ERC GeoDiverCity

International workshop

Theories and models of urbanization

Day 1
Thursday October 12th

9:30 – 11:00

URBAN THEORIES AND COMPLEXITY (1)

Michael Batty "Which complexity for urban systems?"

Discussion

Olivier Bouba-Olga "Innovation, In and Out of the City"

Juste Raimbault "Complexity, Complexities and Complex Knowledges"

GUEST SPEAKERS

Coffee break

11:30 – 13:00

BUILDING MODELS: EXPERIMENTATION OF THEORIES AND REPRODUCIBILITY

Romain Reuillon "Towards Computer Assisted Modeling"

Discussion

Clémentine Cottineau, Juste Raimbault, Marion Le Texier, Florent Le Néchet & Romain Reuillon "Using OpenMole to explore the impact of initial spatial conditions on geosimulation models"

Roundtable about OpenMole with Paul Chapron, Guillaume Chérel, Clémentine Cottineau, Mathieu Leclaire, Sébastien Rey-Coyrehourcq

GEODIVERCITY PRESENTATIONS

Buffet lunch

14:00 – 15:30

URBAN THEORIES AND COMPLEXITY (2)

Elsa Arcaute "Scaling laws, insights and limitations"

Discussion

Horacio Samaniego "The Topology of Communicating across cities in increasing sizes, or the complex task of "Reaching Out" in Larger Cities"

Francisco Maturana & Horacio Samaniego "Urban scaling and deviations. Exploratory analysis based on functional elements and spatial planning of Chile"

GUEST SPEAKERS

Coffee break

16:00 – 17:30

URBAN THEORIES AND BIG DATA

Marc Barthelemy "Revisiting economics for understanding urban data"

Discussion by Arnaud Banos & Céline Rozenblat

GUEST SPEAKERS

17:30 – 18:30

ARE SCALING LAWS TRANSFERABLE TOWARDS URBAN THEORIES?

Olivier Finance & Elfie Swerts "Scaling laws in urban geography. Linkages with urban theories, challenges and limitations"

GEODIVERCITY PRESENTATIONS

Day 2
Friday October 13th

9:30 – 11:00

ECONOMY VERSUS GEOGRAPHY: THEORIES OF URBANIZATION AND CITIES DEVELOPMENT

Michael Storper "Urban systems: the geography of income and population"

Discussion

Lena Sanders, Isabelle Thomas & Céline Vacchiani-Marcuzzo "Lions and butterflies facing geography of cities"

GUEST SPEAKERS

Coffee break

11:30 – 13:00

ECONOMY VERSUS GEOGRAPHY: THEORIES OF URBANIZATION AND CITIES DEVELOPMENT

Solène Baffi & Clémentine Cottineau "What is emerging? Understanding urbanisation dynamics in BRICS countries through a geographical approach, the case of Russia and South Africa"

WHICH THEORIES AND MODELS FROM AND FOR BIG DATA?

Thomas Louail "Denoising data with talk: augmented interviews to better understand spatial behavior"

Robin Cura "Visual exploration and simulation of large and long data of urban growth"

GEODIVERCITY PRESENTATIONS

Buffet lunch

14:00 – 15:30

URBAN THEORIES AND INTERNATIONAL COMPARISON

Fulong Wu "Urban theories and urbanization processes: is China specific?"

Discussion by Natacha Aveline & Elfie Swerts

GUEST SPEAKERS

15:30 – 17:30

INTERNATIONAL COMPARISONS: HARMONIZATION OF DATA, COMPARABILITY OF RESULTS, LEVEL OF UNIVERSALITY FOR THEORIES AND MODELS

Animation by Eric Denis & Denise Pumain

Questions to Elsa Arcaute, Michael Batty, Marc Barthelemy, Michael Storper & Fulong Wu

CONCLUDING ROUNDTABLE

Programme and abstracts

Day 1

9:30
11:00

URBAN THEORIES AND COMPLEXITY (1)

Michael Batty "Which complexity for urban systems?"

The complexity sciences have provided an important paradigm for cities and urban systems since the 1980s. The paradigm grew out of various systems approaches which had emerged from biology and engineering in the 1920s but its focus on top-down mechanistic articulations of systems such as cities was found sorely wanting by the late 1960s and a slow but sure switch in thinking began. In short, complex systems came to viewed as organisms rather than machines, systems that evolved from the bottom up, rather than designed from the top down. Biology not physics became the dominant influence, as seen for example, in the focus on far-from-equilibrium ideas, fractal structures, allometric growth, and path dependence to name some. In this talk, I will review how we have begun to apply complexity to cities. I will review some key ideas about the properties of cities using scaling relationships for example, but I will also pose the key question as to how we might use these theories to help us design better cities, future cities. Some of us come from the architectural tradition where city design is the key motivator for better theory but intrinsic difficulties over the role of prediction in complexity theory, such systems being essentially unpredictable, confound our use of the to help in designing future cities. I will pose some of these conundrums, the essence of which is the notion that complexity forces us to take a different view of prediction from that that has dominated planning and policy for many years.

Reference: Batty, M. (2009) Cities as Complex Systems: Scaling, Interactions, Networks, Dynamics and Urban Morphologies, In R. Meyers (Editor) Encyclopedia of Complexity and Systems Science, Volume 1, pp 1041-1071, Springer, Berlin, DE.

Olivier Bouba-Olga "Innovation In and Out of the City"

Juste Raimbault "Complexity, Complexities and Complex Knowledges"

This discussion aims at exploring the consequences of the existence of different types of complexities in the study of socio-technical systems. We illustrate links between three different types of complexities, namely weak emergence in the sense of Bedau (2002), computational complexity and informational complexity. Emergence and computational complexity are closely linked, as suggested by the computational capabilities of many complex systems. Informational complexity can also been shown to play a crucial role in selforganisation, through spatial patterns of information flows for example. We postulate that complex knowledge of socio-technical systems must capture conjointly different types of complexities and their interactions, and that this property is another expression of a necessary reflexive nature of complex knowledge.

Reference: Bedau, M. (2002). Downward causation and the autonomy of weak emergence. *Principia: an international journal of epistemology*, 6(1):5–50.

11:30
13:00

BUILDING MODELS: EXPERIMENTATION OF THEORIES AND REPRODUCTIBILITY

Romain Reuillon "Towards Computer Assisted Modeling?"

This talk exposes what has been done in term of model evaluation in GeoDivercity and how it constitutes a footprint of a generalised framework for evaluation driven modeling.

Clémentine Cottineau, Juste Raimbault, Marion Le Texier, Florent Le Néchet & Romain Reuillon "Using OpenMole to explore the impact of initial spatial conditions on geosimulation models"

The most famous agent-based models (ABM) usually run on uniform grids and the basic tools for sensitivity analysis usually take for granted the spatial configuration of agents at initialisation, as well as the location of elements of the environment with which agents interact. In this presentation, we assess the effect of initial spatial conditions in geosimulation models, using a systematic generator, controlled by meta-parameters, to initialise models with different density grids. We show, with the example of two classical models (Schelling and Sugarscape) and a straightforward open-source work-flow using high performance computing (OpenMole), that the effect of space is significant in the two simulations, and comparable in magnitude to the effect of parameters' value change.

Roundtable about OpenMole with Paul Chapron, Guillaume Chérel, Clémentine Cottineau, Mathieu Leclaire, Sébastien Rey-Coyrehourcq

14:00
15:30

URBAN THEORIES AND COMPLEXITY (2)

Elsa Arcaute "Scaling laws: insights and limitations"

In this talk I explore the limitations of urban scaling laws, in specific with respect to using the value of the exponent. I look at variations taking into account spatial delimitations, but also changes of the exponent across 5 different points in time of the British census. In spite of the limitations, I argue that some insights and links to policy can be explored if the fluctuations in the data are taken into consideration.

Horacio Samaniego "The Topology of Communicating across cities in increasing sizes, or the complex task of "Reaching Out" in Larger Cities"

Cities have been compared to social reactors constrained by the communication and coordination possibilities offered an urban environment that has only grown since the advent of industrial age.

We here attempt to provide a first description of human interactions in the urban environment using Call Detailed Records (CDR) of the major mobile phone communication network operator in Chile. We build communication networks for 145 Chilean cities to describe and characterize the communication behavior of urban dwellers. We center our analysis in observed indicators of social activity, such as the number of contacts, number of calls and total communication time in each city and evaluate their scaling relationship with the number of mobile assigned to each city as an approximation of city size.

Interestingly, the values of scaling exponents closely match recent explanations proposed by Bettencourt (2013). The topologies of cell phone networks usage among cities of increasing sizes are slightly assortative, albeit assertiveness' decreases with size. Additionally, they show small average path length relative to their sizes, a typical feature of small-world networks. However, they decrease instead of growing when size is taken into account, unlike other complex networks. Different transitivity indices show mixed results. Average Watts-Strogatz clustering coefficient increases in larger cities much larger than expected by pure chance as it has been shown in other social networks. On the other hand, the fact that classic transitivity index decreases seem to exhibit a regime change with a decreasing relation with size and an unexpected growth in larger cities. Both transitivity indices, as a whole, could describe among those who are making new interactions as the city grows.

All these results indicate that while tightly knit human communities seem to lose cohesion as they grow, such community properties may progressively disappear among the three to four largest urban centers in Chile where the coordination of complex functions requires each city dweller to reach out to a larger network of people and speak for longer periods of time as compared to smaller cities.

Finally, although these results are valid for all networks, there is a division into two regimes when networks reach a critical size of n~10,000 nodes, which raises the possibility of an empirical definition of city for Chile.

Funding for this research is provided to HS by FONDEF-CONICYT grant # ID15I10313 and FONDECYT-CONICYT #1161280

Reference: Bettencourt, L. M. (2013). *Science*, 340, 1438pp

Francisco Maturana and Horacio Samaniego
"Urban scaling and deviations. Exploratory analysis based on functional elements and spatial planning of Chile"

We seek to explore the analysis of the deviations obtained from the urban scaling of a set of indicators for the Chilean case and to link such results to functional characteristics and spatial planning. At first, the state of the art of urban scaling and the difficulties of applying such a method to the Chilean case are quickly analyzed. In a second stage, the resulting deviations based on the results obtained from previous researches (Samaniego, 2017), are grouped to construct classes of cities based on such deviations and to analyze the particularities of each one. A third point corresponds to functionally characterizing such classes and finally, it is analyzed how the Urban Planning, particularly the Community Development Plan, can be associated to the present deviations and resulting classes.

Funding for this research is provided by FONDECYT-CONICYT grant # 116280 and 11150087

16:00
17:30

URBAN THEORIES AND BIG DATA

Marc Barthelemy " Revisiting urban economics for understanding urban data"

The recent availability of data about cities and urban systems opens the exciting possibility of a 'new Science of Cities'. Urban morphogenesis, activity and residence location choice, mobility, urban sprawl and the evolution of urban networks are just a few of the important processes that can be discussed now from a quantitative point of view. In this talk, I will discuss how a data-informed approached can elaborate on urban economics models in order to get predictions in agreement with empirical observations. I will illustrate this approach on (i) the polycentric structure of cities and the number of activity centers, (ii) on the relation between income and commuting distances. I will conclude by highlighting some important challenges and possible research directions.

Arnaud Banos & Céline Rozenblat "Discussion"

Discussion with Marc Barthelemy.

17:30
18:30

ARE SCALING LAWS TRANSFERABLE TOWARDS URBAN THEORIES

Olivier Finance & Elfie Swerts "Scaling laws in urban geography. Linkages with urban theories, challenges and limitations"

Scaling laws are non-linear relationships between size of entities and some of their functional attributes that reveal physical constraints on the structure and evolution of complex systems. Our talk discusses to which extent scaling laws are transferable towards urban theories. After presenting the diverse adaptations of scaling laws to urban theory according to various disciplinary fields, we discuss the different fields of application of scaling laws to urban theories. These fields can be systems of cities as intra-urban dynamics, diffusion of innovation within system of cities and the metropolization process. It notably underlines the relations between urban functions, size of cities and cycles of economic innovation. The accuracy of scaling laws to explain such relations is discussed, based on examples taken in different regions of the world, whose historical, political and economic context are highly differentiated. We finally point out the limitations of the use of scaling laws, as the sensibility of the measurements to the cities' and system of cities delineation and the research objects.

Day 2

9:30
11:00

ECONOMY VERSUS GEOGRAPHY: THEORIES OF URBANIZATION AND CITIES DEVELOPMENT

Michael Storper "Urban systems: the geography of income and population"

Explaining the structure of urban systems encounters a number of empirical and explanatory challenges. Though rank-size systems are present in most countries, their structure varies considerably. Random or proportional growth models are not satisfactory explanations of these empirics. Economic geography models have non-random determinants of localization and repulsion forces, but it is difficult to specify these in sufficient detail and operationalize them fully and fit them to real data. In addition, income does not vary with rank-size. Therefore ultimately urban systems research must be able to explain not only population distributions, but spatial income distributions. In this area, we have some elements of analysis, but we are far from understanding how spatial income distributions relate to urban size, and whether the combination of populations and incomes change with regularity over time. This points out the fundamental theoretical difficulty of combining population determinants and income determinants into a unified theory.

Lena Sanders, Isabelle Thomas & Céline Vacchiani-Marcuzzo "Lions and butterflies facing geography of cities"

Discussion with Michael Storper.

11:30
13:00

ECONOMY VERSUS GEOGRAPHY: THEORIES OF URBANIZATION AND CITIES DEVELOPMENT

Solène Baffi & Clémentine Cottineau "What is emerging? Understanding urbanisation dynamics in BRICS countries through a geographical approach, the case of Russia and South Africa"

In this presentation, we discuss the emerging features of urbanisation in two BRICS countries (Russia and South Africa) by bringing together the different meanings of the concept of emergence in development economics and in complexity science. The objective of this cross-investigation is to crop the features of urban theories which only apply to the first industrialised countries (but do not apply to emerging powers such as the BRICS countries) and to identify the emerging patterns of growth and structure in urban systems deemed as extreme: the former Soviet Union and South Africa.

WHICH THEORIES AND MODELS FROM AND FOR BIG DATA?

Thomas Louail "Denoising data with talk: augmented interviews to better understand spatial behavior"

"Talk is cheap" and ICT data are biased, but their combination might help to fill the gap between people's ordinary practices and how they talk about them. Building upon examples in human mobility and music listening, I will try to summarize what could be questioned in "augmented" interviews, relying upon the participants' digital activity data.

Robin Cura "Visual exploration and simulation of large and long data of urban growth"

Many recent studies focus on comparing systems of cities by fitting complex new models to large datasets coming from messy sources. We think that a better understanding of those systems can be earned by allowing thematic experts build and explore their own datasets with a focus on harmonization : through the different systems, but also through time, so as to gain insights on the past and futures evolutions of those systems of cities. We trust that letting thematic experts explore their datasets, especially through comparison with other systems, can help them acquire knowledge on the objects they study. To facilitate and broaden such analyses, we try to provide experts with dynamic and interactive data exploration tools, allowing them to quickly explore their own data. In this talk, we'll focus on presenting a couple examples of these approaches that have been applied in some GeoDiverCity research groups.

14:00
15:30

URBAN THEORIES AND INTERNATIONAL COMPARISON

Fulong Wu "Urban theories and urbanization processes: is China specific?"

This presentation will begin with a brief summary of recent debate in the 'nature of cities' and then reflect on the major urban theories in the West and their similar representations such as the emergence of new towns and gated communities in China. In addition to seeing the effect of agglomeration, the specific context of development in China is discussed, which plays a critical role in shaping the spatial patterns of urbanisation. We argue that we need to pay attention to the urbanisation processes in order to develop a more nuanced understanding of the outcome of urbanisation in China. China is specific in terms of its political economic setting-ups. But we should not simply attribute its urbanisation to 'state-led' or 'policy-driven' forces. In this regard, China is not unique, which can broaden our perspectives of seeing urban changes.

Natacha Aveline & Elfie Swerts "Discussion"

Discussion with Fulong Wu.

15:30
17:30

CONCLUDING ROUNDTABLE

International comparisons: harmonization of data, comparability of results, level of universality for theories and models

Animation by Eric Denis & Denise Pumain

Questions to Elsa Arcaute, Michael Batty, Marc Barthelemy, Michael Storper & Fulong Wu