

# New Science, New Architecture... New Urban Agenda?

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In December 2016, The United Nations General Assembly adopted by consensus a resolution titled “Implementation of the outcome of the United Nations Conference on Housing and Sustainable Urban Development (Habitat III),” also known as the “New Urban Agenda”. This remarkable document calls for urbanization with the core characteristics of traditional settlements, including walkable streets, a mix of uses, well-connected high-quality public spaces, and other familiar traditional features. It further stresses the importance of “cultural heritage, both tangible and intangible, in cities and human settlements” as well as “traditional knowledge and the arts,” and calls for implementation “tapping into all available traditional and innovative sources at the global, regional, national, subnational and local levels.”

Now the question remains how those involved in implementation can apply an evidence-based approach, engaging lessons from the sciences, to actually implementing the agenda. This task is particularly difficult at a time of institutional and economic dysfunctions that are acting to produce profoundly chaotic and low-quality urbanization. At the same time, bizarre rationalizations, coupled with bizarre designs, continue to emerge from the international “high design” world, and the academic institutions from which it derives much of its continued justification. We discuss herein the issues, the lessons, and the opportunities ahead.

The title of my paper refers to three different but related events in the history of environmental design. One is the 1997 publication of a book by the architectural critic Charles Jencks, titled *New Science = New Architecture?* [1] The second is a 2004 conference organized at the Prince’s Foundation for the Built Environment in London, attended by Jencks as well as a number of scientists and architects, including Christopher Alexander and Bill Hillier. It was titled “New Science, New Architecture... New Urbanism?” [2] and it explored the urban implications of findings in the new sciences. The third reference comes much more recently, the 2016 “New Urban Agenda” developed by the United Nations in the conference called Habitat III [3].

My aim in this paper is to explore the ideas that link these three events, and what I believe is the very important new agenda that they do indeed outline for our professions. I will argue that they all point toward a necessary transition that has occurred in other fields, but that is still slow to catch up – or indeed, prone to be mis-applied – in our own field of environmental design.

## 1 From Jencks to a “New Urbanism”

Jencks’ book argued that architecture was beginning to be transformed by the so-called “new-sciences of complexity” – the new understanding of natural phenomena like fractals, algorithms, strange attractors, and other aspects of what have been called “complex adaptive systems.” For Jencks, these developments created the basis for an exciting new language of expressive form, made possible by the new industrial technologies (such as computer-aided design and engineering) that could now generate these forms.

Two decades later, we can see the full flowering of that development in the work of designers like Frank Gehry, the late Zaha Hadid, the so-called “landscape urbanists” and others, and the computer technologies they have used to generate their complex artistic creations. In Jencks’ own landscape architecture work too, we can see the expression of “strange attractors” and other imaginative metaphorical shapes that, for him, express a “new cosmology” emerging from modern sciences.

A more subtle relationship has been with the work of so-called “deconstructionists” like Peter Eisenman and Daniel Libeskind, for whom the philosophical implications of an increasingly complex and even chaotic world were most important. While they have not been as explicit in linking to the “new sciences of complexity,” they have certainly expressed the limits of an earlier rationalist use of science in design, and what they see as a necessarily avant-garde new artistic response to a globalizing world that is now too complex to control. But this is not a problem, according to Rem Koolhaas, one of their most articulate theorists: “Since it is out of control, the urban is about to become a major vector of the imagination” [4]. In spite of our loss of control, we can at least “deconstruct” the power relationships, and therein is a kind of “art therapy,” if you will. Moreover, we have found a source of endless new material for artists within urban environments, which simultaneously liberates us from former professional obligations: “Since we are not responsible, we must become irresponsible.”

Our intention in organizing the conference at the Prince’s Foundation some seven years after Jencks’ book was, I must admit, subversive. (I can testify to that fact because it was largely my own effort.) We wanted to examine Jencks’ core premise that the contribution of the new sciences were limited to metaphoric expressions, and question whether instead the new sciences actually challenged the very ideological assumptions of the profession as to its role in culture, its view of nature and history (including human nature and history) and ultimately, its professional responsibility. Thus we wanted to forcefully rebut Koolhaas, using the abundant evidence coming from the sciences (Fig. 1).

In that conference we included, along with Charles Jencks, two leading scientists noted for their eloquent writing about complexity, the biologist Brian Goodwin and the physicist Philip Ball. We also included George Ferguson, then head of the Royal Institute of British Architects (RIBA), and Bill Hillier, head of the Bartlett School at University College London, known for his work on “Space Syntax”. Over the next two days we also conducted a short course taught by Christopher Alexander on his most recent work, greatly influenced by late 20th Century sciences as well as deeper thinking about the history of human design and its relation to the natural world, in both form and process [5].



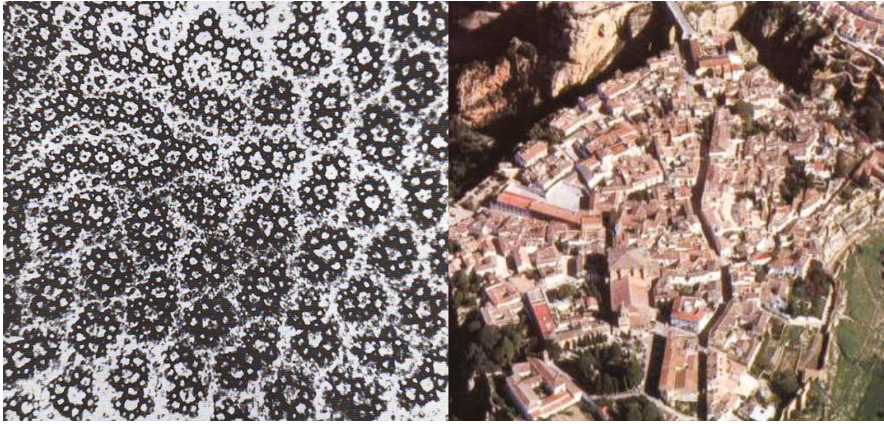
**Fig. 1.** The 2004 conference at the Prince's Foundation for the Built Environment, with (left to right) the author, architect Bill Hillier, theorist Charles Jencks, biologist Brian Goodwin, and physicist Philip Ball. (Photo by the author)

A key premise of the conference was to ask whether individual acts of design contributed to a greater whole, or rather, created disorder, fragmentation and an increasing deterioration of the systems on which we humans depend for our quality of life. If so, was that an inevitable condition, or rather, a willful abdication of responsibility, growing out of a failure to understand what Jane Jacobs called “the kind of problem a city is”? To reverse Koolhaas, if we are irresponsible, must we not seek to become responsible? Can we do so, through a deeper scientific understanding of the dynamics of nature, and human nature? Our thesis was an emphatic “yes.”

More specifically, was it not now necessary to seek to recover a “new urbanism” out of the lessons of history and nature – the lessons brought into focus by the new sciences – and to reject the idea that architecture is a series of one-off art objects? Was it necessary instead to ask how individual acts of architecture must work together to form a coherent civic realm – with implications of constraint and responsibility for the professional, as opposed to a mere creator of giant sculptures and urban sculpture-gardens?

Was it not high time to reject the nearly century-old ideological positions and assumptions about the artist in a technocracy, or at least examine them again in the harsh light of the new evidence?

In this sense, we proposed to turn Jencks’ idea on its head. He had argued that architecture would illuminate the new sciences as a kind of “art supply” to construct exciting and profound new metaphorical artistic expressions, but within an unchanged delivery system of newly imaginative artistic “product packaging” on more or less the same old industrial products. We were arguing that, on the contrary, the new sciences were now illuminating architecture, as a case study of a limited and damaging kind of



**Fig. 2.** As Christopher Alexander argued in his book *The Nature of Order*, the complex processes that generate order in magnetic domains of cobalt (left) are not unlike the complex processes that produce a great urban structure like the medieval city of Ronda, Spain (right). Both forms of generative order are comprehensible and reproducible (Photos courtesy Christopher Alexander)

structure, when compared to the deep richness of the evolutionary world of nature and history. These insights pointed to a capacity for human response – “response-ability” if you will – and created a moral imperative for action (Fig. 2).

Where Jencks saw architecture as detached, observing, powerless, and therefore not responsible, we argued that the profession is indeed responsible, because it now has the tools (in the form of the sciences and their evidence) by which it can respond. That is, the profession can no longer stand apart as a cerebral artist, wringing its hands while actually doing nothing other than packaging more questionable industrial products. The profession can and must act on the world, to improve its quality of life. The “new sciences” showed some dramatic new avenues for doing so, as Alexander and others then explored.

RIBA President George Ferguson was certainly responsive to this message, since he himself was looking into a new emphasis on urbanism in the profession, and in professional education. (He was co-organizing a group later to be known as the “Academy of Urbanism” with that aim.) Bill Hillier also saw *Space Syntax* as a tool for managing the successful design and intervention of complex urban systems, by analyzing how global properties manifest in local places.

This, then, was a reformist agenda, seeking to replace the “irresponsible” urbanism of Koolhaas – and indeed, much of the leadership of the profession and its academic institutions – with a more engaged, more responsible practice, capable of producing more benefit, or at any rate less harm, to human beings.

## 2 The New Urban Agenda

More recently, the United Nations has taken up similar questions, through the latest conference in its Habitat series (otherwise known as the “United Nations Conference on Housing and Sustainable Urban Development”). Begun in 1976, and focusing initially on rural development issues, the conference ran again in 1996 (“Habitat II”) with a focus on sustainable development, and again in 2016 (“Habitat III”), with a focus on rapid urbanization, environmental deterioration, and the challenge of providing quality of life for urban residents.

In that sense, Habitat III asks precisely the same question about the role of professionals (especially environmental designers) in meeting human challenges and promoting quality of life. How can they do so by using the evidence of what has succeeded and what has not? How can the work of the sciences inform this task, and provide a more effective response? How should governments support, empower and, if necessary, compel the work that is needed to ensure human well-being in the future?

This comes at a time when the world is urbanizing at a rate never before seen in history. Indeed, at current rates, the area of new urbanization created over the next five decades may exceed the area created through all of human history to the present.

This is a staggering fact, not least because of the disturbingly low quality of much of the present urbanization. This urbanization falls into two main categories. On the one hand, formerly rural immigrants are populating new “informal settlements” with poor sanitation, limited access to urban opportunity, criminal predation, and other serious environmental deficiencies. On the other hand, new “market-rate” development is often sprawling, fragmented, automobile-dependent, and extremely resource-inefficient. As my own research has shown, the implications for greenhouse gas emissions as well as other impacts on critical resources are nothing short of catastrophic, for the well-being of the species in future generations (if not sooner) [6] (Fig. 3).

This urbanization is not only wasteful. The evidence suggests that it is deficient in the very qualities that urbanism offers as benefits to its residents, namely, opportunities for contact, creative exchange, and human development. These opportunities are particularly important for women and disadvantaged populations. Instead of promoting greater quality of life for larger numbers of people with lower impacts on resources, it seems that modern cities have somehow managed to give us the worst of both worlds: limited and inequitable human development, with a catastrophic cost for the environmental resources on which human well-being and even survival ultimately depend.

This is the urgent backdrop of the “New Urban Agenda.” It seems that something has gone terribly wrong with our “modern” structuring of cities and towns, down to its very conception of what a city is – and this has happened at just the historic moment when we need to engage cities and urbanization to achieve their very best.

It is here that the question of professional responsibility arises most clearly. Certainly there are questions for economic systems, for governance, and for technological efficiency. But at another level, there are disturbing questions for the role of architects and urban designers – or more accurately, the role they have willfully abdicated, in favor of Koolhaas’ gleeful irresponsibility. For once again the “new sciences” do not



**Fig. 3.** Vast swaths of new urbanization are car-dependent and extremely resource-inefficient, such as these isolated superblocks connected by wide freeways in the new city of Kilamba in Angola (Photo by Santa Martha via Wikimedia Commons)

allow Koolhaas and company to cash their “artistic blank check.” They *can* respond, and thus they *are* responsible.

Thus, the New Urban Agenda calls on architects and urban designers (among others) to support the creation of “well-designed networks” of “safe, inclusive, accessible, green, quality” public space systems, including streets, thereby providing access to “sustainable cities and human settlements for all”. It calls for “appropriate compactness and density, polycentrism and mixed uses,” in order to “prevent urban sprawl, reduce mobility challenges and needs and service delivery costs per capita and harness density and economies of scale and agglomeration” for human development and well-being. It also calls for “measures that allow for the best possible commercial use of street-level floors, fostering both formal and informal local markets and commerce, as well as not-for-profit community initiatives, bringing people into public spaces and promoting walkability and cycling with the goal of improving health and well-being.”

This is, in other words, nothing other than a call for a model of traditional urbanism, with buildings lining streets and other public spaces, providing active edges and dynamic networks of interaction. Nowhere is to be seen the “loose sprawls” of functional segregation criticized by Jacobs [7], or the “project land oozings” of Le Corbusier’s “Towers in the Park” so favored by the current Landscape Urbanists and other neo-modernists. Nowhere are the privatized shopping malls of the

Austrian-American modernist Victor Gruen. Nowhere are the supercampuses and superblocks, or the segregation of pedestrians from vehicles, or other hallmarks of modernist planning. Nowhere is the static conception of cities as modernist artistic creations, glorifying (and not incidentally marketing) the industrialization of the human environment. Instead, the city is an evolutionary co-creation of myriad people, a dynamic network of human interaction and placemaking, each with a role and a form of responsibility within the whole.

There are other more explicit calls for re-incorporating the gifts of traditional architecture as well. For the New Urban Agenda also calls for the new application of “cultural heritage, both tangible and intangible, in cities and human settlements” as well as “traditional knowledge and the arts.” It demands implementation “tapping into all available traditional and innovative sources at the global, regional, national, sub-national and local levels.”

All this ought to be welcome news indeed for proponents of traditional urbanism and architecture. Indeed, it is a hard-won achievement for many of us who participated, including those of us who were part of the Future of Places conference series, a partnership of UN-Habitat, Project for Public Spaces, and Ax:son Johnson Foundation, for which I served as academic chair and later a consultant to Habitat III.

But of course, there remains an enormous challenge of implementation. It is surely gratifying to have a “new urbanism” on the agenda, and one that incorporates traditional insights about the structure of great cities and towns and their capacity to promote human and ecological well-being. However, this is only the start of the work ahead.

Now the challenge is to find the levers of change, and to alter what we may think of as the “operating system of growth” to generate a more benign kind of urbanism and architecture for the years ahead. In this work, it will be critical to employ an evidence-based approach, rooted in the rigorous methods of science, and the knowledge of what works and does not work.

This is one of our goals at the new Center for the Future of Places at KTH Royal Institute of Technology, where I am partly based, and the Future of Places Research Network for which I now serve as director. We have a network of collaborators stretching across a number of countries, institutions and disciplines, and we have taken on the task of providing research evidence toward the implementation of the New Urban Agenda. I would welcome discussions with interested colleagues on further potential collaborations.

### **3 What the New Sciences Tell Us**

One of our tasks at the new Center is to assess what we already know about cities, and how we can put that knowledge to work in effective implementation. Our focus is on public space and public space systems, because we have come to see these systems as the essential “spine” of all cities, touching on all other aspects of what cities are and what they can do for us. It is in public spaces that we interact with others, and indeed with the private spaces to which they must connect, in a close-grained structure of support.

Jane Jacobs was certainly one of the most articulate observers of the central importance of public space, down to the “intricate ballet” of sidewalk interactions, generating the “small change from which a city’s wealth of public life may grow.” Since then, a number of researchers in economics, sociology, environmental psychology and even physics have confirmed and deepened many of her earlier insights.

Jacobs was also harshly critical of the design and planning professions and their “deep disrespect” of the city and its inhabitants. The reforms that she called for must now be elevated as a key part of the New Urban Agenda. The irresponsible continued practice of a reactionary neo-modernism, grounded in the follies of willful artists and the imperatives of a failing technocracy, must give way to a more evidence-based, responsible practice of environmental generation for human and ecological well-being.

What are the imperatives of this new agenda, then? What do the new sciences of complexity tell us today, some two decades after Jencks’ book, and two decades after the last Habitat conference, for the path ahead? I would like to close with a summary of the elements that I believe are the most promising topics for exploration, development and application. These are, if you will, my version of the key elements of the New Urban Agenda, according to the new sciences:

### 3.1 Network Science and Economics

Cities offer us an enormous capacity for creativity and human development precisely because they are spatial networks that bring us into contact, exchange and creative interaction. It is crucial that this spatial network has at its core an open, accessible and well-connected public space system. Other more formal, private and electronic kinds of networks supplement, but do not replace, this primary urban network of public spaces. In basic a sense, this is what cities (and towns too) really *are* (Fig. 4).

This primary network of public space also promotes an extremely resource-efficient way of life, since it is based on pedestrian and other low-resource, low-consumption, low-waste activities. Research shows that when a city or town is compact, it promotes many other kinds of efficiencies too. On the contrary, when it is sprawling, or has a poorly connected public realm, it requires massive and unsustainable injections of resources, and it also creates other significant costs, including social and health costs, which put a drag on the performance of the entire city. A related implication is that social diversity and equity are not just a matter of justice and fairness – they’re also good for everyone’s bottom line. This recognition offers important ways of incentivizing change for the better.

### 3.2 Evolutionary Morphology

The structure of environments is only partly an intentional result of the creative will of designers and artists; much of it results from the processes of form generation that are dictated by the systems of production. These processes follow universal structural characteristics and patterns, and the resulting forms are also governed by limitations on the form-generating processes.



**Fig. 4.** Cities bring us together into connective networks of exchange, interaction and creativity. These actions occur at the intricate scale of the “sidewalk ballet” and the “small transactions” from which a city’s wealth can grow, as Jane Jacobs pointed out (Photo by the author)

There are important lessons in the ways that natural processes generate form, and the ways they achieve a dynamic complexity. However, the evidence suggests that we have chosen a very limited and in some ways very destructive set of processes to shape our built environments.

Put in more familiar terms, the defects of sprawl are the results of defects in the form-generating technologies we use. Right now, sprawl is extremely profitable within the systems that are in use. We need more robust systems, able to incorporate more universal kinds of processes for generating environmental form. We need to learn, or re-learn, lessons from natural systems, including the systems of our own human nature stretching back millennia.

### 3.3 Cognitive and Environmental Psychology

The properties that designers regard as important are not necessarily the properties that promote human well-being and healthy interactions within the built environment. This is true for other kinds of specialists too. In fact, the values that specialists construe as important can be diametrically at odds with the needs and values of those who actually live there, and the evidence shows that this is too often the case. The topic of “construal level theory” from social psychology helps us to understand how this is so, and what we can do about it. Other insights from cognitive psychology help us to understand how professional biases and “cognitive distortions” lead us away from good quality habitat, from a human point of view.

There is also another important class of characteristics in the built environment that designers have ignored, or used only in superficial ways, namely so-called “biophilic” characteristics. They are the geometric properties that are characteristic of natural systems, as we have already discussed, and there is evidence that they are very important for human environments and human well-being. Put simply, we need natural characteristics and natural geometries in our environments. Unfortunately our modern technologies, including modernist design ideologies, have been woefully inadequate in providing them. We have focused too much on what may be called “environmental cleansing” to produce conceptually neat but ultimately sterile human places (Fig. 5).



**Fig. 5.** There are reasons that human beings crave forms of nature and natural order, not only in actual instances but also incorporated into architecture and urbanism (Photo by the author)

### 3.4 Anthropology and Sociology

We have known for some time how people interact within public spaces, and in the critical edges of public spaces where private zones begin to govern what can happen. But these lessons have been slow to be taken up by designers of urban spaces in an evidence-based way. Far too much of the design of public spaces, and their critical adjacent private building edges, is focused upon object-buildings and “design statements” that utterly fail on key criteria of human interaction and well-being.

### 3.5 Genetic Science

We are also learning a great deal about how evolutionary and genetic processes actually work, and the role that recapitulation and stability plays, along with novelty and

dynamism. For example, there is the fascinating topic of “structural attractors” in nature – something very close to universal forms or even ideals. By contrast, our own technological systems have tended to favor novelty to the exclusion of stability, and this has caused enormous disruption, chaos, destruction and waste in our built environment, at a time when we are desperately searching for sustainability and resilience.

We are going to have to take the radical step of opening ourselves to recapitulation and revival. If something has been shown to work in human history – to endure, to be successful, to be loved – then the burden is on environmental modernists to show how their ideologies of forbidding “historicism” are sound. The fact is, in light of the new sciences, they are not. The environmental modernists are trapped in a rigid ideological orthodoxy, now almost a century old, reflecting an obsolete scientific worldview.

### 3.6 Game Theory

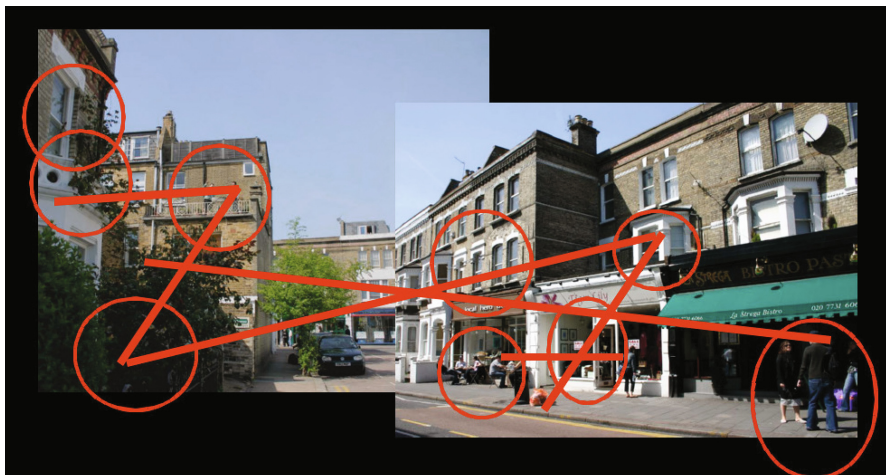
All of us within cities and within the planetary economy are part of a kind of “massive multiplayer game.” All of the rules, the technologies, the “operating systems for growth,” govern what can happen and not happen in this game, and what are going to be the winning and non-winning moves – that is, the strategies that will be successful in promoting our well-being, or in causing our own degradation.

This means that we must re-examine our specialized technologies with an eye to how they interact between the “silos,” and how they can be reformed to function in a more coherent, more responsive, more evidence-based way. Economic changes will be particularly important (and here I will only mention the need for a more “Georgist” approach of penalizing resource waste while rewarding human creativity, and other ways of “monetizing externalities”).

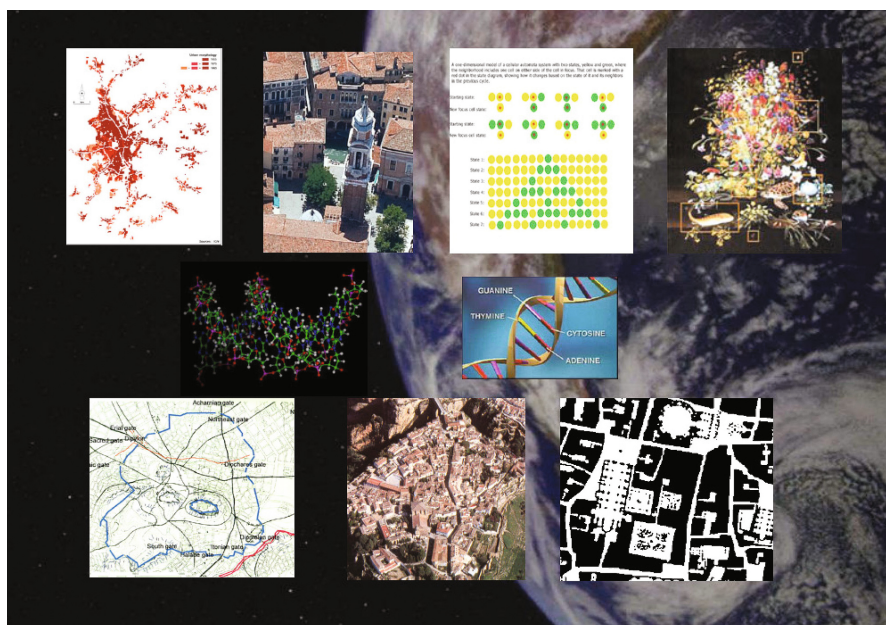
## 4 Putting It All Together: Toward a “Place Network Theory”

I believe it is essential now to gather up these lessons into a working framework – one that is based solidly upon the rich treasury of knowledge about cities, and the rich genetic treasury of urban patterns that still around the globe exists today for our study and learning (and of course deserving our protection as well, as treasury of valuable heritage). This is a necessary step in implementation of the New Urban Agenda, and it is a necessary step in recovering anything like a sustainable and resilient built environment for the future (Fig. 6).

For my own purposes I have developed an approach that I call “place network theory” – a synthesis of the ideas of Jane Jacobs, Christopher Alexander and others. It recognizes that human beings use space in a particular pattern of articulations, based upon the ability to share spaces (at one extreme “public” spaces, at the other “private” spaces) and based upon a mutable, evolving pattern of connections between them [8] (Fig. 7).



**Fig. 6.** “Place network theory” helps us to understand how vibrant urban environments are a complex web of inter-connected places with varying degrees of privacy, and varying ability to change over time. (Photo by the author)



**Fig. 7.** The “new sciences of complexity” do indeed point us toward a new agenda of urbanism, one that works to find more satisfying, more sustainable forms of settlement – from whatever source, including the rich evolutionary patterns of our own history. (Photo by the author)

I will not go into much detail about this synthesis here, other than to say that I believe it and related frameworks acting as consilient forms of knowledge into action, are now essential for our well-being and quite possibly even our survival.

## References

1. Jencks C (1997) *New science = new architecture?*. Wiley, New York
2. Mehaffy M et al (2004) *New Science, New Architecture... New Urbanism?* Companion website to conference. On the Web at [www.katarxis3.com](http://www.katarxis3.com). The full conference proceedings transcript is also available on the Web at <http://www.sustasis.net/2004Conf.doc>
3. United Nations (2017) "The New Urban Agenda. Resolution adopted by the General Assembly on 23 December 2016." On the Web at <http://habitat3.org/wp-content/uploads/New-Urban-Agenda-GA-Adopted-68th-Plenary-N1646655-E.pdf>
4. Koolhaas R (1995) "What ever happened to urbanism?" In S, M, L, XL. The Monacelli Press, New York. Also available separately on the web at [http://www.arhns.uns.ac.rs/wp-content/uploads/Arch432\\_koolhaas.pdf](http://www.arhns.uns.ac.rs/wp-content/uploads/Arch432_koolhaas.pdf)
5. Alexander C (2003) *The nature of order: an essay on the art of building and the nature of the universe*. Center for Environmental Structure, Berkeley
6. Mehaffy M (2015) *Urban form and greenhouse gas emissions: Findings, strategies, design decision support technologies*. Delft University of Technology, Delft (NL). [http://abe.tudelft.nl/index.php/faculty-architecture/article/view/1092/pdf\\_mehaffy](http://abe.tudelft.nl/index.php/faculty-architecture/article/view/1092/pdf_mehaffy)
7. Jacobs J (1961) *The death and life of great American Cities*. Random House, New York
8. Mehaffy M (2017) *Toward a theory of place networks*. <https://foprn.org/2017/04/03/toward-a-theory-of-place-networks/>

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