List of ECTQG'23 Special Sessions

Title, Organizers, & Description/Scope

Quantifying Future Development
Eric Koomen (V.U. Amsterdam), Bart Rijken (PBL Netherlands Environmental Assessment Agency), & Fernando Bação (New U. Lisbon)

Description

Any type of planning involves constructing a plausible outlook on the future. Yet, pandemics, economic crises and hostile dictators make such endeavours highly uncertain. This session brings together empirical and methodological contributions that aim to produce evidence-based projections of future developments that are academically sound and societally relevant.

We especially welcome studies looking into the future of demographic, economic and urban development and how these are likely to alter the way land is used. Rather than case-specific results, we are interested in generic methods and insights that help scholars and planners around the globe to prepare for a more sustainable future.

Uncovering Urban Mobility Patterns from Digital Footprint Data
Chen Zhong (U.C. London), Carmen Cabrera-Arnau (U. Liverpool), Qili Gao (U.C. London), & Yang Zhou (Central China Normal U.)

Description

Mobility is a crucial aspect of urban life since it plays an important role in connecting people to services, promoting economic growth, and enhancing social interaction and inclusion. When urban mobility is not streamlined, however, it can lead to major problems such as congestion or pollution. Advances in the collection and analysis of novel data sources provide an exciting opportunity to improve our understanding of patterns and behaviours of urban mobility and, consequently, also an opportunity to identify potential vulnerabilities displayed by urban systems.

Hence, in this special session, we welcome contributions that explore urban mobility patterns using new forms of digital footprint data, such as mobile phone data/app data, smart card data, etc. In particular, the session will feature presentations on themes including, but not limited to: digital footprint data analysis and modelling; Uncertainties in digital footprint data; Potential and issues of digital footprint data; The variability of mobility patterns at different spatiotemporal scales; Universal laws and theories of urban mobility: urban mobility and the built environment (e.g., spatial structure, land use planning, transport infrastructure development); spatiotemporal modelling of urban mobility; urban mobility and socio-spatial inequality; case studies in different urban contexts.

Uncovering Intra-urban Spatial Patterns

Cyrille Genre-Grandpierre (U. Avignon), & Giovanni Fusco (U. Côte d'Azur)

Description

Identifying, describing, and explaining the spatial structures of cities, especially in the perspective of linking them to particular externalities (in terms of economic performance, mobility, social functioning, etc.), has long been one of the main tasks of theoretical and quantitative geography. To achieve this, both deductive and inductive approaches are used. While there have been many empirical and modelling successes, revealing and understanding intra-urban spatial patterns remains a major challenge for several reasons:

- The quality and quantity of data to address certain issues may be insufficient. This has long been the case, for example, for land and property prices.
- The problem may also be methodological. Methods and tools from spatial analysis sometimes struggle to deal with the complexity of the urban environment or to reveal multiscalar orders. In this respect, space syntax, morphometric analysis, and fractal geometry have recently been important innovations.
- The difficulty can also be explained by the increasing complexity of urban forms. From simple and compact forms with centre-periphery gradients, the early 21st century has seen them evolve towards vast forms with patchworks of built-up areas, natural zones, and agricultural spaces, where accessibility is often more important than geometric centrality. Revealing their orders requires tools to tackle complex objects composed, for example, of built/empty spaces and road networks.

Thus, at a time when new data are being produced and made available to researchers (user-generated data, data from sensors, or administrative registers), when new methods of analysis are being developed (machine learning, deep learning, multiscale modelling), revealing the underlying orders of urban structures still remains a challenge. Therefore, papers presented in this session could deal with the following topics:

- new data sources to reveal urban patterns which so far remained unknown
- new methods to deal with the complexity of urban patterns, especially in their multiscalar logics
- original couplings of new data and new methods to reveal intra-urban orders
- relevance of the newly found patterns for the understanding of the contemporary city
- to what extent does the discovery of new spatial orders in the contemporary city raise questions about theoretical approaches hitherto taken for granted?

From Dynamic Mobility Flows to Functional Systems: Communities, Urban Networks, and Regions

Olle Järv (U. Helsinki), & Ate Poorthuis (K.U. Leuven)

Description

The analysis of functional systems through spatial interactions has been a long-standing interest in quantitative geography. While traditional approaches often focused on single cities or countries, limited themselves to specific kinds of mobility (e.g. commuting or migration), or a single point-in-time, new (big) data sources and computational methods have opened up new avenues. By not only providing new insights on temporal rhythms of functional systems, these systems can also be investigated at larger global and cross-country

scales, and capture for more heterogeneous types of mobility (e.g. cross-border commuting, multilocal living, recreation and social networks). This can shed new light on, for example, border regions from different countries forming one functional system regarding peoples' daily practices or the temporal rhythms of urban networks.

This special session focuses on this new frontier regarding empirical evidence and methodological advancements as well as conceptual and theoretical considerations. We invite contributions that apply new computational affordances to furthering our understanding of these underlying functional systems derived from spatial interactions of people. This includes, but is not limited to:

- The conceptualization of functional systems from the perspective of mobilities and social interactions of people;
- The feasibility (opportunities, challenges) of novel data sources and methodology in capturing functional systems from the perspective of mobilities and social interactions of people;
- The transformation of mobile app, social media and other data sources into a reliable proxy for mobility flows;
- The analysis of cross-border mobility and the role of borders in functional systems;
- The algorithmic inference of regions from mobility data and their change over time;
- The intersection between functional systems and the urban-rural continuum;
- The inference of different types of mobility (i.e. those not conventionally captured in register data) from novel mobility data sources.

Data-driven Approaches for Understanding Landscapes of our Changing Planet

Marj Tonini (U. Lausanne), Christian Kaiser (U. Lausanne), Jingyan Yu (U. Lausanne), & Alex Hagen-Zanker (U. Surrey)

Description

With unprecedented population growth, planetary urbanization and related trends in recent decades, geoenvironmental and anthropogenic processes are increasingly connected. The human interactions with the geosphere and the anthroposphere are evident in different processes, such as land use and land cover changes, urban expansion and sprawl, natural resource and energy consumption. These interactions can lead to unsustainable effects and the degradation of the environment, producing an increase in the frequency and magnitude of natural hazards, environmental pollution, and causing anthropogenic climate change.

The increasing availability of national and global scale multi-temporal datasets on transforming landscapes presents new opportunities to better understand these processes, where spatial data science can provide unique and crucial insights. Especially, data-driven approaches can serve as a powerful addition to traditional theoretical approaches, strengthening the exploration, modeling, comprehension and prediction of complex processes and interactions between human activities and the environment.

We invite interventions that present theoretical and applicational advances of data-driven and evidence-based research about the landscapes of our changing planet, such as:

- Innovative techniques of knowledge extraction based on spatial data mining.
- Spatial modeling using data driven approaches (e.g., geostatistics, spatial and temporal statistics, machine learning, multi-model and ensemble methods).

- Spatial pattern and process recognition and modeling, with a special emphasis on approaches based on Bayesian spatial statistics or computer vision.
- Large geographical scale and multi-temporal analysis and analytics of regional, national and global land use land cover, human settlements and environmental data.

The "15-Minute City" Model: Innovations, Trends, and Future Challenges for Modelling the Proximity Planning

Chiara Garau (U. Cagliari), Beniamino Murgante (U. Basilicata), Valerio Cutini (U. Pisa), & Claudia Yamu (Oslo Met. U.)

Description

Recently, the 15-minute city approach has become a key design paradigm in several urban or spatial policy plans. Not surprisingly, this is made even worse by the pandemic lockdowns that forced inhabitants to rediscover their immediate living area. This redesign of the urban system (temporal, spatial, and activity-related) in terms of liveability, urban health, and well-being is promising in cities with access to daily needs or destinations (work, housing, urban facilities, amenities, food, health, education, culture, and leisure) within 15- or 30-minutes walking, cycling, or travelling on public transport. This approach is crucial for solving everyday complexities, including all measures related to auto-dependent policies, the decrease of air pollution, noise, and heat island effects, and the development of green space and physical activity.

Although the concept is largely focused on rethinking urban morphologies, the 15-minute city model may be improved by adopting:

- different urban methods and approaches for modelling proximity planning,
- Smart Cities network technologies such as digital twins, Internet of Things IoT, and 6G,
- configurational analysis for cities,
- computational analyses for modelling and developing sustainable cities.

Modelling the 15-minute city also requires a strategy that includes transportation planning, urban design, and governance in order to create well-designed public spaces and streets that are good for walking, cycling, and mixed-use projects.

Based on these suppositions, the aim of this session (but is not limited) is to foster debates about the 15-minute city by considering its concept, its morphological approach, structure-function models, its computational analysis, and its application in urban planning.

Spatio-temporal Data Science: Harnessing Big Data and AI for Geocomputation

Beniamino Murgante (U. Basilicata), Itzhak Benenson (Tel Aviv U.), Federico Amato (E.P.F. Lausanne), Antonino Marvuglia (Luxembourg I.S.T.), & Federico Martellozzo (U. Florence)

Description

The proliferation of urban and environmental spatiotemporal data has transformed the field of geocomputation in recent years.

Parallel development of open access tools and libraries for spatial analysis, geostatistics, machine learning, as well as the instantaneous growth of available computational resources, opens new horizons in understanding, modelling and forecasting complex spatio-temporal systems, including landscape and societal dynamics.

We invite cutting-edge contributions that showcase the use of big data analytics and AI techniques in modern geocomputation with a focus on spatio-temporal data. Topics of interest include, but are not limited to:

- Innovative approaches to big spatio-temporal data analysis in geostatistics and machine learning
- Novel solutions in cellular automata and agent-based modelling of spatio-temporal systems, including integrations with reinforcement learning
- Uncertainty measurement and representation in spatio-temporal data science
- Interpretable machine learning models for spatio-temporal geocomputation and their interfaces and tools for interaction with stakeholders and decision-makers
- Crowdsourcing and citizen science data for spatio-temporal Geocomputation
- Deep learning, neural networks, and other advanced machine learning techniques in spatio-temporal geocomputation.

Relevant domains of application include, but are not limited to:

- Urban morphology and design
- Land use dynamics and urban planning
- Transportation and urban mobility
- Environmental dynamics and sustainability
- Biodiversity and conservation
- Ecosystem risk assessment

Theoretical Geography

Clémentine Cottineau (T.U. Delft), Isabelle Thomas (U.C. Louvain), Denise Pumain (U. Paris 1), & Juste Raimbault (IGN-ENSG, U. Gustave Eiffel)

Description

In our European Colloquia on Theoretical and Quantitative Geography, the adjective "theoretical" belongs to a long-standing phase, that of the affirmation and consolidation of a discipline that has created an epistemology of its own and is able to disseminating its models to other sciences. In this session, we invite you to discuss this topic around several questions that the recent evolution has raised:

- Do we agree with Waldo Tobler claiming in 1993? "Five of the most important and useful theoretical models in the study of geography are, in historical order: the Von Thünen model of agricultural land use; Weber's model of industrial location; Walter Christaller's central place formulation; the gravity model of spatial interaction; and Hägerstrand's model of the geographical spread of innovation. All of these models are of fundamental importance in understanding the world around us. They also have in common the fact that they simplify reality by invoking an isotropic geographic space. Of course they do this to varying degree, and some then relax this assumption. Most of them are also computationally explicit models, again to varying degrees". (Waldo Tobler, non-isotropic modelling, 1993). Could we add other models to that list?
- Has the "geographical turn" in social sciences really taken place? In which sciences and how?

- How do various currents of critical geographies relate to an ambition of theoretical geography?
- How can we expand or reconstruct the foundations of theoretical geography in the world of massive data? To which extent do geographical theories benefit from the development of urban analytics and geographical data science?
- What contributions to theory development has be achieved / could be achieved with simulation models?
- What links between theories of complexity and theoretical geography have been explored, and what remains to be investigated regarding geographical complexity? To what extent does space induce a higher complexity?
- What is there to be learned about theories from the history of geography?

The special session aims at bringing together geographers interested in discussing these questions and their contribution to theoretical geography more generally.

Spatial Dynamics of Networks

Celine Rozenblat (U. Lausanne), & Zachary Neal (Michigan S.U.)

Description

In the perspective of the recent improvements in Network science and in Complex science, we propose a session where we could discuss the contribution of geographers in spatial networks' dynamics studies together with other disciplines like physics, sociology, archaeology, and economy to quote only few of them. We expect proposals including theoretical and empirical questions and results, reflecting on the geographic community future agenda in the context of the development of big data and Local digital twins.

We could focus on the following (but not limited) questions:

- Did the role of space change in the topologic network approaches?
- How to identify processes of several geographic levels and scales in the dynamics of networks?
- How to combine geographic dimension with other dimensions of networks' dynamics in multi-partite/ multimodal networks (i.e. relatedness, multiplex)?
- How to evaluate the resilience of geographic networks?
- In the new network models what does remain from the old geographic models?
- Does big data and machine learning tools change network approaches?
- How to manage and analyze geographic network data in Local digital twins for supporting policy actions?

New Methods for the Validation of Spatial Simulation Models

Juste Raimbault (U. Gustave Eiffel, IGN-ENSG), Denise Pumain (U. Paris 1), & Romain Reuillon (ISC-PIF, CNRS)

Description

Spatial simulation models in quantitative geography, or other quantitative spatial social sciences, are specifically prone to difficulties to be validated, for several reasons including the complexity intrinsic to spatial processes, the high dimensionality of their parameter

space and in which their dynamics take place, or the recurrence of path-dependency and equifinality. Methods have been developed to explore model behavior, to validate and evaluate model outcomes and to increase confidence on the modelling process, including sensitivity analysis, calibration and optimisation. This special session will focus on the latest investigation and future perspectives in that context. Specific questions on this subject include:

- the development of novel methods for simulation models exploration and validation;
- sensitivity analysis methods focusing on the role of space or the spatial properties of models;
- the use of diverse methodologies which are not often coupled with simulation, such as bayesian signal processing, or machine learning to build surrogates;
- open tools, methods and platforms implementing such approaches;
- epistemology of simulation models and model validation, different definitions of model validation depending on model functions and context;
- the role and implication of various stakeholders in the model validation process (experts, modellers, citizens, decision-makers).