

A Critique of Urban Genome Project

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Urban Genome Project seminar
University of Toronto, School of Cities
December 9th 2020

1 General comments

2 Specific comments

3 Discussion

- Link with geographical/economic stylized facts at multiple scales seems to be weak - urban theory construction is generally conditioned by available data
- Constructing a formal model of urban evolution is not a guarantee of explanation (“answering the why”): the actual processes corresponding to the semantics will capture the causal structure of systems
- Definitions of a city, of urban systems, etc. are not constructed in strong link with the theory and with empirical observations
- The model formal development, which can be specified in many ways them , is a good thing as it provides a general framework; but as it is now it leaves too much doubt on how to actually measure these processes, the signals, the diffusion of information, etc.
- Does not seem to allow endogeneity and open-ended evolution

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- [Batty, 2013] one view on urban systems; integrative approaches see [Lobo et al., 2020]
- Link and distinction between theories and models? see [Livet et al., 2010] [Raimbault, 2017]
- Should urban evolution encompass “everything urban”? → examples on the opposite of evolutionary processes?
- On the need for interdisciplinarity and multiple perspectives, totally agree: see [Pumain and Raimbault, 2020]

- On urban ecology, see also industrial symbiosis: analogy or equivalence? [Raimbault et al., 2020]
- On Complex Adaptive Systems approach: indeed morphogenesis models are not evolution models - confusion of concepts in the literature? (as in evolutionary economic geography in general? [Schamp, 2010])
- On Scaling Theories: allometric growth/scaling is linked to scaling but not the same concept - [Chen and Jiang, 2009] [Lang et al., 2019]; issue of non-ergodicity [Pumain, 2012]
- When switching from biological to social evolution, evolution units become more complex, heterogenous, fuzzy.

- Evolution as an analogy or as underlying general processes? → transfer of concepts/theories/models between disciplines - nature of interdisciplinarity
- What exactly is a “socio-cultural entity” is still fuzzy at this stage

Proposing “physical” urban entities is challenging on several points:

- Link form-function? (included in definition of formeme)
- Selected as optimizing spatial organization - but fitness functions in social/urban environments are tied to multiple actors at multiple scales, with multiple objectives
- How to draw the boundary for units (nature, scale, delimitation), how to define the system
- Information essential in complex systems (included in the formeme) [Haken, 2006]
- Why necessarily a “molar unit”? Can it span multiple scales?
- Compatibility with weak/strong emergence? (people interact with higher level entities: state, municipal council) [Bedau et al., 2000]

- Origin of cities: A life strongly interested in Origins of Life, these must have been evolutionary (from chemical evolution to biological evolution): emergence of life as a phase transition [Cronin and Walker, 2016]
- Reductionism and determinism: totally agree: complexity of evolution, order out of chaos, frozen accidents
- Not “teleological” but teleonomical: always some agents with some objective functions [Monod, 1970]
- From the bottom-up - daily urban life: importance of emergence
- Not mimic biological evolution: see comment on transfer of concepts between disciplines
- Not anti-planning: complexity of managing/designing complex systems from the bottom-up: see the field of morphogenetic engineering [Doursat et al., 2012]

- Difference between urban genome and phenotype? How does the genome express itself? The genome is defined as a set of formeme, which are already “expressed” through the function f to define uses. Is the expression the link between U and H ? Is phenotype the signature?
- The sets P, A, G are fixed - does it mean that a given instantiation of the model is not able to endogenously introduce new categories, and thus not able to exhibit open-ended evolution?
[Taylor et al., 2016]
- Tying the genome to a world is a good idea e.g. to account for non-ergodicity, explore “what-if” worlds (“Cities as they could be” [Raimbault, 2020a])
- The genome is somehow independent of function H and information propagation S - could we include these in the genome, or is it a fundamental divergence point with biological evolution?

- To what extent already specifying precise signal characteristics corresponds to model implementation - could it stay generic?
- Defining distances between genomes is indeed crucial for phylogenetic studies; estimating distances between organisms (based on proteins alignment for example) is a very difficult problem in biology; would the same difficulties transfer to urban evolution, or would some known historical data/spatial models help directly construct the phylogenies? (section 6 defines the tree in a way).
- The link between genome distance and spatial distance is crucial in specifying the model of urban evolution (as for example in [Raimbault, 2020b])
- To what extent are activity costs and recoding dependent on context and not only on the formeme?

- Innovations in formeme are physical innovations - to what extent does the model capture the evolution of concepts/ideas/knowledge? It may have very different dynamics.
- Environmental variations are a way to capture spatial interactions/diffusion through signals.
- Spatial interactions are also crucial in the different selection processes detailed.
- On the concept of niche, what is the link between spatial niche (as it is used here) and evolutionary niche (local fitness optimum)?

- Could 6 years be too short to observe meaningful evolutionary processes?
- Are numerical values for distances directly interpretable?
- Is it possible to link longitudinal distance iwth transversal distance? (Extrapolate some divergence time?)

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Emergence of life as a succession of phase transitions in an information propagation process [Cronin and Walker, 2016]

“Without an understanding of what life is, how can we approach understanding its origins” [Walker et al., 2017]

→ Succession of chemical, biological, cultural evolution, with increasing complexities

Should urban evolution be considered as a new phase transition? (see [Batty, 2018]) What is its main support then? (autocatalytic sets, intelligence, ?)

Differentiation between using metaphors/analogies, transferring concepts and models, and unveiling universal models and theories across disciplines

→ Building a theory of urban evolution should be related to an epistemological work on the nature of interdisciplinarity, the transfer of concepts.

→ Link with reflexivity and complexity itself [Raimbault, 2020c]

A core element of the proposed model is the link between form and function (formeme including form and usages)

→ Revisit the concept of urban morphogenesis?

[Batty and Marshall, 2009] Endogenize this link within the model? More general concept than biological morphogenesis?

Question of system definition and system boundaries is not very clear in the proposed model (beyond taking into account geographical areas c)

System boundaries are crucial in evolution / co-evolution (evolution occurs in spatio-temporal domains with isolation): notion of niche

→ Link with the concept of autopoiesis? *Network of processes self-sustaining itself* [Bourgine and Stewart, 2004] Are urban systems autopoietic?

The sets used to define formemes are fixed in the model description:
does the model apply to very long time scales, across multiple time scales, spatial scales (minimal resolution in mentioned in II, what about maximal resolution?), ontological scales?

→ Capacity of the model to endogeneize the emergence of new elements, new innovations, to capture open-ended evolution?

[Taylor et al., 2016]



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