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Urban Challenges in a complex World - Key factors for urban growth and decline

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Paper Title: Organizing the City for an Uncertain Future. Morphological Resilience and Antifragility in Urban Strategic Foresight.

Extended abstract (2-3 pages):

- Theoretical background

Cities are complex systems characterized by the interplay between self-organization and attempts of (incomplete) control from decision makers and planners. The kind of knowledge we can have of such systems and their future development is always approximative and uncertain. This puts in crisis the traditional approach of rational comprehensive urban planning, based on future state prediction and system control (Portugali 2000, Marshall 2012). Even more, in a context of accelerated socioeconomic and technological change, uncertainty pervades the very external environment in which the evolution of the city takes place. “Planning” the complex city in a changing complex world is one of the main challenges for the coming decades.

For some authors, the task is simply impossible. In economics, Hayek (1967, 1978) already argued that we cannot achieve detailed, specific knowledge for complex social systems, but only knowledge in principle which is qualitative and refers to typical system behaviors. Taleb (2007) even suggests that this knowledge could be challenged by the occurrence of black swans, unpredictable disruptive events. Moroni (2015), as well as Alfasi and Portugali (2007) thus propose to renounce to patterning instruments (like land-use plans and urban projects) and to limit system control to framework instruments defining the rules of market-like interaction among self-organizing free agents. However, these authors overlook the fact that any system of rules acts as a filter on possible urban forms and injects assumptions on the kind of spatial patterns to be achieved. Moreover, as Moroni (2015) admits, public authorities will always be asked to supply the morphological infrastructure (streets, public space and facilities) for private self-organization, which begs the questions of what form this infrastructure should have and how to justify it.

A different strain of literature argues for new approaches to urban planning, instead of renouncement to planning. Shared projects produced within urban strategic foresight are seen as a way to coordinate the actions of private and public actors (Loinger and Spohr 2005, Blecic et Cecchini 2016). Self-organization is not denied, but steered by a common vision. Uncertainty is not seen as a handicap that plans try to reduce, but as an unavoidable epistemic condition and even as a positive resource in scenario building.

- Research questions

The question still remains, though, of the most suitable spatial organization of the physical elements of the city in the face of an uncertain future. If plan flexibility and possible

reversibility of actions are often presented as general desirable features, more specific inputs could come from the (qualitative) understanding of the functioning of complex self-organizing systems. What should the very goal be of shared plans and projects for the urban form in a context of uncertain future?

Resilience and antifragility have been proposed as general goals to be pursued for planning and intervening on self-organized complex systems like ecosystems and financial markets. For Blečić and Cecchini (2016) urban planning in a context of uncertain future should thus be guided by these very principles.

The specificity of urban plans and projects is their deliberate intervention on the physical form of the city in order to catalyze different kinds of urban functioning (some of which are unknown and will only emerge in the future). The main research question of the present paper is thus to understand how the concepts of resilience and antifragility should be understood and applied when dealing with urban form in the context of urban strategic foresight. More specifically, we have to both identify what is specific to the city when compared to other self-organized complex systems and what is the contribution of morphological antifragility and resilience to more general goals of urban resilience.

- Methodology

The paper is a theoretical and conceptual literature-based exploration of the questions of morphological antifragility and resilience in urban strategic foresight. It also proposes qualitative approaches to implement the assessment of morphological antifragility and to coordinate interventions on the physical form of the city.

The paper first analyzes comparatively how the concepts of antifragility and resilience have been developed in different research domains, and more particularly in ecosystems (Holling 1973, Folke et al. 2004, Cumming 2011), in sociotechnical systems (Holling and Sanderson 1996, Taleb 2007, 2012) and in complex networks (Albert et al. 2000). It later explores how these concepts have been adapted in urban geography and planning (Ernstson et al. 2010, Lhomme 2012, Toubin et al. 2012, Voiron-Canicio 2015, Biggs et al. 2015, Forgaci and Van Timmeren 2016) and how questions of urban morphology have progressively been introduced (Cutini 2013, Mehaffy and Salingaros 2013, Marcus and Colding 2014, Abshirini and Koch 2017). It also highlights how specific question settings have focused urban research on some issues of urban resilience, at the expense of others. Building on this corpus of scientific literature, a new definition of urban morphological resilience is proposed.

The new concept is later used to instruct the assessment of the potential fragilities of observed urban forms. In order to tackle the deep uncertainties (Walker et al. 2013) that characterize scenario building in urban strategic foresight, new heuristics are employed: the *via negativa* (Taleb 2012) and the Lindy effect (Mandelbrot 1982). Finally, we explore the implications of the new concepts of morphological antifragility and resilience for the interventions on the physical city. Traditional urban morphology (Conzen 1960, Caniggia and Maffei 1979, Borie and Denieul 1984), Alexander's pattern language (Alexander et al. 1977, 1987) and the high-tech based solutions of the smart city (Campbell 2013, Ratti 2013, Scientific American 2014) are reinterpreted in the light of our problem setting.

- Results/findings

Contrary to Taleb's point of view, the concepts of resilience and antifragility are not opposed, but overlap: highly adaptive and transformative resilience is a form of antifragility.

The concepts of general resilience, proposed by Holling (1973) in ecology, and further developed in its spatial dimension by Cumming (2011) allows interesting analogies with the urban system. Nevertheless, the city is not (or not only) an ecosystem and specific issues of spatial organization and human functioning arise when dealing with its physical form.

Besides, research on urban resilience has been traditionally focused on the persistence of urban functioning in the face of external perturbations. This is even true for research on morphological urban resilience (like Cutini 2013, Marcus and Colding 2014, Abshirini and Koch 2017), which analyze through space syntax (Hillier 1996) the capacity of street configurations to withstand a debilitating perturbation (earthquake, flooding, targeted attack). New concepts and operational methods need to be developed to evaluate urban morphological resilience in the face of urban change, i.e. the emergence of disruptive innovations (in socioeconomic organization, technology, behaviors, etc.) which, unlike perturbations, persist after having set in and are endogenously produced by cities. These concepts and methods should help identify urban fragments (neighborhoods, districts) whose morphology is unable to self-organize in response to urban change and risks becoming morphologically obsolete, requiring expensive operations of large scale destruction and reconstruction.

The first applications of our new concepts and qualitative analyses identify traditional, highly connected, densely and diversely built morphologies as having the greatest potential of antifragility and highly adaptive resilience. Traditional urban morphologies are interpreted as technological solutions to spatial arrangement problems which have undergone the proof of time. Like Alexander's pattern language, they are an archive of collective intelligence which can be exploited in the challenges posed by the strategic foresight for the complex city.

- Significant/general conclusions

In the face of the easy attractiveness of high-tech solutions pushed forth by the smart city agenda, this paper highlights the central role that urban form can play in urban antifragility and resilience. The surprising modernity of traditional spatial arrangements derives from their ability to combine self-organization with more conscious coordination and continuous adaptation to ever-changing urban functioning.

Several research questions remain open, namely a better understanding of the complex system properties of traditional urban forms, the limits of traditional spatial arrangements in the integration of new urban objects, or the possibility to combine qualitative knowledge on highly resilient complex morphologies and inputs from participatory processes with more analytical approaches of quantitative spatial analysis. These questions should be tackled by a new research agenda on highly resilient urban morphologies in the face of urban change.

- References

- Abshirini A., Koch D. (2017) Resilience, space syntax and spatial interfaces: The case of river cities. *ITU A/Z*, vol. 14, n° 1, 25-41
- Albert R., Jeong H., Barabasi A. (2000) Error and attack tolerance of complex networks. *Nature*, 406, 378-482.
- Alexander Ch., Ishikawa S., Silverstein M. (1977) *A pattern Language. Towns, Buildings, Construction*. Oxford University Press, New York
- Alexander Ch. et al. (1987) *A New Theory of Urban Design*. Oxford University Press, Oxford
- Alfasi N., Portugali J. (2007) Planning rules for a self-planned city. *Planning Theory*, 6(2), 164-482
- Biggs R., Schlüter M., Schoon M. (eds.) (2015) *Principles for Building Resilience - Sustaining Ecosystem Services in Social-Ecological Systems*. Cambridge University Press, Cambridge

- Blecic I., Cecchini A. (2016) *Verso una pianificazione antifragile. Come pensare al futuro senza prevederlo*. Franco Angeli, Milano
- Borie A, Denieul F (1984) *Méthode d'analyse morphologique des tissus urbains traditionnels*. UNESCO, Paris
- Campbell T. (2013) *Beyond Smart Cities: How Cities Network, Learn and Innovate*. Routledge, London
- Caniggia G., Maffei G. (1979) *Lettura dell'edilizia di base*. Alinea, Firenze
- Conzen M. R. G., (1960) *Alnwick, Northumberland: a study in town-plan analysis*. Institute of British Geographers Publication 27, George Philip, London
- Cumming G. S. (2011) Spatial resilience: integrating landscape ecology, resilience, and sustainability. *Landscape Ecology*, vol. 26, no. 7, 899–909
- Cutini V. (2013) The city when it trembles. Earthquake destructions, post-earthquake reconstruction and grid configuration. In: Y. O. Kim et al. (eds.) *9th International Space Syntax Proceedings*. Sejong University, Seoul
- Ernstson, H. et al. (2010) Urban transitions: on urban resilience and human-dominated ecosystems. *AMBIO*, 39(8), 531–545
- Folke C., Carpenter S., Walker B., et al. (2004) Regime shifts, resilience, and biodiversity in ecosystem management. *Annual Review of Ecology, Evolution, and Systematics*, 35, 557–581
- Forgaci C., Van Timmeren A. (2014) Urban Form and Fitness: Towards a Space-Morphological Approach to General Urban Resilience. *ISDR2014*, University of Science and Technology, Trondheim, Norway
- Hayek F. (1967) *Studies in Philosophy, Politics and Economics*. Routledge, London
- Hayek F. (1978) *New Studies in Philosophy, Politics, Economics and the History of Ideas*. Routledge, London.
- Hillier B. (1996) *Space is the machine*. Cambridge University Press, Cambridge
- Holling C.S. (1973) Resilience and Stability of Ecological Systems. *Annual Review of Ecology, Evolution, and Systematics*, vol. 4, 1–23
- Holling, C. S., Sanderson S. (1996) Dynamics of (dis) harmony in ecological and social systems. In S. Hanna, C. Folke, K. G. Mäler (eds.) *Rights to nature: ecological, economic, cultural, and political principles of institutions for the environment*. Island Press, Washington, p. 57-86
- Lhomme S. (2012) *Les réseaux techniques comme vecteur de propagation des risques en milieu urbain. Une contribution théorique et pratique à l'analyse de la résilience urbaine*. PhD dissertation, Université Paris-Diderot
- Loinger G., Spohr C. (2005) Prospective et planification territoriales, état des lieux et propositions. *Travaux et recherches de prospective*, No. 24
- Mandelbrot B. (1982) *The Fractal Geometry of Nature*. Henry Holt and Company, New York
- Marcus L., Colding J. (2014) Toward an integrated theory of spatial morphology and resilient urban systems. *Ecology and Society*, 19(4), 55
- Marshall S. (2012) Planning, Design and the Complexity of Cities. In J. Portugali et al. (eds.) *Complexity Theories of Cities Have Come of Age*. Springer, Berlin, p. 191-205
- Mehaffy M., Salingaros N. (2013) Towards Resilient Architectures I: Biology Lessons. *Metropolismag.com*, March 2013. <http://www.resilience.org/stories/2013-03-25/toward-resilient-architectures-i-biology-lessons/>
- Moroni S. (2015) Complexity and the inherent limits of explanation and prediction: Urban codes for self-organizing cities. *Planning Theory*, vol. 14(3), 248-267
- Portugali J. (2000) *Self-Organisation and the City*. Springer, Berlin
- Ratti C. (2013) *Smart City, Smart Citizen*. Egea, Milano
- Scientific American (ed.) (2014) *Designing the Urban Future: Smart Cities*. Scientific American, New York
- Taleb N. N. (2007) *The Black Swan: The Impact of the Highly Improbable*. Random House, New York
- Taleb N. N. (2012) *Antifragile. Things that gain from disorder*. Random House, New York
- Toubin M., Lhomme S., Diab Y., Serre D., Laganier R. (2012) La Résilience urbaine : un nouveau concept opérationnel vecteur de durabilité urbaine ? *Développement durable et territoires*, vol. 3, n°1, 1-17
- Voiron-Canicio Ch. (2015) Une ville résiliente ? Quid de l'innovation dans la marche vers la durabilité urbaine. In I. Hajek, Ph. Hamman (ed.) *La gouvernance de la ville durable entre déclin et réinventions – Une comparaison Nord/Sud*. PUR, Rennes, p. 267-277
- Walker W., Lempert R., Kwakkel J. (2013) Deep Uncertainty. In S. Glass and M. Fu (Eds.) *Encyclopedia of Operations Research and Management Science*, Springer, Berlin