

Peris A., Meijers E. (2017) “A systematic analysis of the evolution of the system of cities literature”, extended abstract for the special session ‘Mapping urban networks’ at the ERSA conference, Groningen, 2017.

From the ancient and recurring ecological analogy of the city to the recent contributions of what Gabriel Dupuy (2013) calls “naive outsiders”, urban research has always been very sensitive to theories and models from outside the discipline. The urban system literature, which studies the external relations of cities, is no exception. In its early stage, during the 1960s, its two main bases were the Central Place Theory (Christaller, 1933) and the General System Theory (Bertalanffy, 1950; Forrester, 1968). The first one is a general deductive theory developed to understand the distribution, size, number and functions of towns in a given geographical area, and the second one is an encompassing epistemology with notable contributions from natural scientists and computer engineers. Since this period, the urban system literature has been influenced by many other contributions from disciplines such as psychology, physics, economics and more recently management literature and computer science. Some of these contributions have led to distinct new research lines, most of them claiming to be a “paradigm” change. As a consequence, the study of urban systems has become rather fragmented.

Despite the review of Ducruet and Lugo (2013) on cities and transport networks and the detailed work of Van Meeteren (2017) on several approaches of urban systems, there are at present no reviews covering the entire diversity in approaches to studying inter-city relationships and giving their relative positions. The aim of this paper is to develop a clear and as comprehensive as possible review of the current research on urban networks by answering the following questions: How have new concepts been introduced to the urban system literature? What were the most important theoretical changes? Did these changes lead to fragmentation of the field or is there communication between the different research schools? How did the different approaches evolve? What are the current trends in urban network research?

Method

Considering the breadth of the literature on urban systems, it is challenging to sketch a clear representation of research approaches on intercity-relationships and how they evolved. Here we employ quantitative epistemology to unravel the evolution of urban systems research. Quantitative epistemology is an approach that allows to explore and map the evolution of scientific fields in an automated way. ICT has been essential to its rise and the availability of digital trails in the form of for instance bibliometric data (co-operation patterns, citation patterns) allows for large-scale longitudinal analysis.

Citation networks not only reveal intellectual connections, but also the social organization of science (Leydesdorff, 1998). As we are primarily interested in intellectual connections, we decided to use a mixed methods approach using both citation and semantic networks. The semantic network is obtained through text mining techniques applied to titles and abstracts of the studied papers. As we are interested in the evolution of concepts, the first step of this research is to analyse the evolution of the vocabulary within scientific publications. We follow Chavalarias and Cointet (2013) who define scientific fields “as sets of ‘keywords’ delineating a research area”, rather than using predefined categories, this approach allows a “bottom-up” reconstruction of science. The citation network is then used to see whether people using different approaches are embedded within very homogeneous

clusters or if there are exchanges between different 'invisible colleges'. The data has been collected from the online *Scopus* database, which, compared to other databases (e.g. Web of Science) indexes more, if not all, social science journals. We work on papers published after 1994, because the Scopus database does not systematically provide information before this date. The methodology follows four steps:

- The delineating procedure: To identify the set of relevant publications to be studied, an approach using both keywords strategy and citation patterns has been used. Following Milanez et al. (2016), we first mined the references of the existing literature reviews cited above to select relevant keywords. This first step allowed to identify a large spectrum of the field because they cover different aspects of the literature. Then we built a search query for the database to retrieve a first set of publications. To exclude some publications external to the field, we used an iterative cleaning procedure based on the exclusion of papers containing irrelevant keywords by excluding them in the final query (Milanez et al., 2016). This final query has been submitted to experts of the field. The last part of this delineating procedure is the analysis of the papers which are not connected to the biggest connected group of publications to see whether they were rightly deleted or not.
- Mining of key phrases in titles and abstracts to identify subfields through co-word analysis. This kind of analysis is used in scientometrics to identify proximity. The basic hypothesis is that two words co-occurring often within papers have a great probability to be strongly related.
- Temporal analysis of the use of phrases and cluster of phrases to identify the evolution of subfields through time.
- Analysis of the citation patterns of papers relative to different subfields to identify interrelationships.

Some preliminary results

The co-words analysis reveals clear clusters corresponding to different subfields of the literature on system of cities (figure 1). Some of the clusters are relative to internal dynamics of geography and regional science, some others clearly manifest concepts imported from other sciences, or a transdisciplinary vocabulary. We can identify for instance a cluster corresponding to the 'world city' vocabulary, a cluster structured around the concept of polycentric urban region with a strong emphasis on planning vocabulary, a cluster with terms related to the economic field, another referring to agent based modelling and one around the vocabulary of complexity theory.

The temporal analysis is in its early stage but some major trends can already be observed (figure 2). For example, the 'world city' approach, which skyrocketed in the beginning of the 2000s is now quite stable while the vocabulary of complex systems, which aim for identifying the 'laws' of urbanization has seen rapid development over the past ten years. Different dynamics can also be observed within the same cluster. Within the cluster around 'polycentric urban region' the notion of 'competitiveness' and 'polycentricity' experienced a growth while the reference to the central place theory has declined. This temporal analysis of the vocabulary also reveals trends in methods (agent based modelling, scaling laws, graph indicators, etc.) and favoured empirical cases (United States, China, Netherlands, etc.).

We will refine our analysis further, and add an analysis of the communication between the different schools.

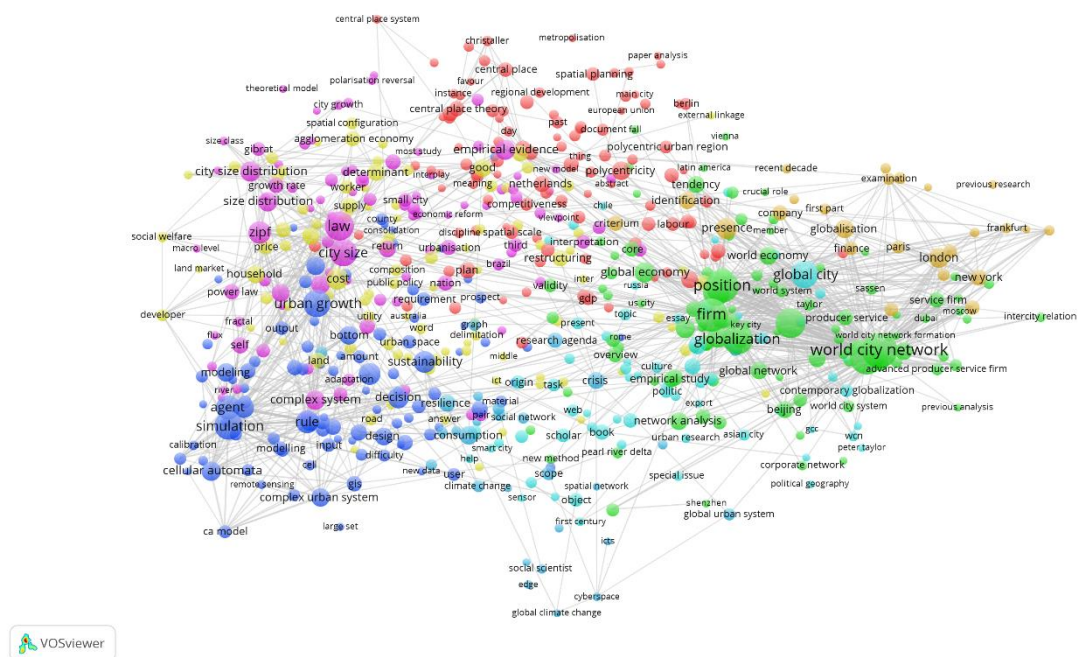


Figure 1 - The subfields of urban network literature (this visualization will be refined, notably by aggregating synonyms and by manually deleting irrelevant terms)

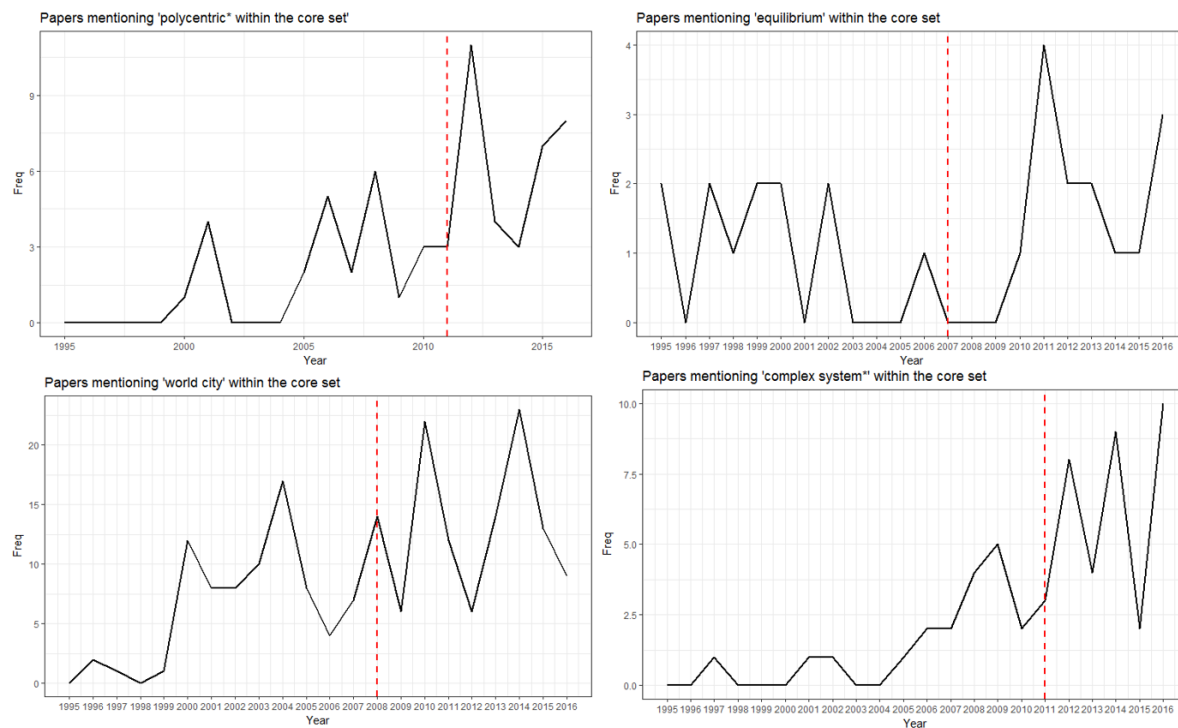


Figure 2 - An example of the dynamic of selected terms from inside and outside the discipline

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