ABSTRACTS FOR IIIRD MEETING OF AESOP THEMATIC GROUP ON COMPLEXITY

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Mike Batty
(Director, Centre for Advanced Spatial Analysis (CASA), University College, London,UK)

Complexity, Prediction, and Planning

In this talk, I will sketch the rise of complexity theory within the formal sciences and speculate on the ways in which it is being adopted within the social sciences, management, and planning. Complexity theory is in many senses a contemporary statement of systems theory but with a very significant twist: complexity theory articulates systems as being unpredictable due to their intrinsic complexity and the notions of control and management which were deeply embedded in systems theory, no longer stand. In short, complexity theory suggests that as systems are inherently unpredictable, their planning and management is always in doubt. This reflects, in part, the move to contemporary social theory with its focus on lack of structure, on events and episodes rather than grand structuration. It also reflects the notion that systems are best understood from the bottom up and in this sense, institionalised planning as we find it in the urban context is in direct contradiction with this philosophy. In this talk, I will show briefly what complexity theory is, with respect to cities in terms of its vocabulary of novel change, emergence and so on, and then I will sketch how ideas from this theory can be used to examine and inform contemporary one-off events which require many actors and agencies in their management. I will tell you a little of our work on small scale simulation models such as we used in the Notting Hill Carnival and I will illustrate how ideas about understanding, prediction and design that we have previously seen as separate stages in the planning process are better treated as being different sides of the same coin. I hope to impress on you ways in which these ideas are really quite central to the practice of planning and management.

Background References

Batty, M. (1980) Limits to Prediction in Science and Design Science, *Design Studies*, *1*, 153-159.
Batty, M. (2005) *Cities and Complexity: Understanding Cities with Cellular Automata, Agent Based Models and Fractals*, MIT Press, Cambridge, MA.
Batty, M. and Torrens, P.M. (2005) Modelling and Prediction in a Complex World, *Futures*, *37*, 745-766.

Fulong Wu
(School of City and Regional Planning, Cardiff university, Cardiff , UK)

"Cities and Complexity": a book review

Cities and Complexity is a truly cornerstone piece of work to sustain the scientific paradigm to understand cities. Following his well-cited earlier co-authored book, Fractal Cities: A Geometry of Form and Function, Michael Batty gives a masterpiece account of his pioneering research in Cellular Automata and Agent-based Simulation in this 565 pages book. This presentation will provide a review of this book, together with some reflection on the development of this subject.

Elisabete Silva
(School of School of Engineering, Catholic University, Portugal)

Waves of Complexity: bifurcations or phase transitions

This paper and its presentation highlights one element that might help clarify what is complexity, this element is the mechanics of complexity.

What are the mechanics of complexity?, What make the mechanics of complexity different from other non-complex phenomena?, Are there complex and non-complex phenomena?; If so, when can we state that we are in one or another “state”?, Is complexity an attribute a particular time and space?, If so how can we measure its transient identity?, Can we state that the only constant of complexity is time?, If so, how can we asses complexity time-frames?

This paper will answer to the previous questions emphasizing that there are a particular models suited to cluster complex phenomena. These models are at its begins, but, its present attributes and the future enhancements they will suffer make it the most capable of answering to one of the most determinant questions at this time: the classification of complexity.

Joanna Barros
(School of Geography, Birbeck College, University of London, London, UK)

Complexity and dynamics in Latin American cities: an agent-based simulation approach

Complexity theory provides theoretical framework and tools that help us to improve our understanding of complex systems in the real-world, such as cities. Cellular automata and, more recently, agent-based models have been successfully contributing to our understanding of urban dynamics. These models not only provide the means to study certain aspects of urban phenomena in isolation, but also allow us to investigate the dynamic mechanisms of change in urban systems.
The paper presents a study on dynamics of Latin American cities using an agentbased simulation model. The model is introduced and simulation exercises are presented linking aspects of urban reality to simulation results, as an example of how simulation models can be part of the theory building process.
The simulation exercises allow us to question some of the main assumptions about the growth dynamics of Latin American cities. Based on these exercises, the present paper focuses on the aspects of urban policy and intervention in Latin American countries that are challenged by the model’s results.
The paper suggests that the study of cities as complex systems changes the perspective from statics to dynamics, providing us with the necessary tools and knowledge to locate points that offer opportunities for intervention. In the case of Latin American cities, knowledge produced with the help of simulation models provides evidence that could serve as basis to planning policies and suggests that urbanisation could be driven along a different path.

Lidia Diappi
(Department of Architecture and Planning, Milan Polytechnique, Italy)

A Multi Agent Simulation approach based on Smith’s Rent Gap theory

This paper presents a dynamic model of Smith’s theory through a multi agent/cellular automata system approach (Batty, 2005) which is developed on a Netlogo platform.

A set of behavioural rules is formalized for each agent involved (homeowner, landlord, tenant and developer, and the passive “dwelling” agent with their rent and level of decay). The

simulations allow to show the formation of neighbouring degradation or renovation and the population turn over, starting with different initial states concerning levels the of decay and potential and current land rent values.

Consistent with a Self Organized Criticality approach, the model is able to show that non linear interactions at local level may produce different configurations of the system at macro level.

This paper represents a further development of a previous version of the model (Diappi, Bolchi, 2005). The model proposed here provides a more realistic setting of the housing market dynamics by including some key parameters and spatial configurations of the city of Milan: the shape of the potential rent according to city form and functions, the division in submarkets, according to the current real estate rents and maintenance levels, and a more realistic dynamic visualisation of the city, able to show the emergent and declining neighbourhoods in the period considered.

Oswald Devisch and Harry Timmermans
(Department of Architecture, Building and Planning, Eindhoven University of Technology, The Netherlands)

In search of a complex urban model: The case of residential mobility

A model is –by definition- a simplification of reality and can as such only generate simplified interpretations of this reality. Depending on the level of simplification, three model categories can be defined: a first category collects models with a high level of simplification regarding both the underlying assumptions as the generated output. Models belonging to this category typically extrapolate trends to construct future images. The second category of models still stresses simple assumptions but aims at generating a ‘complex’ output. These models are developed around the concept of emergence. The third category of models even goes a step further requiring a minimum level of detail for both the assumptions and the output. Not only the emerging phenomena should refer to real-life phenomena but, also the behaviour incorporated to generate these phenomena.

This paper argues that, for a model to support planners in their decision-making, it should belong to the third category. The paper supports this argument analyzing a number of operational residential mobility models, weighing both the assumptions supporting the model and the generated outcome. As operational ‘complex’ models hardly seem to exist, the paper makes a plea for a wider interpretation of the concept of emergence; no longer only promoting the search for simple rules but also encouraging the development and implementation of a complete and coherent framework linking these rules. This plea will be illustrated with a ‘complex’ residential mobility model, swarmCity, linking concepts such as decision-making under uncertainty, cognitive learning and adaptive behaviour.

Chris Webster
(School of City and Regional Planning, Cardiff university, Cardiff , UK)

Organisational anarchy, garbage cans and planning

This session will include a brief outline of Cohen's (1972) garbage can model of organisational complexity, an introduction to SK Lai's recent spatial variant and a consideration of the usefulness of these ideas for the study and practice of urban planning.

Edwin Buitelaar
(Radboud University, Nijmegen, The Netherland)

Complexity, institutions and transaction costs: a complicated triangular relationship

There is an interesting link between complexity theory and transaction cost theory. Institutions and transaction costs are the core concepts in the latter. In Williamson's theory, the level of complexity of the transaction, and hence the transaction costs, determine the appropriate institutional arrangement. Institutions are generally considered as means to reduce uncertainty and complexity by providing structure to the way people act. However their creation and use does not always reduce complexity; an oversupply can also lead to more complexity and more uncertainty. In addition, not only do institutions economise on transaction costs, they are also subject to transaction costs (see North). One key observation from an international comparison is that institutions are not only means to reduce uncertainty, they are also means to exercise power and control. The bigger the quest for control, the more complexity and the more transaction costs.

Erel Avineri
(Centre for Transport & Society, Faculty of the Built Environment, University of the West of England,Bristol,UK)

Braess' Paradox and the Fractal Geometry of Road Hierarchy

The Braess' paradox was originally identified and studied in road traffic context. It shows that adding new capacity (such as a new link) to a traffic network may not necessarily reduce travellers' travel time. This situation happens because the users of the network users do not face the true social cost of an action, reflected by a '*User Equilibrium*' rather than a '*System Optimum*'.

The complex characteristics of urban traffic networks can be explained by a fractal growth of cities. It has been observed that transport networks exhibit properties of self-organization and emergence. Whether Braess' paradox does or does not occur depends on the conditions of the problem, where some of the parameters leading to such a paradox are related to the network topology.

This paper examines the possibility of applying fractal measures in the modelling of network equilibrium, and presents an investigation of the effect of the fractal dimension of the road hierarchy on such equilibrium. Conceptual and methodological issues that could be addressed by further research in transport planning are suggested.

Yos Sunitiyoso, Erel Avineri, Kiron Chatterjee
(Centre for Transport & Society, Faculty of the Built Environment, University of the West of England,Bristol,UK)

Agent-based simulation of social interactions to model diffusion of compliance with a transport policy measure

This study utilizes an agent-based approach to simulate behaviours of individuals in order to obtain some informed insights about how behavioural change may be induced during diffusion process of compliance with a policy measure. We aim at providing a better representation of social interaction, which includes consideration of various interaction domains (e.g. neighbourhood, workplaces, or out-of-work activity clubs) and the processes of interaction itself, and the development of a model of social learning, which primarily concentrates on the role of minority influence for the spread of compliance with a policy measure. Aspects like inertia and bounded rationality of agents are also considered. An

explorative behavioural survey has been conducted to obtain initial information regarding mechanisms of social interaction and social learning, as well as parameters required for the simulation model. The survey suggests that some individuals interact with each other and take into account opinions from close persons (e.g. family, housemates, coursemates) when making a travel-related decision. Both empirical and theoretical findings are combined to develop a multi-agent simulation model. The results of simulation experiments suggest that the model is able to provide some informed insights about the spread of compliance with a transport policy measure from an individual to other individuals and the diffusion from a group to other groups. The role of minority influence on eliciting compliance has been demonstrated in the experiments. A very small number of influential individuals with consistency of choice on complying with the measure are able to diffuse their choice to others. Also, a group that cons ists of members with high preference to comply is able to diffuse their compliance to other individuals from different groups. A social club domain with a high opportunity of repeated interactions between its members, like workplace, has an important role on the spread of compliance.

Gert de Roo
(Department of Planning and Environment, Faculty of Spatial Sciences, University of Groningen, The Netherlands)

Complexity and complex systems – promise and critique

Building on the results of the Reading meeting I will explore further the possibilities of the concept of complexity and of complex systems within the realm of planning and decision-making. I will consider how to see complexity from a decision-making perspective, which is a different one than the perspective of complex systems, interacting and interdependent actors and simulation techniques. I believe both perspectives are important and cannot be ignored. While both perspectives are seemingly promising there is also the need for being critical. While complexity is an emerging issue, also within planning, this critique should keep us focused about the possibilities it can have within the field of planning and decision- making. I would like to use this line of reasoning also to work towards a structure of a book, as an editorial to be put together on the basis of contributions of TG-members.

Luca Bertolini
(Amsterdam Institute for Metropolitan and International Development Studies, University of Amsterdam, The Netherlands)

Why and how can complexity theories help spatial planners?

The core assumption that brings us together in this AESOP thematic group is that complexity theories can be of help to spatial planners. In order to more rigorously explore if and in which measure this is the case there is a need to go beyond still rather vague, albeit certainly intriguing analogies between natural and planning phenomena and try to be clearer about the steps of the underlying reasoning. The latter should at least include an answer to the three basic questions: what is spatial planning? what do spatial planners do? and why can complexity theories be of help?

In this paper/presentation a possible way of doing this is introduced in the form of a set of propositions. Both the final outcome and each of the steps are open to discussion. The propositions are the following:

Central to spatial planning is the relationship between (future) societal processes and (the transformation of) physical spatial structures.
The effect/goal of spatial planning is both facilitating societal processes - by helping provide the physical space they need to take place - and conditioning them - because the physical space provided will inevitably be more favourable to some rather than other processes.
The relationship between spatial structures and societal processes is a complex one, in that it is embedded in a system characterized by many components and relationships, and one

where the typifying relationship is mutual dependence (A B), rather than linear causality (A B).
Such complexity means that uncertainty about goals and means is intrinsic to spatial planning and to a significant extent (even if by no means always) irreducible. Finding ways to cope with this fact is a key challenge for planners.
In her famous 1985 article Christensen has already shown how to reduce uncertainty about goals (i.e. by bargaining) and uncertainty about means (i.e. by experimenting). However, what to do when both apply and/or when uncertainty does not prove to be reducible is much less clear.
Complexity (or is it evolutionary?) theories can be of help in this latter, all too frequent situation. In the face of irreducible uncertainty the identification and implementation of two sorts of actions seems crucial: either actions that increase the resilience of the system (or its ability to keep performing in the face of unpredictable change) or actions that increase the adaptability of the system (or its ability to change itself in the face of unpredictable change).
The identification and implementation of means that can serve more goals and of goals that can be valid within different configurations of means (or technological contexts) is an action of the first kind. Finding ways of leaving options open is an action of the second kind.
As the two types of actions are in many ways contradictory, striking an optimal balance is always a dilemma (to intervene or not to intervene?).
The main instrument planners have to influence the highly political process of striking this optimal balance is the construction and deployment of substantive spatial information.
Both constructing and deploying information are social (and thus complex) processes, which planners need to understand and engage with.

In the full paper/presentation these propositions will be further articulated, embedded in the theoretical literature and illustrated by means of examples from planning practice.

Ing. Walter Schoewandt and Jens-Peter Grunau
(Institute for the Foundations of Planning, University of Stuttgart, Germany)

Dealing with complex problems

Many planners state, that we are living in an increasingly complex world with increasing complex problems. Research tries to capture the nature of complexity in planning and its implications. But how do we deal with complex problems?
It was essential for us not to limit ourselves to reflecting on problem-solving, but to create a “guide” with explicit steps to problem-solving for university-teaching and use in practise.
The presentation will outline this structure and illustrate how we teach and use it.

Even though real, socially constructed problems are mostly unique, we use and teach a transferable structure, which describes the steps of planning and helps to handle complex problems.
Experience has shown that four aspects are often the foundation of many planning-processes. They set the scope and the view of the problem, methods and solutions and give the power to define the solution:

One step is to understand problems before finding solutions by defining the “big mess” – the situation that someone considers negative and that should be changed.
In planning, one never deals with the world „as such“, but rather with descriptions of the world. The used concepts vary from person to person and between professions. Thus they are subjective and can lead to misunderstandings.
If one does not know or ignores the causes that led to the „big mess“, it is hard to do find suitable solutions . The problem will often persist.
In planning, the underlying paradigmatic approaches of those involved are important. There is no way around them, as everybody uses subjective approaches. Hence it often helps to reflect upon approaches to i.e. find new solutions by adapting a different approach (reframing).

Beyond the focus on those four key points, our concept incorporates many other aspects, i.e. defining goals, finding solutions, deliberating on positive and negative effects of alternatives,

describing stakeholders, planning the path to implement the solutions, methods like communication, participation, project management etc, just to name a few.

Angelique Chettiparamb
(School of City and Regional Planning, Cardiff university, Cardiff , UK)

Autopoiesis and the Possibility for Planning

This paper introduces the theory of autopoiesis within sociology. Features of the same, in contrast to some other theories within sociology and its linkages to complexity theory are hightlighted. The possibility for planning within this paradigm is then examined.
(School of Environment and Development, University of Manchester, Manchester, United Kingdom)

Joanne Tippett
(School of Environment and Development, University of Manchester, Manchester, UK)

Rejuvenating democracy – systems-based ecological design and participatory planning

Sustainability is often heard as a goal, but it is widely agreed that it is hard to achieve this goal in practice. At the same time, there is increased pressure for more effective community and stakeholder participation in planning, but debate about the best way to mobilise and utilise such participation. The research discussed in this paper has developed and tested innovative approaches to animating the process of planning for sustainability. This has used a participatory planning methodology, DesignWays, that has been developed in different countries; from the mountains of Lesotho, where its was first used to teach ecological land management, to a University campus in California, to redesigning a former landfill site in a deprived area in NorthWest England, which led to £1.6 million being secured to regenerate the site.

It is a toolkit for enabling community and stakeholder participation in ecological design. In developing future plans for their neighbourhoods, companies and regions, participants learn to think creatively, and to look for areas of common interest instead of conflict. Unlike many participatory methods, sustainability is not a ‘bolt-on’ at the end. Nature is seen as an integral part of the fabric of human settlements. Systems thinking brings these elements together into a coherent whole.

This paper introduces the approach. It details its underlying principles and their basis in new paradigm systems thinking. This discussion is illustrated with analysis of participants’ experience of the process, derived from action research in neighbourhood regeneration and stakeholder engagement in City Council strategies in Manchester, UK.

Cletus Moobela
(Department of Civil and Building Engineering, Loughborough University, Loughborough,UK)

Intervention without violation of natural order: towards a complexity perspective of the urban system

The rise to prominence of complexity theory over the past three decades has paralleled an increasing level of dissatisfaction with the traditional or classical scientific view of the world. It may not be a quantum leap to describe this dissatisfaction a crisis of perception that occurs when people subscribe to a mental model that no longer achieves their standards of accuracy. The dominant goal of this positivist approach has been to predict and control the behaviour of systems not yet explored and in time periods that are still a distant cry in the future. Although many classical worldview assumptions still work well within a certain range of conditions, beyond that (where complexity begins) they no longer give us a reliable guide to the understanding of the real world. In this regard, the complexity revolution appears to be making headway as an alternative window through which to view the world. One of the

celebrated features of the new science is its acclaimed ability to cut across disciplinary boundaries, offering potential solutions to questions that have stood the test of time. In urban studies, such questions revolve around the notoriety and reluctance of the urban system to be harnessed into our control-oriented predictive models. The irony of the issue is that despite the existence of copious volumes of literature on the subject, there are still more questions than answers in the understanding of the urban system. The paper builds upon this dilemma (of planning) by sweeping through the principle theoretical platforms of urban change and approaches to urban planning, with the ultimate aim of pronouncing their poverty in understanding the urban system. The fundamental argument that is championed in the paper is that even prior to central planning intervention within a socio-spatial system, there is usually a highly resilient prior reality that characterises that particular setting and that successful intervention is a function of how well plans conform to these natural tendencies. Thus, the paper concludes by suggesting that if planners and urbanists are to behave intelligibly in the urban system, they should be prepared to embrace the notion of intervention without violation of natural order as a central element of their philosophy.

Janneke Hagens
(Wageningen University, The Netherlands)

Dealing with spatial complexity -*Conceptualization in regional planning practice*

Spatial conceptualization is an important activity in spatial planning practices. Concepts, varying from metaphors to models, represent an area from a particular perspective. They are used in planning to define problems and ambitions, accordingly combine facts and fictions. Examples are ‘urban network’, ‘blue banana’ and ‘ecological network’ concepts.

The use of spatial concepts in planning practice can be ambiguous. Ignorance of different interpretations of one concept can result in misleading agreement. Misunderstanding about the mix of actual and desired elements within a concept can bring about circular argumentations. Moreover, planners often label our present society as ‘dynamic’, ‘relational’ or ‘networked’, yet at the same moment use traditional approaches of spatial analysis. In other words, concepts can possibly confuse in application and contain inadequacy in spatial approach. Nevertheless, I assume that spatial concepts are useful in planning practice, for example to grasp complexity and communicate aspirations.

To get more insight into benefits and risks of spatial conceptualization in planning practice, I study the use of concepts in a Dutch regional strategic planning document. Which concepts are encountered? What are elements and characteristics of the concepts? What about their background and linked ambitions? How are they used in the document and related debates? It will be a discursive study, in which the concepts of the policy document are researched in the actual and political context.

Complexity theories, mainly from social and geographical fields, can be helpful as both research-approach and practical-approach in this study. Firstly as a research-lens: to identify and study ways of spatial conceptualization in practice. Secondly as input: to advance the activity of spatial conceptualization. Therefore, I perform literature research on complexity theories to support above mentioned policy analysis and following suggestions.

Nazire Diker
(Faculty of Architecture, City and Regional Planning Department, Yildiz Technical University, Istanbul, Turkey)

SYNERGETIC DYNAMICS FOR COMPLEX SOCIETY
Case Study: The Chaos and Self-Organization Process after Earthquakes of 1999 in Turkey.

Settlement systems are complex and dynamic systems, and with the process of strong interaction and rapid transformation they reached high complexity levels which cause

“unpredictable futures” and “uncertain situations”. That’s why the behaviours’ of society could be perceived “chaotic” which creates problems for planning.

According to the chaos theory and synergetic paradigm, in the chaos situation self – organization process was developed in the system. During this process, “synergy” which is unexpected and unpredictable power occurs within new communication and interaction channels between sub – systems, organs and elements. System evolves to a new order which is more complicated.

From this point of view, the self-organizations of settlement systems and social dynamics are studied, and a synergetic model for the society was developed. In the model of “synergetic society” which was developed according to the logic of fractal geometry and the principles of self – organization process, each level of societies has seven dynamic systems and every one has three dynamic sub-systems like wheels which were in high interaction level. The “butterfly effect” concept of the chaos theory could also be seen.

How could society self – organize and create synergy? Which kind of relations and communication channels could exist? Could planners join this self – organization process of society? And, could they orient this social synergy? For understanding and finding answers for these questions, the research, which was undertaken during a significant case of chaos and self-organization process after earthquakes of 1999 in Turkey?