Inspire Policy Making with Territorial Evidence

// Profiling urban populations through mobile phone data: an application on the Milan urban region
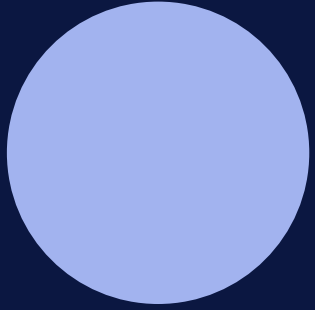
Mobile phone data for urban studies

Conventional data sources

Conventional data sources for urban investigations (surveys, census): pros

- Socioeconomic information

- Demographic information

… and known limitations

- high cost

- low frequency

- difficulty of updating,

- difficulty of describing city dynamics and time dependent variations in intensity of urban spaces usages by temporary populations at different scales

- small sample

Mobile phone data: characteristics

- measure of traffic intensity carried by the network (avg number of concurrent contacts in a unit of time)

- Data structure geo-time-series

  - Time-series of georeferenced data

    - Spatial resolution: 1px=250m x 250m

    - Temporal resolution: 15 minutes (96 maps per day)

  - Structured as an atlas of charts (sections) covering a geographic area

  - Equipped with methods to extract aggregated informations (in time and/or space)

New data sources: applications

- **supporting and increasing the efficiency of urban policies** and transport services with more detailed knowledge of the intensity of the use of the city (during the day, weekdays/holidays, seasons) linking them to the differences in the urban activity distribution at different hours, days and weeks;

- **managing large and special events** (inflow, outflow, monitoring), also estimating the mobility demand and the spatial-temporal variation in population density, to offer guidance for future decisions on the provision of new urban services;

- **updating origin–destination transport matrix**, dealing with the behavioral mechanisms of the modal diversion process and operationalizing travel behavior studies;

- realizing a **land-use classification** according to mobile phone uses, in which different "basic" profiles of city usages can concur to identify different profiles of use and consumption without the burden of a direct survey;

- managing environmental and industrial risk protection with information deduced from mobile phone data used as a **"proxy" of the population exposed to specific risks**.
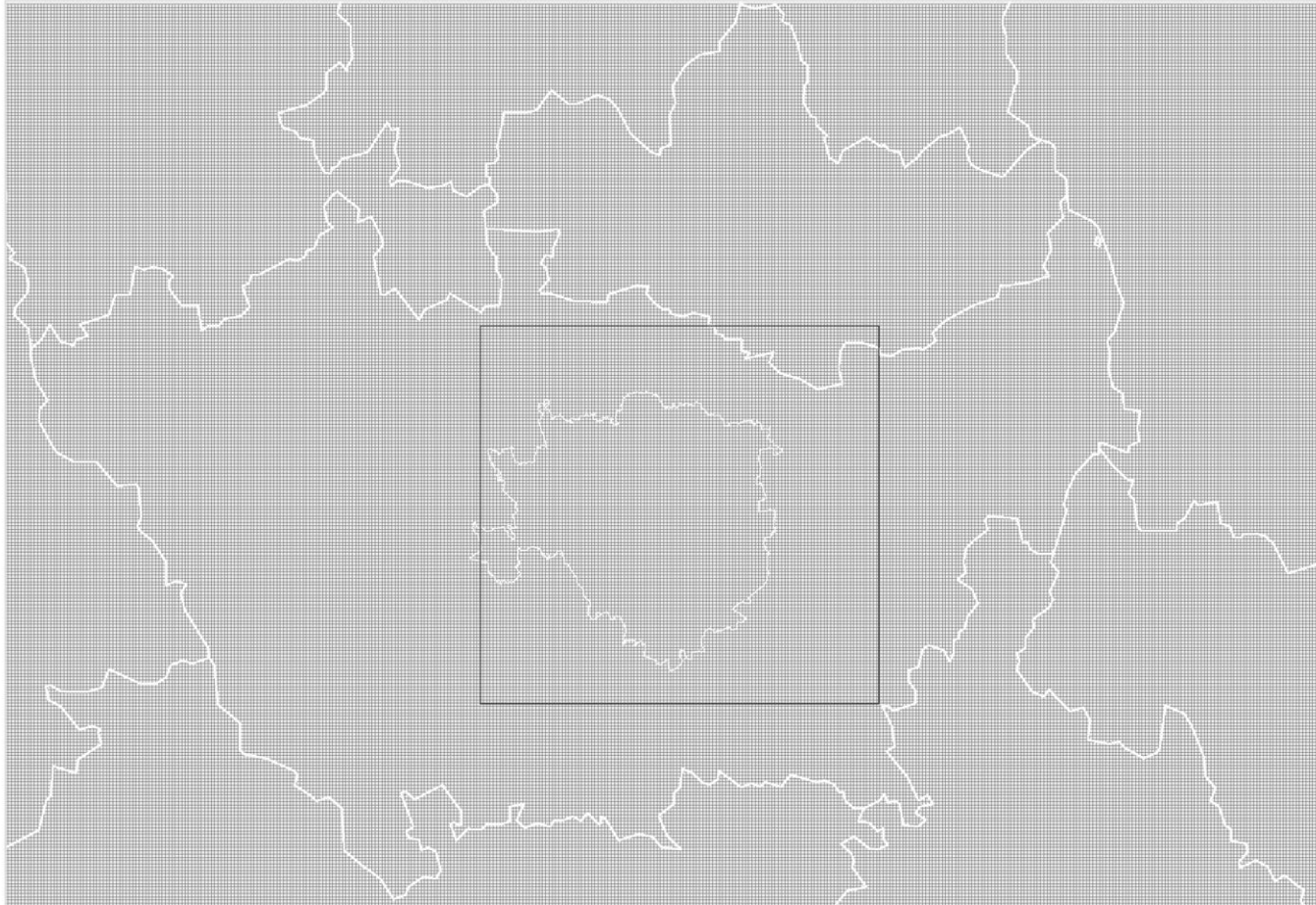
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An application on Milan urban region

The research

Our research with mobile phone data, provided by Telecom Italia in 2010 and 2012 (Pucci et al., 2015) showed the significance of this data source for at least the following applications:

- Monitoring in real time the density of people during a large event as the International Design Week in Milan;

- Detecting the space-time variabilities of urban practices, providing information on temporary populations and city usage patterns (daily/nightly practices, non-systematic mobility);

- Detecting prevalent flows and their intensity and variability to distinguish systematic vs. non-systematic mobility as well as the recurrence of mobility practices;

- Searching for relevant boundaries to deal with the variability of social and spatial relationships and with the multi-scalar dimension of urban practices.

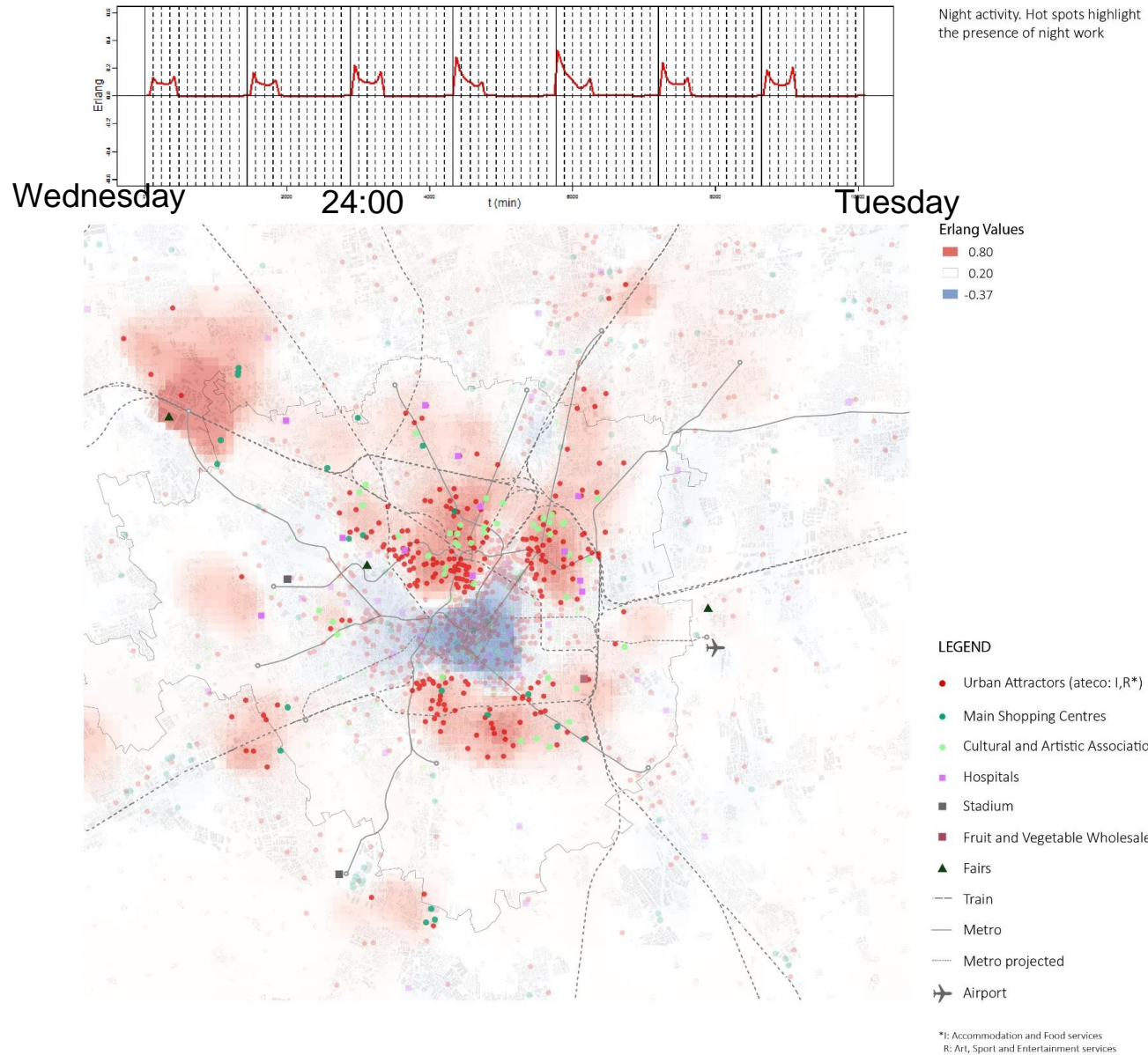# Institutional boundary and mobile phone activity


NUTS3

Vs

Municipal boundary

Vs

Mobile phone data cells

Night activity

Night activity. Hot spots highlight the presence of night work

Wednesday   24:00   Tuesday

Erlang Values
- 0.80
- 0.20
- -0.37

LEGEND
- ● Urban Attractors (ateco: I,R*)
- ● Main Shopping Centres
- ● Cultural and Artistic Associations
- ■ Hospitals
- ■ Stadium
- ■ Fruit and Vegetable Wholesale
- ▲ Fairs
- – – Train
- — Metro
- ···· Metro projected
- ✈ Airport

*I: Accommodation and Food services
 R: Art, Sport and Entertainment services

- ▪ geographical distribution of night work activities within the Milan area
- ▪ presence of urban attractors in the sector of accommodation, food and entertainment
- ▪ night populations: night workers and temporary populations

Residential districts
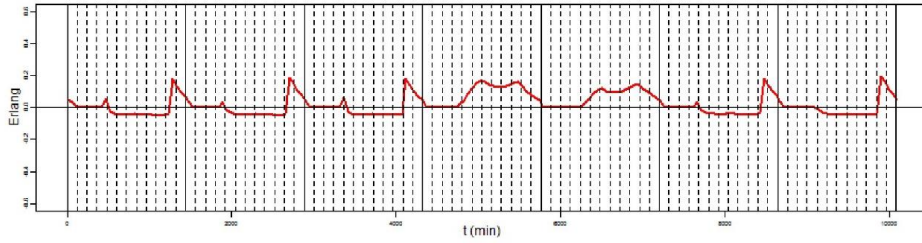
Concentration of activities during working day evenings and daytime (from 8 a.m. until 8 p.m.) in the weekend: residential districts of Milan urban region
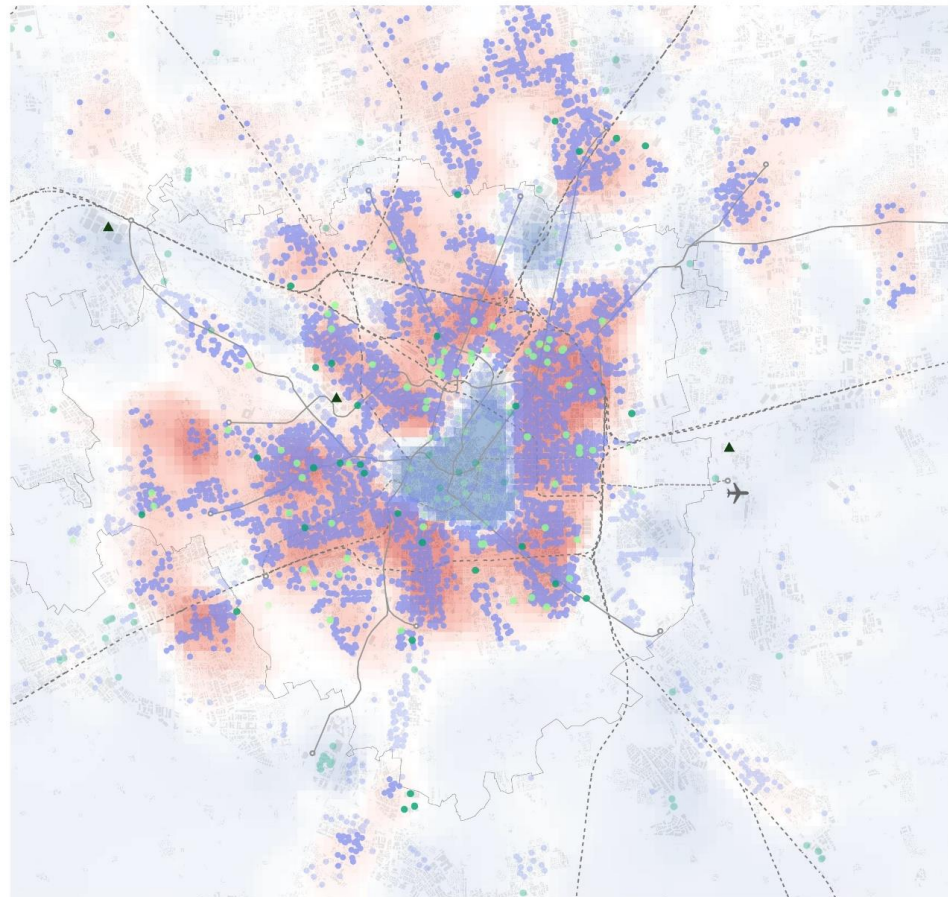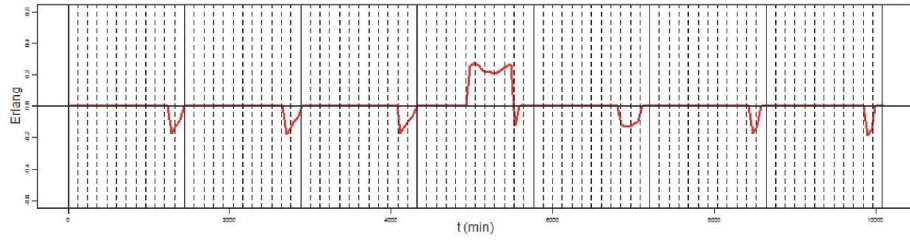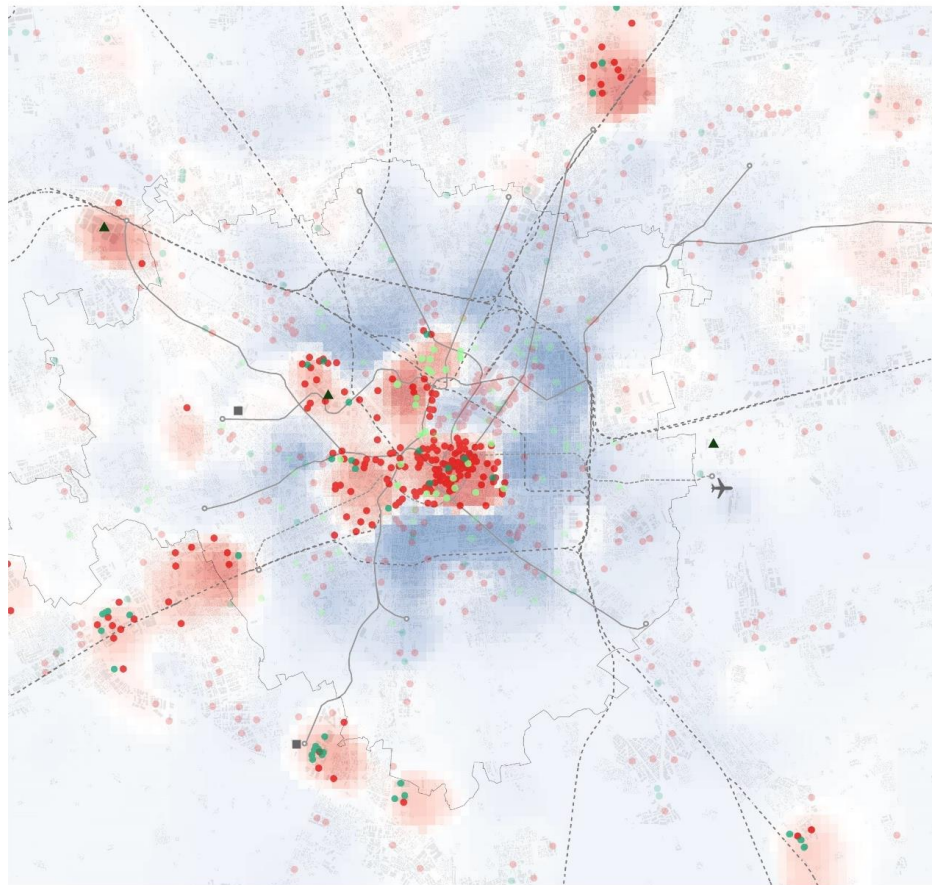
Erlang Values
- 3.40
- 1.23
- -1.50

LEGEND
- Urban Generators (Pop/Area)
- Main Shopping Centres
- Cultural and Artistic Associations
- ▲ Fairs
- – – Train
- — Metro
- ---- Metro projected
- ✈ Airport

- main residential districts in Milan as well in some municipalities with large scale social housing and residential neighbourhoods
- the city centre is characterized by a low value of activity
- these are urban mobility generators
- urban populations of commuter students and workers

Shopping and leisure activities

Density of activity on Saturday (10 a.m.-8 p.m.): shopping and leisure activities

Erlang Values
■	0.64
☐	0.00
■	-0.63

- geographical distribution of shopping and leisure activities during Saturday daytime
- city centre, western urban sector, more dispersed centralities
- mobile populations
- spatial and temporal patterns

LEGEND

- ● Urban Attractors (ateco: G,I*)
- ● Main Shopping Centres
- ● Cultural and Artistic Associations
- ■ Stadium
- ▲ Fairs
- --- Train
- — Metro
- ···· Metro projected
- ✈ Airport

*G: Wholesale and Retail Trade services
  I: Accommodation and Food services

3

Challenges for mobility policy and official statistics

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Implication for mobility policy

- understanding of complex practices related to mobility and temporary uses of urban spaces

- support to decision-making processes in terms of the identification of different issues related to the spatial distribution of mobility patterns, on their spatial implications in the direction of supporting equal access to urban opportunities

- definition of new needs in relation to a growing, dispersed and intermittent mobility demand, not clearly and fully identified with traditional data.

- Assessment of the effects of the current trends in the transport supply in respect to the emerging mobility needs

- definition of a more flexible mobility service, aimed at being effectively demand-responsive for the temporary populations and for the emerging mobility needs

- Identification of relevant and effective boundaries, challenging institutional and normative spaces.

Implication for official statistics

- evaluation of the potential contribution of new sources of data based on information collected anonymously by users to official statistics

- definition of methods able to integrate new data sources with conventional data sources to overcome the limitations of conventional data in describing and measuring phenomena occurring in urban spaces.

- mobility in its spatial and temporal articulation appears to be one of the main issues that call for identification of new sources of data and methodologies

- the official statistics institutions, both at national and European scale, can play a relevant role in incorporating some of the methodologies and of these new sources of data in their own tasks

- official statistics institutions can act as public interlocutors of telephone companies in order to define formats and conditions to obtain mobile phone data for the general interest

- definition of public interest use of mobile phone data may lead companies to share some data for specific purposes

Open issues

- the real availability of mobile phone data at a European scale is a relevant issue

- huge fragmentation of providers in the European countries and of their scarce willingness to cooperate for public interest purposes like the improvement of the territorial development understanding

- the identification of conditions for the acquisition of private data by public institutions is a topic that needs to be fully addressed in order to define an effective contribution of this data source to a near real time understanding of the European spatial processes

- the original raw data are provided to the scientific community in different formats, at different spatial and temporal resolutions without an established standard for privacy issues, which is a dimension regulated by national laws

- integration with conventional data sources (e.g. mobility data, land use/land cover, sociodemographic data, census data) and other sources that have become available in recent years (open mapping websites, social media data and in general user-generated data) for the interpretation of complex spatial patterns

- common task for the research community, policy makers, statistical institutions, public and private data providers: understanding and monitoring in their spatial and temporal dimensions urban and territorial processes that conventional data fail to catch

Thank you

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This presentation will be made available at: www.espon.eu/espon-scientific-conference-2018