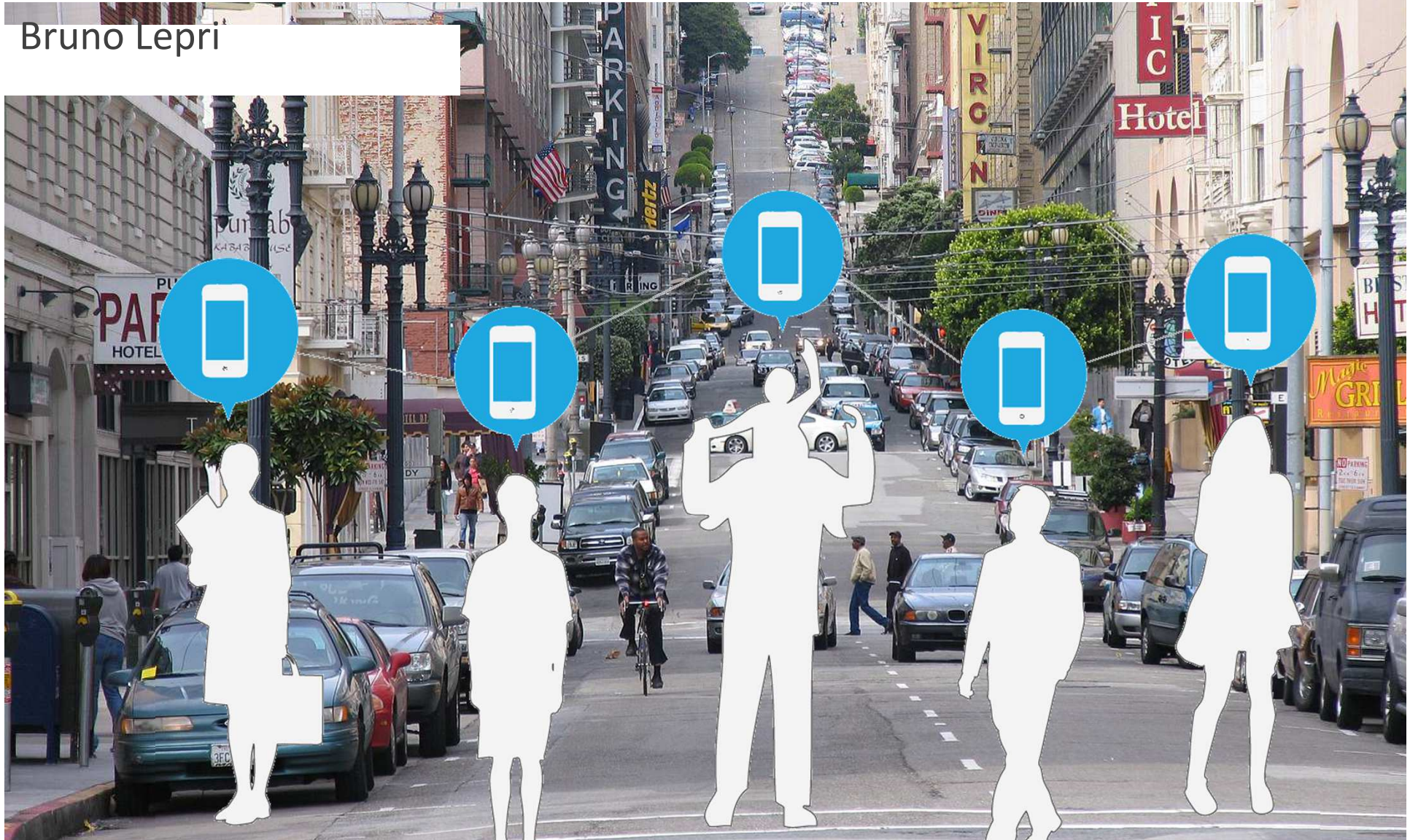


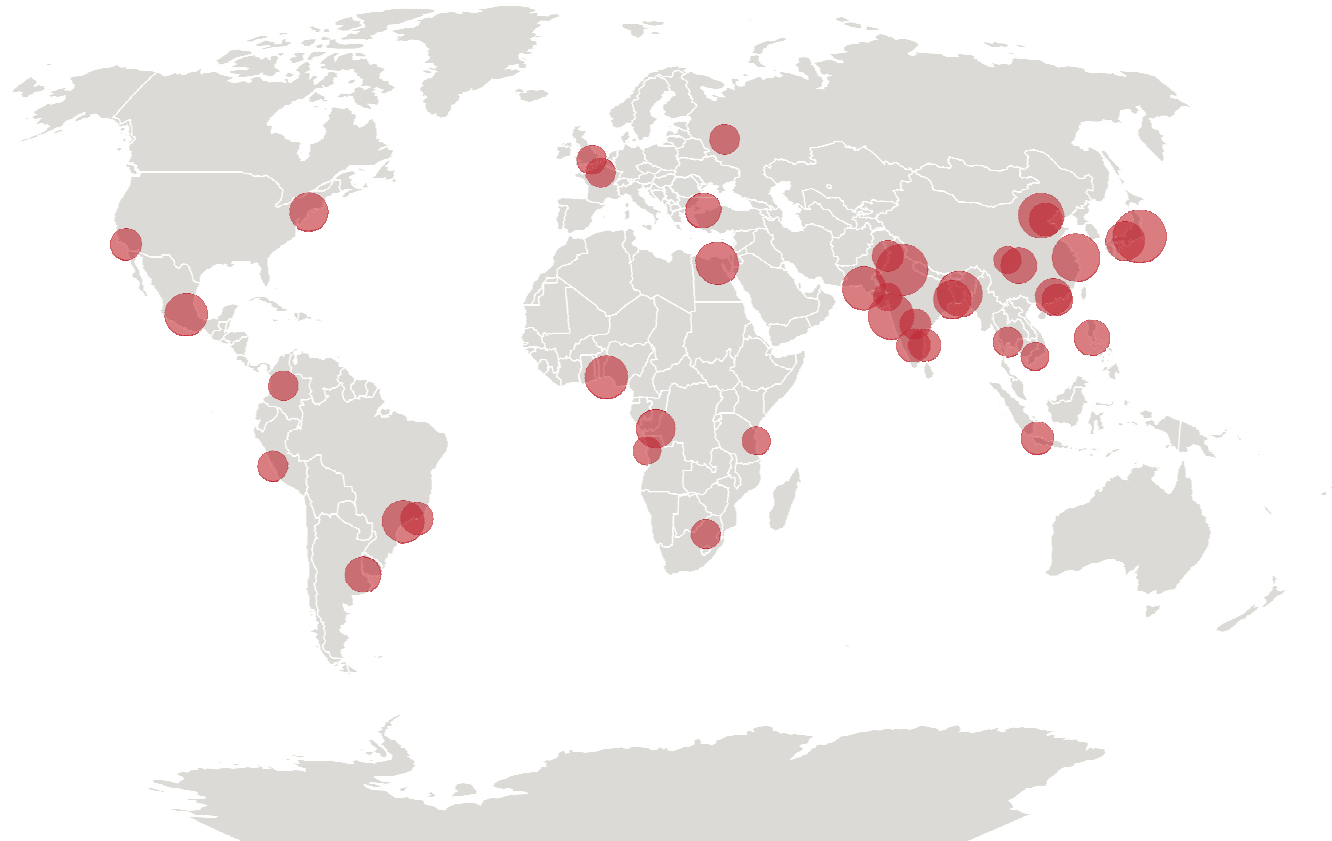
Data-driven Cities

Bruno Lepri



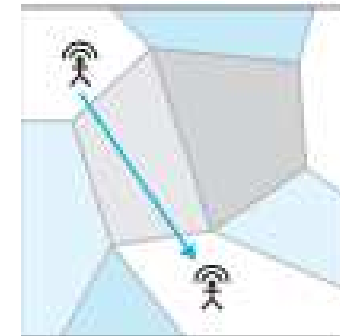
The Tale Of Cities

- Cities are places with high innovation and prosperity, but are also polluted, jammed and caotic
- By 2030, 9% of world population will live in **41 MEGA-cities** (10M+ inhabitants)



Call Detail Records

- **Mobility:** from cell towers we can reconstruct the movement patterns of a community

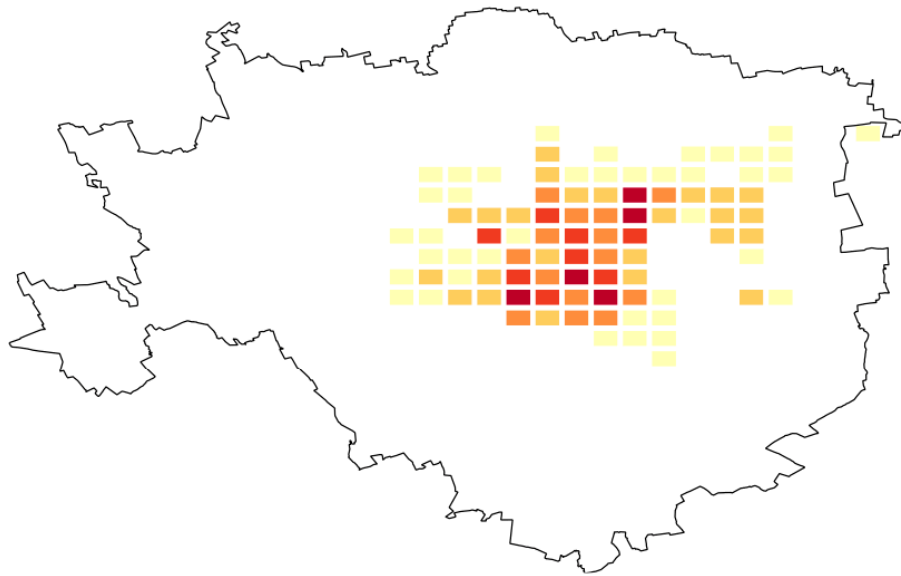


- **Social Interactions:** from call and sms we can reconstruct social networks and interactions

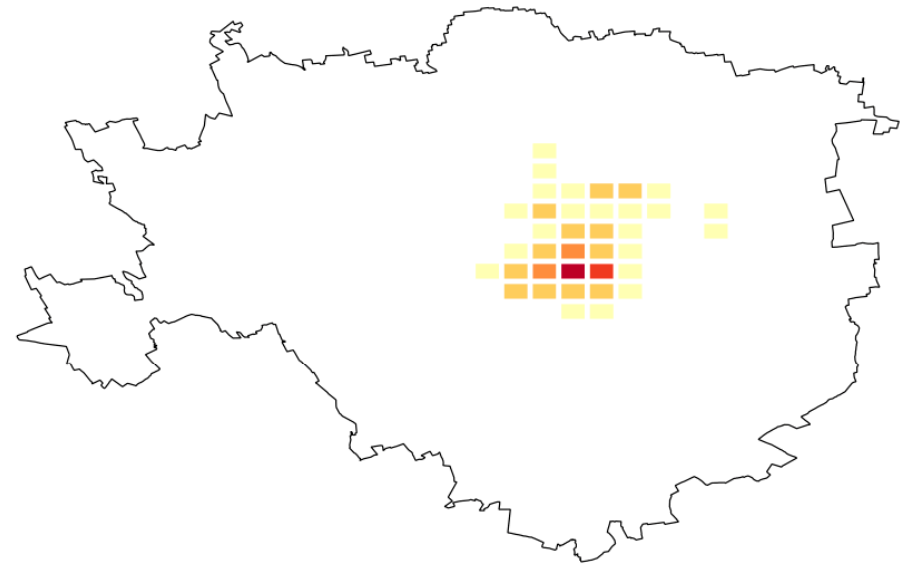


-

Tales of Cities



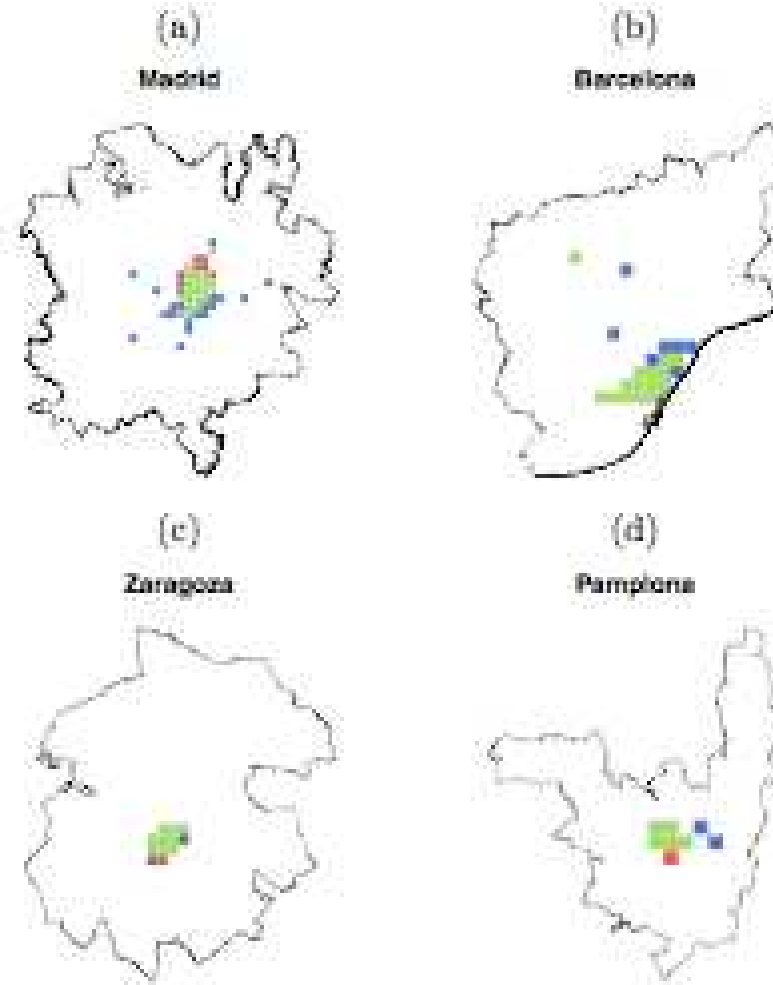
MILANO - 10:00



MILANO - 15:00

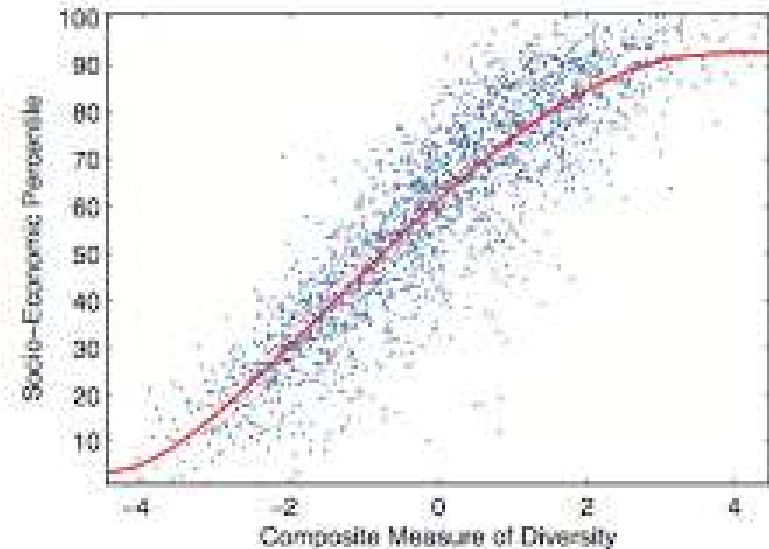
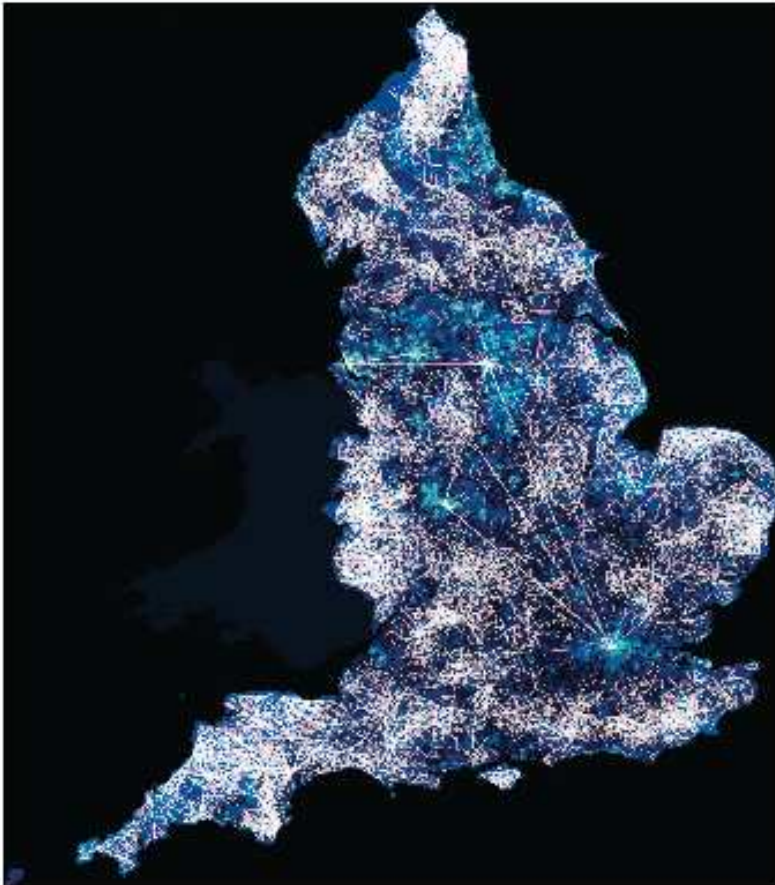
- Hotspots evolution highlights the cities behaviour during the day

Tales of Cities



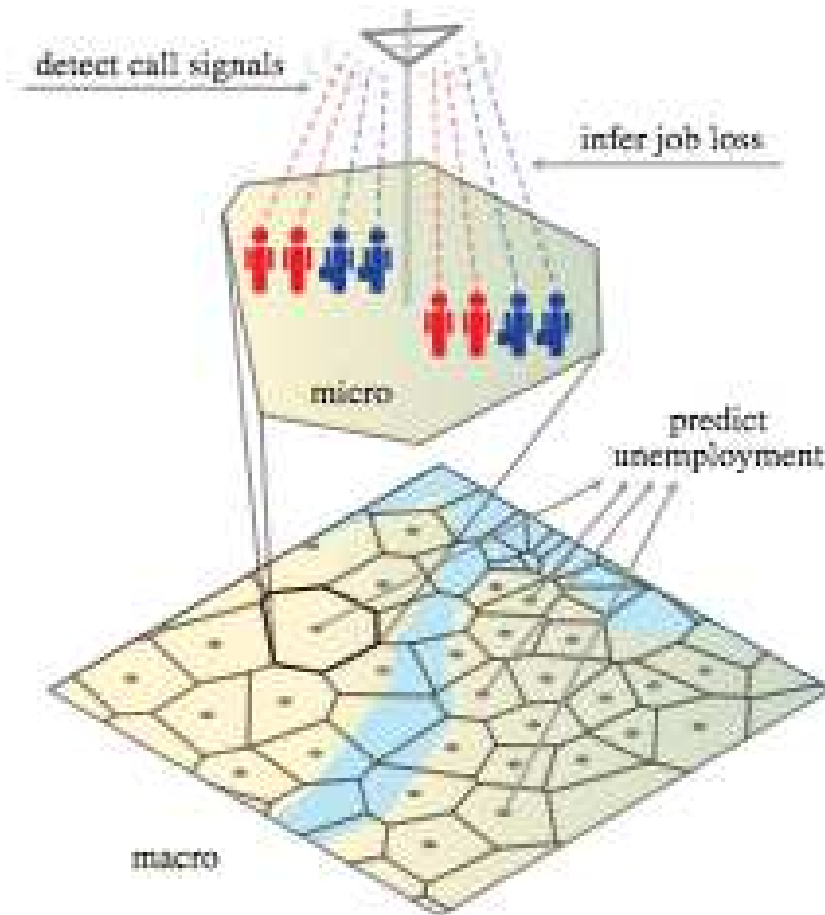
- ✓ red = work
- ✓ blue = residential
- ✓ green = work+residential

Economic Development



social and spatial network diversity (computed using Shannon entropy and Burt structural holes) is strongly associated with IMD rank (measure of prosperity) [Eagle et al., 2010, Science]

Tracking Employment Shocks



- ✓ Toole et al. [Royal Society of Interface, 2015] show that it's possible to observe mass layoffs and identify the users affected by them in mobile phone records
- ✓ job loss has a systematic dampening effect on their social and mobility behaviour

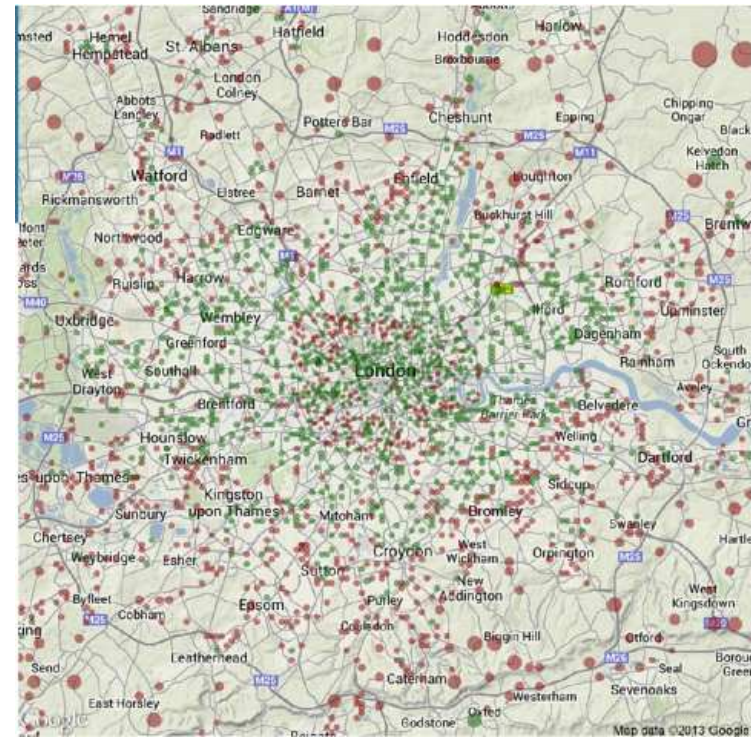
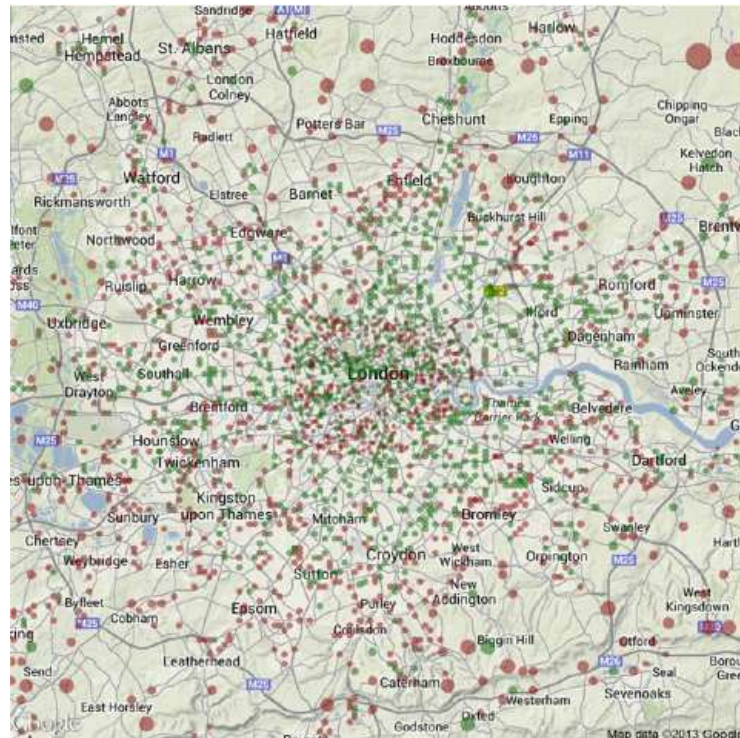
Crime and Urban Environment

- ✓ **natural surveillance** as key deterrent for crime: people moving around are **eyes on the street** (Jacobs, 1961)
 - ✓ **high diversity** among the population and **high number of visitors** -> **less crime**
- ✓ **defensible space theory** (Newman, 1972)
 - ✓ **high mix** of people -> **more crime**



Crime Prediction

- prediction of crime hotspots from *people dynamics* derived from mobile network activity and demographics (accuracy>70%)
- high diversity of functions in a area and high diversity of people (gender and age-diversity) act as *eyes on street* decreasing crime levels



Mobile Territorial Lab



- Understanding Behaviors
 - daily stress, daily happiness, personality, life satisfaction
 - spending patterns, mobility patterns, routines
 - spreading of contagions, political opinions, attitudes
- Changing behaviors:
 - Incentives for supporting healthy behaviors, enforcing cooperation, inducing smarter spending

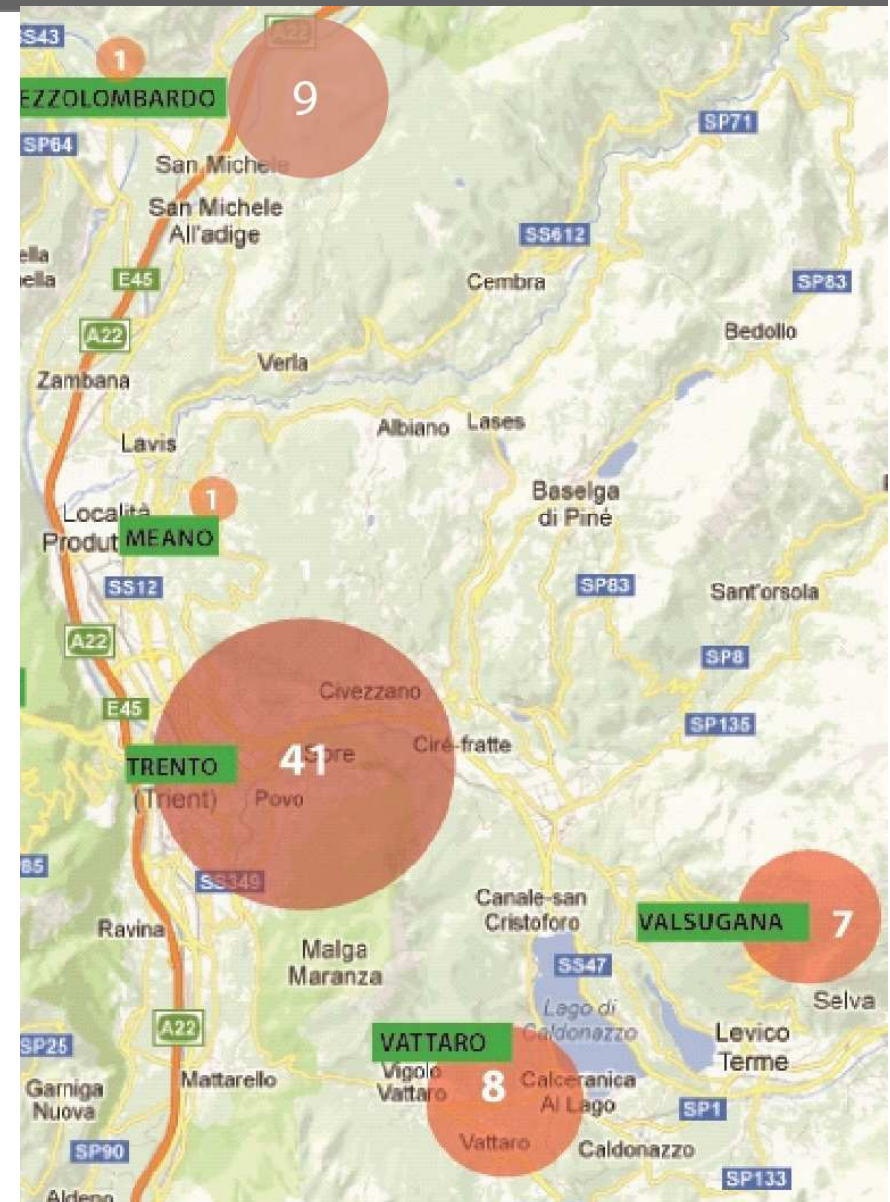
Mobile Territorial Lab

First Phase (Nov 2012–Nov 2013)

➤ 70 parents living in Trentino Area with children aged 0-6

Second Phase (Nov 2013–Nov 2014)

> 120 parents with children aged 0-10



Research Challenges

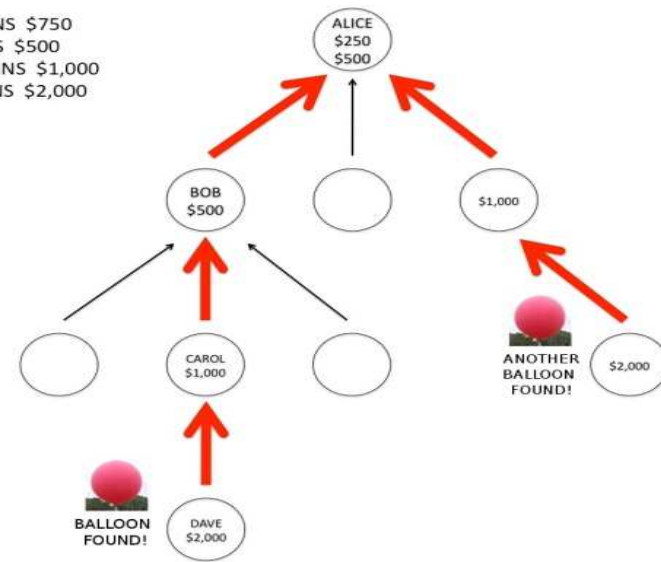
- Understanding links between subjective well being (mood, stress, etc.), individual traits, sociability, mobility
- Predicting individual spending patterns and understanding links between mood, sociability, spending behavior



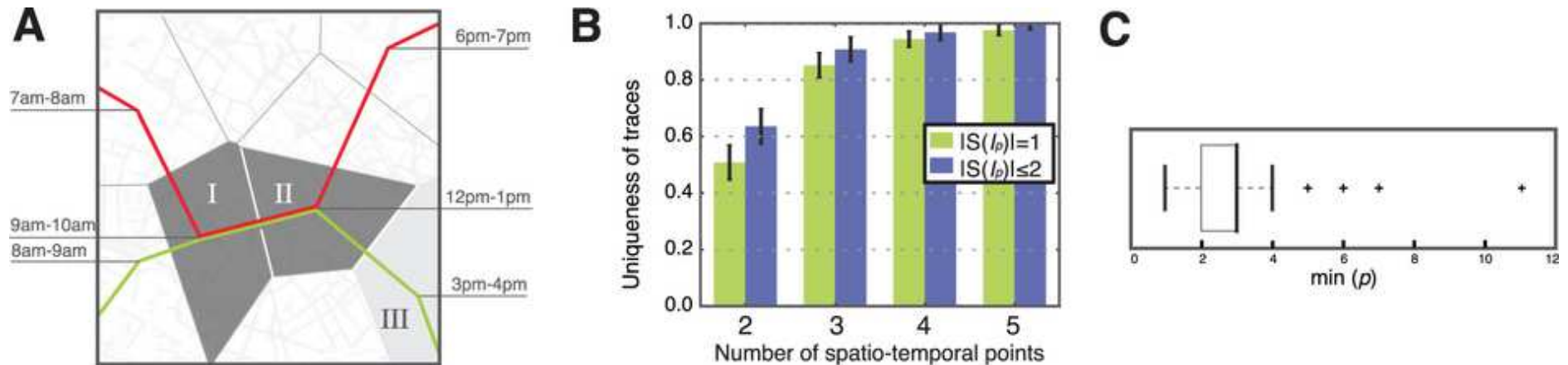
Social Network Incentives



ALICE WINS \$750
BOB WINS \$500
CAROL WINS \$1,000
DAVE WINS \$2,000

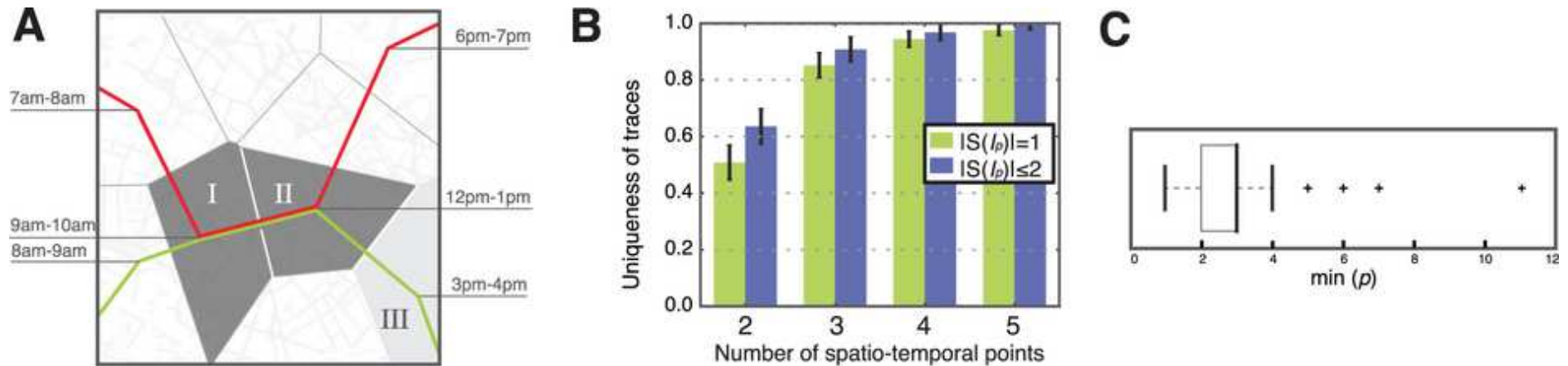


Unique in the Crowd



- ✓ de Montjoye et al. (Scientific Reports, 2013) study fifteen months of human mobility data for one and a half million individuals and find that human mobility traces are highly unique.
- ✓ in a dataset where the location of an individual is specified hourly, and with a spatial resolution equal to that given by the carrier's antennas, four spatio-temporal points are enough to uniquely identify 95% of the individuals.

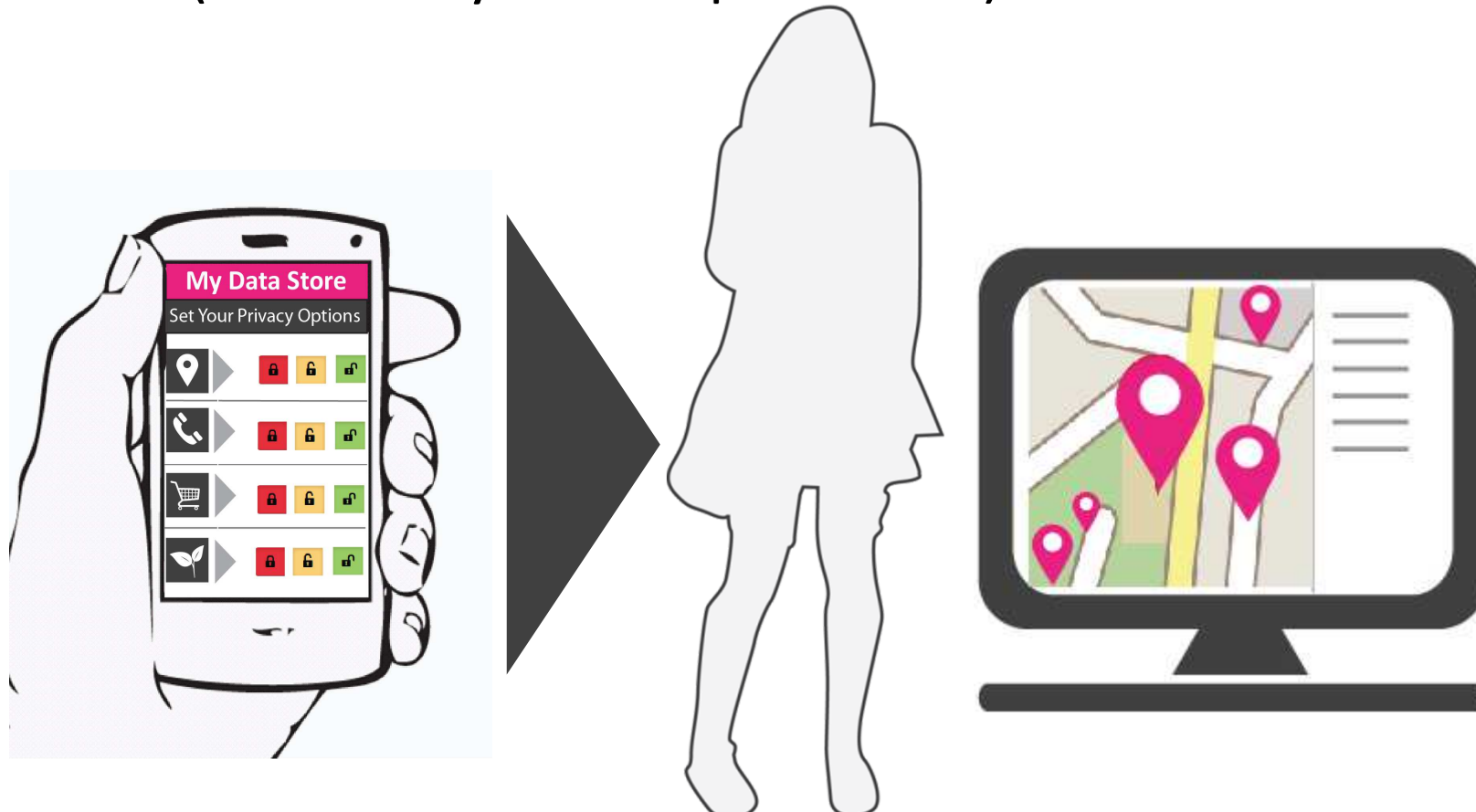
Unique in the Crowd



- ✓ These findings represent fundamental constraints to an individual's privacy and have important implications for the design of frameworks and institutions dedicated to protect the privacy of individuals.

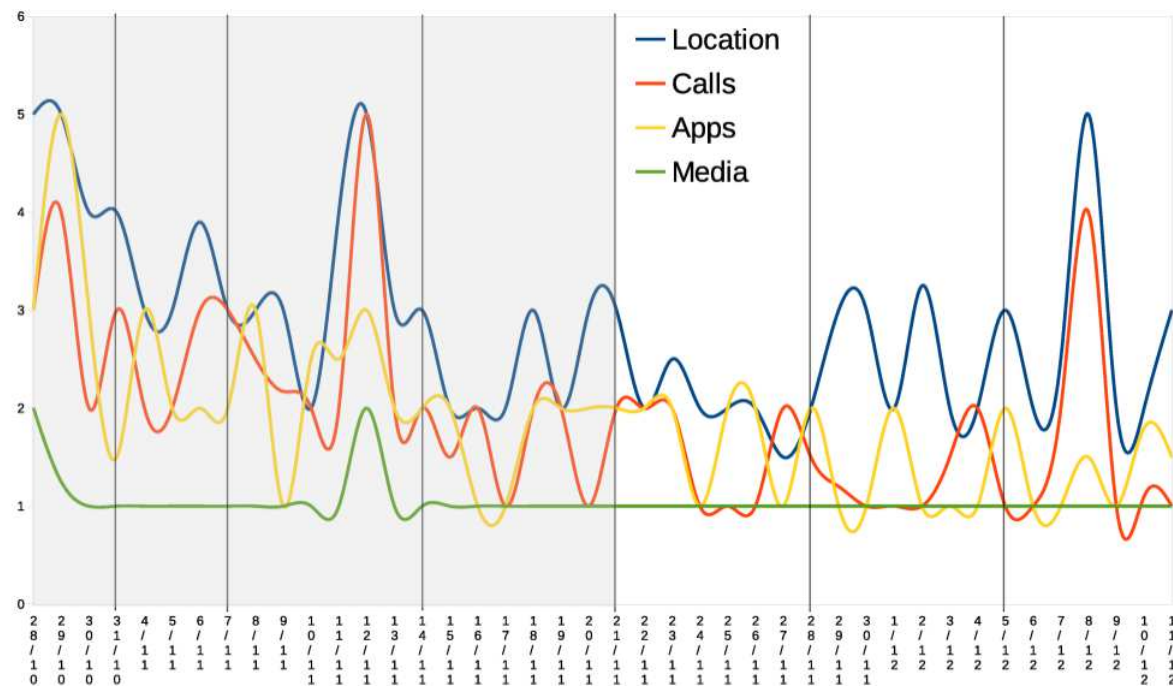
Personal Data Back to People

- Personal Data Store: a tool for managing/sharing/selling personal data, individuals are owners of their personal data (case study WEF report 2013).



Personal Data Monetization

- location is the most sensible and highest valued
- subjects show desire of control of their personal data
- traits and dispositions does not explain monetary valuations, behavior does



median daily valuation (euro) per category

Data Challenge Initiatives

- ✓ Data for Development (D4D): 2012-2013 on Ivory Coast and 2014-2015 on Senegal
- ✓ Datathon for Social Good: London Data
- ✓ Telecom/Tim Italia Big Data Challenge: 2014 and 2015: data on Italy (CDRs, twitter, traffic, energy consumption)



Telefónica



Thank you

lepri@fbk.eu

