Planning and Complexity: Engaging with temporal dynamics, uncertainty and complex adaptive systems

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The nature of complex systems as a transdisciplinary collection of concepts from physics and economics to sociology and ecology provides an evolving field of inquiry (Laszlo and Krippner, 1998) for urban planning and urban design. As a result, planning theory has assimilated multiple concepts from the complexity sciences over the past decades. The seemingly chaotic or non-linear urban phenomena resulting from the combination of hard and soft systems (Checkland, 1989) or physical and environmental aspects of the city with human intervention, motivation and perception have been of particular interest in the context of increasing criticism of top-down approaches. Processes such as self-organisation, temporal dynamics and transition, previously ignored or assumed problematic within equilibrium centred conceptualisations or mechanistic theories, have found their way back into planning through complexity theories of cities (CTC) (Allen, 1997; Batty, 2007; De Roo and Silva, 2010; Marshall, 2012; Portugali, 2011b). While there is an overlap with Structuralist-Marxist and humanistic perspectives (Portugali, 2011c) and a continuity from an older science of cities (Batty, 2013), it is interesting to observe the engagement with bottom-up phenomena, structural and functional co-evolution, and resultant adaptable and self-organisational systems within complexity planning. It has taken time for planning to adopt complexity thinking beyond metaphor or common usage of the term, but we now appear to be at a tipping point where complexity planning is exploring methods of engagement and cognition, rather than the question of whether cities are complex.

Planners are often challenged by the volatility of city systems and networks, by the impact of both foreseen and unforeseen changes, and by the high level of interdependencies between elements, both human and non-human (Balducci et al., 2011; Duit and Galaz, 2008; Moroni, 2010; Rauws, 2015). The small collection of papers presented in this themed issue demonstrate attempts to understand processes of change and continuous interaction, and to engage with them in the governance and development of cities using a complexity framework. The papers include theoretical and empirical experiments and present methodological innovations. The focus on self-organisation, temporal dynamics and complex adaptive systems (CAS) (Folke et al., 2004; Holland, 1992; Levin, 1998) is evident in both experimental methods and attempts to engage stakeholders in processes of co-creation. The latter has a particular emphasis on creating the conditions to encourage development and emergent structures with the potential to interface with existing governance frameworks. It is noteworthy that several contributions either explicitly or implicitly bridge between planning theory and socio-spatial modelling. As a stage in the ongoing development of CTC, it is also pertinent to observe the adoption of concepts and methods to deal with both soft and hard systems and the acceptance of open systems and networks.

The rise of complexity planning

The Complexity Sciences stipulate a world that is dynamic, changing and full of uncertainty. However, the idea of working with uncertainty is not new in the planning context. Horst Rittel (Rittel and Webber, 1973) supported by Churchman (Churchman, 1967), introduced the challenging concept of 'wicked' problems to the planning debate. The main point being that unlike a 'tame' problem which could be defined clearly, 'wicked' problems have no clear start, end or ultimate solution because they are intrinsically uncertain, non-linear and complex. Rittel was ignored within the planning debate, and the debate eventually took a 'communicative turn' (Forester and Fischer, 1993). The complexity sciences however rediscovered Rittel and embraced his 'wicked' problems fully (Conklin, 2005) as wickedness represents precisely the fundamental uncertainties observed by the complexity sciences in the real world.

Karen Christensen (1985), in the tradition of Thompson (1967), attempted to address uncertainty and complexity within planning and its institutional environments. Her work, which was a 'complexity' point of reference to planners for a period of two decades, referred to a type of complexity allowing variation in types of planning issues, a variation which depended on uncertainty. It should be noted however that a distinction exists between 'static' complexity and 'dynamic' complexity. Where, the former refers to complexity within a world as it is and the latter to a world that is becoming, a world out of equilibrium. While Christensen elaborates on the issue of uncertainty, her work marks the beginning of a reasoning on 'static' complexity.

Aware of the work by Christensen and with reference to the ideas of complexity theorist Stuart Kauffman (1990) to differentiate 'static' systems, De Roo (2000; 2003) and Zuidema point out the peculiarity of spatial planning theories attempting to work with futures using a 'static' complexity, supporting nothing more than the idea of a differentiated world at a fixed moment in time. They argue that planning rationales – technical and communicative – first need to add the notion of time in order for a non-linear kind of rationale to emerge. This step, of temporality is necessary for a dynamic kind of complexity within planning theory, in order to bridge with concepts from the complexity sciences such as non-linearity, emergence, path-dependency, transitions, co-evolution, adaptivity and self-organization. Lately a group of planning scholars (Boonstra and Boelens, 2011; Byrne, 2003; de Roo and Rauws, 2012; Innes and Booher, 2010; Portugali, 2011a, 2012; Rauws, 2015; Sengupta, 2011) are heavily investing in a dynamic understanding of planning that builds strongly on the complexity sciences.

Temporal dynamics and 'wicked' problems posit the fundamental issues of uncertainty and unknown unknowns. As uncertainties are viewed as risks for planned interventions, the typical approach within planning is to reduce or avoid them as much as possible (Abbott, 2009; Gunn and Hillier, 2014). Complexity concepts from evolutionary biology, social sciences, psychology and ecology have played a significant role in demonstrating cities are evolving open systems due to the influence of biological cognitive agents on multiple urban processes (Allen, 1997; Batty and Marshall, 2012; Holling, 2001; Portugali, 2016). Uncertainties are a product of the interactions and interdependencies between elements and dynamic environments and as such are an intrinsic part of how urban systems and networks function. Unforeseen development trajectories can be perceived as both risk and opportunity. CTC is slowly expanding beyond the influence of cybernetics and with it the emphasis on top-down controls (Sengupta and Cheung, 2016). Some developments in complexity planning demonstrate a combination of the negative feedback loops typical for mechanical systems with positive feedback loops observable in social and biological systems, in an attempt to engage positively with emergent structures and latent possibilities for collective agency. The undeniable existence of cities incorporating and being transformed by cognitive agents and agencies with the ability to learn and the capability for behaviour change has led to the increasing adoption of perspectives related to CAS, in order for planners and other actors to seize unexpected opportunities that can emerge.

A note on the contributors

The 12th meeting of the thematic group on Planning and Complexity of the Association of European Schools of Planning (AESOP) offered an opportunity to take another step in this debate. The meeting, titled 'Confronting urban planning and design

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with complexity: Methods for inevitable transformation' was hosted by the Manchester School of Architecture (MMU). The focus of the event was on evolutionary or emergent processes of urban change driven by trans-scalar and dynamic relationships ranging from policy and infrastructure to local and bottom up agency. New approaches and tools including open data use and digital interfaces for e-governance were in evidence along with developments based on urban acupuncture, spatial pattern recognition, stakeholder negotiation and policy design. An underlying theme was the attempt to utilise a complexity framework to retain dynamics, evolutionary resilience, adaptability and vitality within cities.

The contributors to this themed issue are all members of the Planning and Complexity thematic group. This Thematic Group was founded in 2005 to explore linkages between spatial planning and the complexity sciences. The collaborations in this group has resulted in several publications including 'A planner's encounter with complexity' by De Roo and Silva (2010), 'Complexity and planning: systems, assemblages and simulations' De Roo, G., Hillier, J. & Van Wezemael, J. (2012), 'Spatial planning and self-organisation' in the Town Planning Review edited by Rauws, W.S., De Roo, G., Zhang, S. (2016) and this thematic issue on 'Planning and complexity: engaging with temporal dynamics, uncertainty and complex adaptive systems' by Sengupta, U., Rauws, W.S., De Roo, G.

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