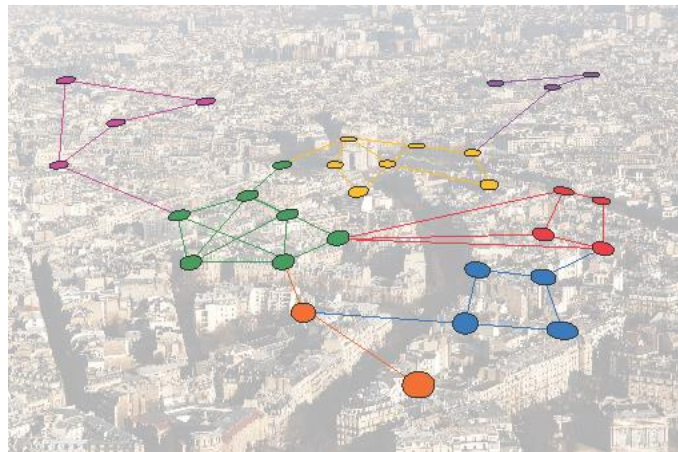


Social Networks and Travel Behaviour

COST TU1305



Summary report

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COST Association

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COST Association

COST (European Cooperation in Science and Technology) is a unique platform where European researchers can jointly develop their own ideas and new initiatives across all fields in science and technology, including social sciences and humanities, through pan-European networking of nationally funded research activities. Based on a European intergovernmental framework for cooperation in science and technology, COST has been contributing - since its creation in 1971 - to closing the gap between science, policy makers and society throughout Europe and beyond. As a precursor of advanced multidisciplinary research, COST plays a very important role in building a European Research Area (ERA).

It anticipates and complements the activities of the EU Framework Programmes, constituting a “bridge” towards the scientific communities of COST Inclusiveness Target Countries. It also increases the mobility of researchers across Europe and fosters the establishment of scientific excellence.

The COST mission is to enable breakthrough scientific developments leading to new concepts and products and thereby contribute to strengthen Europe’s research and innovation capacities.

COST's interdisciplinary bottom-up research and innovation networks are effectively bridging the innovation divide and participation gaps in Europe and are providing a large spectrum of opportunities for young generations of researchers and innovators. Involvement in COST Actions both anticipates and complements the activities of the EU Collaborative Framework Programme (FP), spreading excellence across Europe and beyond.

For more information: http://www.cost.eu/about_cost

Dr. Mickael Pero

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Preface

The past decade has gone through rapid ICT developments, which had wide societal impacts. ICT enhanced the shift from social groups defined by location to individually-based social networks. High-speed telecoms allow for ad-hoc personalised networks that affect travel behaviour.

The motivation for this COST Action raised from the understanding that research has lagged behind ICT advances, as our understanding of current travel behaviour is limited and existing urban mobility solutions cater to population behaviour that no longer exists. The transport demand models used today are based on inadequate understanding of the new social structure. A new transport paradigm is needed, one that is based upon ICT social networks and their subsequent travel behaviour, for the ultra-urbanized smart city of today.

COST Action TU1305 “Social Networks and Travel Behaviour” aims to initiate a new collaboration framework for the various EU research groups that develops a new transport paradigm. Our goals are to explore ways in which social activities become mobilised in space, identify how social ties affect the integration of local public transport into urban patterns, and establish a linkage between social networks, travel behaviour and urban structure.

Throughout our work we developed a conceptual framework for new ideas and methodologies and broaden the theoretical and practical framework of the field, taking into account both urban structure, and jointly performed social activities. This work had been done through discussions on different COST platforms; large assembly meetings and small workings groups, different workshops and training school. Collaboration was created among young and senior researchers, from various fields of knowledge and background.

In this booklet we would like to share the knowledge gathered, presented and discussed in our Action’s meetings, including state-of-the-art presentations on the various topics discussed, summaries from our training school, workshops and annual Young Researchers’ Session as well as new research ideas developed through STSMs.

Prof. Pnina Plaut

*Chair,
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*Vice Dean for Research and Graduate Studies
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Introduction and main outcomes

1. Introduction and main outcomes

COST Action TU1305 Kick-off meeting took place on March 24th, 2014. However, the actual work began only in December 2014, at the MC&WGs meetings in Vienna, due to administrative delays in the COST Association.

Since the Vienna meeting the Action has continued to grow, and the management Committee includes now 57 MC members and 39 MC Substitutes from 31 countries participating in the Action (see section 2). Alongside with the formal members, the Action developed a wide network of ECIs and Young Researchers whose research is within the Action scope.

The members' involvement in the Action is significant and is reflected by high attendance to the Action's activities as well as in their involvement in the Action's outcomes.

The Action hosted seven MC & WGs meetings; Vienna was the first one in December 2014 followed by meetings in Budapest (June 2015), Haifa (October 2015), Bucharest (May 2016), London (November 2016), Krakow (June 2017) and the final meeting in Milano (February 2018). In addition to the assembly meetings, several Working Groups meetings were arranged to discuss specific issues and elaborate ideas (for a full list of the Action's meetings and activities see section 12).

The Action also organized special activities for young researchers: the training school in Gavel, Sweden (June 2016) hosted 20 ECIs and young researchers for five days; Mobile Tartu Workshop in Tartu, Estonia (June 2016), hosted 10 young researchers and the 3rd CSUM in Volos, Greece (May 2016) hosted a special session for COST members (see sections 6, 7, 8 accordingly). In addition, the Action initiated a yearly "ECIs and Young Researchers' Session" as part of the assembly meetings aiming to give young researchers an opportunity to present their work, enlarge their network and take part in the COST experience (see section 11).

Short Term Scientific Missions bring opportunity to young and senior researchers to develop new skills, experience working with colleagues from other countries and develop networks and collaboration. During the life time of the Action, seven Calls for STSMs have been published and 25 missions were carried out. In section 5 there is a detailed summary on each STSM.

As the subject of the Action is wide and interdisciplinary there was a need to establish a strong base of advanced research methodologies for analysing social networks and travel behaviour. For this purpose, in each assembly meeting "state-of-the-art" lectures were presented by members of the Action and by invited experts. In section 4 there is a collection of these presentations.

For the same purpose, a panel of expert members presented, at London meeting, a comprehensive overview of the different methods for collecting and analysing big data (see section 9). During this meeting, a special workshop was conducted dealing with advanced research on transportation and urban analysis methods (see section 10).

Contribution and outcomes

A direct result from the Action's network collaboration which will enrich the knowledge in these fields are two edited books and two empirical studies as follows:

❖ Edited books

- *Edited book 1: ICT Social Networks and Travel Behaviour in Urban Environments*
- *Edited book 2: Social Media and Big Data in Transport Analysis and Planning*

These books are the product of the work of members and contributors in COST Action TU1305. It is focused on the challenges related to the question of how we can synchronize social networks activities, transport means, intelligent communication/information technologies and urban form. There is a lack of common ground, conceptual frameworks and research methodologies to cope with this new field of inquiry. At this stage the relevant academic/research community is in need of consolidation of existing approaches, discussion in depth of theoretical and methodological issues, an exploration of practical applications, and the formulation of a research and policy agenda.

The books present state-of-the-art knowledge, cutting edge research results and new perspectives. It integrates methods from three disciplines including social networks analysis, travel behaviour analysis and urban analysis. Each has their own theories, methodologies, and tools. They built up upon previous research traditions and were developed in parallel to one another. The books go beyond the current literature by providing a platform for a broad scope of discussion regarding ICT social networks and travel in urban space and, more importantly, by encouraging multidisciplinary fusion among these diverse disciplines.

❖ Two empirical studies that have been carried out within the Action:

- A quantitative study based on a web-based survey developed within the working groups regarding "*Social Networks, Social Media usage and Travel Behaviour among students in EU countries*". The survey was distributed at 23 universities in 20 countries in different languages. The analysis of the 8250 responses is currently in progress.
- A qualitative study based on the qualitative method developed within the working group. The study includes 20 in-depth interviews from 6 countries, and the analysis of the interviews is in progress as well.

The outcomes of these studies generated several publications in high ranked journals. A technical report based on the quantitative survey, proposing ways to collect travel behaviour data, will be published as well.

These major visible achievements are part of the long term contribution of the Action. The seeds of collaboration and networking, created within COST Action TU1305, will continue in further Horizon2020 proposals as well as other future collaborations after the end date of the Action.

The Actions' members and management wish to thank the COST Association for this wonderful opportunity and their excellent support during the four years of the Action.

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3. Working Groups

The Action consists of four Working Groups proposed in the MoU and assigned during the Kick-Off meeting.

WG1: Social networks and travel behaviour analysis

WG leader: Prof. Rein Ahas, University of Tartu, Estonia

This work group aims to identify the gaps within current theories and paradigms for analysing ICT based social networks including privacy issues. The end result is the identification of the social networks variables that affect social travel behaviour.

WG2: Scenario building and simulations of various alternative developments in land use and urban structure

WG leader: Prof. Sven Kesselring, Nürtingen-Geislingen University, Germany

The goal of this work group is to apply scenarios of various alternative developments in land use and urban structure, topography, weather variations and cultural aspects and evaluate comparatively the travel behaviour derived from ICT social network activities and transport infrastructure and services. The urban scenarios will be taken from existing plans of the COST European partners.

WG3: Urban analysis, relating to social aspects and transport behaviour in the built environment.

WG leader: Prof. Isabelle Thomas, Université catholique de Louvain, Belgium

The goal of this work group is to present and explore urban analysis tools that relate to social aspects and transport behaviour in the built environment. For example, to apply accessibility measures that will draw on network-based approaches. This analysis will allow us to understand the structure of the urban network and the ability to generate people's movement.

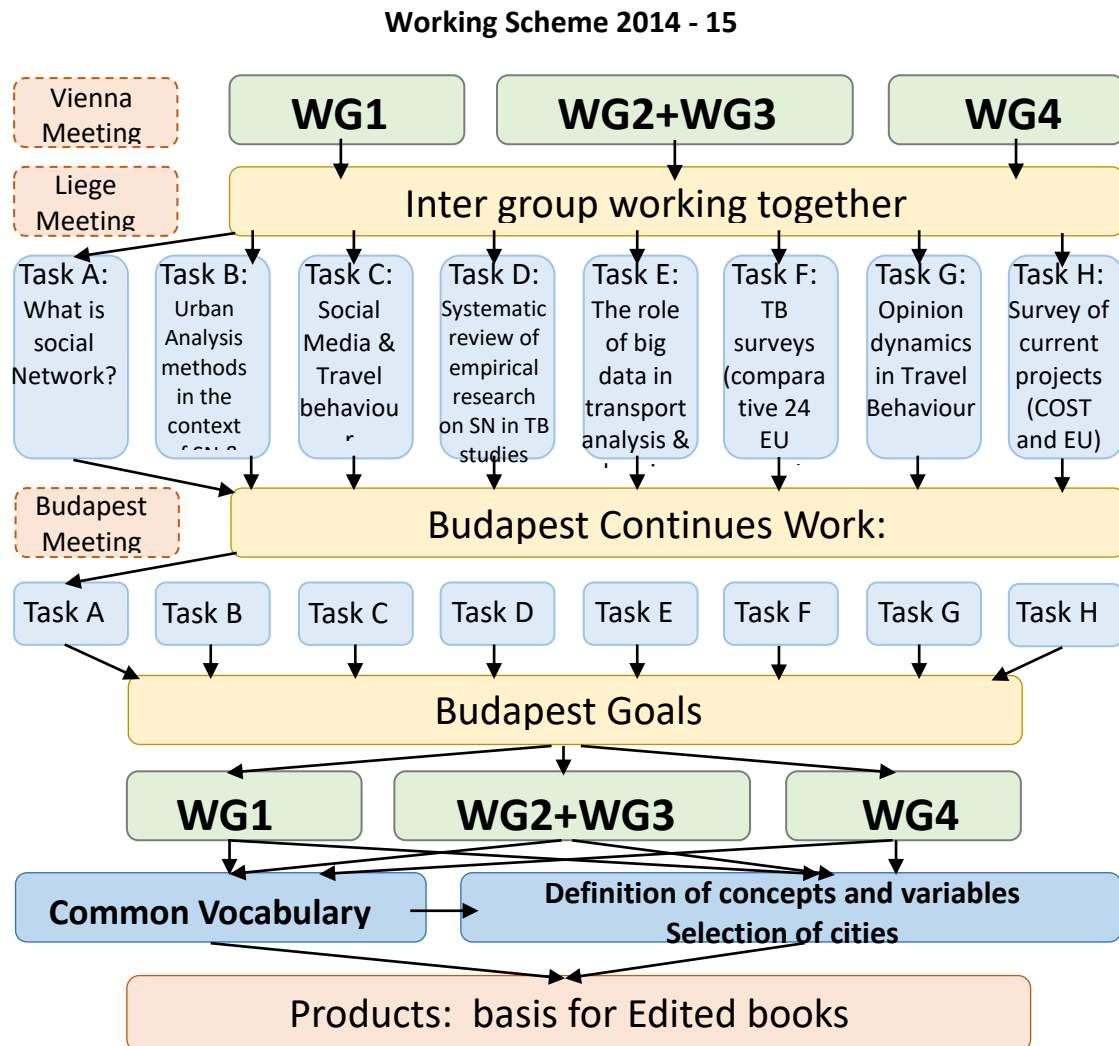
WG4: Dissemination, uptake and policy measures, including privacy and data security.

WG leader: Ms. Lucia Cristea, European Integrated Projects, Romania

The goal of this work group is to define short, medium and long term uptake of methodologies developed in the other work modules in view of feasibility and as outlined by EU policy.

The Working Groups discussions in the first meeting in Vienna (December 2014) led to the decision that as the subject is wide and interdisciplinary, we need to create small inter/intra task groups to focus on the relevant issues according to research fields and interest. A web-questionnaire was distributed, asking members to choose their preferred subject for in-depth literature review and discussion. With high level of participation and interest, we came out with 8 Task-Groups (TGs) and leaders. The Task Groups met in Liege (April 2015) and continued their work through the Budapest meeting (June 2015) until the Haifa meeting (October 2015). The work in the Task Groups established the beginning of a systematic interdisciplinary literature

review which created a basis for the following steps in the COST Action and for the two Edited books (see working scheme below).



Since the Haifa meeting (October 2015) the groups' modules re-started their work in the original Working Groups.

WG1 focused on developing a survey on Travel behaviour and Social Networks. Based on two different STSM projects done within the Action and several discussions, the WG developed a comprehensive web-based survey on *"Social Networks, Social Media usage and Travel Behaviour among students in EU countries"*. The survey includes questions on social networks, both off-line and on-line, on travel behaviour related to different social activities, and on other people participating in the activities.

In addition, the survey includes specific questions to capture the spatial analysis of travel behaviour, which are analyzed by the Spatial Analysis group within WG3. The survey was distributed at 23 universities in 20 countries different languages. The analysis of 8250 respondents is currently in progress.

WG2 focused on qualitative methods and developed a guide for qualitative interview. 20 in-depth interviews from 6 countries have been accomplished and the analysis is in progress.

State-of- the-art presentations

A: Social Networks

B: Transportation Models

C: Urban Models and Urbanity

D: ICT Sources, Big Data and Travel Behaviour,
and legislations issues

4. State –of-the-art presentations

Social Networks and Travel Behaviour research have gone through immense changes in the last decade, both in their field of knowledge and in research methods. The importance of being up-to-date on these fields and raising these issues on high level discussions is mostly important.

The strength of our Action is in its interdisciplinary fields of research. In order to support it and benefit from it we needed to state a common knowledge amongst the researchers of the various fields.

State-of-the-art presentations were part of every meeting. By this we could create a common language and have a vibrant discussions on the Actions' meetings. This exposure to variety of subjects encouraged also collaboration among researchers from different fields.

In this section, we present collection of the presentations from the different meetings, divided into 4 main parts, according to the relevant field of knowledge.

Part A is a collection of works on Social Networks, a field explored today from different angles. Thanks to the interdisciplinary and richness of context, this papers' collection include sociologists point of view together with Sociophysics and Economic sciences research.

Part B includes discussions on the challenges of today's transportation models; the relevance of ICT social networks in the models and the ways to apply Big Data information in the analysis and forecast of travel behaviour.

The 3rd dimension of the Action is presented in Part C, with discussions on the different urban models used today. Urban models are facing too the challenge, of integrating social networks information and Big Data into the models.

Part D focus on the ability to collect Big Data from the different ICT sources, in order to study the actual travel behaviour. These new methods of data collection have implication on privacy and new legislation in this field.

Part A: Social networks

- Prof. Bridgette Wessels: ***Information Age Travel: Social media, Networks and Transport.*** (Vice chair, UK. Presentation in Vienna meeting 11.12.2014)
- Prof. Harry Timmermans: ***Considerations and issues in collecting social networks data.*** (MC member, Netherlands. Presentation in WG1 meeting in Brussels 26.2.2016)
- Dr. Tom Eric Julsrud: ***What is a social network?*** (MC member, Norway. Presentation in Liege meeting 28.4.2015)

- Prof. Silvana Stefani: ***Opinion dynamics and price formation: a non-linear network model.*** (MC member, Italy. Presentation in Vienna meeting 11.12.2014)
- Dr. Marija Mitrovic Dankulov: ***Social networks: a sociophysics prespective*** (MC member Serbia. Presentation in Liege meeting 28.4.2015)

Part B: Transportation models

- Prof. Harry Timmermans and Ms. Soora Rasouli: ***Social Network and Travel Demand Forecasting*** (MC members, Netherlands. Presentation in Budapest meeting 2.6.15)
- Prof. Juan Carrasco: ***What social network are we gathering? Some challenges on personal network data collection and analysis (for travel behaviour research).*** (Invited speaker, Chile. Presentation in Bucharest, 18.5.16)
- Dr. Constantinos Antoniou: ***Integrating social network information into travel behaviour models*** (MC member, Greece. Presentation in Vienna meeting 11.12.14)
- Prof. Amalia Polydoropoulou: ***The Influence of Social Networks on Modeling Travel behaviour : opportunities and Challenges.*** (Invited speaker, Greece. Presentation in Budapest meeting 3.6.15)

Part C: Urban models and urbanity

- Prof. Isabelle Thomas: ***"Urban Models" and "Social Networks": do we converge?*** (MC member, Belgium. Presentation in Haifa meeting 14.10.15)
- Prof. Michael Batty: ***Defining cities: using networks and flows.*** (MC member, UK. Presentation in London meeting 10.11.16)
- Prof. Bin Jiang: ***Natural cities as new way of looking at human mobility from Location-Based Social Media*** (MC member, Sweden. Presentation in Vienna meeting 11.12.2014)
- Prof. Ruth Conroy – Dalton: ***Wayfinding and social activity*** (Invited speaker, UK. Presentation in Budapest meeting 3.6.15)

Part D: ICT sources, Big Data and travel behavior and legislation issues

- Prof. Rein Ahas: ***ICT based BIG data sources in studying social networks and travel.*** (MC member, Estonia. Presentation in Vienna meeting 11.12.14)
- Mr. Andrew Nash: ***"Civic Technologies and Travel Behaviour"*** (MC member, Austria. Presentation in Haifa meeting 15.10.15)
- Dr. Cesare Bartolini: ***An overview of the limitations to the dissemination of data.*** (MC member, Luxembourg. Presentation in Budapest meeting 3.6.15)

Part A: Social networks

Prof. Bridgette Wessels: *Information Age Travel: Social media, Networks and Transport.* (Vice chair, UK. Presentation in Vienna meeting 11.12.2014)

History of WWW - networks

- Berners Lee – everything linked, association between things
- Designed on universalist principles – be able to see things and discuss from different perspectives
- Freedom to send content and freedom of association
- Architecture of openness – network shaped by users - decentralized system
- Commercialization – the value of networks

Networked society

- Networked individualism – the individual creates his/her networks (Wellman and Haythornthwaite), which has increased now 'hyperconnectivity' (Wellman)
- Networked services – e-services (public and private) organized on networks and the potential of big data
- Increased mobility in travel: commuting, tourism, trip chaining (Richardson and Gillespie), events travel, mixing personal and public transport, inequality in provision

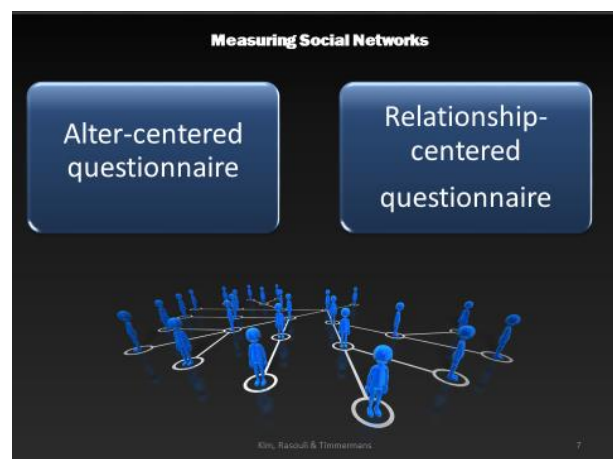
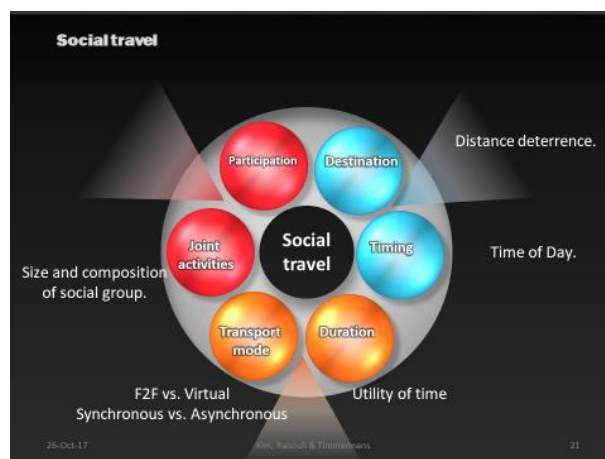
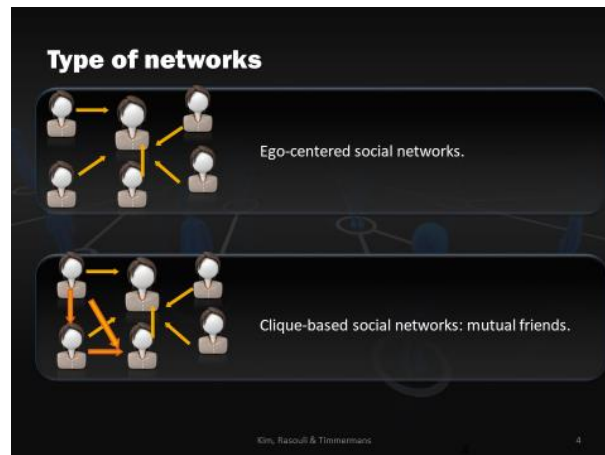
Social media

- Web 2.0 – 'participative web' – active role of users (Frissen)
- Wide range of applications: blogs, wikis, SNS, podcasts, bookmarking sites, peer-to-peer etc.
- Services allow users to publish, distribute, share content, work/play together, create knowledge
- Flickr, YouTube, Second Life, Wikipedia, tags, Tripadvisor, Facebook etc.
- Also create big data – integrated into everyday life and service provision

Conclusion: networks & Web.

- High use of social media is a tool used by both travellers and transport providers – adds value
- People's networked lives - networked individuals, networked services: create and share transport knowledge and content in networked travel
- Providers manage transport systems in real time, communicate in real time, improve the passenger experience, starting to use big data
- Moving towards smart networked travel: social media and data are key – principles behind Web
- Governance – users and providers – who is responsible for the data, for integrating transport, for algorithms of smart travel

Prof. Harry Timmermans and Dr. Soora Rasouli: *Considerations and issues in collecting social networks data.* (MC members, Netherlands. Presentation in WG1 meeting in Brussels 26.2.2016)



Alternative – Rasouli & Timmermans

Synthesizing the population

Measurement vs synthesis

1. Identify categories of social links
2. Ask for size per categories
3. Ask for details
4. Ask for number and size of cliques
5. Synthesizing algorithm

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Measuring Social Influence on Activity-Travel Decisions

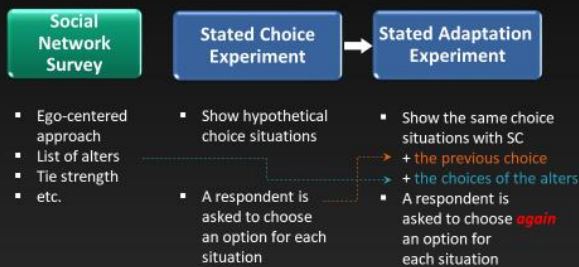
People may act upon or change their decisions to match attitudes, beliefs and behaviors according to the norms of their social network.

A combination of social network survey and *sequential stated adaptation experiment* approach allows us to systematically investigate social influence on activity-travel decisions.

Kim, Rasouli & Timmermans

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Sequential Stated Adaptation Experiment



Kim, Rasouli & Timmermans

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Measurement of the Choices of Alters

Recruit actors to participate the stated choice experiment

- ❖ Allows collecting actual choices of alters
- ❖ Time consuming
- ❖ Difficulty in systematic control
 - some of alters will not accept the experiment.

Experimentally design (Make hypothetical choices)

- ❖ Allows controlling systematically and experimentally choices of alters
- ❖ Efficiency in the investigation
- ❖ Reliability issue

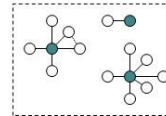
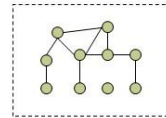
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Dr. Tom Eric Julsrud: *What is a social network?* (MC member, Norway.
Presentation in Liege meeting 28.4.2015)

What is a social network?

- *Social networks* are groups of social actors that are related through communication, relationships (Cognitive, affective, formal) flow of resources, co-presence or adjacency through participation in same groups or activities.
 - *Social networks can be seen as representations of social structure*
- *Social network analysis* is the disciplined inquiry into the patterning of relations among social actors, as well as the patterning of relations among actors at different levels of analysis (Breiger 2004 p. 505).
 - *Well developed field with a rich set of concepts/methods to analyse network structure, positions and dynamics*
 - *Bounded networks and ego-networks*
 - *Quantitative & qualitative approaches*



Bounded network and ego-networks

Page

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Social network theory

- Builds on various theoretical fields within structural anthropology sociology and social psychology (Simmel, Moreno, Homans, Barnes, etc)
 - *Cohesion/Balance theory*
 - *Strength of weak ties*
 - *Social comparison theory/Homophily*
 - *Structural role theory*
 - *Social capital theories*
- J.A. Barnes (1952): Early fieldwork study of a small Norwegian island community describing this as a social network



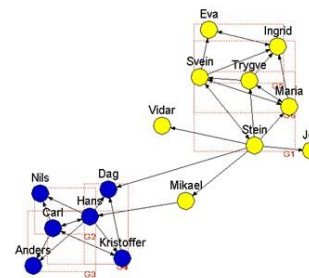
"Their social world had an abundance of formal organizations, but most individuals appeared to make decisions with reference to personal contacts that often cut across organizational boundaries"

Page

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Social networks in the context of travel

- Face-to-face interactions -and Travelling - is important to build and sustain social networks
 - *Mobility and obligations (Urry)*
 - *Travel as a gift (Lyons)*
- New communication media and transport are transforming social networks in many ways:
 - *More widespread (Glocalized)*
 - *More individual*
 - *Complex structures*
 - *Multiplexity*
- ICT may substitute for travels, but also initiate more travels and new travel patterns
- Social networks will facilitate attitudes and travel behaviour

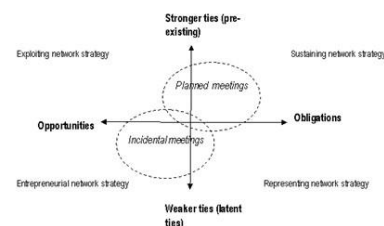


Network structure of distributed work group
(Julsrud 2007)

Page

What aspect of travel behaviour is being investigated?

- Use of social media and mobile ICT while travelling
 - *Study of travel time use and mobile communications on public transport*
- Individual social networks and business travels
 - *Study of how business managers travel to sustain and develop their business networks.*
- Network structures and relationships in distributed work groups
 - *Study of communication and collaboration in global companies*
 - *Focus on interplay of stronger (trust) and weaker ties*

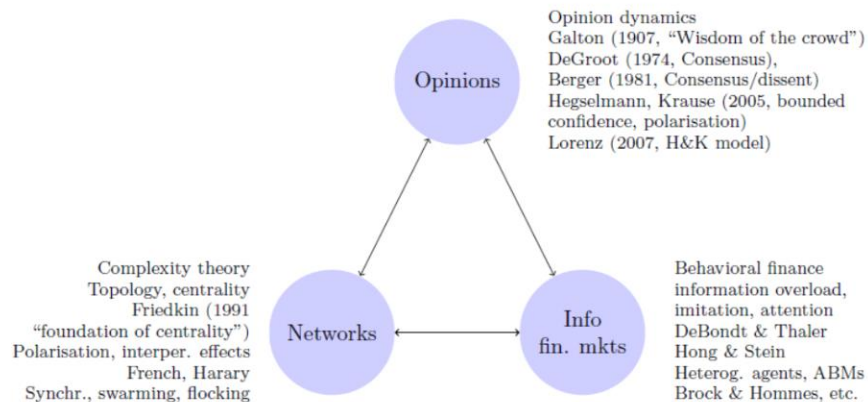


A typology of managers' personal network strategies in global organizations (Julsrud & Gjørtdåker 2012)

Page

Prof. Silvana Stefani: *Opinion dynamics and price formation: a non-linear network model.* (MC member, Italy. Presentation in Vienna meeting 11.12.2014)

Overview & related literature



Interlude: opinion dynamics

Consider n agents with an initial opinion vector $\mathbf{x}(0) \in \mathbb{R}^n$ (e.g. on the price of 1 asset). **General model:** at each time $t = 1, 2, 3, \dots$ agents revise their opinions by averaging neighbors' opinions:

$$\mathbf{x}(t+1) = \mathbf{A}(t+1)\mathbf{x}(t)$$

Influence/confidence/attention matrix $\mathbf{A}(t)$ is row – stochastic and has positive diagonal (acyclic graph \rightarrow aperiodicity) $\forall t$ and represents the *weighted adjacency matrix* of a network (graph).

Question

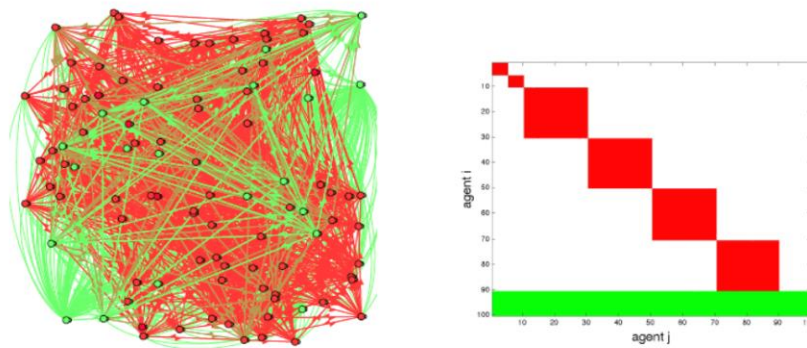
Under what conditions does this system converge to an asymptotic opinion vector?

Answer

It depends on the (*evolving*) network topology!

Agents classification - example

For a given network, how can we classify agents?

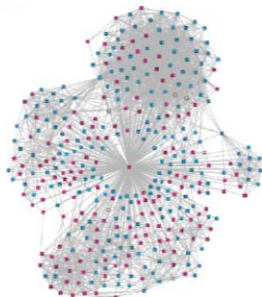


Take-home message

- Opinions in financial markets *matter*
- Topological classification: quantifying *who* matters
- Opinion shifts: play a key role for subsets of agents
- High variability in fundamental innovations not necessarily bad: can prevent very large deviations

Dr. Marija Mitrović Dankulov: Social networks: a sociophysics perspective
(MC member Serbia. Presentation in Liege meeting 28.4.2015)

Social networks




- Social Networks: nodes (humans) and links (interactions and relations).
- Structure of social network: local, mesoscopic and global properties.
- Dynamics on/of social networks: epidemic, innovation, knowledge and emotion spreading in the network; structure of network is changing.

Marija Mitrović Dankulov
Institute of Physics Belgrade

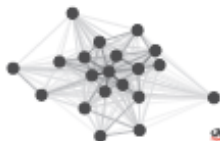
Types of social networks: edges

Binary



Albert, R. et al., Rev. Mod. Phys. 74, (2002)

Weighted




Boccaletti, S. et al., Phys. Rep. 424, (2006)

Marija Mitrović Dankulov
Institute of Physics Belgrade

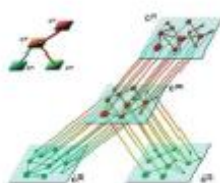
Types of social networks: edges

Temporal



Holme, P. et al., Phys. Rep. 519, (2012)

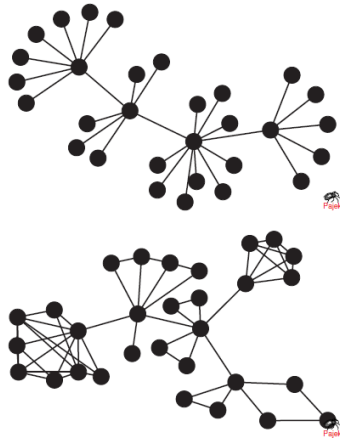
Multiplex



De Domenico, M. et al., Phys. Rev. X 3, (2013)

Marija Mitrović Dankulov
Institute of Physics Belgrade

Quantitative measures: network level



- Assortative mixing-preference of nodes to attach to similar nodes.
- Clustering coefficient-measure of the degree to which nodes in a graph tend to cluster together.
- Network motifs-statistically significant subgraph pattern.
- Community structure-densely connected groups of nodes.

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Marija Mitrović Dankulov

Institute of Physics Belgrade

Social networks and sociophysics

- Quantitative study of network architecture.
- Models of social network growth.
- Predictions of links, epidemic, rumour, and information spreading.
- Network resistance. Interplay between network structure and its dynamics.

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Marija Mitrović Dankulov

Institute of Physics Belgrade

Part B: Transportation models

Dr. Constantinos Antoniou: *Integrating social network information into travel behaviour models* (MC member, Greece. Presentation in Vienna meeting 11.12.2014)

COST TU1305/Vienna 11/12/2014

Need to incorporate the “social dimension” in travel behavior

2

- Axhausen, K. W. (2005), "Social networks and travel: Some hypotheses," in Social Aspects of Sustainable Transport: Transatlantic Perspectives, K. Donaghy, Ed. Aldershot: Ashgate.
- “Transport planning and even more so transport modelling has ignored the social dimension of travel in the past. There is therefore no empirical literature to fall back on. The general lack of detailed address geocoding of previous travel diary data makes these large data sets less useful then they could be, as they cannot be used to trace the development of the spatial visiting and meeting patterns in detail” (p.3)

Carrasco, J. A., Hogan, B., Wellman, B., & Miller, E. J. (2008). Collecting social network data to study social activity-travel behavior: an egocentric approach. Environment and planning. B, Planning & design, 35(6), 961.

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COLLECTING SOCIAL NETWORK DATA TO STUDY SOCIAL ACTIVITY-TRAVEL BEHAVIOUR

9

- Incorporate social dimension in social activity-travel behaviour
 - Explicitly studying the link between individuals' social activities and their social networks.
 - Using survey and interview instruments
 - Respondents' social networks collected using an egocentric approach
- Individuals' networks are studied in their relationship with social activity-travel generation, spatial distribution, and information communication technology use (ICT).

Example of a sampling in name interpreting questions

Carrasco, J. A., Hogan, B., Wellman, B., & Miller, E. J. (2008). Collecting social network data to study social activity-travel behavior: an egocentric approach. Environment and planning. B, Planning & design, 35(6), 961.

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Input to microsimulation

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- Empirically identifying the social network in space
- Two improvements are recommended to combine the existing approaches for generating networks to applications in activity-based trip generation:
 - Link attachment (or existence) as a travel behavior (trip generation) model
 - An explicit bridging mechanism between geographic and social space

Hackney, J. (2009), Integration of social networks in a large scale travel behavior microsimulation, DSc Dissertation, ETH Zurich

Hackney, Jeremy K. and Kay W. Axhausen (2006) An agent model of social network and travel behavior interdependence, paper presented at the 11th International Conference on Travel Behaviour Research, Kyoto, August 2006

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11/12/2014



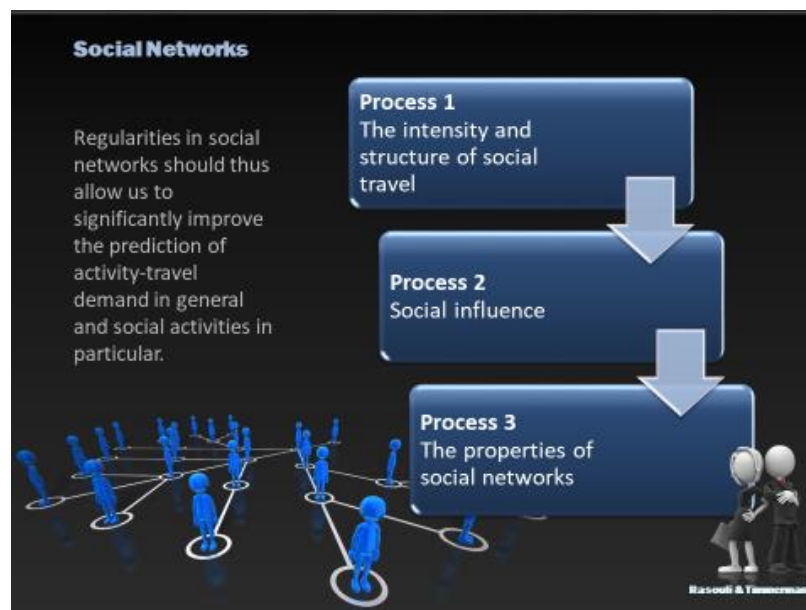
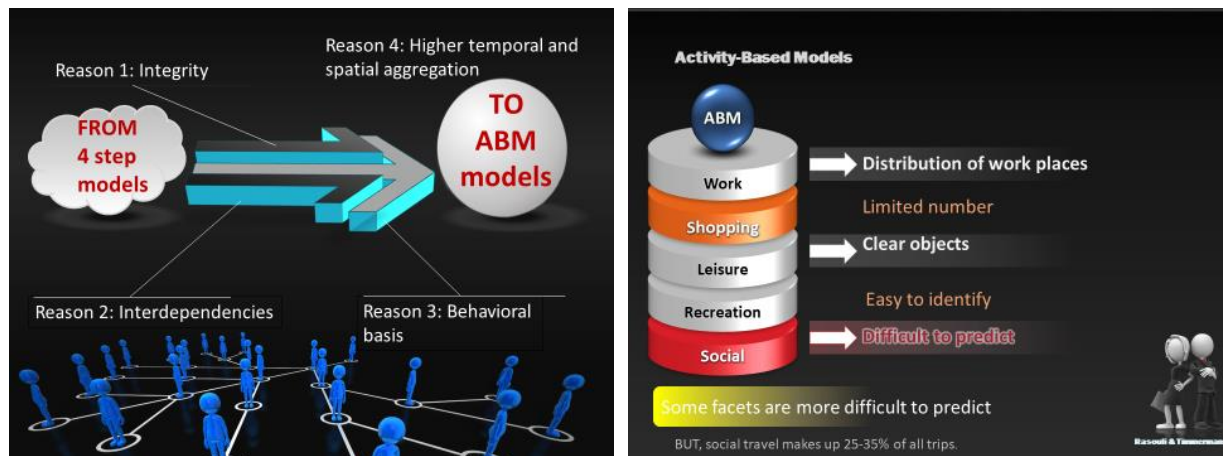
Travel needs changes in response to social network evolution

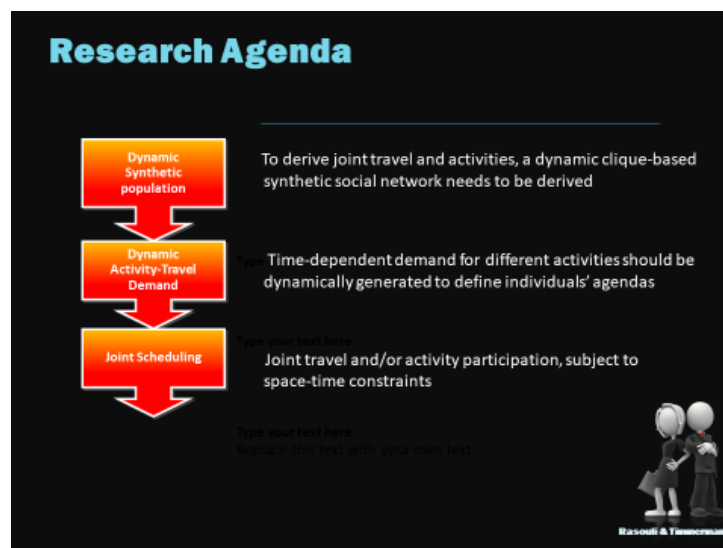
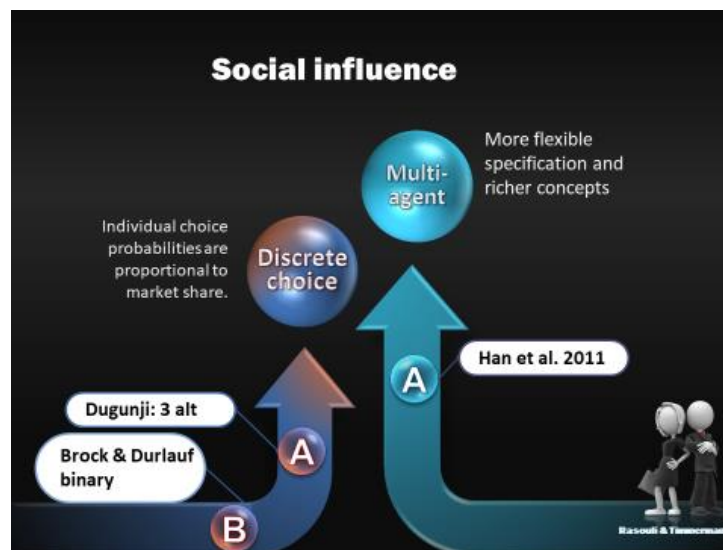
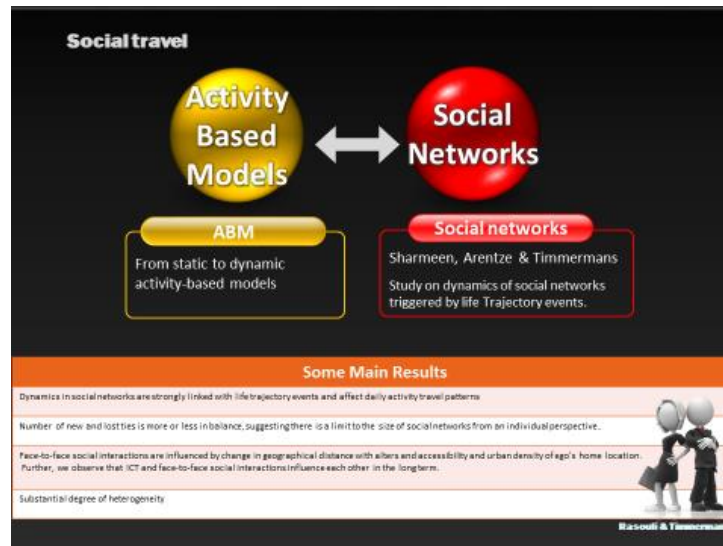
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- "social networks may not remain unchanged in the long term, particularly in response to life-cycle events"
- "A change in the social network in turn may have a repercussion on activity and travel behaviour"
- "A structural equation model was developed to elicit activity and travel needs and their dependencies on life-cycle and social network dynamics"
- "Results suggest that activity and travel dynamics are influenced by life-cycle and social network dynamics"
- "social network and activity travel dynamics were found to be interdependent"

Sharmeen, F., Arentze, T., & Timmermans, H. (2014). An analysis of the dynamics of activity and travel needs in response to social network evolution and life-cycle events: A structural equation model. *Transportation Research Part A: Policy and Practice*, 59, 159-171.

Prof. Harry Timmermans and Dr. Soora Rasouli: *Social Network and Travel Demand Forecasting* (MC members, Netherlands. Presentation in Budapest meeting 2.6.2015)





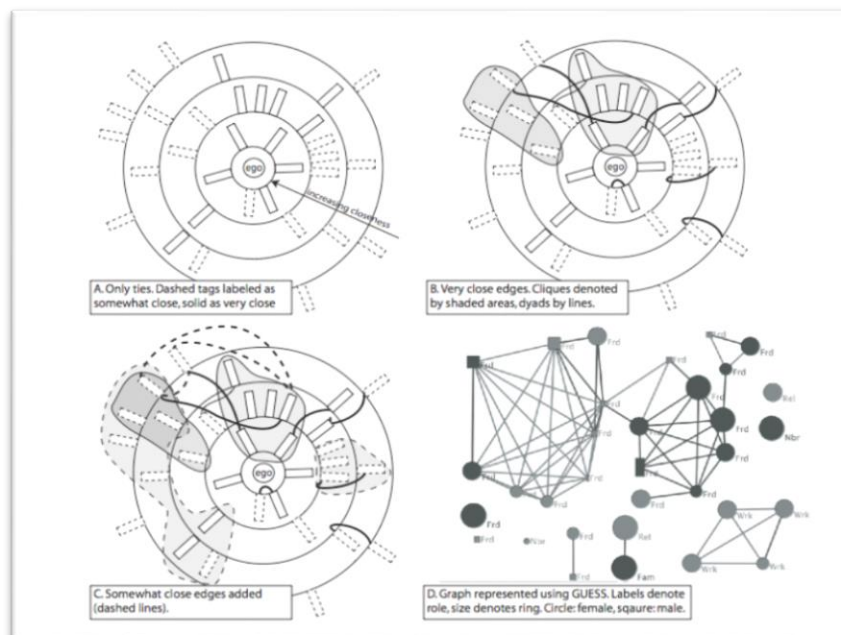
Prof. Juan Carrasco: *What social network are we gathering? Some challenges on personal network data collection and analysis (for travel behaviour research).* (Invited speaker, Chile. Presentation in Bucharest, 18.5.2016).

Network structure: Challenges

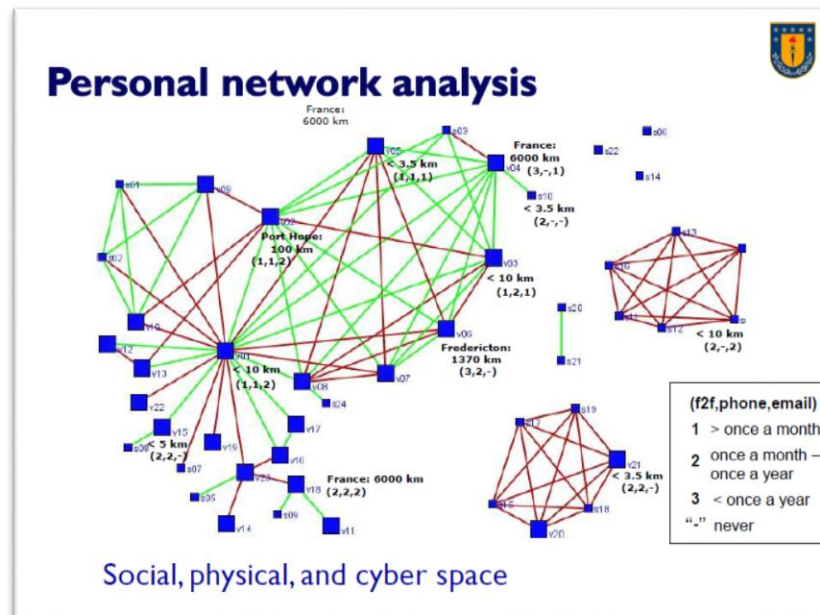
Challenges on studying network structure

- Name generator DOES matter
- Network composition as a key
Income, gender, age
- Structural characteristics: How relevant?
Overall network: Size, density, subgrouping...
Node: degree, transitivity, structural equivalence...

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Hogan, B., J. A. Carrasco, and B. Wellman (2007), "Visualizing personal networks: Working with participant-aided sociograms", *Field Methods*, 19(2) 116-144



Carrasco, J.A., B. Hogan, B. Wellman, and E. J. Miller (2008), "Collecting social network data to study social activity-travel behaviour: An egocentric approach," *Environment and Planning B*, 35(6), 961-980.

Summary

- **Collecting** personal network data
 - Feasible!
 - Aware of intrinsic challenges / biases of the process
 - We **always** gather only **a part** of the social network
- **Analyzing** personal network data
 - Travel behavior as truly **emerging** from social relations
 - Several dimensions to be explored: Richness comes with **integration**
- **Integrating** qualitative and other information
 - Serve to understand embedded contexts and decision-making processes

Prof. Amalia Polydoropoulou: *The Influence of Social Networks on Modeling Travel behaviour : opportunities and Challenges.* (Invited speaker, Greece. Presentation in Budapest meeting 3.6.2015)



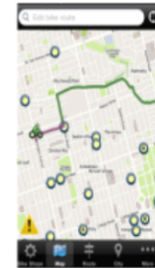
OSN effect on Activities and Travel

- Individuals may communicate with their friends and relatives without physically traveling
- Effect of OSN on different segments of population
 - trip purposes
 - activity engagement
- Important to complement the current data collection surveys with information regarding social networks

Logos at the bottom include: Ministry of the Republic, COST Action TU1305, and various social media icons (Facebook, Twitter, etc.).

Opportunities and Challenges

- Data Collection
 - Online Social Networks
 - Dynamic Data: Consecutive Panels
- Big data
 - Volume, velocity, variety
 - Data curation: validate, transform, clean, integrate
 - Visualization (MapD.csail.mit.edu)
 - Fast algorithms: Streaming and Sampling
 - Privacy and Security



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Opportunities and Challenges

- Develop Travel Behavior Models that incorporate:
 - Info from Tweets and Facebook posts
 - Attitudes and perceptions
 - Group decision making
 - Social interaction effects
 - Happiness / satisfaction



<http://vimeo.com/88629127>



COST Action TU1305



Part C: Urban models and urbanity

Prof. Isabelle Thomas: *"Urban Models" and "Social Networks": do we converge?*
(MC member, Belgium. Presentation in Haifa meeting 14.10.2015)

What is a city ? What are its limits ?
Long term research topic in urban geography

Size and Extension of the urban area (border)
Composition of the urban area → MODEL

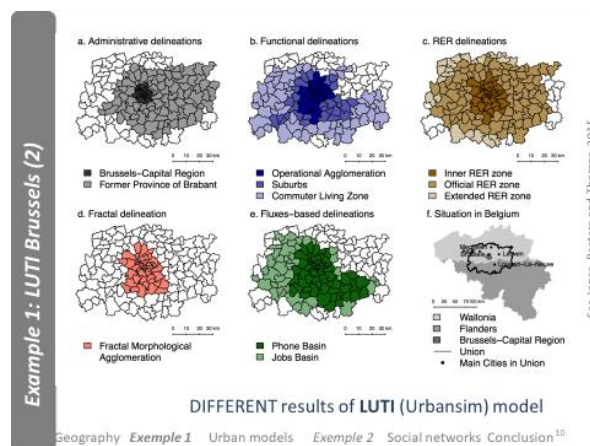
Choice of

- ◆ Criteria (variables)
- ◆ Thresholds
- ◆ Method

Example 1: LUTI Brussels (1)

See on going paper Thomas, Jones, Gerber and Caruso

Geography Example 1 Urban models Example 2 Social networks Conclusion 9



What did we learn ?

1. **Delineation of the urban area**
determines the « urban model ».
2. **Strong internal structures** (autocorrelations)
→ results
3. «Data crunching» rather than modelling.

Example 1: LUTI Brussels (5)

Geography Example 1 Urban models Example 2 Social networks Conclusion 13

Models

DATA driven

- Simple and quick
- Little knowledge of underlying process
- ? Validity in extrapolation
- ? Improving understanding

THEORY driven

- Applicable to wide range of condition
- Great flexibility in modelling complexity
- ? Time to compute complex models
- Assumes knowledge of all important processes, var. & math. formulation

Geography Exemple 1 Urban models Exemple 2 Social networks Conclusion¹⁶

What do we measure ? Social networks ? interactions ?

- **Geographers:** *interactions* - distances, fluxes.
Interactions not ALL social (ex VAT)
- **Sociologists:** initially not geolocated.
- **Computer scientists** (Big data): dynamic (short term)
geo-location. Transport / ICT communications.
Individual mobility constrained by technology.

Do they converge ?

Virtual footprint of activities ≠ «social networks »

Geography Exemple 1 Urban models Exemple 2 Social networks Conclusion³²

Prof. Michael Batty: *Defining cities: using networks and flows.* (MC member, UK. Presentation in London meeting 10.11.2016)

<http://www.tu1305.eu/sites/default/files/BATTY-Cost-Lecture.pdf>

Preliminaries: Defining Cities

We Cannot Define Cities Until We Know What a City Is

- It is spatial extent that is key here – the properties of cities will change as we change extent – this is the ecological fallacy and the modifiable areal unit problem
- It also relates to commuting and interactions, migration, trade flows and now of course the whole issue of electronic interactions
- In short globalisation – where does the city begin and end – how do we define the system in terms of its environment. Here are some pictures

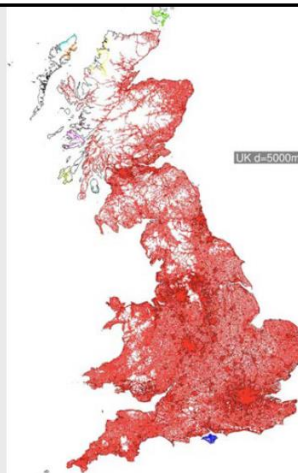
I will tell you the method we used first and only then tell you the detail of why and how we are doing this.

It is part of our project to look at the nature of urban morphology, city size, urban allometry and more particularly the qualitative changes that take place in the economy of cities as they agglomerate

This is a key issue for thinking about a world where every one will be living in cities by the end of this century. But before that, back to Britain.

We start at 5km and then we progressively build the clusters from the bottom up which assembles the hierarchy from the top down.

This produces nations, regions and then cities which is our main focus, not the Scottish election which I will return to at the end



City Performance: Wealth and Inequality

Do Bigger Cities Generate More Wealth

We are testing a theory that is as old as the hills: and that is that as cities get bigger, they get more prosperous, *ceteris paribus*

When we put all these definitions together defining cities at **14pph and with the 30% commuting** thresholds, and we examine a range of indicators wrt to city size, **we do not get superlinear scaling** for income against the population cities.

The bigger the city does not mean the richer in E&W and London is an enormous outlier.

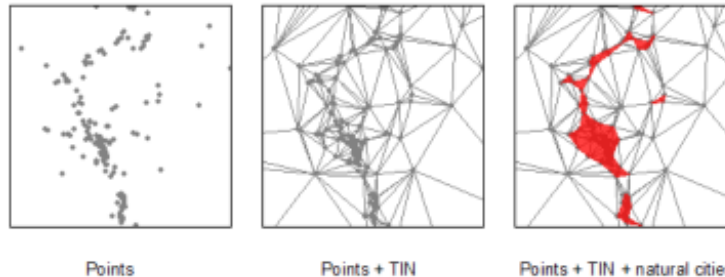
We show these scaling relations and they are quite different from the Bettencourt-West results

- What we need is a well worked out theory – a wider framework – and there are elements of this in the making – in this talk allometry of course and also in hierarchy and central place theory and so on
- It would be very nice to connect all this up and for someone, not me, to try and pull many things together
- I think much of this is consistent with quantitative and theoretical human geography of the last 50 years, and of urban economic theory too
- But it has to be cast in terms that we know which is size and shape of cities, and it has to be cast in how cities change through time and how technology changes

Prof. Bin Jiang: *Natural cities as new way of looking at human mobility from Location-Based Social Media* (MC member, Sweden. Presentation in Vienna meeting 11.12.2014)

Defining natural cities

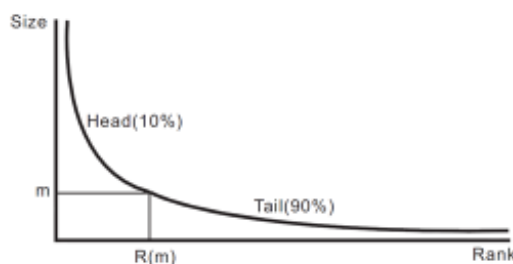
- Natural cities refer to **objectively or naturally** defined and delineated human settlements, or human activities in general on Earth's surface, using massive geographic information of various kinds, and based on **the head/tail division rule**.



5

Head/tail division rule

- Given a variable X , if its values x follow a **heavy tailed distribution**, then the mean (m) of the values can divide all the values into two parts: a high percentage **in the tail**, and a low percentage **in the head**.



Jiang B. and Liu X. (2012), Scaling of geographic space from the perspective of city and field blocks and using volunteered geographic information, *International Journal of Geographical Information Science*, 26(2), 215-229.

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Ht-index

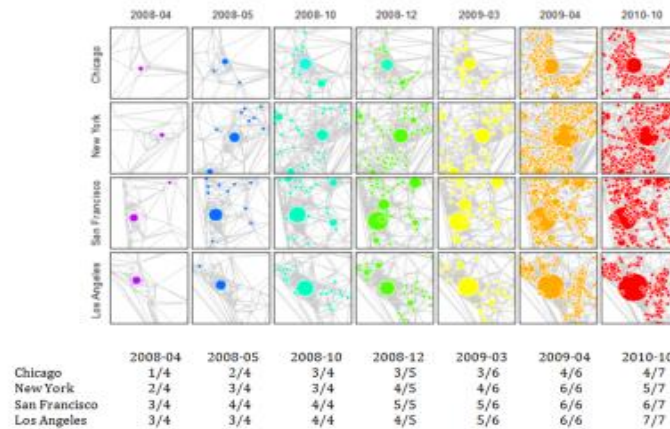
- A geographic feature has ht-index h if the pattern of far more small things than large ones **recurs** ($h-1$) times at different scales.
- The higher the ht-index, the more complex the geographic feature.
- For example, $h=3$ for **the** Koch curve



Jiang B. and Yin J. (2014), Ht-index for quantifying the fractal or scaling structure of geographic features, *Annals of the Association of American Geographers*, 104(3), 530–541.

20

City size distributions (local)



25

Conclusion

- The **natural cities** provide an effective means or perspective to study human mobility, or human activities in general, for better understanding geographic forms and processes.
- We found **nonlinearity** during the evolution of natural cities in both spatial and temporal dimensions, and the universality of Zipf's law.
- We therefore call for **nonlinear mathematics** such as fractal geometry, chaos theories and complexity for geographic and social science research.

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Prof. Ruth Conroy – Dalton: Wayfinding and social activity (Invited speaker, UK. Presentation in Budapest meeting 3.6.2015)

What is Wayfinding?

- Navigation is a routine, everyday activity.
- It draws upon numerous cognitive functions, including perception, memory, imagination, language, reasoning and decision-making.
- Emotion is involved too, as when anxiety impairs spatial decision-making during emergency egress.
- We can distinguish “*locomotion*” the movement of one’s body coordinated to the proximal environment, from “*wayfinding*” the planning involved in efficient and goal-directed navigation (Montello, 2005; Montello & Sas, 2006).

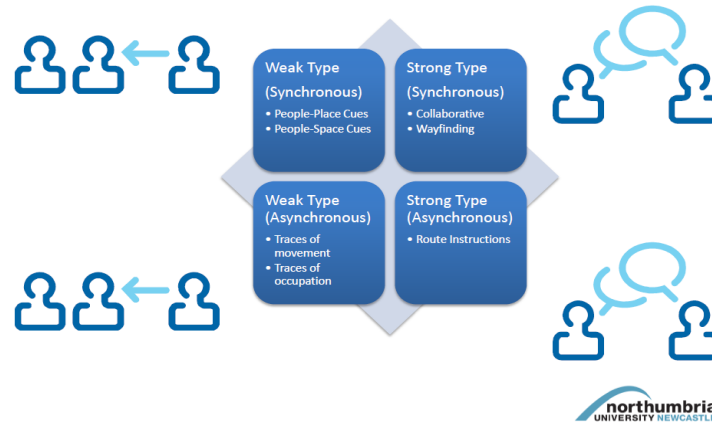


What is Social Wayfinding?

- Any situation where the presence or activities of others, now or in the past, has an observable impact on wayfinding can be “*social wayfinding*”
- Even when others are not present during navigation or have not provided any information directly relevant to a traveler’s route choice, it is clear that other individuals always exert some influence on the psychology of wayfinding.
- For instance, the design and comprehension of navigation technologies and artifacts always reflect past decisions and influences of others (Hutchins, 1995; MacEachren, 1995).

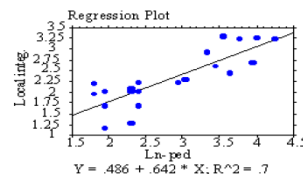


The Two Types of Social Wayfinding



Person-space Cues

- Space syntax theories suggest that we are able to 'pick up' visual cues leading to inferences about a space's importance.
- We 'read' these cues unconsciously having learnt their significance throughout our lives.
- Generally there will be an agreement between the numbers of people walking along the street and that street's strategic importance, and this is also something that we are unconsciously aware of.



Future opportunities

- There are significant gaps in the research: it is an under-researched area
- Research into navigational aids is currently a big area: the importance of social wayfinding becomes all the more relevant to designing the UX of these aids
- Research into indoor navigation (another growth area), shopping centers and airports, is another areas when some of these ideas area particularly relevant
- Conclusion: there is a huge amount left to do!

Part D: ICT sources, Big Data and travel behavior and legislation issues

Prof. Rein Ahas: *ICT based BIG data sources in studying social networks and travel.* (MC member, Estonia. Presentation in Vienna meeting 11.12.2014)

Traditional sources to get travel + social network data

Population Census – NOT MUCH about social connections

Transportation Census & Survey – NOT MUCH about social connections

Questionnaire – OK

Interview – OK

Observation - Ok

Focus group – OK

...

1. Primary sources designed for getting „concrete“ information (active methods)

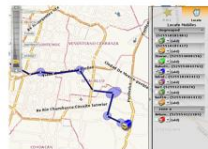
Active mobile positioning:

Smartphone based tracking + questionnaires

GPS quality location/time

Phone use – social ties

ICT use ...



Smartphone based questionnaires:

Movement, phone use, sensor data

+

Questions with voice, sms, special queries

„Location aware“ questionnaires, travel diaries

• – you entered Vienna, what is purpose...

• - you met with Birgit, what is purpose...



Social media based active data collection:

Questionnaires, interviews...:

- + information about social ties
- + information about locations of posts



Other ICT based solutions to track + record connections

Bluetooth, wifi based tracking of connections



2. Secondary data or passive data – using secondary sources, not designed for study

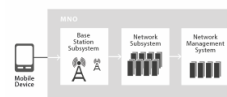
Log files from social media

Geocoded (place, time) messages + information about connections, communication



Memory files of Mobile Network Operators:

Call detail records (CDR) – location and time of call and number of respondent



Mr. Andrew Nash: "*Civic Technologies and Travel Behaviour*" (MC member, Austria. Presentation in Haifa meeting 15.10.2015)

What was travel behaviour analysis used for?

Travel behaviour analysis was used to help design and improve transport infrastructure and services.

- Where to build a metro line or highway;
- How often to operate a bus service;
- How to attract more users.

What happened to travel behaviour analysis?

Travel behaviour analysis was made unnecessary by civic technology apps for ...

- Reporting conditions;
- Analysing data;
- Designing services and infrastructure;
- Providing transport.

... and vastly improved computing power.

Collecting data became *simple and ubiquitous*

- Social media
- Reporting applications
- Sensor data (automatic, e.g. from phone)

... giving transport agencies sufficient data to fully understand real time transport conditions and make projections without complex models.

Analyzing all this data became *easy**

- (Smart) city data;
- Application data (e.g. Waze);
- Citizen data (cheap sensors).

... data and vastly improved computing enabled transport providers to analyze countless scenarios and develop precise transport plans in real time.

* So easy *anyone* could do it (open data)!

Collaboration became more *efficient*

- Education – transport planning is complex;
- Better processes – meeting management;
- Increased engagement – more is better.

... improving the quality of ideas, increasing the ability to implement and test new ideas, and helping build community spirit.

Providing transport became *open*

- Information via social networks (Twitter real time);
- Implementation via civic groups (596 Acres, Casserole);
- Behaviour modification (Chromaroma, Walk-a-Stop);
- Crowd-sourced civic works (Spacehive, Kickstarter);
- Service providers & sharing (Uber, BlahBlahCar, Bridj).

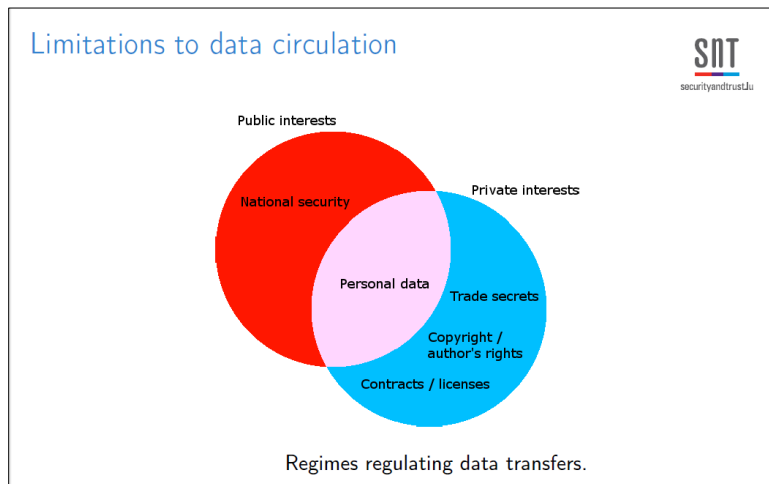
... reducing the need for centralized transport planning and service provision.

How could these technological improvements and new services be harnessed for the public good?

- Public-private partnerships?
- Strong public benefit requirements?
- Privacy requirements and data ownership?
- Role of the market?

OK, travel behaviour analysis is probably not going away, but it's clearly going to change significantly.

Dr. Cesare Bartolini: *An overview of the limitations to the dissemination of data.*
(MC member, Luxembourg. Presentation in Budapest meeting 3.6.2015)



Databases

- ▶ Protection for the database and not the content
- ▶ Only if the database has creativity
- ▶ Does not apply to data for which the content imposes the structure

Article 5(a) of Directive 96/9/EC

[...] the author of a database shall have the exclusive right to carry out or to authorize [...] reproduction by any means and in any form, in whole or in part.

Article 6.2(b) of Directive 96/9/EC

[...] the author of a database shall have the exclusive right to carry out or to authorize [...] reproduction by any means and in any form, in whole or in part.

Member States shall have the option of providing for limitations on the rights set out in Article 5 [...] for the sole purpose of [...] scientific research, as long as the source is indicated [...].

Cesare Bartolini (SNT)

An overview of the limitations to the diss Budapest, June 3, 2015

18 / 35

Collected data are not subject to this protection, but their aggregation and organization (i.e., the database) is.
If the supplier of the data collected them in a non-obvious way, then it would be advisable to obtain the copyright holder's consent.

Location data



Two possible conditions to process location data:

1. Ok if anonymous data are used
2. If data are not anonymous, then
 - ▶ consent (withdrawable)
 - ▶ necessary duration
 - ▶ inform about the type of data and the purpose
 - ▶ possibility to refuse processing for single connections

Cesare Bartolini (SnT) An overview of the limitations to the diss Budapest, June 3, 2015 24 / 35

The reform



- ▶ Reform ongoing since 2011
- ▶ The bulk is the General Data Protection Regulation (GDPR)
- ▶ Uniform legislation, directly applicable in Member States
- ▶ Entry into force: no sooner than 2018
- ▶ Main changes
 - ▶ Centered more on the data subject and **withdrawable** consent
 - ▶ *Privacy by design* and *by default* (incl. security)
 - ▶ High fines (might be 2-5% of the annual turnover)
 - ▶ Research: principle of necessity (anonymization and separation), or consent
- ▶ Data transfer is essentially the same

Cesare Bartolini (SnT) An overview of the limitations to the diss Budapest, June 3, 2015 29 / 35

Copyrighted material concerning social networks



- ▶ Long debate over who the owner is
- ▶ Check the license agreement
 - ▶ But it might contain an invalid clause
- ▶ In general, the material belongs to the author

Bouncing

- ▶ Am I allowed to repost a copyrighted material from a social network?
- ▶ This actually depends on the license agreement (and it's valid)
- ▶ E.g., material can be reposted from Facebook (recent debate), but the only owner is the author

Cesare Bartolini (SnT) An overview of the limitations to the diss Budapest, June 3, 2015 35 / 35

Short Term Scientific Mission (STSM)

5. Short Term Scientific Missions (STSM)

STSM Coordinator: Prof. Eftihia Nathanail

STSM Committee: Prof. Eftihia Nathanail, Prof. Pnina Plaut, Prof. Bridgette Wessels, Dr. Slaven Gasparovic, Dr. Domokos Esztergar-Kiss

Short Term Scientific Mission (STSM) aim at supporting individual mobility, strengthening the existing networks and fostering collaborations by allowing scientists to visit an institution or laboratory in another Participating COST Country or an approved NNC (Near Neighbour Countries) institution or an approved IPC (International Partners Countries) institution.

STSM applicants must be engaged in a research programme as a PhD student or postdoctoral fellow, or be employed by or officially affiliated to an institution or legal entity, which has within its remit a clear association with performing research. The selection of applicants is based on the scientific scope of the STSM application that must be in line with the Action objectives. Necessary geographical and gender balance issues are taken into consideration and applications from Early Career Investigator (ECI) are privileged.

During the lifetime of the Action, 7 Calls for STSM were published and 25 researchers accomplished successfully their mission.

COST TU1305: STSM Grantees – Summary table

Name	Country	STSM topic	Host	Host institute and Country		No. of days	STSM Period	Mail
Mr. Emmanouil Chaniotakis	Greece	Capturing the effect of social networks on human mobility behavior using data from Social Media	Prof. Bin Jiang	University of Gavle	SE	19	June, 2015	chaniotakis@certh.gr
Mr. Or Caspi	Israel	Public transportation's coverage of natural city	Prof. Bin Jiang	University of Gavle	SE	11	June 2015	orcaspi@gmail.com
Dr. João de Abreu e Silva	Portugal	Influence of web based social networks on individuals travel behaviour	Prof. Juan De Ona	University of Granada	ES	10	July, 2015	joao.abreu@civil.ist.utl.pt
Mr. Matthew Hanchard	UK	Location-based services and urban navigation: a qualitative investigation of transport use in Oslo	Dr. Tom Erik Julsrud	Institute of Transport Economics, Oslo	NO	6	Oct, 2015	matthewhanchard@googlemail.com
Dr. Patricia Melo	UK	Home-Based Telework, Residential Location and Intra-Household Dynamics	Dr. João de Abreu e Silva	Instituto Superior Técnico, University of Lisbon	PT	23	Nov – Dec, 2015	patricia.melo@hutton.ac.uk
Dr. Helen Carter	Denmark	Young Peoples' Mobilities, Socio-Spatial Networks and Urban Space	Prof. Sven Kesselring	Nürtingen-Geislingen University, Geislingen	DE	48	Nov – Dec, 2015	helen.carter@tum.de
Ms. Rumana Sarker	Austria	The use of social media in public transport to understand the passenger preferences.	Dr. Sigal Kaplan	Technical University of Denmark	DE	61	Feb-April, 2016	rumana.sarker@uibk.ac.at
Dr. Reza Farahbakhsh	France	iTrip, a Framework to Enhance Urban Mobility by Leveraging Various Data Sources	Prof. Eftihia Nathanail	University of Thessaly, Volos	EL	31	April, 2016	reza.farahbakhsh@it-sudparis.eu
Dr. Maria del Mar Alonso	Spain	Use of social networks on travel decision making.	Prof. Claudia Ribeiro De Almeida	University of Algarve, Faro	PT	15	April, 2016	mar.alonso@uam.es
Prof. Silvana Stefani	Italy	Opinion dynamics models and complex networks	Prof. Candelaria Gil	Universidad de la Laguna, Tenerife	ES	21	April, 2016	silvana.stefani@unimib.it
Mr. Francisco Javier Diez de los Rios Mesa	Spain	Study of the interpretation and decision making around mobility by different typologies of passengers.	Dr. Bridgette Wessels	University of Sheffield	UK	90	May-July, 2016	Franmesa@ugr.es
Prof. Ana Margarida Barreto	Portugal	Predicting and Changing Travel Behaviour	Prof. Silvana Stefani	Università degli Studi di Milano-Bicocca	IT	13	Sep, 2016	ambarreto@fcsh.unl.pt

Name	Country	STSM topic	Host	Host institute and Country		No. of days	STSM Period	Mail
Dr. Reza Farahbakhsh	France	Enhance Urban Mobility by using available data sources	Prof. Eftihia Nathanail	University of Thessaly, Volos	EL	31	Oct-Nov, 2016	reza.farahbakhsh@it-sudparis.eu
Dr. Ainoa Serna	Spain	Innovative Travel data collection methods for Transport Planning	Dr. Odette Lewis	University of Malta	MT	52	Sep – Oct, 2016	aserna@mondragon.edu
Mr. Ioannis Karakikes	Greece	How travelers' behavior affects urban freight distribution	Dr. Mihails Savrasovs	Transport & Telecommunication Institute	LV	7	Sept, 2017	iokaraki@uth.gr
Mr. Vishnu Barajan	Portugal	Labeled data versus likert scales, analyzing its effect in the collection of travel behavior and ICT information	Prof. Francisco Pereira	Technical University of Denmark	DK	42	Sep-Oct, 2017	vishnu.baburajan@tecnico.ulisboa.pt
Dr. Ainhoa Serna	Spain	Transport survey method: using Social Media Big Data to study Travel Behaviour	Dr. Slaven Gasparovic	University of Zagreb	HR	32	Oct-Nov, 2017	aserna@mondragon.edu
Prof. Lidia Zakowska	Poland	Social Networks and Human Behaviour	Prof. Francesco Viti	University of Luxembourg	LU	12	Nov 2017	izakowsk@pk.edu.pl
Mr. Arkadiusz Drabicki	Poland	Investigation of impact of real-time crowding information systems on passengers' travel behaviour in public transport networks – SP survey design and validation	Prof. Achille Fonzone,	Edinburgh Napier University, Edinburgh	UK	21	Nov 2017	arkadiusz.drabicki@gmail.com
Dr. Stefano Pensa	Italy	Social Networks, Social Media usage & Travel Behavior among students in EU countries – Urban data analysis	Prof. Pnina Plaut	Technion	IL	11	Nov - Dec. 2017	stefano.pensa@polito.it
David Duran Rodes	Germany	Identification of leisure mobility patterns related to the use of social media	Prof. Pnina Plaut	Technion	IL	17	Nov-Dec 2017	davidduran@hotmail.com
Yuval Rubinstein	Israel	Social network - urban data analysis	Dr. Stefano Pensa	SiTI – Torino	IT	15	Dec. 2017	yuvrub@gmail.com
Dr. Domokos Esztergar - Kiss	Hungary	EU funded research projects in the field of Social networks and travel behaviour	Dr. Odette Lewis	University of Malta	MT	15	Jan 2108	esztergar@mail.bme.hu
Dr. Fariya Sharmeen	Netherlands	On the mutual transposition of individuals' social and travel geographies	Prof. Mario Cools	Univeristy of Liege	BE	92	Nov 2017-Jan 2018	F.Sharmeen@fm.ru.nl
Mr. Jesper Bláfoss Ingvardson	Denmark	The influence of perceived fairness, equity and social networks on location patterns and public transport use	Prof. João de Abreu e Silva	Instituto Superior Técnico, University of Lisbon	PT	28	Jan 2018	jbin@dtu.dk

1. Mr. Emmanouil Chaniotakis National Technical University of Athens (EL)

Period: 8/6/2015 – 26/6/2105

Host: Professor Bin Jiang. Faculty of Engineering and Sustainable Development, Division of Geomatics. University of Gävle, Sweden

STSM topic: Capturing the effect of social networks on human mobility behaviour using data from Social Media

Purpose

The main goal of this proposed STSM is to use data collected from Social Networking Services (SNS) to extract human mobility data that can be used in inferring human mobility activities and patterns. In the period leading to the STSM, preliminary data collection and analysis activities will be performed, to identify candidate locations for the analysis, as well as narrow down the methodological components of the research. This data would originate mainly from the open Twitter data and more specifically the georeferenced tweets of the chosen area. The data collected is going to be further analysed, in order to examine the capability of inferring activities and the related trips of the SNS users using content analysis tools. For each user collected data on their social network is also going to be used, in order to identify the capability of SNS on transportation related social network effects. Using activities, location and social network, analysis is going to be performed on transportation mobility patterns and the methodology of defining the effect social networks might have to the transport related choices.

Main results

More specifically on the results, it is believed that the existence of areas that are not represented by POIs indicates the advantages of exploring further this option for deriving dynamic AoI that can be used in transportation related models and applications. It is believed that this dynamic character might allow for the identification of the system that governs the choice of locations to be visited.

Furthermore the derivation of trips and the exploration of the distributional behaviour is also promising for understanding the behaviour of users tweeting from different locations and deriving trips based on the posted tweets. Although we did not found a clear scale-free behaviour that would allow for modelling trips derived in a scale-free context we believe that this is mainly due to the sample used and that larger samples should be explored for understanding the tweeting process that individuals undertake related to travel behaviour. This would allow for future investigation of the social networks in travel behaviour using social media.

2. Mr. Or Caspi, Technion - Israel Institute of Technology (IL)

Period: 14/6/2015 24/6/2015

Host: Professor Bin Jiang. Faculty of Engineering and Sustainable Development, Division of Geomatics. University of Gävle, Sweden.

STSM topic: Public transportation`s coverage of natural city: exploring twitter data for better understanding hotspots and public transportation.

Purpose

The aim of this STSM is to find whether the public transportation system in the City of London provide a satisfying coverage for the natural city of London, defined by its human activities. We chose to study London, United Kingdom, because of its very complex and well-established public transportation system. In this research, we focused on the city level and instead of using natural cities, we delineated patches of massive human activity within the city into natural hotspots. We defined these hotspots using one week's worth of Twitter data from the Greater London area. Twitter is a very popular social network that is used by a large variety of people across the United Kingdom, and thanks to its high spatial data availability, its data complimented our research objectives. We identified the hotspots and examined whether or not they followed the power law distribution. These hotspots were classified into different hierarchical levels using the head/tail breaks. Those in the head are more attractive, while those in the tail are less attractive. Then we superimposed the city's public transportation data on the top of the hotspots in order to examine the spatial factors of the public transportation's availability and to determine whether or not the city's public transportation covers human activity hotspots adequately.

Our research gives a new examination method for public transportation's efficiency by revealing the real patterns of human activity in the city and shows the gaps between the required and the actual public transportation's coverage.

Main results

We found that more than 99% of the tweet locations are within a reasonable walking distance from transit service. The main lines that cross many other routes cover more tweets relative to their measure of connectivity. We also found that most of the main hotspots are served well by the public transportation system. Our conclusions suggest a high level of efficiency in London's public transportation system.

Although London has a highly developed public transportation system, this method can also be applied in other natural cities with less complex public transportation systems. This method can be used to determine the areas in a city that require better service and also which areas have excessive services; allowing a city to use its resources most efficiently.

3. Prof. João António de Abreu e Silva, Instituto Superior Técnico, Lisbon, (PT)

Period: 1/7/2015 – 10/7/2015

Host: Prof. Juan de Oña, TRYSE Research Group - University of Granada Spain

STSM topic: Development of a web survey about travel behaviour and the use of web based social networks.

Purpose

This STSM had the following main interrelated objectives/tasks:

1. To perform a literature review about the influence of web based social networks on individuals travel behavior,
2. Based on the literature review, propose a conceptual model to be tested with purportedly collected data.
3. Design and implement a web survey about travel behavior and the use of web based social networks to be applied in several cities in Europe, the first candidates could be Lisbon, Granada, Copenhagen and Zagreb.

Based on the literature review, and on the answers of a previous simplified questionnaire about the relation of ICT usage and travel behavior it was decided to focus on social travel and the use of ICT and web based social networks and social media.

Main results

Previous literature relates several characteristics on social networks with travel behavior, in particular with travel related with social activities. Also, the relations between the use of ICT and travel behavior have been studied in the literature in particular the possibility that ICT's could substitute travel, complement travel or could eventually being neutral. As a result and based on these elements a series of potential research questions that the survey should contribute to respond were defined. These are the following:

- The nature of the relations between ICT and social media usage, and face to face social activities, are they complementary neutral or there are substitution effects?
- How do the use of social media and ICT interacts with social networks?
- How land use patterns interact with ICT usage and social activities? And how both contribute to a reduction or an increase in the activity space of students?
- How does the perception about the utility of social media and ICT and the satisfaction about its use relates to its usage for travel purposes?
- Does the use of ICT and social media contributes to more efficient travel?

Based on the literature review and on the research questions the final version of questionnaire was designed. The survey is planned to be implemented in three European cities at three universities: Lisbon, Granada and Zagreb.

Several hypothesis are been put forward when relating the use of ICT and travel behavior. One of the first was that the use of ICT would substitute travel. In general the hypothesis relating travel behavior and the use of ICT comprehend the following relations (Salomon, 2000, Mokhtarian and Salomon, 20002; Aguilera et al.,2014):

- Substitution;
- Generation, either by complementarity or by stimulation;
- Modification;
- Neutrality.

Several studies, in the context of different travel purposes (with a particular focus on social travel) and sociodemographic groups, tried to look at the relations between ICT and travel. Some examples include: van der berg et al (2013), Nobilis and Lenz, (2009); Yuan et al., (2009); Hjorthol and Gripsrud, (2009); Kourounioti et al. (2015); Kamargianni, and Polydoropoulou (2014); Wee et al. (2013); Sasaki and Nishii (2010); Paez and Scott, 2014; Lyne et al.,(2011).

Particularly relevant in this context is also the concept of activity fragmentation (Ben-Elia et al., 2014) - which could affect travel scheduling, activity participation and location, and multitasking (Kenyon and Lyons, 2007). Parallel to these analyses several studies looked at the composition and characteristics of social networks and social travel (Carrasco et al, 2008; Lin and Wang, 2014; Axhausen, 2008; Arentze and, Timmermans, 2008) and also its relations with ICT and land use patterns (Wang an Lin, 2013; Kwan, 2007).

4. Mr. Matthew Hanchard, Dept. of Sociological Studies University of Sheffield, (UK)

Period: 26/10/2015 to 30/10/2015

Host: Tom Julsrud, Institute of Transport Economics, Oslo (NO)

STSM Topic: Location-based services and urban navigation: a qualitative investigation of transport use in Oslo

Purpose

There were two purposes to this STSM: The first was primarily a means to carry out fieldwork. The five days allowed time to carry out five qualitative interviews, transcribe all relevant sections, and carry out analysis using the pre-existing coding scheme from my PhD. The second, was to build a relationship with the host institution and supervisor as a platform for future work.

As tangible objectives, and ongoing work beyond the STSM, I plan to draw out a deeper analysis of the findings, and work collaboratively with the host supervisor in order to draft a short research paper/report for the STSM. This will be submitted by July 2016.

Main results

There were several interesting findings drawn from interviews, which will be elaborated on in short research paper/report. For example, following the pre-set coding scheme, three are of interest to potential future work:

1. *Generational differences in the organisation of social networks* - Age does not necessarily

stratify social media use, but rather social networks amongst older participants hold more rigidly hierarchical structures with 'group leaders' carrying out a centralised function or social role as information source. Often, social media used as one means amongst many for communication. This contrasts younger interviewees' accounts of a more horizontally organised set of relations amongst social network members, that use social media extensively - commensurable with network theory.

2. Diverse levels of ICT engagement in everyday travel routines - In planning travel routes, there are a diverse range of engagement levels with ICT's. This should not to be conflated with technological capability, or access to digital resources.

3. Online-offline entanglement of resources - In making decisions on what to do, and where to go, social networks are central - both for gaining information and to co-ordinate activity. Social networks can be both online and offline. To understand how social networks are incorporated into everyday life and the effect on travel behaviour, it is important to understand how online-offline entanglements are negotiated.

5. Dr. Helen Carter, Aalborg University, Aalborg (DK)

Period: 1/11/2015 to 18/12/2015

Host: Sven Kesselring, Nürtingen-Geislingen University, Geislingen (DE)

STSM Topic: Young People's Mobilities, Socio-Spatial Networks and Urban Space

Purpose:

The purpose of the STSM was to work on a review of existing literature on young people's mobilities, socio-spatial networks and place, together with beginning to develop concepts and methodologies for researching the connections between these areas. The work was specifically proposed to cover a literature review, work on qualitative visualization methodologies and groundwork for further collaboration with Professor Kesselring and participation within the wider COST Action.

Main results

I can make some initial conclusions regarding gaps in the literature which could be addressed in future research on young people and mobilities.

The first conclusion is the need for an increased focus on the holistic study of different forms of mobilities, through focusing on virtual and communicative mobilities, as well as physical mobilities. Although this is becoming increasingly common, the starting point of studies is often physical mobility, which is then subsequently connected to other forms of mobilities.

This leads to the second conclusion – that an implicit focus on physical mobility as a starting point leads to a definition of physically mobile people as the de facto interesting individuals for study. This means there is often an exclusion of those who are apparently 'physically immobile', and the study of how they use different forms of mobilities.

Finally, there is a wide variety of literature on different types of transnational mobilities of young people, which points to many interesting debates regarding mobilities, identities, belonging and relations to place, but there is potential for greater consideration of the regional, urban and rural mobilities of young people, where similar ideas could potentially be applied and debates taken up for discussion.

These conclusions are anticipated to form the basis of potential future research in the area of young people's mobilities and socio-spatial networks, working at the intersection of geography, sociology and urban planning.

6. Dr. Patricia Melo, The James Hutton Institute, Aberdeen (UK)

Period: 16/11/2015 to 7/12/2015

Host: João de Abreu e Silva, Instituto Superior Técnico, University of Lisbon, Lisbon (PT)

STSM Topic: Home-Based Telework, Residential Location and Intra-Household Dynamics

Purpose

The aim of the STSM was to investigate the impacts of home-based teleworking on travel behaviour and residential location using individual and household data. The STSM had the following main objectives:

1. Carry out a literature review on home-based teleworking and its effects on travel behaviour and residential land use patterns.
2. Measure the indirect impact of home-based teleworking on partner's travel (work and non-work travel).
3. Examine the potential land use effects of home-based teleworking relating to urban sprawl and counterurbanisation, by estimating the relationship between residential location and home-based teleworking.

Main results

The main findings obtained from the regression analyses are summarized below:

- Home teleworkers, and their households, have longer one-way commute distances and journey times, compared to non-teleworkers and their households.
- The longer total household commutes derive exclusively from the longer commute distances and travel times of home teleworkers, and there is no compensation effect from reduced commute distance and travel time of the partners of home teleworkers. That is, non-teleworker's commute distances and travel times are not statistically significantly affected by his/her partner's home telework status.
- Despite the increase in the proportion of workers using home telework, from 3.8% in 2005 to 5.9% in 2012, the magnitude of the effect does not seem to have changed over the period studied.

These findings have some implications for urban policy and spatial planning, principally policies relating land use and transport interactions. In particular, the results suggest that the possibility of working from home might affect residential location decisions of individuals to live further away from their places of work, and consequently make fewer but longer trips. This, in turn, can contribute to more urban sprawl especially in the context of a greater centralization of jobs compared to (greater decentralization of) residences and thus can also be associated with an increased jobs-household imbalance and excessive commuting (e.g. Chowdhury et al., 2013). However, the analysis carried out does not allow testing directly the hypothesis that households with home teleworkers are more likely to live in suburban and peri-urban areas of large cities and metropolitan areas.

7. Ms. Rumana Islam Sarker, Institute for infrastructure, Unit for intelligent transport systems, University of Innsbruck (AT)

Period: 5/2/2016 to 5/4/2016

Host: Sigal Kaplan, DTU-Transport, Technical University of Denmark, Lyngby (DK)

STSM Topic: **The use of social media in public transport to understand the passenger preferences**

Purpose:

This STSM had the following main interrelated objectives/tasks:

- Conducting a thorough literature review regarding the role of social networks and social media platforms for receiving and sharing transit information
- Proposing a conceptual framework for analysing the factors underlying the willingness to share and receive transit information across transit users via virtual platforms and networks. A new methodological approach has been explored by combining elements from Ajzen's Theory of Planned Behavior, Davis's Technology Acceptance Model, Schwartz's Norm Activation Model and Alderfer's ERG model.
- Developing and designing a survey on the basis of the proposed behavioural framework to be administered in Austria and Denmark.
- Establishing cross-national collaboration between Denmark, Austria and the Netherlands and a cross disciplinary collaboration between psychologists and transport modellers.
- Preparing abstract and submitting to the European Regional Science Association Congress (ERSA 2016) to be held in Vienna, 23-26 August 2016. The title of the paper is "The use of social media in public transport to understand the passenger preferences and increase the user satisfaction" co authored by Rumana Islam Sarker, Sigal Kaplan, Sonja Haustein and Otto Anker Nielsen
- Preparing another abstract and submitting to the European Association for Research in Transportation (hEAR2016) conference to be held in Delft, The Netherlands, 14 - 16

September 2016. The paper title is “Understanding transit user’s intention to voluntarily share transit information through social media” co-authored by Rumana Islam Sarker, Sigal Kaplan, Sonja Haustein, Otto Anker Nielsen, Harry J. P. Timmermans.

Main results

The working visit resulted in an innovative conceptual framework and a quantitative model to understand one’s own information needs, recognizing the information needs of others and the transformation process. This will enable users to move from passive to active by sharing information, which is a crucial element in the success of PT systems. The formulation of conceptual framework was complex and it is till date first of its kind in transport planning. It is expected that, this survey will help to understand if encouraging reciprocity and active involvement of users by enabling them to share information can increase consumer loyalty and information quality. It will also identify whether with the help of social media, people can obtain information about alternatives and update their expectations of the outcomes of their choices from their social network members.

As the survey is expected to conduct from 25.04.2016, considering the two countries, the required sample size is roughly 500 completed questionnaires for each country. The hypothesized behavioural framework will be investigated by formulating a structural equation model (SEM) of the need to model simultaneously endogenous latent constructs, their relationship with exogenous observed variables, and their correlation pattern.

8. Dr. Reza Farahbakhsh, Institut Mines Telecom, Telecom Sud Paris, CNRS Lab (FR)

Period: 26/4/2016 to 30/4/2016

Host: Eftihia Nathanail, University of Thessaly, Volos (EL)

STSM Topic: iTrip, a Framework to Enhance Urban Mobility by Leveraging Various Data Sources

Purpose:

In this research work, we aim to provide a framework to enhance urban mobility by leveraging all these various source of data and provide different range of services to different group of customers.

Main results:

The framework introduced in this research work, namely iTrip, provides various types of innovations that can be implemented for providing different services for different customers in urban mobility. Firstly we overview comprehensively the literature and identified some existing gaps. Next we propose a framework including different modules and component. The iTrip framework is an integration of all these studies with a rich information set that can be used to implement very accurate decision making systems with new technologies such as cloud based IoT analysis systems. Lastly a list of future ideas is proposed based on the iTrip framework.

9. Dr. Maria del Mar Alonso Almeida, Autonomous University, Madrid (ES)**Period:** 17/4/2016 to 30/4/2016**Host:** Claudia Ribeiro de Almeida, University of Algarve (PT)**STSM Topic:** Use of social networks on travel decision making**Purpose:**

- Understanding the link between social networks and travel behavior in the context of leisure travel.
- Creating a measure tool in order to collect information.
- Diffusing the questionnaire.
- Analyzing the data collected.
- Writing the report and diffusing the results.
- Working together in the chapters of the book “Social networks, mobility and urban form” which results from the Working Group 1 meetings (Cost Action TU 1305).

Main results

A pre-test of the questionnaire was conducted in Spain and in Portugal among bachelor students. A total of 58 questionnaires were filled, 36 in Portuguese and 22 in Spanish. The report only contains some relevant questions but it will be widened with the rest of information for the deliverables developed as a result of this STSM. Questionnaire contained information about type and source of information before, during and after the trip. Also, WhatsApp use was asked. Some of the main results are discussed in the report.

10. Prof. Silvana Stefani, Università Milano Bicocca, Milano (IT)**Period:** 11/4/2016 to 30/4/2016**Host:** Candelaria Gil, Universidad de la Laguna, Tenerife (ES)**STSM Topic:** Opinion dynamics models and complex networks**Purpose**

This STSM aimed at generating a collected bibliography and understanding models of opinion dynamics especially in social fields and related issues.

Main results

The research with Candelaria Gil Fariña has been conducted along two parallel topics:

1. **From the theoretical point of view:** the conditions under which the system may converge towards a uniform opinion or fragmented consensus have been studied. Taking some results from Markov chains theory, it is possible to show that if the network is strongly connected, uniform consensus may be reached. Extending this known result to weakly connected networks or even non connected networks is hard. Berger's Theorem (1975) gives necessary and sufficient conditions for a uniform consensus when there may be absorbing states in the system. In terms

of networks, this corresponds to the case in which the adjacency matrix is reducible, i.e. the system is at best weakly connected. In this setting, it may be helpful to recur to the Gantmacher form of a square matrix. The essential classes (and inessential classes) may correspond to absorbing states (or transient states). Logically, the central agents should locate in the essential classes. As a consequence, to check for consensus, it would be enough to check on essential classes. In fact, Berger's theorem shows that inessential agents do not count in forming consensus. However, the concept of centrality (hubs and authorities) is not so clear cut as in the strongly connected case. Through simulation and using the most known type of networks (Erdos-Renyi, Random, small worlds,...), we have built counterexamples where eigencentral agents are located in inessential classes and other examples where essential agents are pendant nodes. Thus, new concepts of centrality must be introduced, like centrality for communities (block centrality) or eigen-indegree – combined centrality. This may be interesting since, in the case of a constant attention, “central” agents can be detected at once and consensus, or at least a majority, can be obtained just by looking closely at those central/essential agents. Another possible way is to apply the Page Rank algorithm (the Google algorithm for net surfing) for overcoming to get stuck into an absorbing state. In other words, the system becomes strongly connected, even if in fact it is not at the beginning. This may have practical and sound applications. However, this may introduce biases since the system changes.

2. From the application point of view: Candelaria Gil takes part of a national project titled “Big data, social networks and data journalism: using computer tools for sources and journalistic content analysis” (01/01/2014 - 31/12/2017: Chief Researcher: Carlos Elías, Universidad Carlos III, Madrid). The project focuses on Big data analysis and the application of some digital tools for monitoring data in order to detect behavioural patterns and relevant trends in the flows of information that are generated in the social networks. She is also interested in the issue of opinion dynamics and related topics in various fields, not necessarily related to urban mobility, for instance, biology, psychology and periodism. In particular, this last field may have interesting relationship with urban mobility. While the theory of opinion dynamics is somehow established and it is easy to proceed towards extensions of it, the applications may hide in a lot of different publication sites and journals. However, this is exactly what we are investigating, that is finding applications that are not even seen as opinion dynamics but in fact they are.

The results of this investigation on different fronts will be part of future articles and of the Chapter of the book “Social Networks in Mobility and Urban Environment” that will be published within this same COST project and of which I am the coauthor of the chapter, Opinion Dynamics Models and Complex Networks.

11. Mr. Francisco Javier Diez de los Rios Mesa, Universidad de Granada (ES)**Period:** 1/5/2016 – 29/7/2016**Host:** Bridgette Wessels, University of Sheffield, Sheffield (UK)**STSM Topic:** Study of interpretation and decision making around mobility by different typologies of passengers**Purpose:**

Our goal with this STSM was to contribute to the exchange of different personal experiences and to assess the role of Social Media on travel behaviour in different urban settings.

This STSM had 5 main interrelated tasks:

1. Literature review on decision making.
2. Identify existing data sets on trip patterns in 2 different scenarios: (a) extra demand on travel services i.e. extra demand due to refugee travel; (b) multiple routine trips in travel i.e. travelling across Sheffield City region. Only, in the second scenario was possible to identify data sets.
3. Explore if social media such as twitter, Instagram, Facebook, etc., can inform our understanding of decision making in travel.
4. Design and conduct qualitative interviews, specifically, semi-structured interviews with passengers (10 in each scenario) and with transport providers in each scenario (5 in each scenario). Only 10 passengers and 2 transport providers were interviewed in the second scenario (Sheffield City region).
5. Develop a survey based on the extracted conclusions from semi-structure interviews.
6. Analyze and develop a preliminary model of decision making based on qualitative data and assess how researching on travel decision making can be further developed by large scale quantitative analysis.

Main results

The current literature in this area is lacking. One possible reason is that field has started to be researched in the beginning of this century. The brief literature shows that Social Media has three main functions: The first one is like a source of data. Operators and other companies use Social Media like a useful tool to extract different kind of data (e.g. opinions, patterns, behaviours, etc). This fact allows to develop strategies of marketing which are focused on specific profiles or take decisions about how the company should work or improve their services. The answers in the operators' interviews show that the PT operators are starting to use Social Media in this way. Passengers' feedbacks are current used by them in order to improve their services.

The second one is like a variable. Operators and researchers use Social Media in studies about service quality, to understand travel behaviour, develop models of mobility, etc. Although, it can be a useful way of using Social Media, operators do not use it currently. It is possible to extract from operators' interviews that they do not have integrated this aspect in their researches. In

the best of the cases, they ask about their performance through social media in satisfaction passenger surveys.

And finally, like a way of communication in disruption events. Although Social media used to be used in this way in habitual situations too, like a customer service. This is the main function of Social Media for PT operators. In the interviews, they said that is crucial Social Media in order to help passengers and provide quick information in disruption events. It is important to highlight that in the survey, passengers showed that they are not satisfied with the current service of operators in disruptions events and it is an aspects should be improved.

The answers in the passengers' interviews show Social Media is totally integrate in the lifestyle of young people and, PT represents a crucial support in order to do social activities. Another interesting point is the use of Social Media in the journeys. People difference two main uses: Social Media to organize the activity and Google Maps, PT Apps or Websites to plan the journey.

12. Dr. Ana Margarida Barreto, NOVA University, Lisbon (PT)

Period: 12/9/2016 – 24/9/2016

Host: Silvana Stefani, Università degli Studi di Milano-Bicocca, Milan (IT)

STSM Topic: Predicting and Changing Travel Behaviour

Purpose

- a) Foster new academic collaborations,
- b) Investigate the current state of the art,
- c) Continue designing and implement empirical research studies, meaning to continue working in a research proposal to pursue further in time.

Our aim is to provide with further understanding of consumer decision- making process in this domain, at individual and social level and to identify possible different travel behavior patterns. A major challenge is to develop models for ICT-impacts, combining behavioral realism with (econometric) tractability. These findings are expected to contribute to future communication campaigns on urban mobility.

Main results

- Clear formulation of the research problem
- Specification of a the dependent and independent variables
- Preliminary exploration of an empirical research design.
- Initial steps towards the implementation and evaluation of the research proposal.

13. Dr. Reza Farahbakhsh, Institut Mines Telecom, Telecom SudParis, CNRS Lab (FR)

Period: 15/9/2016 – 15/10/2016 (actual 30/9/2016 – 8/10/2016)

Host: Eftihia Nathanail, University of Thessaly (TTLog), Volos (EL)

STSM Topic: Enhance Urban Mobility by using available data sources

Purpose:

- Extend the proposed framework in the previous STSM in modules based on available data categories
- Setting the roadmap for implementing the proposed framework in future.
- Extended literature review

Main results

The framework introduced in this research work, namely iTrip, provides various types of innovations that can be implemented for providing different services for different customers in urban mobility. Firstly we overview comprehensively the literature and identified some existing gaps. Next we propose a framework including different modules and component. The iTrip framework is an integration of all these studies with a rich information set that can be used to implement very accurate decision making systems with new technologies such as cloud based IoT analysis systems. Lastly a list of future ideas is proposed based on the iTrip framework.

14. Dr. Ainhua Serna, MONDRAGON UNIBERTSITATEA, Arrasate-Mondragon (ES)

Period: 11/9/2016 - 31/10/2016

Host: Odette Lewis, University of Malta, Msida MSD 2080 (MT)

STSM Topic: Innovative Travel Data Collection Methods for Transport Planning

Purpose:

The availability of mobility information based on social networks will contribute positively to studies of Transportation Planning and the ongoing work carried out by the University of Malta regarding the preparation of reports relating to mobility plans, service plans of public road transport and mobility studies in general.

Dr. Ainhua Serna will contribute with using online social networks to study the characteristics of tourist destinations as an explanatory factor of mobility for leisure reason. The results of the stay will be especially useful in areas related to the mobility of people in urban areas, especially public administrations with responsibility for urban transport.

Main results

The Work Plan has been fulfilled, including the identification of the data sources with user generated content; the measure the quality and quantity of the data, the identification of the data gathering techniques and tools for each source; the analysis of the data Through Conceptual framework, taxonomy, natural language processing (NLP) techniques and sentiment analysis; the Design of the persistence layer, defining the appropriate formats depending on the type, quantity and dynamic characteristics of each data. Finally, the Integration of heterogeneous data to homogenize all information.

The number of topics related to mobility is relevant on Traveller social networks (TripAdvisor,) since social media is a great tool for communication and meeting point. The analysis of that type of information can be very important for travel behaviour analysis.

Information and Communication Technologies (ICT) offer the opportunity to improve traditional survey methods to collect travel behaviour data, decreasing bias in the data, reducing respondent burden, and increasing data quality.

Social media have become a valuable source for knowledge but there is a big gap in the automatic Sentiment Analysis with Semantic taxonomy annotation of online textual content. Specifically, the UKB and morphosyntactically Analyser inexistent for some languages. UKB is a collection of programs for performing graph-based Word Sense Disambiguation (WSD) and lexical similarity/relatedness using a pre-existing knowledge base.

The type and focus of discourse has to be with the type of social media. In this sense, as TripAdvisor is a network of travellers, it makes sense that the highlight is the experience and the person who helps building that experience, the guide. Positive and memorable experiences have an important presence in TripAdvisor. In Twitter and Facebook users in general are local users writing daily experiences. In TripAdvisor incidents are almost non-existent. The type of discourse does not depend only on the type of user but on the channel. Significantly, the comments of TripAdvisor are mainly positive. The experience usually depends on the type of user, i.e. daily user or tourist, since for the latter ones are mainly leisure experiences, which means better organization with a guide and other facilities that make the user enjoy the destination.

Our approach enriches the data of the traditional surveys, extends traditional analysis with Big-Data methods, using data mining algorithms and Natural Language Processing techniques to extract urban mobility information from Social Media data.

15. Mr. Ioannis Karakikes, University of Thessaly, TTLog (EL)

Period: 17/9/2017 - 23/9/2017

Host: Mihails Savrasovs, Transport and Telecommunication Institute (LT)

STSM Topic: How travelers' behavior affects urban freight distribution

Purpose:

The main goal of this STSM was to shape an idea about modeling and evaluating a number of smart logistics solutions, considering also travelers' behavior change. This would be achieved by deploying different "what if" scenarios in a traffic micro simulation tool (VISSIM) and a multi-method simulation software (AnyLogic), that the Host Institute uses. The integration of the interfaces of the two different simulation softwares (VISSIM and AnyLogic) was also a goal of this STSM. By completing the integration, we will have the chance to explore any modeling possibilities that may arise from it and investigate how it can contribute to the achievement of the main goal.

This STSM aimed also at setting the grounds for future collaborations

Main results

By changing the values of various input parameters of the model (see below) and comparing the base scenario with “what if scenarios” we were able to see the improvement or deterioration achieved. Specifically, in the abstract model a 10% decrease in (1) & (2) and a 10% increase in (3) & (5) indicated a 4,5% decrease in CO2 emission of the designed network.

Input parameters that were altered in the “what if scenarios”

- 1) Volume of the transferred cargo
- 2) Number of distribution vehicles
- 3) Capacity of the cargo vehicles
- 4) Geometrical characteristics of the UCC (entrance location, number of loading/unloading bays)
- 5) Traffic volumes on the transport network around the UCC

The effort of integrating the interfaces of the two softwares is on-going.

16. Mr. Vishnu Baburajan, Instituto Superior Tecnico (PT)

Period: 20/09/2017 - 31/10/2017

Host: Francisco Pereira, Technical University of Denmark (DK)

STSM Topic: Labeled data versus likert scales, analyzing its effect in the collection of travel behavior and ICT information

Purpose:

The objective of the STSM was to propose and develop a framework to compare the responses from Likert scale with those of open-ended questions. The second objective focused on estimating the loss of information with the use of Likert scales, over open-ended questions. This would allow researchers to address issues related to both the approaches and improve the quality of data collection.

Main results

To better understand the state-of-the-art, a literature review focusing on use of Likert scales and open-ended questions to measure attitudes and their associated issues were carried out. In addition to this, the developments in the field of Machine Learning, importantly in topic modelling was also carried out to know how open-ended responses could be analyzed.

The questionnaire was developed based on the Theory of Planned Behavior (TPB). The focus was on measuring the intention to use autonomous shuttle service. Two formats of the questionnaire were used, the first relies only on Likert scales, while the second uses a combination of Likert scales and open-ended questions.

Before the launch of the final version of the survey, a pilot survey was carried out, which helped fine-tune the questionnaire further. The full survey will be launched among staff and students of Technical University of Denmark (DTU). After the collection of the responses, a detailed

exploratory analysis will be carried out to identify patterns. This will also help identify some of the common pitfalls associated with the use of Likert scales, such as overestimation of attitudes, midline/outlier confusions, etc.

An extended abstract summarizing the research findings and the methodological contributions from the STSM were submitted to the “International Association for Travel Behavior and Research (IATBR)” conference, 2018.

17. Dr. Ainhoa Serna, MONDRAGON UNIBERTSITATEA, Arrasate-Mondragon (SP)

Period: 12/10/2017 to 12/11/2017

Host: Slaven Gasparovic, Department of Geography, Faculty of Science, University of Zagreb (HR)

STSM Topic: Transport survey method: using social media big data to study transport behaviour.

Purpose

The goal of the stay has been to propose a qualitatively and quantitatively approach to investigate the tourists’ satisfaction according by transport mode used. The methodology implemented in the research have included data collection from *TripAdvisor.com* with geographic locations and their integration with statistical territorial data. Sentiment analysis techniques have been applied in order to assess tourists’ perceptions on success factors, which may be used as planning support tools. The case study is focused on Croatia and has demonstrated the complementarity and value of social media-related data jointly with official statistics in tourism planning.

Main results

- One of the main results have been the elaboration and submission for CIT 2018 Conference.
- Moreover, the results and interpretation obtained of the Sentiment analysis from Social Media.
- Another contribution, is the creation and sharing of a Sentiment Labelled Sentences Data Set as training dataset for supervised learning algorithm and to publish the analysed data set (polarity analysis, positive data set and negative dataset) as Open Data for reuse of researchers from around the world.
- Finally, the elaboration of a data visualization with a dashboard panel.
- The results of the stay have been especially useful in areas related to the mobility of people in urban areas, especially public administrations with responsibility for urban transport.

18. Prof. Lidia Zakowska, Cracow University of Technology (PL)

Period: 06/11/2017 - 17/11/2017

Host: Francesco Viti, University of Luxembourg (LT)

STSM Topic: Social Networks and Human Behaviour

Scope:

- Evaluation of the future mobility that is based on social needs in modern societies
- Integration of social mobility and public transport plans with advanced methods of data collection

19. Mr. Arkadiusz Drabicki, Cracow University of Technology, Kraków (PL)**Period:** 6/11/2017 – 26/11/2017**Host:** Achille Fonzone, Edinburgh Napier University, Edinburgh (UK)**STSM Topic:** Investigation of impact of real-time crowding information systems on passengers' travel behaviour in public transport networks – SP survey design and validation**Scope:**

Designing a passenger survey, which would help us to understand travel behavior in the event of access to realtime crowding information i.e. a novel, feasible ICT (ATIS) solution which is likely to be implemented in urban public transport systems in the near future.

20. Dr. Stefano Pensa, SiTI – Higher Institute on Territorial Systems for Innovation (IT)**Period:** 12/11/2017 - 24/11/2017**Host:** Pnina Plaut, Technion - Israel Institute of Technology (IL)**STSM Topic:** Social Networks, Social Media usage & Travel Behavior among students in EU countries – Urban data analysis.**Scope:**

Evaluation of travel behaviors and usability of data for urban analysis, based on GIS software

21. Mr. David Duran Rodas, Technical University Munich, Munich (DE)**Period:** 29/11/2017 – 15/12/2017**Host:** Pnina Plaut, Technion - Israel Institute of Technology (IL)**STSM Topic:** Identification of leisure mobility patterns related to the use of social media**Scope:**

Building a model to identify leisure-related mobility patterns related to the use of social media.

22. Mr. Yuval Rubinstein, Israel Institute of Technology (IL)**Period:** 10/12/2017 - 24/12/2017**Host:** Stefano Pensa, SiTI – Higher Institute on Territorial Systems for Innovation (IT)**STSM Topic:** Social network - urban data analysis**Scope:**

- Understand the opportunities of extracting mobility related information out of the questionnaire about Social Networks, Social Media usage & Travel Behavior among students in EU countries
- Analyze raw data using Geographic Information Systems
- Provide a literature review document
- Identify a list of potential indicators based on the review

23. Dr. Domokos Esztergar - Kiss, Budapest University of Technology and Economics (BME) (HU)

Period: 13/01/2018 - 27/01/2018

Host: Odette Lewis, University of Malta (MT)

STSM Topic: EU funded research projects in the field of Social networks and travel behaviour

Scope:

Initiate a new collaboration framework for the various EU research groups that develops a new transport paradigm based upon ICT social networks and their subsequent travel behavior in the urban environment.

24. Dr. Fariya Sharmeen, Radboud Univeristy Nijmegen (NL)

Period: 01/11/2017 – 31/01/2018

Host: Prof. Mario Cools, University of Liege (BE)

STSM Topic: On the mutual transposition of individuals' social and travel geographies

Scope:

Understanding the mutual transposition of social networks and travel behaviour of individuals:

- Understanding spatio-temporal diversity of activity-travel profiles of individuals with reference to accessibility and geographical attributes.
- Estimating the correspondence of (a) with their social network composition and mode of interaction (including the role of social media).

25. Mr. Jesper Bláfoss Ingvardson, Technical University of Denmark, Kgs. Lyngby (DK)

Period: 04/01/2018 – 31/01/2018

Host: João de Abreu e Silva, CESUR/CEris, Lisbon (PT)

STSM Topic: The influence of perceived fairness, equity and social networks on location patterns and public transport use

Scope:

- Investigating the interrelationships between travel behavior, peer pressure due to social networks, location patterns and land use characteristics, level of service of public transport, and perceptions of fairness and equity through on line survey results among students in Lisbon and Copenhagen. Re-estimation of models and Paper writing.

Training School, Gavel, Sweden

6. Training school in Gavle, Sweden June 13th- 17th 2016:

Topological and Scaling Ways of Thinking for Social Networks and Travel Behavior

Summary by Prof. Bin Jiang

Current geospatial analysis is highly constrained, consciously or subconsciously, by Euclidean geometry and Gaussian statistics in the sense of geometric details such as locations, directions, and sizes, and these geometric details are with a well-defined mean and small variance. These two ways of thinking – Euclidean geometric and Gaussian statistical – suffer from some major disadvantages that prevent us from developing new insights into the underlying complexity of geographic phenomena, e.g., social networks and travel behavior. On the other hand, topology without geometric details, fractal geometry, which is under the third definition of fractal: *a set or pattern is fractal if the scaling of far more small things than larges recurs multiple times or with the ht-index being at least three* (Jiang and Yin 2014), and power law statistics represent new perspectives for geospatial analysis, particularly in the era of big data, for better understanding social networks and travel behavior.

Given the circumstances, we organized the summer school on alternative geospatial analysis methods surrounding topological and scaling ways of thinking. These methods include for example head/tail breaks (Jiang 2013), ht-index (Jiang and Yin 2014), topological analysis (Jiang and Claramunt 2004), complex networks, and agent-based simulations in various applications of pedestrian modeling and human evacuation. The summer school was further motivated by the emerging big data harvested from the Internet and social media such as OpenStreetMap, Flickr, Twitter, and Brightkite, which provide a new instrument for transport research and human mobility (Jiang and Miao 2015). Big data differs fundamentally from small data in terms of basic data characteristics such as accurately measured or roughly estimated, individual-based or aggregated, and massive or small amounts. Big data also differs fundamentally from small data in terms of the data analytics that surround these two ways of thinking, geometrically and statistically.

The summer school was combined with lectures, hands-on exercises, discussions, and projects. We provided related data obtained from OpenStreetMap, Twitter, Brightkite, and Gowalla for the hands-on parts. We offered a brainstorm session that had led to some joint publications among the participants. Over 20 young researchers (PhD students and postdoc researchers) and three senior instructors have one-week intensive discussions and exchanges during the five-day summer school. For more details about the summer school, one can refer to this site: <http://www.tu1305.eu/content/training-school>

Organizer:

Bin Jiang, PhD and Professor
Faculty of Engineering and Sustainable Development, Division of GIScience
University of Gävle, SE-801 76 Gävle, Sweden. bin.jiang@hig.se

Trainers:

- Prof. Bin Jiang, University of Gävle, Sweden
- Dr. Marija Mitrovic Dankulov, University of Belgrade, Serbia
- Prof. Toshi Osaragi, Tokyo Institute of Technology, Japan
- Prof. Itzhak Omer, Tel Aviv University, Israel

Trainees:

Name	Country	Status	Institute	Research field
Joris Becker	Belgium	PhD student	University of Antwerpen	Geography
Gaëtan Montero	Belgium	PhD candidate	Université Catholique de Louvain	Geography
David Kocich	Czech Republic	PhD student	Institute of Geoinformatics, VSB - Technical University of Ostrava	Geoinformatics (physical geography)
Xiaoyan XIE	France	post doc	LVMT (Laboratoire Ville Mobilité Transport) École Nationale des Ponts et Chaussées (ENPC)	PT (modelling, simulation, evaluation); Traffic flow theory; Urban mobility
Jakub Krukar	Germany	post doc	University of Munster	Geo-informatic (Psychology & architecture)
Kornilia Maria Kotoula	Greece	PhD candidate	Centre for Research and Technology/Hellenic Institute of Transport (CERTH/HIT)	Transport research
Dalit Shach Pinsly	Israel	Dr. (MC member)	Technion	Architecture + Urban Planning
Yoav Lerman	Israel	Dr.	Ben Gurion University	Geography (mba, computer sci)
Yuval Rubinstein	Israel	M.Sc. student	Technion	Architecture + Urban Planning
Nir Kaplan	Israel	PhD student	Tel Aviv University	Geography and urban planning

Name	Country	Status	Institute	Research field
Karim Keramat Jahromi	Italy	PhD student	Milano University	Computer science
Stefano Pensa	Italy	post doc (MC Sub)	Politecnico di Torino	Architecture / geoVisualisation / accessibility of public spaces
Daniele Oxoli	Italy	PhD student	Dept. of Civil and Environmental Engineering, Politecnico di Milano, Como Campus	Geomatics // analysis and manipulation of geospatial data
Odette Lewis	Malta	Dr (2013) MC member	University of Malta	Transport engineering, decision making policy
Luis Fernando Santa	Portugal	PhD student	Universidade Nova de Lisboa	Geomatics
Francisco Pedro Luque	Spain	Researcher	CeDInt-UPM (Center of energy efficiency), Madrid	Telecommunications Engineering (M.Sc) Virtual Reality
Maria del Mar Alonso	Spain	Dr. (2007) (MC S member)	Autonomous University of Madrid	Economics and Business Administration, Tourism
Anastasios Koutoulas	Sweden	PhD candidate	KTH Royal Institute of Technology, Stockholm, Sweden	Transportation engineering
Ding Ma	Sweden	PhD student	University of Gävle	Geospatial Information Science
Leonard Nilsson	Sweden	PhD student	Chalmers University of Technology	Architecture, Software development, GIS

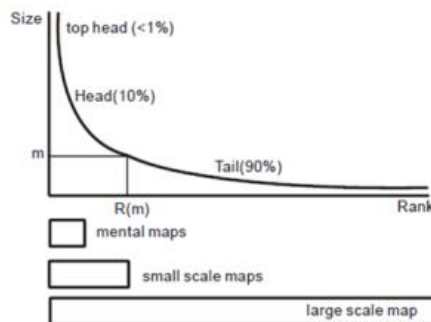
Training school summary

Presentation in London Meeting 10.11.16 by Arch. Yuval Rubinstein, Israel.

2 ways of thinking: Topology and scaling Paradigms | Fractal Theory

Head/tail division rule

Given a variable X , if its values x follow a heavy tailed distribution, then the mean (m) of the values can divide all the values into two parts: a high percentage in the tail, and a low percentage in the head.



Head/tail breaks thinking

- AT&T
- Britinica
- National mapping agency
- Governments/CNN
- Skype
- Wikipedia
- OpenStreetMap
- WikiLeaks(OpenLeaks)



Scale free; Average free; Differentiation;
Adaptation: Geometric, Topological, Semantic

2 ways of thinking: Topology and scaling Paradigms | Fractal Theory

Conclusion

- We need to shift our paradigm from geometric to topological, from the Gaussian thinking to something, which is "more normal than normal".
- The paradigm shift is a de fact shift from Newton's physics metaphor to a biological metaphor, focusing on the individual interactions from the bottom up.
- We need to shift our paradigm from computational science (since the invention of computers) to data-intensive computing (since the 21st century), in order to uncover the underlying forms and processes geographic space and society.

Linked to the COST Action

The duality of social networks

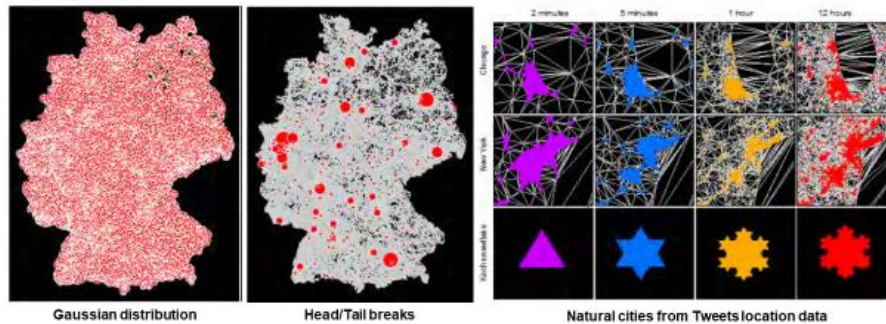
- A new method of analysis – a complex network approach to complexity of society, e.g., small world, scale free, community detection, hierarchy
- A new way of data collection – location based social media, e.g., Flickr, Twitter, and Brightkite

In terms of collective traffic flow, there is no much difference between human beings and random walkers.

Fractals or living structures emerged from big data; "Natural Cities" Lab

The notion of natural cities

Natural cities refer to objectively or naturally defined and delineated human settlements, or surface, human activities in general on the Earth's using massive geographic information of various kinds, and based on head/tail breaks.



Space Syntax Modeling and Urban Morphology

Space syntax principles

- large-scale space is beyond human body perception, and cannot be perceived from a single viewpoint;
- small-scale space is presumably larger than the human body, but can be perceived from a single viewpoint.

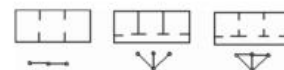


FIGURE 1 Closed building plans and their connectivity graphs

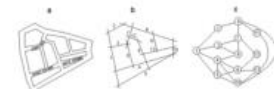
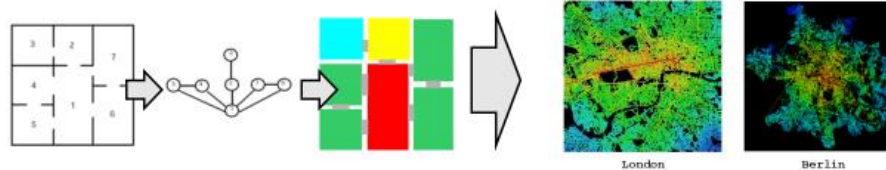
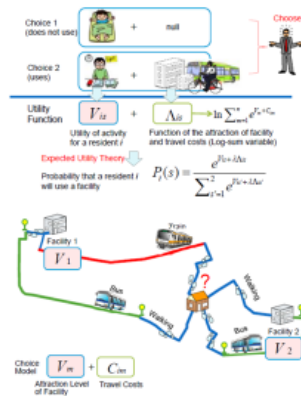


Figure 1: A Active urban system (a), its axial map (b) and connectivity graph (c)

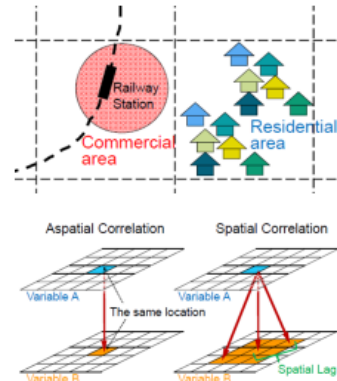


Thoshihiro Osaragi: Choice Behavior Model; Spatial Correlation Analysis



Choice Behavior Model

Choice model = Attractiveness of facility + travel cost

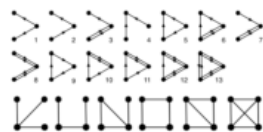


Spatial Correlation Analysis and its Extension to Road Network Spaces

Marija Mitrovic Dankulov: Complex networks theory: an introduction

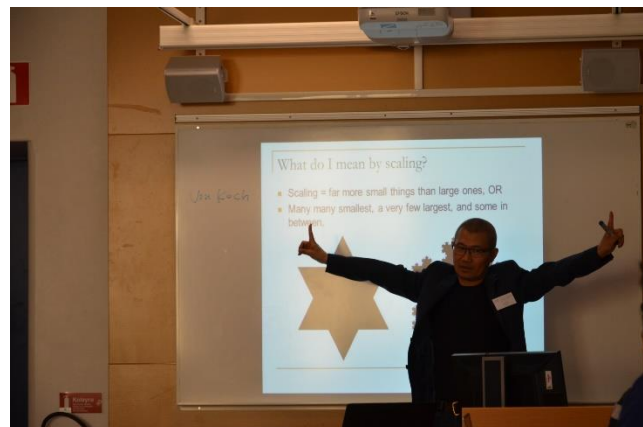
Complex systems

- Consists of large number of interacting components.
- Exhibits emergent, collective, behaviour which cannot be derived from behaviour of individual components.
- Self-organised behaviour.



Structure and dynamics of complex networks

- Structure influence network dynamics
- Dynamic influences network structure
- Understanding network structure => understanding dynamic of network/system



**COST Workshop in *Mobile Tartu,*
*Tartu, Estonia***

7. Workshop in Mobile Tartu 2106, 29.6.16 Tartu, Estonia

Summary by Dr. Slaven Gasparovic

As part of the International Scientific conference **Mobile Tartu 2016**, COST TU1305 workshop and PhD seminar, with a field experiment of smartphones and GPS tracking, took place on 29th of June 2016 in Järveveere holiday centre, near Tartu.

Prof. **Rein Ahas** (*Tartu University, MC member and WG1 leader of COST TU1305*) opened the conference and introduced leaders of the working groups of the *Field Experiment* as a part of PhD seminar.

Keynote speaker was **Prof. dr. Stefan van der Spek** from *TU Delft*. In his lecture "*Sensing the City/Advances in Tracking Technologies*", he discussed the relation between movement and the cognitive system, the relation between actual movement and structure offered. One of the most important questions within his speaking was about possibility to reveal the logic of people's movement and translate this into design of smarter cities. For this purpose social media and VGI are becoming more and more important sources for understanding perceptions and experiences. The built environment provides a framework for our movement. This framework is on a longer scale temporal as well as resulting in both spatio-temporal data and temporal-spatial data. The future is using smartphones and user-generated data for (parametric) design and interventions.

Field Experiment of smartphones and GPS tracking, as a part of PhD seminar, was organized in three parts and in three groups.

- ❖ Part 1 - 13:00 - 13:30. All participants chose to participate in one of the groups:
 - Group A "Smartphone tracking & social network analyses with YouSense" (leaders Anto Aasa, Anniki Puura),
 - Group B "GPS tracking & urban planning" (leader Stefan van der Spek)
 - Group C was "CDR data exercise" (leaders Erki Saluveer, Margus Tiru).

In this first part leaders of the groups explained to participants all the tasks, tactics and gave the data/devices/materials to participants to work with.

- ❖ Part 2 - 19:10 – 20:00 All participants, i.e. fieldwork groups continued with their work from 19:10 until 20:00. Some participants worked with the GPS devices, some of the participants analyzed the data etc.
- ❖ Part 3 - Next day (30th of June) all groups presented their work within the separate session at the end of the day.

COST TU1305 seminar was organized in two sessions, chaired by Prof. Rein Ahas (from 14:20 until 16:00) and Prof. Joao de Abreu e Silva (from 16:20 until 18:00). In total 10 lectures were held with very good feedback from other participants (in average 2-3 questions after every lecture).

Thibaut Dubernet (*ETH Zurich*) presented a topic regarding new data for simulating the impact of social networks on travel. The lecture aims at filling a data gap that exists in data to better understand the way individuals plan activities together, and how much this kind of joint process might be relevant for transport planning. Based on the needs of a simulation-based experimentation, a two-fold data collection is designed (Call Detail Records and an interactive survey).

Maria del Mar Alonso-Almeida (*Autonomous University of Madrid, MC Substitute in COST TU1305*) performed a lecture regarding social media use in mobile devices and leisure tourism travel behaviour. The main aim was to understand the link between the social networks and apps' use in leisure travel on mobile devices between Portugal and Spain, to create a measure tool in order to collect information, to perform a survey and analyze a data and to provide information to main stakeholders. She concluded that social media are mainly used in mobile devices in a multiple way with relevant role of Instagram and with clear differences between Portugal and Spain (her work is based on STSM she has accomplished in COST TU1305).

Arnaud Adam (*Université catholique de Louvain, Young Researcher in COST TU1305*) presented a topic regarding revisiting the urban structure of Brussels by means of mobile phone data and community detection. The objective of his lecture was to detect the socio-spatial organization within the metropolitan area of Brussels by means of almost 20 million mobile phone calls collected by one operator. Using the origin and the destination of all calls, the Louvain method is applied to detect communities of places. He showed clear spatial pattern in and around Brussels, phone data added an interesting viewpoint to more classical urban models and methodological choices impact the delineation and the composition of the metropolitan area which questions their use for decision-makers.

Emmanouil Chaniotakis (*Centre for Research and Technology Hellas-Hellenic Institute of Transport, MC Substitute in COST TU1305*) discussed about understanding activity patterns from social media data (a fusion of Facebook and Twitter). He presented a research about activity patterns found from geo-referenced data coming from social media, by analysing and comparing data collected from two major social media websites (Twitter and Facebook) in the same location and period of time. Data obtained from both sources is analysed and fused based on its temporal and spatial distribution. Data from Facebook (check-in events) is used to define Points Of Interest (POIs), while data from Twitter is used to define the activities performed. His presentation emphasized that most of the check-ins performed (Facebook) and the tweets posted (Twitter) are related to leisure activities, and that there is high spatial correlation among the two different sampled data.

João de Abreu e Silva (*University of Lisbon, MC member in COST TU1305*) presented the relationship between travel behavior, ICT usage and social networks in university students in 3 European cities. He presented the results obtained from a web-survey applied to university students in 3 southern European cities, Lisbon, Granada and Zagreb. The survey was aimed at

studying the relations between ICT and social media usage, social networks and social travel in this specific sociodemographic group. It aims to investigate a series of potential research questions related with the effect of ICT on social travel, its interaction with social networks, and, how the perception of its usefulness influences its usage, and to research the existence of differences between these three places and examine the role of cultural differences in explaining them. A description of the obtained results is presented as well as a series of statistical tests related with the research questions that oriented the survey design.

The topic of **Josep Maria Salanova Grau** (*Centre for Research and Technology Hellas-Hellenic Institute of Transport*) was about social media for transportation planning (estimating demand for taxi). He presented the study which investigates practical applications of using social media data for enhancing the transportation planning capabilities. A methodological framework is defined for the identification of the citizens' mobility patterns using social media data. The data, composed by the geographic location of the check-in locations and the time intervals in which the data is extracted (in aggregated values) is obtained by Facebook through the check-in service. The results illustrate the actual correlation of demand for taxis to the check-in events, while it is noted that models should take into account the hysteresis of the demand production to the check-in events for departure from the location of the check-in based on the type of location. He discussed practical implications of the findings and the model derived.

Domokos Esztergar-Kiss (*Budapest University of Technology and Economic, MC member in COST TU1305*) performed a lecture regarding the extensions of the activity chain optimization method. He elaborated a method for the optimization of daily activity chains. Flexible demand points were introduced, because some activities are not necessarily fixed temporally and spatially, therefore they can be realized in different times or locations. The simulations were performed on arbitrarily chosen test networks using Matlab. He presented promising results for all transportation modes (car, public transport, combined). The application of the extended method produced shorter activity chains and a decrease of travel time for travelers.

Stefano Pensa (*The Polytechnic University of Turin, MC Substitute in COST TU1305*) presented a topic regarding a map comparison for the evaluation of usability of Twitter data (traditional vs data-driven approaches). He described the use of quantitative data obtained from the social media Twitter to analyse urban patterns. A case study in the urban neighbourhood of Pampulha, Belo Horizonte, Brazil, was described to show the outcomes of a comparative analysis with traditional data used in the urban and transport planning processes of the city. He showed similarities and differences to evaluate the accuracy of analysis performed by the use of freely and quickly available data instead of costly but official data.

Oded Gal (*Technion - Israel Institute of Technology*) discussed about shared-private transportation and social media: the role of social media as platform for ridesharing (developing an alternative model). He showed a study which attempts to examine how people's perception

of ridesharing influence their willingness to use it as a model of urban transportation. The study is based on a questionnaire. The main question was how people perceive the trust factor in social media ridesharing platforms. He showed two models for the integration of ridesharing in social media: dynamic dominant and trust-dominant.

Adeline Decuyper (*Université catholique de Louvain*) presented the topic about the issues of spatial aggregation for community detection in communication networks. The objective of her research was to address specific methodology issues that arose from the nature of large datasets collected automatically. As case study, she analyzed the communities within the Brussels metropolitan area, using Twitter and mobile phone data. Regarding results she showed that pre-aggregating the network by geographical areas can have a high impact on the structure of the communities that are found. She discussed the biases that can be present in the datasets analyzed, and proposed methods to compensate for those biases.

At 18:00 we gather to dinner of some food specialties from Estonia. The 2nd part of the *Field Experiment* followed dinner and ended the Conference's first day.

During the evening a social program was organised. All participants had a chance to try sauna, swimming in a pool or walking. Everybody went back with a special bus to Tartu for the 2nd day of the Conference.

Mobile Tartu 2016 Conference's first day including *COST TU1305* Session and *Field Experiment* was organized in a beautiful environment on the lake bord of Järveveere holiday centre. Prof. Rein Ahas and all his crew gave their best and hosted all participants excellent. *Field Experiment* and *COST TU1305* Session was very usufel to get some new knowledge and insights about topics regarding ICT, social network and travel behaviour.

Link to the pictures gallery: <http://mobilitylab.ut.ee/mobiletartu/2016/img/photos/>





COST Session in 3rd CSUM, Volos, Greece

8. COST Session in 3rd CSUM, Volos Greece.

Summary by Prof. Eftihia Nathail.

The 3rd Conference on Sustainable Urban Mobility – 3rd CSUM was held on 26-27 May 2016, in Agria, Volos, Greece. The idea about CSUM started in 2012, with a certain emphasis given in each event, all around the main pillar of Urban Mobility. The 1st CSUM acknowledged the importance of mobility in urban areas, and addressed in particular the role of green modes of transport in accommodating traveling and at the same time protecting the environment. In the next 2nd CSUM, emphasis was given to the impact of ITS in transit services, and the behavioral changes of traveling in the urban agglomeration. The 3rd Conference focused on the “Anthropocentric approach in urban mobility planning”.



The challenges and problems in urban transportation systems are many and complicated. Traffic congestion, environmental deterioration, consumption of fossil fuels and energy conservation, safety, accessibility, comfort are some of the major concerns associated with urban mobility. Local administration, service providers and operators are asked to deliver an efficient service for the transport of travelers and goods and users are expected to develop a sustainable attitude and behavior; and all these, ensuring that harvested or used resources in the altar of transport are not depleted or permanently extinct.

To address sustainable urban mobility, several concepts, solutions and applications have been developed, including demand responsive transit and car sharing systems, cooperative traffic management, dynamic time schedule coordination, integrated ticketing, social networks, innovative city hubs, smart solutions for city logistics, green modes, parking management schemes, waste collection and disposal, recycling, sensor data sources and data mining, simulation and assessment techniques.

The papers presented at the Conference highlighted some of the recent developments in the domain of planning, designing, implementing and assessing sustainable urban mobility solutions. Some of them focus on the role of social networks in mobility behavior and transferability. A number of papers present applications using blue tooth and other sensor data for predicting performance of the transportation system. Activity-based transport modeling, micro and macro analysis, fuzzy and Monte Carlo simulation, optimization and dynamic traffic assignment are some of the methodologies which attract current research. Case studies of sustainable transportation interchanges, journey planning dial a ride, electric vehicles and mobile payments in public transport are included. Also, papers cover issues of resilience management and economic crisis, environmental impacts and user acceptance.

The role of social networks in sustainable urban mobility was addressed by the **special COST TU1305 session**, which took place during the first day of the Conference. Six presentations were given by the action's members.

The action's coordinator, Pnina Plaut, and the STSM coordinator, Eftihia Nathanail, presented "The linkage among social networks, travel behavior and spatial configuration", where the interconnection of geography, urban transportation modeling and information and communication technology was analysed.

Or Caspi demonstrated the "Electric bikes usage potential as a substitute for private car usage in Israel". Itzhak Omer and Nir Kaplan showcased "An agent-based pedestrian model considering spatial behavior parameters". They compared contemporary pedestrian volume models which are mainly constructed according to the space syntax framework with an agent-based model for predicting pedestrian movement at the urban scale, taking into account the dynamics of the reciprocities observed between street networks, pedestrian movement and land-use patterns. They implemented the proposed model in two Israeli city centers and examined the pedestrian flows with respect to the relevant street network structure and land-use distribution.

Ainhoa Serna, Jon Kepa, Gerrikagoitia, Unai Bernabé and Tomás Ruíz ran a "Sustainability analysis on urban mobility based on social media content". They identified sustainability issues related to urban mobility based on the perceptions and experiences that underlie in the User Generated Content (UGC) and they followed a quantitative and qualitative content analysis using Sentiment Analysis techniques with Semantic taxonomy annotation of online textual content.



Domokos Esztergár-Kiss made the "Definition and classification of parameters for daily activity chain optimization", building a roadmap of optimization parameters, ideal target groups and optimization algorithms, which incorporate different transportation modes and personal preferences.

João de Abreu e Silva, Juan de Oña and Slaven Gasparovic investigated "The relation between travel behavior, ICT usage and social networks". They designed a web based survey to be applied to university students, as they are strong users of social media and ICT devices. They presented the survey structure and its relations with the previous literature and some preliminary results from a pilot already implemented in 3 cities – Lisbon, Granada and Zagreb.

Conference papers are accessible in Transportation Research Procedia, Volume 24, Pages 1-538 (2017) (<http://www.sciencedirect.com/journal/transportation-research-procedia/vol/24>) and they provide a useful and enlightening reading for all interested parties in the domain of urban mobility and sustainability.

Events in CASA, UCL, London:

- **Social Media and Big Data analysis:
Panel and discussion**
- **Progress in Transportation and Urban
Analytics workshop**

9. Social Media and Big Data Analysis

Panel and assembly discussion, London 9.11.2016

The “Social media and Big Data analysis Panel” opened the MC&WGs meeting in London. During previous meetings we heard several presentations about “Big Data analysis” topic from different research points of view. We thought this time to bring them all into one table and discuss them together.

The panel aim is to present a comprehensive overview on methods of Social Media and Big Data analysis and compare them. Each of the five participating researchers presented one specific methods for big data sources, collection and analysis.

The panel was divided into three parts: short presentations, cross questions and discussion.

- **Five Short presentations : Data collection**

Each panel participant had five minutes presentation on **his data collection methods**. In the presentation they refer to the following issues with regard to the specific method/instrument: Type of data, data sources, quality of data and specific characteristic of the data.

- **Cross questions on data analysis and recommendations**

1. Tools used for analysis
2. Analysis potential : advantages of the technique
3. Analysis limits & boundaries: Problems
4. Compare to traditional survey?
5. Relevance for urban / transportation analysis and models
Description ability? Ability to forecast? Ability to use in models? What are the gaps?
Which complementary data you need and/or can have from regular survey? Please propose 1 question you would recommend to add to the COST comparative survey.
6. Do you have any question to the other panel participants? Could you see collaboration among your methods and the others?

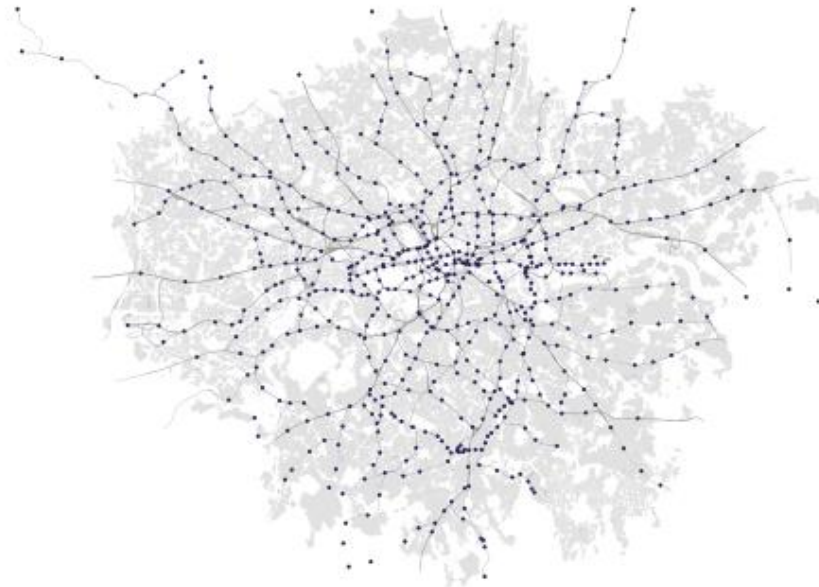
- **Open discussion**

Panel Moderator: *Prof. Pnina Plaut, Chair of Action. Israel.*

Panel participants:

1. *Dr. Ed Manly, CASA UCL, London (UK): Oyster Card data*
2. *Dr. Stefano Pensa, SiTI, Torino (IT) : Twitter and Urban planning*
3. *Mr. Emmanouil Chaniotakis, NTUA, Athens (EL): Facebook, 4SQ, Twitter & Transportation planning*
4. *Dr. Ainhoa Serna, Mondragon university (ES): Semantic Analysis*
5. *Dr. Peter Holecko, University of Zilina (SK): Sensors of human mobility*

- **Dr. Ed Manley:** *Oyster travel cards* (MC Substitute, UK, Presentation in “Social Media and Big Data analysis” Panel in London meeting 9.11.16)



UCL

Oyster Card Transactions

Dataset

July to September 2012

1 billion transactions

762 million trips on all modes

471 million bus trips

291 million Underground or rail trips


11.5m Oyster Cards

No routing data

September to December 2013

February 2014

Not open – Available from Transport for London through Academic Agreement



Oyster Card Transactions

Attributes

User ID – *anonymised but consistent across datasets*
Card Type – Youth, Elderly, Staff

Transaction Type – Tap in, tap out, bus tap in, fund top up
Transaction Date
Transaction Time
Station ID
Bus Route ID
Bus Stop ID
Top Up Location

Travel Card
Balance

No social network data – *but could be derived*

Oyster Card Transactions

Quality

Missing tap out locations due to user behaviour

Barriers missing, left open or not functional

No bus trip end points

Paper tickets missing

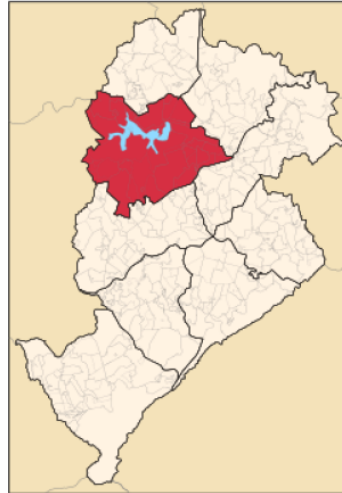
Potential for multiple cards per person

Minute-level granularity

No route data

- **Dr. Stefano Pensa:** *Traditional VS Data-driven Approaches: A Map Comparison for the Evaluation of Usability of Twitter Data* (MC Substitute, Italy, Presentation in “Social Media and Big Data analysis” Panel in London meeting 9.11.16)

Case Study – Pampulha, Belo Horizonte



Belo Horizonte is the capital of the state of **Minas Gerais, Brazil**

The municipality has a population of **2.500.000** inhabitants (up to 5.000.000 in the Metropolitan Area)

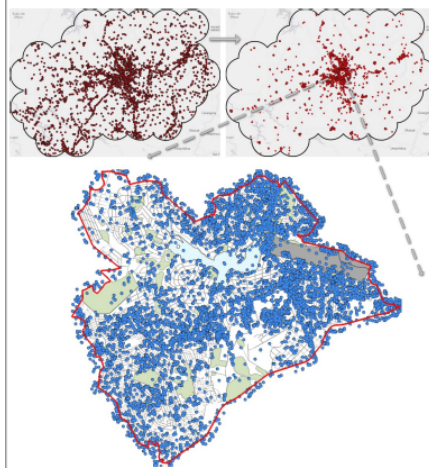
The Case Study is localised in **Pampulha** neighborhood.

Pampulha has a population of 145.000 inhabitants and a density of 3.082 inh/km²

COST TU 1305 - Social networks and travel behaviour - London Nov 9th 2016

stefano.pensa@polito.it

Data Collection



- All the tweets sent by the users who sent **at least one tweet from Pampulha**:
 - 42,991 tweets
 - 5,173 users.
- **4,6%** of the total amount of tweets have been sent from the area of Pampulha.
- **12,52%** of total amount of Twitter users tweeted from Pampulha
- **63%** of tweets from the outside of Pampulha

COST TU 1305 - Social networks and travel behaviour - London Nov 9th 2016

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Conclusions

- Tweets can provide the reading of a place in a **particular period**. They can not be used to provide a general overview but they should be included within a specific context.
- They could be used for future simulations, but a **specific elaboration** should be done **to convert them in usable data**.
- The “Big” number of data provide a large number of possible correlations which could inspire different reasoning. However, only through the **exploration and analysis** of those data, the **cause-effect relationships can be distinguished from correlations** (Andrienko & Dykes, 2011; Andrienko, et al., 2007; Andrienko, Andrienko, Keim, MacEachren, & Wrobel, 2011; Jiang & Li, 2005; Jiang, Huang, & Vasek, 2003; Keim, Andrienko, Fekete, Görg, KohlhammeXr, & Melancon, 2008; Masala & Pensa, 2016).

Conclusions

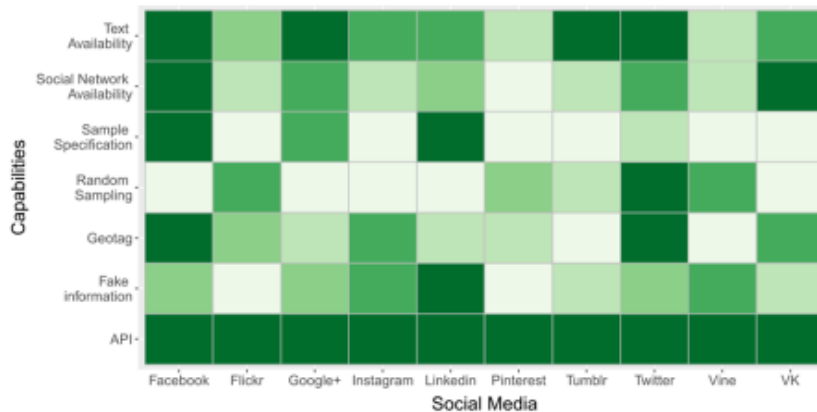
- Maps derived from **different sources provide different information**. Whereas information matches, it could be justifiable taking those data as reliable. Otherwise, different information should be taken as a warning for dedicating some deeper investigation.
- It is evident that data need an interpretation because **data provides an information which is not unique**. This implies a stronger effort for planners and decision-makers in interpreting the information included in data.
- Data-driven approaches should provide data to the actors involved in the decision-making, but they should also let the **actors play with those data** in order to explore different combinations and discover correlations, cause-effects relationships and the best strategies for converting those dynamics into working elements for a spatial system.
- It is evident that tweets are sent by a self-selected population which is not a sample. Thus, they are not representative of the whole population, but can be the **mirror for comparing official data**.

- **Mr. Emmanouil Chaniotakis:** *Facebook, 4SQ, Twitter & Transportation planning* (MC Substitute, Greece, Presentation in “Social Media and Big Data analysis” Panel in London meeting 9.11.16)

Chair of Transportation Systems Engineering
Department of Civil, Geo and Environmental Engineering
Technical University of Munich



Social Media Data Availability



Chaniotakis, Antoniou, Pereira, "Mapping Social Media for Transportation Studies" Intelligent Systems, accepted for publication, 2016

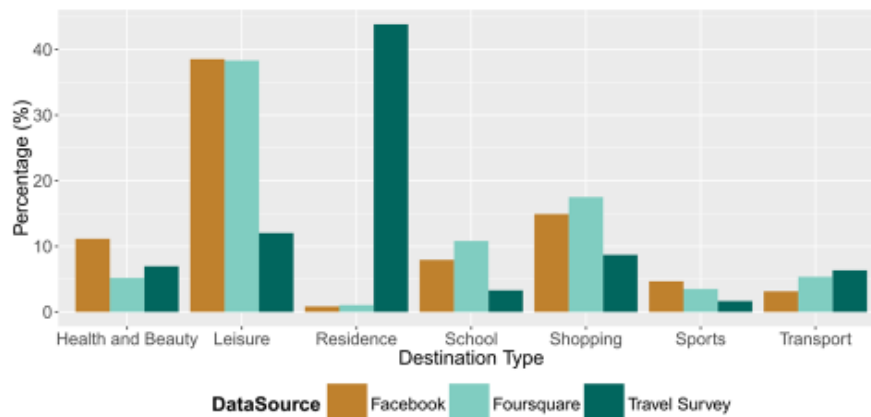
COST TU1305 | Manos Chaniotakis | Social Media and Transportation Planning | m.chaniotakis@tum.de

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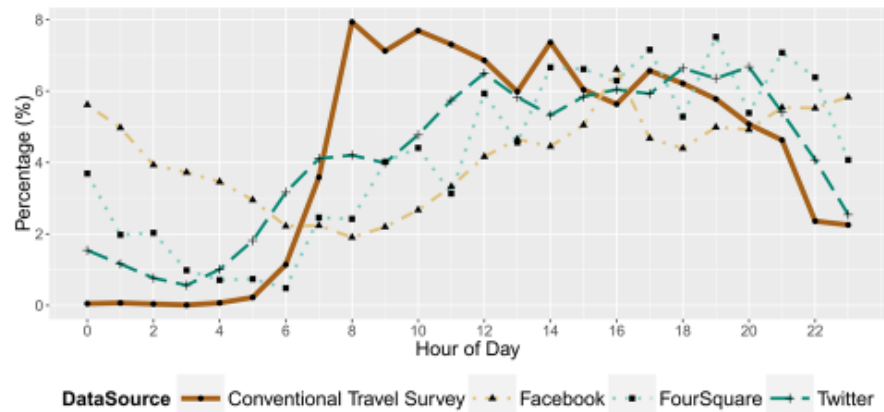
Activities Distribution



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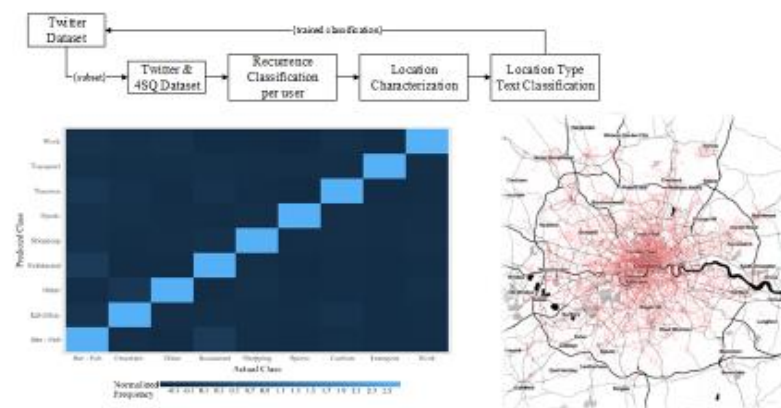
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Temporal Distribution



Putting everything together

User-Centric Activity Enrichment methodology



- **Dr. Ainhoa Serna:** *Semantic analysis* (MC Substitute, Spain, Presentation in “Social Media and Big Data analysis” Panel in London meeting 9.11.16)



How it is collected technically?

- Ad-hoc software through API's and Crawling+ scraping techniques.

six main phases:

1. semantic discovery (source identification),
2. data acquisition,
3. data preparation for analysis,
4. data curation,
5. data storage
6. and data visualization



Data Curation

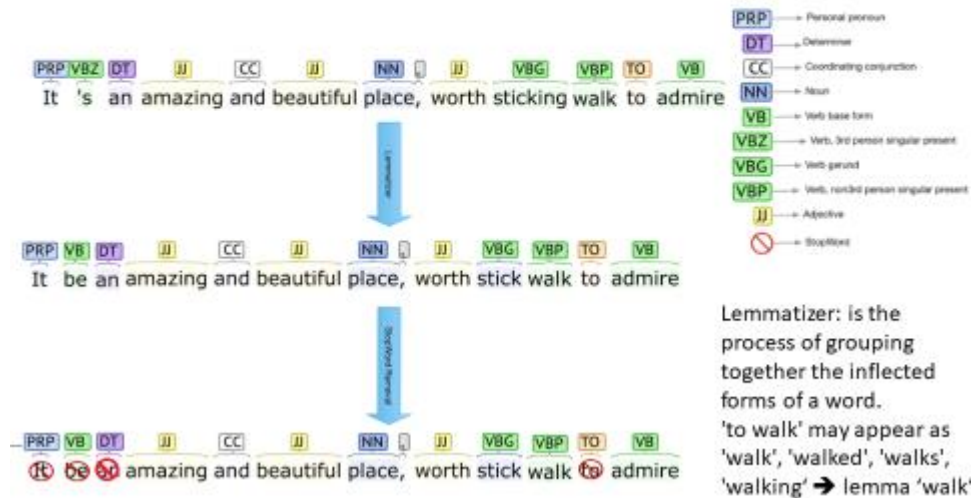
- The categorization is aided by a text-mining tool developed by Mondragon Unibertsitatea based on FreeLing and the Wordnet lexical database.
 - two upper ontologies - WordNet and SUMO
 - two tourism ontologies: ACCO, QALL-ME
 - to add the feeling of the reviews, two ontologies were mapped: Marl (subjective opinions domain) and SIOC (Semantically-Interlinked Online Communities).



Opinion #13: 2013-12-02 21:50:24.0

An amazing place

It's an amazing and beautiful place, worth sticking walk to admire !!



Quality of data

- **Twitter:** poor information, difficult to find something of value. Identify Twitter channels whose theme is the interest for analysis. For instance: @Maltese_Traffic;
https://twitter.com/Maltese_Traffic
- **TripAdvisor:** Excellent (rich data and a large sample, many languages)
- **Minube:** Excellent (rich data but only spanish language)
- **Official statistics:** one year later and small sample

- **Dr. Peter Holecko:** *Sensors of human mobility* (MC member, Slovakia, Presentation in “Social Media and Big Data analysis” Panel in London meeting 9.11.16)

The Libelium Technology



- 110 sensors
- Radios: 802.15.4, 868, 900, WiFi, 4G, Sigfox and LoRaWAN
- Cloud integration (Amazon, esri, IBM Bluemix, IoT Ticket, Microsoft Azure, MQTT, Telefónica, ThingWorx...)

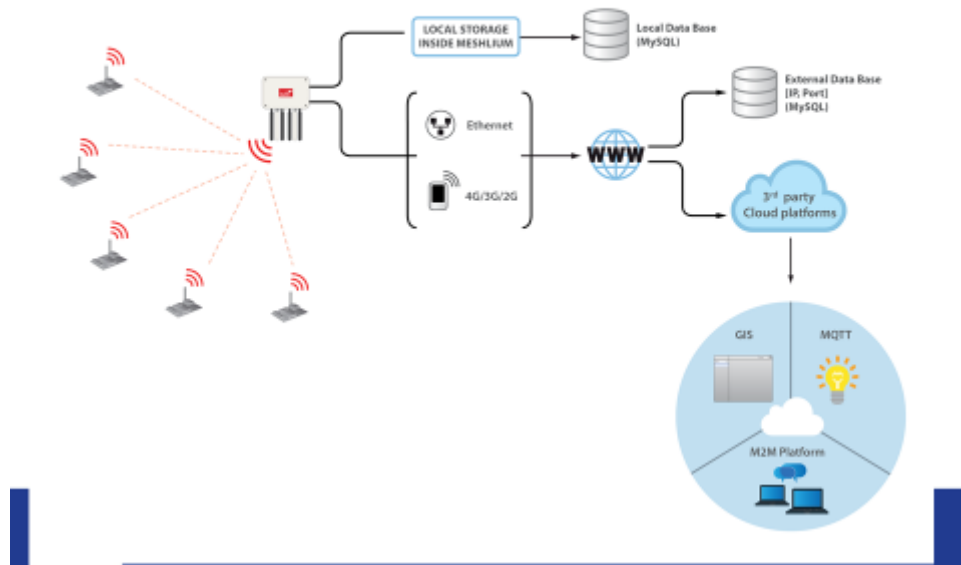


The Libelium Technology

- **Smart Cities** (Parking, Noise, **Mobile Devices Detection**, **Traffic Congestion**, Lighting...)
- Smart Environment
- Smart Water
- Smart Metering
- Security & Emergencies
- Smart Agriculture...



The Libelium Technology



NetStat

WiFi Wifi Scan

Bluetooth Scan

GPS

Beep

phybbyscience

Encryption

Captured Data

Local Database | External DataBase | Local file

☒ Store frames in the local data base Save

Last 100 insertions Delete data

TimeStamp	MAC	ID	RSSI	CoD	Vendor
2016-11-06 17:32:42	00:14:09:0C:4E:8A		-77	Handsfree	MAGNETI MARELLI S.E. S.p.A.
2016-11-06 14:48:27	FC:62:B9:F4:DC:9A		-82	Handsfree	ALPS ELECTRIC CO.,LTD
2016-11-06 12:23:10	00:26:7E:32:74:94		-81	Handsfree	Parrot SA
2016-11-06 10:13:39	FC:62:B9:5C:DE:D8		-88	Handsfree	ALPS ELECTRIC CO.,LTD
2016-11-06 09:00:59	00:08:C6:44:E6:1D		-80	Handsfree	Philips Consumer Communications
2016-11-05 21:57:42	00:23:3D:1E:A8:D3		-87	Handsfree	Novero holding B.V.
2016-11-05 20:29:15	BC:72:81:18:86:D6		-86	Smartphone	Samsung Electronics Co.,Ltd

10. Progress in Transportation and Urban Analytics, Workshop in CASA - Centre for Advanced Spatial Analysis, UCL, London (UK)

This workshop in CASA took on Friday, 11.11.16 as part of COST TU1305 MC & WGs meeting in London (9th -11th November 2016) and was organised by our hosts in CASA: Prof. Michael Batty (MC member) and Dr. Ed Manely (MC Sub member).

The workshop consist of a series of lectures and discussions that introduce work developed in London and the UK by researchers concerned with problems of future cities.

We were presented with research and applications in how information technologies are being used to explore new theories and models of city systems. Work on the use of smart card technologies for transit systems was introduced together with new measures of accessibility in land use transportation models, new ways of sensing the city linked to 3D models and augmented realities, and new definitions of cities and regions which are linked to new sources of data and new ideas from urban complexity.

10:00 - 13:00 Transportation

- Dr. Ed Manley, UCL CASA - Spatiotemporal Variation in Travel Regularity through Transit User Profiling
- Dr. James Haworth, UCL SpaceTimeLab - Using Mobility Tracking App Data to Estimate Cycle Flows
- Dr. Chen Zhong, King's College London Geography - Variability in Regularity: Mining Temporal Mobility Patterns in London, Singapore and Beijing
- Professor Mike Batty and Richard Milton, UCL CASA - Simulating and Scaling Urban Land Use Transportation Models Using Web-Based Technologies for Very Large Spatial Systems
- Dr. Sarah Wise, UCL CASA - A Simple ABM Framework for Collaborative, Task-Driven, Multimodal Movement

14:00 - 17:00 Cities

- Professor Tao Cheng, UCL SpaceTimeLab - Space-Time Analytics for Smart Cities
- Dr. Clementine Cottineau, UCL CASA - Scales of Urban Inequality
- Dr. Carlos Molinero, UCL CASA - Applications of Percolation Theory to Road Networks for its Hierarchical Classification
- Dr. Jens Kandt, UCL Geography - Using Big Data to Study Urban and Regional Dynamics in the United Kingdom
- Ollie O'Brien, UCL Geography - London: Visualising the Moving City



ECIs and Young Researchers' Sessions

11.ECIs and Young Researchers' Sessions

The “Young researchers’ session” bring the opportunity for permitting ECI's¹ and PhD's students to present their work and develop their academic network. This session was initiated successfully in 2015 in Budapest and continued once a year since then; in Bucharest on 2016 and in Krakow on 2017.

For the final event of the Action in Milano, the *Final Meeting Committee* decided to include young researchers’ presentations as part of the conference sessions. It will enable the young researchers to present their work with senior researchers and also will enrich the “state-of-the-art” sessions with current research. In addition, a Poster Session of young researchers was added to the program.

Dr. Slaven Gasparovic (Croatia) is the ECI coordinator of the Action and in charge of these sessions.

ECIs & Young researchers' 1st session in Budapest, June 1st 2015

Moderator: Dr. Slaven Gasparovic, ECI coordinator

1. **Jose Luis Machado Leon**, University of Granada, Spain:
Improving and implementing PT, satisfactory surveys, academic and field work.
2. **Matthew Hanchard**, University of Sheffield, UK:
Towards a Digital Sociology of Cartography.
3. **Jelena Smiljanic**, Institute of Physics Belgrade, Serbia:
Conference attendance patterns.
4. **Michiel De Meyere**, University of Antwerpen, Belgium:
Assessing daily urban systems in Belgium: a network approach based on commuting flows.
5. **Arnaud Adam**, Catholic University of Louvain-la-Neuve, Belgium:
Bru-net: a new look at interactions within the Brussels Metropolitan area
6. **Anniki Puura**, University of Tartu, Estonia:
Social networks and travel behavior
7. **Bogdan Toader**, University of Luxembourg:
PLAYMOBeL – PLanning and Activity-travel analyTics for future Mobility Optimisation in BelvaL.
8. **Francois Spurmont** (ECI) University of Luxembourg:
STABLE - Sustainable Transport behavior considering Activity chains of BelvaL commutERs
9. **Michal Gat Morad**, Technion, Israel:

¹ ECI (**Early Career Investigator**) - An individual who is within a time span of up to 8 years from the date they obtained their PhD/doctorate (full-time equivalent).

Enhancing pedestrians Urban Navigation Experience by means of a Smart Environment accounting for spatial, temporal and social factors.

10. **Maria Tsami**, University of Thessaly Volos, Greece:
Transit Quality of Service & travel behaviour.

ECIs & Young researchers' 2nd session in Bucharest May 19th 2016

Moderator: Dr. Slaven Gasparovic, ECI coordinator

1. **Fariya Sharmeen** (ECI, MC Sub) Radboud Univeristy Nijmegen, Netherlands:
Dynamics of Social Networks and Activity Travel Behaviour.
2. **Emmanouil Chaniotakis** (PhD student, MC Sub) National Technical University of Athens, Greece:
Connecting Social Networks and Mobility through Social media.
3. **Sabri Khouri** (PhD student) Technion, Israel:
Social Networks and the City: the influence of social networks information on the creation of new mental maps of cities.
4. **Anniki Puura**, Institute of Geography University of Tartu, Estonia:
Patterns of co-presence in geographically distant relationships.
5. **Peter Holecko** (ECI, MC member) University of Žilina, Slovakia:
Optimization of channel access in wireless sensor networks.
6. **Arnaud Adam**, Université catholique de Louvain, Belgium:
The Brunet project: a new look within the metropolitan area of Brussels.
7. **Lien Bakelants**, University of Antwerpen, Belgium:
Spatial and social inequalities in job accessibility – A case study in Belgium.

ECIs & Young researchers' 3rd session in Krakow, June 30th 2017

Moderator: Dr. Slaven Gasparovic, ECI coordinator

1. **Heinrich Löwen** (PhD student), Institute for Geoinformatics, University of Muenster, Germany:
Identifying Context-Dependent Orientation Information for Incremental Route Instructions.
2. **Nir Kaplan** (PhD student), Tel Aviv University, Israel:
Why angular centralities are more suitable for space syntax modeling?
3. **Cayetano Ruiz-Alarcon-Quintero** (PhD. Candidate) Transportation Engineering, Faculty of Engineering, University of Sevilla, Spain:
Missing data processing in the Smart-City context.

4. **Yuval Rubinstein** (PhD student), Faculty of Architecture and Town Planning, Technion (Israel):
Developing a dynamic urban planning model, based on advanced information systems.
5. **Rumana Islam Sarker** (PhD student), Unit for Intelligent Transport Systems, University of Innsbruck, Austria:
Relating reactions to service disruptions and transit use frequency: the mediating role of perceived service quality and transit system resilience
6. **Maria Karatsoli** (PhD student), University of Thessaly, Greece:
Intelligent transport systems with usage of "big data" for management of sustainable mobility
7. **Ioannis Karakikes** (PhD candidate) University of Thessaly, Greece:
Simulation and impact assessment of innovative systems for urban freight distribution
8. **Andrzej Jarynowski** (PhD candidate) Interdisciplinary Research Institute, Wroclaw (Poland):
The spread of nosocomial infections based on topological structure of hospital studied by computer simulations and social network analysis"

Young researchers' 4th session in Milano February 14th-15th 2018

❖ Presentations in COST TU1305 Final Conference:

In Session 1: ICT Social Networks and Travel Behaviour – Theory and Practice

- **Mr. Oded Gal**, The Faculty of Architecture and town planning, Technion, Israel:
Perceptions and usage of ridesharing platforms: the role of trust.
- **Dr. Francois Sprumont**, University of Luxembourg, Luxembourg:
Workplace relocation and travel behavior: what could be the benefit of ICT social network information?

In Session 2: The Urban Perspective of ICT Social Networks and Travel behaviour

- **Mr. David Duran**, Technical University of Munich, Germany :
Identification of spatiotemporal factors affecting arrivals and departures of shared vehicles: Methodology for comparing multiple cities on a local level using open-source
- **Ms. Candan Eylül Kilsedar**, Politecnico di Milano, Italy:
2D and 3D visualization of OpenStreetMap data

In Session 3: Social Media and Big Data in Transport Analysis and Planning

- **Ms. Maria Karatsoli**, University of Thessaly, Greece:
Intelligent transport systems with usage of “big data” for management of sustainable mobility
- **Ms. Rosa Arroyo**, Universitat Politecnica de Valencia, Spain:
Influence of attitudes towards the use of ICT Social Network in mobility and social interactions on commuting trips
- ❖ **Young researchers’ Posters Session (by alphabetic order) in COST TU1305 Final Conference:**
 1. **Mr. Adam Arnaud**, *Rediscovering urban models with non -conventional data and methods? The mosaic of Brussels.* Catholic University of Louvain-la-Neuve, Belgium.
 2. **Mr. Aschauer Florian**, *The changing character of travel behaviour: An innovative survey design for understanding individuals’ trade-off processes.* Institute for Transport Studies, University of Natural Resources and Life Sciences, Vienna, Austria.
 3. **Mr. Ding Ma**, *A Smooth Curve as a Fractal Under the Third Definition.* University of Gävle, Sweden.
 4. **Mr. Hanchard Matthew**, *Latent resources and spatial practice: if mobile media are not directly used, can they still inform mobilities?* Newcastle University, UK.
 5. **Mr. Karakikes Ioannis**, *Evaluation of Social Delivery as key-measure to last mile distribution.* University of Thessaly, Greece.
 6. **Mr. Khoury Sabri**, *Virtual Mental Maps.* Faculty of Architecture and town planning, Technion, Israel.
 7. **Mr. Rubinstein Yuval**, *Dynamic Urban Planning. Developing a dynamic urban planning model based on advance information systems.* Faculty of Architecture and town planning, Technion, Israel.
 8. **Mr. Soler Daniel Casquero**, *Influence of attitudes towards the use of ICT Social Networks in mobility and social interactions on leisure travel behavior.* Universitat Politecnica de Valencia, Spain.
 9. **Ms. Vranic Ana**, *Social network structure: physics perspective.* Institute of Physics in Belgrade, Serbia.

Meetings and activities

12.Meetings and activities

1st Grant Period

1. 2nd MC & WGs meetings in Vienna, 11-12 December 2014
University of Natural Resources and Life Sciences (BOKU), Vienna, Austria.
Hosted by Prof. Regine Gerike
2. Task groups meeting in Liege, 28th-30th April 2015
University of Liege, Liege, Belgium.
Hosted by Prof. Mario Cools
3. 3rd MC & WGs meetings in Budapest, 3rd – 4th June 2015
Faculty of Transport Engineering
Budapest University of Technology and Economics (BME)
Hosted by: Dr. Domokos Esztergar-Kiss

2nd Grant Period

4. 4th MC & WGs meetings in Haifa, 14th – 15th October 2015
The faculty of Architecture and Town planning
Technion, Israel Institution of Technology, Israel
Hosted by Prof. Pnina Plaut
5. WG1 meeting in Brussels, 26th February 2016
COST Association, Brussels, Belgium.
6. WG2 meetings in Geislingen, 8th-9th March 2016
Nürtingen-Geislingen University of Applied Sciences, Geislingen, Germany.
Hosted by Prof. Sven Kesselring
7. WG3 meeting in Haifa, 29th - 30th March 2016
The faculty of Architecture and Town planning
Technion, Israel Institution of Technology, Israel
Hosted by Prof. Pnina Plaut

3rd Grant Period

8. 5th MC & WGs meetings in Bucharest, 18th-19th May 2016
"Ion Mincu" University of Architecture and Urbanism, Bucharest, Romania
Hosted by Ms. Lucia Cristea

9. COST TU1305 Session in 3rd Conference on Sustainable Urban Mobility (CSUM) in Volos, Greece 26th May 2016
Organized by Prof. Eftihia Nathanail
10. Training school in Gavle, 13th-17th June 2016
University of Gavle, Sweden.
Organized by Prof. Bin Jiang
11. COST TU1305 Workshop in Mobile Tartu, 29th June 2016
University of Tartu, Tartu Estonia
Organized by Prof. Rein Ahas
12. 6th MC & WGs meetings in London, 9th– 11th November 2016
Center for Advanced Spatial Analysis (CASA) UCL, London, UK
Hosted by Prof. Michael Batty

4th Grant Period

13. 7th MC & WGs meetings in Krakow, 29th-30th June 2017
Krakow University of Technology, *Politechnika Krakowska*, Krakow, Poland
Hosted by Prof. Lidia Zakowska
14. WG2 meeting in Oslo, 25th October 2017
Institute for Transport Economics, Oslo, Norway
Hosted by Dr. Tom Julsrud
15. WG1 Scientific Committee meeting in Brussels, 8th November 2017
COST Association, Brussels, Belgium
16. Spatial analysis meeting in Torino 18th December 2017
SiTI Istituto Superiore sui Sistemi Territoriali per l'Innovazione, Torino, Italy
Hosted by Dr. Stefano Pensa
17. 8th MC & WGs and Final meetings in Milano, 14th-16th February 2018
University of Milano-Bicocca, Milan, Italy
Hosted by Prof. Silvana Stefani



MC & WGs meetings in Vienna, December 2014



Task Groups meetings in Liege, April 2015





MC& WGs meetings in Budapest, June 2015



MC & WGs meeting in Haifa, October 2015





Visit to the Galilee, October 2015



WG1 meeting in Brussels, February 2016



WG3 meeting in Haifa, March 2016



MC & WGs meetings in Bucharest, May 2016



MC&WGs meeting in London, November 2016



MC & WGs meeting in Krakow, June 2017



WG2 meeting in Oslo, October 2017



WG1 Scientific committee meeting in Brussels, November 2017



Spatial Analysis meeting in Torino, December 2017



COST TU1305 members in the city hall of Krakow, June 2017

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