Workshop on Urban Development and Global Systems Science

Brussels, 13-14 February June 2013
List of participants

External participants
- Rudiger Ahrend (OECD)
- Lisa Amini (IBM)
- Ricardo Baeza-Yates (Yahoo! Research, Barcelona)
- Sylvain Haon (POLIS)
- Colin Harrison (IBM)
- Christian Heimgartner (City of Zurich)
- José Lobo (Arizona State University)
- Vittorio Loreto (Universita la Sapienza Roma)
- Peter Nijkamp (Vrije Universiteit Amsterdam)
- Denise Pumain (CNRS, Paris)
- Frédéric Sgard (OECD, Global Science Forum)
- David Simmonds (David Simmonds Consultancy)
- Folke Snickars (KTH, Stockholm)
- Luis Willumsen (UCL, London)

European Commission
- Pedro Ballesteros (DG ENERGY)
- Ralph Dum (DG CONNECT)
- Christian Svansfeldt (DG REGIO)

Global Systems Dynamics & Policy
- Joan David Tabara (UB, Barcelona)

EUNOIA Team
- Marc Barthélémy (CEA-IPhT, Paris)
- Michael Batty (UCL-CASA, London)
- Oliva García (Nommon, Madrid)
- Ricardo Herranz (Nommon, Madrid)
- Antonio Lucio (Independent Consultant)
- José Ramasco (IFISC, Mallorca)
- Maxi San Miguel (IFISC, Mallorca)
- Alex Serret (IMI Barcelona)
What is ‘Global’ in Urban Systems?

- worldwide challenge: growth of urban population

- global problems within a city: cutting across different policy areas

- the city as a node of intersection of worldwide global issues: economy, immigration, distribution of goods...

- system of systems: cities coupled by mobility networks

- cross-disciplinary challenge: the city defined as a social network + infrastructures
What does GSS bring in the study of Urban Systems?

- data mining, data analytics, integrated complex systems approach
- test bed for societal informatics: beyond traditional governance
- interactions:
  - two levels of ‘intra-city’ interactions:  
    - 1) physical/geography,  
    - 2) symbolic: meaning, value
  - ‘inter-city’ interactions

- multilevel dynamical networks: system of systems:
  - multilayer nets: transport, economy, health, business...
  - functional networks and territorial networks

*Global systems are networks of networks whose structures change stochastically through time (Research program for GSS, C. Jaeger, Feb 2013)*

- spatio-temporal multiscale structure
What we ordinarily call “style” may stem just as much from these decisions about the design process as from alternative emphases on the goals to be realized through the final design.

When we come to the design of systems as complex as cities, or buildings, or economies, we must give up the aim of creating systems that will optimize some hypothesized utility function, and we must consider whether differences in style of the sort I have just been describing do not represent highly desirable variants in the design process rather than alternatives to be evaluated as “better” or “worse”.

We have usually thought of city planning as a means whereby the planner's creative activity could build a system that would satisfy the needs of a populace. Perhaps we should think of city planning as a valuable creative activity in which many members of a community can have the opportunity of participating if we have wits to organize the process that way.

Herbert A. Simon
Nobel Prize in Economics decision-making process (1978)
Founding father of
- Artificial Intelligence
- Bounded Rationality
- Complex Systems
....
Challenges for Urban Development in the 21st Century
globalisation and urbanisation

• global challenges are intimately and intricately linked to cities

• pervasiveness of ICT: impact on spatial dynamics

• ICT and globalisation: world cities

• smart cities
challenges for urban development in the 21st century

• managing demographic changes
• converting quantitative growth to qualitative improvements
• competitiveness in the global economy vs geographical diversity
• sustainability of urban ecosystems
• from industrial age centralisation to the distributed systems of the information age
• managing new ICT-driven forms of spatial organisation
• exploiting the opportunities offered by ICT while avoiding a new alienating coupling between machines and society
• adapting governance structures and empowering citizens to achieve a better matching between global/societal needs and individual needs
Concepts and Methods
1) policy informatics: models and data

- **scientific explanatory role**
  - understanding of urban dynamics: towards a ‘science of cities’

- **predictive role**
  - virtual experimentation: prediction of the impact of new infrastructures, technologies, or policies

- **narrative and deliberative role**
  - models for participatory planning and collaborative policy assessment
2) societal informatics

<table>
<thead>
<tr>
<th>Participatory Sensing</th>
<th>• gather user-generated and user-mediated information from web-based and mobile sensing devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web-Gaming and Social Computing</td>
<td>• the web as a laboratory to run experiments in the social sciences</td>
</tr>
<tr>
<td>Collective Awareness and Decision-Making</td>
<td>• fostering awareness to stimulate more informed decision making and fundamental behavioural shifts</td>
</tr>
<tr>
<td>Learning</td>
<td>• new ICT-based concepts and learning schemes</td>
</tr>
</tbody>
</table>
Research Challenges and Opportunities
research challenges

- Data integration and analysis
- Modelling and simulation
- Social computing and collective awareness
- Policy making and participatory governance
data integration and analysis

• data availability and quality
  – data collection means and system interfaces bias the data we collect
  – privacy issues
  – coherence and harmonisation

• data filtering and integration

• spatio-temporal data analysis
modelling and simulation

• a ‘science of cities’

• theoretical challenges:
  – behavioural drivers and social determinants of the observed trends
  – partial rationality and emotional behaviour
  – coupling between slow and fast dynamics
  – coupling between intercity and intracity interactions
  – urban resilience
  – model calibration and validation...

• adaptation of models to the current socio-economic landscape and new global challenges

• new tools for planning and decision support

• multi-level modelling
social computing and collective awareness

- the dynamics of cooperation and human computation
  - how to sustain collaborative behaviour in intelligent tasks
  - role of motivations, incentives and mechanism design together with other factors such as social ties, culture and the cognitive framing of problems
- using the web as a laboratory for the social sciences
policy making and participatory governance

• integration of urban models into multi-stakeholder policy making processes

• transparency and ease of use

• user-model interaction - information visualisation and visual analytics

• societal informatics for participatory urbanism
yet, some precautions...
data is not (always) a substitute for theory

prediction and prescription before explanation can be risky

(“For most applications we don’t need Big Data, but the Big Picture”)
data analysis isn't just about fancy visualisation
models and data are not a substitute for politics

(“It’s not me, it’s the data”)
models and data are useless if they are not integrated into governance process
Example Projects
• project funded under FP7 ICT Call 8
• focused on urban mobility
• example research questions:
  – use of non-conventional data sources (Internet social networks, mobile phone call logs, credit card data) to analyse mobility patterns
  – interactions between social networks and travel behaviour
  – integration of improved travel behaviour models into MATSim
• case studies: Barcelona, London, Zurich
• project funded under FP7 ICT Call 10

• focused on location models: housing, retail, public services

• example research questions:
  – positive/negative synergies between social and economic activities
  – impact of the financial crisis
  – coupling between short term and long term dynamics
  – sustainability indicators based on land use mix/service availability

• case studies: Barcelona, London, Rotterdam, Madrid
3 Gigas per day of data
1534 users geolocalised in ZRH, 10528 in BCN, 80017 in London.
7 months
• CDRs for 60 days in the period of Sep-Nov 2009 for the whole of Spain (approx. 100 million calls per day)
  – Telephone of origin (encrypted)
  – Telephone of destination (encrypted)
  – Starting day and time of the call
  – Duration of the call in seconds
  – Mobile phone operator for the telephone of origin
  – Mobile phone operator for the telephone of destination
  – Coordinates of the base transceiver station(s) (BTS) to which the user is connected when the call starts and when the call ends
08:00:00-09:00:00

DP=5,390/km²

4DP \leq

3DP \leq <4DP

2DP \leq <3DP

DP \leq <2DP

0.5DP \leq <DP

<0.5DP
10:00:00-11:00:00

DP=5,390/km²

4DP <= ⬜️
3DP <= ⬜️ <4DP
2DP <= ⬜️ <3DP
   <DP <= ⬜️ <2DP
0.5DP <= ⬜️ <DP

<0.5DP
14:00:00-15:00:00

DP=5,390/km²

4DP <= 3DP <= <4DP
2DP <= <3DP
DP <= <2DP
0.5DP <= <DP
<0.5DP
16:00:00-17:00:00

DP=5,390/km²

4DP $\leq$ $<4DP$

3DP $\leq$ $<4DP$

2DP $\leq$ $<3DP$

DP $\leq$ $<2DP$

0.5DP $\leq$ $<DP$

<0.5DP
18:00:00-19:00:00

DP = 5,390/km²

4DP <= 3DP < 4DP
2DP <= 3DP < 4DP
DP <= 2DP < 3DP
0.5DP <= DP < 0.5DP
<0.5DP
DP=5,390/km²

- 4DP <= ●
- 3DP <= ● <4DP
- 2DP <= ○ <3DP
- DP <= ○ <2DP
- 0.5DP <= 🔧 <DP
- <0.5DP
22:00:00-23:00:00

DP = 5,390/km²

- 4DP ≤ 3DP < 4DP
- 2DP ≤ <3DP
- DP ≤ <2DP
- 0.5DP ≤ <DP
- <0.5DP