguments of this genre reiterate existing arguments about the global city, and the city as the seat of entrepreneurial and technological innovation. The trope of the ‘global sustainable city’ thus comes across as a neoliberal imaginary of ‘the city’ as an innovative solution which extends the economic dynamics of global capitalism to addressing planetary ecological problems.

Popular discourse of the ‘global sustainable city’ references and alludes to tropes of urban complexity and non-linear dynamics in describing ‘the city’ as a self-organizing entity that generates interactions that can be scaled up to a planetary level. Examples of ‘global sustainable city’ discourse allude and refer to urbanist Jane Jacobs’s notion of ‘bottom-up urbanism’ from *The Death and Life of Great American Cities* (1961) in putting forward arguments about vibrant entrepreneurial and creative social community networks, as well as about the transformative advantages of compact urbanism and high urban density. Her analogy of the city to a biological or ecological entity is also more generally evoked and juxtaposed with ideas of metabolic urban complexity, such as the metabolic theory of cities from theoretical physicist Geoffrey West, who describes his research on cities as ‘finding a way to “scientifically confirm” [Jacobs’s] conjectures’.¹ These allusions and references to Jacobs’s ideas of urban complexity underscore her position in a genealogy of urban thinking that sees cities as complex systems constitutive of systemic networks and physical flows – a notion which becomes mobilized in global sustainable city discourse as an infrastructural imaginary of neoliberal urban innovation.

This article analyses urban economist Edward Glaeser’s *Triumph of the City: How Our Greatest Invention Makes Us Richer, Smarter, and Greener* (2011), urbanist Leo Hollis’s *Cities Are Good for You: The Genius of the Metropolis* (2013) and urban strategist Jeb Brugmann’s *Welcome to the Urban Revolution* (2009) as examples of popular global sustainable city discourse, along with the smart building showcase of engineering multinational conglomerate Siemens, The Crystal, located in London’s Green Enterprise District. By drawing attention to how ideas of urban complexity become articulated in these books, and manifested in the design of The Crystal’s architecture and exhibition materials, I demonstrate how Jacobs’s ideas have become mobilized as part of what Antoine Picon terms the ‘social imagination’ of infrastructure: ‘the image-based systems of representation and values of infrastructure that are shared by various collective stakeholders concerned with infrastructure’.² I argue that global sustainable city discourse presents ‘the city’ as a sustainable force in this current age of global ecological crisis, as it implies that the city can transform the planet by generating creativity and improving energy efficiency through its self-organizing dynamics. However, the epistemic limits to theories of urban complexity render the global sustainable city as more of an infrastructural sociotechnical imaginary of urban innovation than a plausible planetary ecological reality.

The ‘Global Sustainable City’ and Urban Complexity

The trope of the ‘global sustainable city’ draws upon and modifies existing tropes of the global city in the context of planetary ecological transformation. The trope of the global city as the key economic, informational and political spatial node of global capitalism and driver of globalization is supplemented with the trope of increasing planetary urbanization, or what Neil Brenner and Christian Schmid identify as the ‘urban age thesis’: for the first time in history, more than half the world’s population lives in cities.³

Tropes of the sustainable city, such as the city as ‘the fulcrum of global sustainability’,⁴ have emerged from discussions on sustainable development and urban sustainability which were spurred by international directives established in the 1970s, such as the United Nations Environmental Programme and the United Nations Human Settlements Programme (UN-Habitat).

Articulated in the context of planetary threats such as burgeoning urbanization, global poverty and climate change, the trope of the 'global sustainable city' presents the city as a planetary ecological problem as well as a solution, with 'the city' identified as the scale on which global ecological problems would be solved. Hillary Angelo and David Wachsmuth note that there has been a marked shift in global urban policy and discourse from viewing the city primarily as a sustainability problem in the 1970s to a sustainability solution in the 1990s, as international policy consensus ostensibly promoted the 'sustainable city' and sustainable urbanism as solutions to global sustainability. Angelo and Wachsmuth encapsulate this historical shift in three developments that demonstrate how sustainability policy reframed and naturalized the city from problem to solution: (1) suburban sprawl in the Global North, especially in the USA; (2) the expansion of informal settlements or 'slums' in the Global South; and (3) climate change.⁵ Viewed as environmentally destructive, the post-Second World War American suburb was regarded as the site of voracious resource consumption and pollution, and it was initially synonymous with urban development. However, the problematic urban status of the suburb changed with the oil crisis in the 1970s. As city governments redeveloped hollowed out city centres in the 1980s and 1990s, the suburb became distinguished as the problem solved by the environmentally friendly 'compact city'.⁶ Likewise, informal settlements, or slums were framed as sources of environmental degradation in the 1970s, with their lack of infrastructure and poor hygiene, but by the 2000s, they were regarded as innovative forms of sustainable and even creative urbanism as they were either eradicated or upgraded by local authorities.⁷ In the 1980s and 1990s, cities were viewed as contributors to climate change for their high greenhouse gas emissions and resource consumption. But they were repositioned in global policy later in the 1990s as potential actors of environmental sustainability, as policymakers recognized that the world was being increasingly urbanized.

The trope of the 'global sustainable city' becomes definitive from the 1990s onwards due to developments in entrepreneurial urban governance. Angelo and Wachsmuth argue that the solutions for the various global environmental problems identified in the 1960s did not initially involve the city; however, sustainability took on an urban cast due to developments within cities.⁸ Urban governments, with their competitive focus on attracting global investment, moved towards instituting environmental policy and projects of green economic development, as seen in the formation of international networks, such as the C40 Cities Climate Leadership Group and the Rockefeller Foundation-sponsored 100 Resilient Cities Network, which support the notion that cities 'lead the way' in mitigating climate change and establishing solutions to other climate governance problems.

While Angelo and Wachsmuth describe sustainable city discourse as 'cities saving the planet', I draw attention to the biological imaginary evoked in such discourse, which emphasizes humanity's evolutionary potential in developing the city through strategic organization and as technological innovation. The trope of the 'global sustainable city' as the genus of civilization and the solution to planetary challenges for the increasing human species surfaces most apparently in a genre of trade books produced from the late 2000s written by urban consultants and urban economists. Functioning as popular surveys of urban theories and case studies ranging from global cities such as New York to the megacity slum Dharavi in Mumbai, these books argue for urban entrepreneurship and innovation through modes of strategic design and policy, and valorize the city as a planetary ideal. In *Triumph of the City*, Edward Glaeser promotes cities as mankind's best invention for their density, economic opportunities, energy efficiency and capacity for creativity and technological innovation. He sees the city as an environmentally friendly option, especially for the developing world.⁹ Leo Hollis's *Cities Are Good for You* regards cities as the 'front-line of climate change' and also asserts that 'cities are good for us, and may be the best means to ensure our survival'.¹⁰ In *Welcome to the Urban Revolution*, Jeb Brugmann notes that 'the scale of the global City's mundane forces is so great that it has revolutionized Earth's ecology',¹¹ and argues that the application of urban strategy would enable the city to develop into a more politically, economically and ecologically stable system that would transform cities into sites of solutions for global problems.¹²

Behind these overarching triumphal claims for the city's capacities are summarized arguments of 'hyper-urbanization', advocated by urban experts who see urban density, technological innovation, energy efficiencies and economies of scale as environmental advantages of urban living.¹³ These are explained

as features and products of the city as a complex system. The city is described as an organic entity of evolutionary systemic growth, constitutive of discursive–material dynamic flows of infrastructural processes, energy use, economic production and consumption, as well as functional social interactions that generate creativity and innovation. Jane Jacobs’s ideas of urban complexity function as an allusive anchoring influence to explain the relationship between the city’s agglomerative features (that is, the close clustering of businesses and people in a given area that usually gives rise to economic benefits to the area) and the aggregate aspects of ‘the city’ (for example, total population). Glaeser and Hollis explicitly reference her notion of urban dynamics, especially of ‘bottom-up urbanism’, while Brugmann alludes to her ideas in discussing the ‘urban advantage’ that cities have in their density, scale, association and extension infrastructure.¹⁴ He extends the complexity of the city on to the planetary scale in arguing that with urbanization, ‘We are organizing the planet itself into a City: into a single, complex, connected, and still very unstable urban system’.¹⁵ Leo Hollis evokes Jacobs for her analogy of the city to a biological entity; he cites her in stating that ‘the city is not a rational, ordered place but a complex place that has more in common with natural organisms’.¹⁶

While these authors explain urban dynamics in terms of complexity, they reference and allude to complexity in abstract terms, which Brendan Gleeson critiques as ‘weak on epistemology’.¹⁷ Given its citational and allusive character, global sustainability discourse reflects more of an ideology of complexism¹⁸ than the workings of complexity science. This ideology is also manifested in the architectural and exhibition design of The Crystal, Siemens’s smart sustainable building located in London’s Green Enterprise District at the Royal Victoria Dock. Opened in 2012, The Crystal functions as the multinational conglomerate’s urban infrastructural showcase. It also hosts a public exhibition on urban sustainability, as well as the Siemens Centre of Competence for Cities. Its crystalline architecture, designed by Wilkinson Eyre Architects, ‘represents the many facets of sustainability and the complexity of urban life’,¹⁹ while its exhibition installations by ISO Design thematically present the city as the solution to the planetary ‘forces of change’ (for example, climate change) (see Figure 1) through applications of infrastructural design and technology. Taking the visitor through various subzones showcasing different urban technological systems (which include ‘Creating Cities’, ‘Transportation’ and ‘Security’),²⁰ the exhibition is designed to communicate to the layperson to ‘understand the mechanics and workings of a city as a total entity before looking at the individual elements that create it’ (see Figure 2),²¹ much as how Jane Jacobs explained the concept of organized complexity as ‘a sizeable number of factors which are interrelated into an organic whole’.²² The Crystal functions as a neoliberal imaginary of urban innovation, whereby Siemens offers technological solutions to urban governance and energy management that would harness the city’s self-organizing dynamics from the top down instead of the bottom up, the scale that Jacobs foregrounds.



Figure 1 Photograph taken at the entrance of The Crystal exhibition (Source: author, 2021).



Figure 2 The interface of the Green City Index installation in The Crystal’s urban exhibition (Source: author, 2021).

The infrastructural technology-centred imaginary of sustainable urbanism projected by the exhibition and design of The Crystal reflects the current trend for sustainability in cities and the recent development of ‘eco-cities’ – new cities which have been conceptualized and designed by international engineering conglomerates and urban planning firms in terms of technological innovation and development. Although sustainability discourse is associated with environmental health and social justice, it is also used by urban governments, developers and corporations as a market-oriented mode of boosterism. This is especially true in the case of new master-planned ‘eco-cities’, such as Masdar City in the United Arab Emirates, which have focused mostly on economic development in their planning and less on the social and environmental dimensions of the triple bottom line of sustainability.²³ Going beyond greenwashing, sustainability has been shaped into a form of corporate branding that emphasizes values such as ‘innovation’, ‘quality of life’, ‘transparency’, ‘efficiency’ and ‘resilience’ more than ecological amelioration.²⁴ In the case of The Crystal, the smart building landmark is designed as a larger edutainment complex that includes the Emirates Air Line, a cable car attraction across the River Thames sponsored by Emirates Airline. The Crystal’s message of urban sustainability becomes incongruous when one considers the environmental implications of fossil fuel-powered air travel.

The concept of The Crystal also reflects how the notion of urban sustainability has become increasingly amalgamated with the ‘smart city’ concept, with computational technologies applied as solutions to improve ecological sustainability. The notion of urban complexity, or the city as a complex system, is being promoted by computing technology and big data conglomerates such as IBM and CISCO. They project the city as a collective entity of different integrated data systems (or a ‘system of systems’),²⁵ with information communications technology and the internet of things²⁶ forming a seemingly ubiquitous urban digital infrastructure. Urban sustainability is conceived as processes of technological development and innovation,²⁷ particularly in the form of green and renewable energy technology, which includes environmental sensors and computerized interfaces that regulate energy use in a building or urban district. This technological approach of ‘smart’ urban governance sees urban sustainability as the optimized management of various forms of resources, particularly of an expanding population, that is enacted through the application of effective policy with respect to the strategic collection and analysis of data.

Leo Hollis, Edward Glaeser and Jeb Brugmann do not endorse the ‘smart city’ or ‘eco-city’ concept, but they emphasize the potential of information and communications technology to connect people in the city as an infrastructural extension and development of social relations. They explain how these urban dynamics also bring about environmental resource efficiency. Their identification of urban complexity as the underlying characteristic of cities aligns with the ‘storytelling’ inspired by cybernetic (the science of control and communication systems in humans and machines) and systems thinking that surrounds smart cities and the application of smart technology to cities,²⁸ reflected in Siemens’s complex, The Crystal.

In global sustainable city discourse, Jane Jacobs's notion of urban complexity alludes to a scientific conception of urbanism that bridges a socio-economic notion of urbanism and contemporary 'smart-eco' technological urbanism.

Projecting the Complexity of the City through Jane Jacobs

The influence of Jane Jacobs's ideas on Glaeser's, Hollis's and Bruggmann's expositions of urban dynamics reflects the impact of her application of scientist mathematician Warren Weaver's notion of organized complexity to the city in the field of urban design and planning. A critique directed at the top-down nature of modernist planning, *The Death and Life of Great American Cities* (1961) articulated an urbanism that emerged from the ground up through the interaction of various interrelated factors in a given urban space (for example, the variation of spatial uses and functions, types of businesses and kinds of people with different needs and skills in a given area). Her analysis led to a paradigm shift in the problem of urban renewal in the twentieth century, whereby high urban density – defined as a high concentration of people within a given space engaged in a sufficiently diverse range of socio-economic interactions – becomes regarded as a positive feature. Edward Glaeser, Leo Hollis and Jeb Bruggmann draw upon Jacobs's critique in arguing for the advantages of compact urbanism and high urban density. They identify urban density and proximity as key urban characteristics, along with economies of scale and the agglomerative dynamics of collaboration that extend within and across cities. Leo Hollis argues that 'large dense cities are more creative' and that a 'network of weak ties, diversity of parts and the added competitiveness encourage innovation'.²⁹

Jacobs's notion of urban density was not unprecedented, but her cross-disciplinary incorporation of ideas from economics and urban sociology – disciplines that utilized biological analogies and adopted complexity theory as an analytical framework – into urban planning was.³⁰ Post-Second World War American social science from the 1950s to the 1970s was characterized by the study of social and economic phenomena as underlying structures of behavioural relational processes, especially through the application and simulation of complexity models by scientists such as Warren Weaver and economist Herbert Simon.³¹ Jacobs referenced Weaver's article 'Science and Complexity' (1948), in which he argued for the scientific analysis of problems epitomized by biological organisms – 'organic whole' entities constituted of systems of multiple interconnected components interacting in observable patterns. While Jacobs provided the caveat that the problem of the biological organism was not the same as the problem of the city, she argued that the city and the biological organism were the same kind of problem.³² In applying Weaver's notion of organized complexity, Jacobs articulated urbanism as interactive and interdependent social, economic and spatial processes, of which urban space was one influential factor, and thus advocated for urban planning to be conducted at the local scale. Her interactive processual notion of urban space, reflected in her description of the 'sidewalk ballet' of ritualized actions of neighbours and strangers on the street, departed from more Euclidean notions of urban space that were advocated by modernist urban designers such as architect Le Corbusier (whom Jacobs critiqued), and enforced through the top-down application of traditional zoning laws and practices, which strictly divided the city into fixed functional areas.

Jacobs's articulation of urban complexity was part of a larger design discourse in the 1960s and 1970s, when architects and urban designers were concerned with the impact and integration of media and information communications networks into the urban fabric.³³ Architects and urban designers incorporated cybernetics and communications theory into urban planning and conceptualized urban space as networks and flows of information. Jacobs's urban design ideas were specifically focused on fostering the dynamics of socio-economic networks that constituted the 'vitality' of the city – relations that emerged from diverse face-to-face interactions within a given area or community, especially slums which were targeted by master planners. Glaeser, Hollis and Bruggmann draw from her notion of bottom-up social dynamics to explain how the city is archetypally entrepreneurial and creative due to the social networking of its people, especially urban migrants, who benefit from their access to economic opportunities in the city. Processes of knowledge transfer and idea development are portrayed through the notion of face-to-face meetings and collaborations between individuals in communities that are facilitated through physical proximity provided in urban space.

Glaeser, Hollis and Bruggmann also extend the logic of Jacobs's self-organizing dynamics beyond her socio-economic critique of urban density to suggest that urban interactions include other factors, such as ecological interactions and energy use. In particular, Hollis analogizes the 'weak links' of social interaction to 'human contact that act like electricity for the city'.³⁴ He subsequently equates social energy with the 'raw material' of electrical energy, and it is an energy that he continues to describe as 'a strange power that feeds back into the fabric of the city itself',³⁵ as he introduces the research of Geoffrey West, a theoretical physicist at the Sante Fe Institute. West researched whether cities, like other social organizations, were also subjected to growth according to universal scaling laws that were behind the growth of biological organisms.³⁶ Drawing a connection between his and Jacobs's work, West implicitly highlights Jacobs's role in 'science of cities' discourse that sees cities as evolutionary systemic entities of metabolic networks and infrastructural material flows, instead of as space and place.³⁷ His research joins recent studies by scientists, geographers and urban planners that engage network theory in analysing attributes of the city in terms of interactive connections/links and nodes/agents through enumerated data, as well as computational methods such as agent-based spatial modelling. The space of the city is regarded as the intersection where multiple diverse networks (political, social, economic, technical, infrastructural) of various scales converge, with the city itself a node in larger networks.³⁸

From Urban Complexity to the Metabolic Theory of Cities

West's theory explains how cities, in following patterns of sublinear scaling, require less energy and infrastructure per capita the bigger the city in terms of population size, just as larger animals require less energy compared to their smaller counterparts due to greater biological metabolic efficiency. Utilizing network theory to analyse sets of statistical census data on aspects of the city, such as the length of roads and the wealth and wages of the city population, his theory affirms Hollis's (and also Glaeser's and Bruggmann's) arguments on the energy and infrastructural efficiency of dense cities and, thus, their sustainability. For West, infrastructure serves as the material networked medium facilitating physical energy flows such as heat and light, as well as the energy of 'social metabolism' produced from interactive socio-economic networks that exchange information.³⁹ Offering a framework that allows all cities to be compared with each other as networks of material energy generalized through quantified data, he suggests that the city operates according to generic principles and asserts that it is possible to quantitatively predict the growth of cities, as 'Despite their amazing diversity and complexity across the globe, and despite localized urban planning, cities manifest a surprisingly coarse-grained simplicity, regularity, and predictability.'⁴⁰ He thus presents the city as a generic scalable figure constitutive of systemic forms and logics replicable around the world.

However, West's use of power-law scaling has been critiqued as not providing any stronger predictions than other functional forms. Professor of statistics Cosma Shalizi points out that West's scaling model of cities 'rests on an oddly monadic, interaction-free view of metropolitan areas',⁴¹ instead of considering individual cities as being part of a larger economic assemblage that consists of other cities and rural areas. West himself notes that his claim that 'cities are . . . approximately scaled versions of one another' only pertains to the category of physical infrastructure, which is assumed to consist of 'self-similar' units.⁴² He also states that there are limits to comparing the growth patterns of the city with those of organisms and companies: cities keep growing and persisting, unlike organisms and companies, which eventually mature and die.⁴³ While West's metabolic theory of cities reveals its epistemic limits, the appeal of his theory suggests a shift towards thinking of cities in terms of infrastructural networks and predictive patterns of data, instead of the mutual interactions between what Jane Jacobs calls the 'vital, unique, intricate, and interlocked details'⁴⁴ of a given urban place.

The City as Infrastructural Imaginary of Neoliberal Innovation

In global sustainable city discourse, ideas of urban complexity articulate the generic city as a scalable infrastructural sociotechnical imaginary. All three authors argue that the city provides the physical sites that enable functional social interactions and information exchange to generate the necessary creativity and innovation that would help the human species progress. For Glaeser and Bruggmann, cities play crucial

roles in the global knowledge economy, and urban network efficiencies extend more globally through urban infrastructure such as communications and information technologies and shipping networks. Hollis describes the city as a ‘superlinear site of information’.⁴⁵ The authors reiterate existing arguments on the global city and the creative/entrepreneurial city as the seat of innovation. But, as Brendan Gleeson points out, the authors project the development of the city as following seemingly immanent laws⁴⁶ that suggest all cities follow the same ‘natural’ scalable patterns of development and could also be designed to do so.

As a global showcase of intelligent urban infrastructures and urban research, The Crystal’s thematic emphasis on complexity functions as the physical site that reflects the ‘social imagination’ of infrastructure projected by various stakeholders of global urban management – from politicians and policymakers to architects and engineers around the world, who are projected as producers and consumers of innovative infrastructure, and infrastructure as innovation. Urban systems are synoptically presented in exhibition fixtures and dashboard diagrams, which relay material energy and various urban factors as information drawn from cities around the world effaced of geographical particularities. Exemplifying this aesthetic is the exhibition’s centrepiece, The City Icon sculpture (see Figure 3), which displays simulations of complex systems such as the movement of traffic and the arteries of a body that morph as abstract grid-like patterns on a large LED screen.⁴⁷ The interface The World’s Greenest Cities, which displays the Siemens Green Cities Index, sits at the base of the sculpture. The index compares and ranks 120 capital cities and business centres around the world over eight categories, such as energy consumption and air quality, by utilizing the extrapolation of partial and national data when city data are not available, and statistical methods to create commensurability between the data of cities of different regions and developmental profiles – especially those of developing cities which have ‘limited comparability’.⁴⁸



Figure 3 The City Icon digital sculpture, located in the Creating Cities subzone of The Crystal’s Future of Cities exhibition (Source: author, 2021).

Conclusion

The design of The Crystal and the examples of global sustainable city discourse portray urban complexity as the dynamics of physical, social and economic interactions between different actors and forces in the city that would collectively contribute to economic and ecological innovation on a planetary scale. They also project urban complexity as a phenomenon that could be mobilized, directed and controlled through infrastructure that manifests in physical and abstract forms of information exchange and management, especially through policy and urban design, as well as modes of computation that enable

urban factors to become replicable and commensurable. While these ideas of urban self-organization promise better urban futures on the aggregate level, the amelioration of planetary problems such as climate change are still yet to concretely materialize. Functioning as more imaginary than ecological reality, the sustainable complex city is the twenty-first-century ideal of the innovative entrepreneurial global city.

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Conflicts of Interest

The author declares no conflict of interests with this work.

Notes

- ¹Lehrer, 'A Physicist Solves The City'.
- ²Picon, 'Urban Infrastructure, Imagination and Politics', 264.
- ³Brenner and Schmid, 'The "Urban Age" in Question'.
- ⁴Yanarella and Levine, *The City as Fulcrum*.
- ⁵Angelo and Wachsmuth, 'Why Does Everyone Think Cities Can Save the Planet?'
- ⁶Peter Calthorpe, cited in Angelo and Wachsmuth, 'Why Does Everyone Think Cities Can Save the Planet?', 2205.
- ⁷Ananya Roy, cited in Angelo and Wachsmuth, 'Why Does Everyone Think Cities Can Save the Planet?', 2207.
- ⁸Angelo and Wachsmuth, 'Why Does Everyone Think Cities Can Save the Planet?', 2211.
- ⁹Glaeser, *Triumph of the City*.
- ¹⁰Hollis, *Cities Are Good for You*, 5–6.
- ¹¹Brugmann, *Welcome to the Urban Revolution*, 13.
- ¹²Brugmann, *Welcome to the Urban Revolution*, 201.
- ¹³Isenhour, McDonogh and Checker, *Sustainability in the Global City*, 54.
- ¹⁴Brugmann, *Welcome to the Urban Revolution*, 55.
- ¹⁵Brugmann, *Welcome to the Urban Revolution*, ix.
- ¹⁶Hollis, *Cities Are Good for You*, 6.
- ¹⁷Gleeson, 'Critical Commentary', 933.
- ¹⁸Cogdell, *Toward a Living Architecture?*
- ¹⁹Siemens, 'The Crystal Brochure', 17.
- ²⁰The Crystal, 'Exhibition Zones'.
- ²¹Miranda and Powell, *Our Urban Future*, 19.
- ²²Jacobs, *The Death and Life*, 432, italics in the original.
- ²³Cugurullo, 'How to Build a Sandcastle', 25.
- ²⁴Greenberg, 'The Sustainability Edge', 110.
- ²⁵Harrison, 'Urbanisation and Complex Systems'.
- ²⁶Harrison, 'Urbanisation and Complex Systems'.
- ²⁷Cugurullo, 'Urban Eco-Modernisation', 2.
- ²⁸White, 'Anticipatory Logics', 575.
- ²⁹Hollis, *Cities Are Good for You*, 130.
- ³⁰Roskamm, 'Taking Sides with a Man-Eating Shark'.
- ³¹Heyck, 'The Organizational Revolution'.
- ³²Jacobs, *The Death and Life*, 439.
- ³³An extensive body of architectural history scholarship exists on this topic. See Martin, *The Organizational Complex*. Also see Dutta et al., *A Second Modernism*.
- ³⁴Hollis, *Cities Are Good for You*, 26.
- ³⁵Hollis, *Cities Are Good for You*, 27.
- ³⁶Bettencourt and West, 'A Unified Theory of Urban Living'.
- ³⁷The term 'science of cities' is coined in Batty, *The New Science of Cities*. The urban planner, geographer and spatial data scientist describes the 'new science of cities' as based 'literally on the idea that cities are devices that enable us to communicate' (xvii), and explains that 'the idea that it is relations – or rather, networks – between places and spaces, not the intrinsic attributes of place and space, that condition our understanding, is the first principle that [he] will use in [his] new science' (1–2). He explains this new science as built upon knowledge from disciplines such as social physics, urban economics, transportation theory, regional science, urban geography and the systems approach to physical planning (xix).

- ³⁸Pflieger and Rozenblat, 'Introduction. Urban Networks and Network Theory', 2723.
- ³⁹West, *Scale*.
- ⁴⁰West, *Scale*, 29.
- ⁴¹Shalizi, 'Scaling and Hierarchy in Urban Economies', 5.
- ⁴²West, *Scale*, 112–3.
- ⁴³West, *Scale*, 10.
- ⁴⁴Jacobs, *The Death and Life*, 408.
- ⁴⁵Hollis, *Cities Are Good for You*, 49.
- ⁴⁶Gleeson, 'Critical Commentary', 932.
- ⁴⁷Squint/Opera, *Siemens' Crystal*.
- ⁴⁸Siemens AG Corporate Communications and Government Affairs, *The Green City Index*.

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