*UrbanSensing: listening to the digital city

Cities are complex systems, with emerging qualities which cannot be reduced to static understandings or representations. Dynamic networks of human flows and social interactions are deployed within an evolving infrastructure and architecture that defines the urban morphology. New models and analytical work based on complexity science and network theory can inform our understanding of both what the city is and what it could be. Such studies, rely heavily on the availability of appropriate data at the city level, which has always been a serious problem for urban policy making. Major economic data for measuring the health of the urban economy, like city product, investment, income disparity, and financial status and other data for measuring the living condition of the city, like infrastructure service levels and environment, are increasingly easy to access, especially in Western countries.

The fast-paced metabolism of the contemporary metropolis, though, makes more and more evident the lack of production in real-time knowledge at a fine grain, at the neighborhood scale, or even at level of the metropolitan subject, the mobile citizen. Urban real-time data are increasingly popular, but what is still missing is indicator capacity at all levels of government.

Real-time data can be processed to produce knowledge, in order to collect useful information on urban conditions and trends; to analyze this information to improve access to and coverage of basic services and other urban infrastructure; to improve targeting and operational performance of services; and to apply that knowledge in formulating and implementing urban policies and programs.

*UrbanSensing (http://urban-sensing.eu/) is a two year funded European Union project, it involves six European Partners, that all contribute their specific expertise and skills in the fields of the project. The Consortium includes 3 SMEs: Accurat (IT), LUST (NL), Mobivery (ES) and 3 Research Performers (T-Connect (IT), IT4all (FR), Technical University of Kosice (SK). The *UrbanSensing project is funded by the European Union, as part of the FP7 Framework Program.

The project will bring a new product to the urban design, city planning and urban management market: a platform extracting patterns of use and citizens' perceptions related or concerning city spaces, through robust analysis of User Generated Content (UGC) shared by the city users and inhabitants over social networks and digital media. The platform will allow to analyze users' perceptions related to specific geographic areas and understand how population reacts to new urban policies within participatory mechanisms. It also gives insight in the lack of structures offered by institutions and city administrations and propose interventions, also within collaborative frameworks and to discover possible emergent structures and bottom-up initiatives responding to uncovered needs and desires. Next to this it will help to understand how specific user groups use public spaces and for instance, identify locations suitable for design interventions.

Within the project, we are conducting several experiments.
One of the latest investigations we worked on it's called Geographies of time, exploring the possibility to build novel maps of city areas' boundaries, mapping the different patterns of use (activities on Social Media) on specific areas of the city, and aiming to derive and represent new boundaries of the city neighborhoods: evolving, interplaying and overlapping.

In fact, while municipal boundaries (zip codes or administrative boundaries) are actually necessary to

provide order and organization to the city, they are not reflecting how people actually live and perceive areas.

By measuring social media activities (e.g. profile of people sharing from a place, characteristics of venues of the place, "pulsation" of social media activities according to diverse timestamps in the place, typology of pictures people take in different areas, etc etc) in specific places of the city we aim at identifying some initial clustering operations highlighting similarities and drawing novel boundaries of those area sharing a strong "identity".

This experiment builds novel geographies out of Social Media data production, rather than confirming / evaluating existent and well known ones.

Areas are defined and coloured according to the time period of the day they are pulsing the most, on Twitter over a monthly period.

We gathered and analysed data on the city of Milan for the month of April 2013; dividing our analysis into weekdays, weekends, and weeks when special events happen (i.e. Milan Furniture Fair)

WEEKDAYS
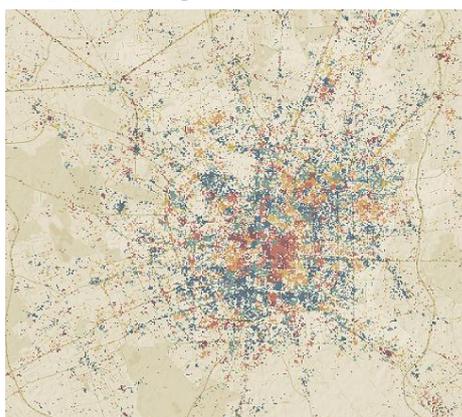
General comments
The city geography is strongly related to the use of urban areas during the two different parts of the day: working hours and non-working hours.

Among the most interesting and well highlighted clusters identified are:

The business areas (where administrative centres, banks and large company headquarters are located) San Babila, Duomo Missori, Porta Garibaldi, and Repubblica, as well as those areas close to the Central station and Cadorna, are populated during office hours: 9am-6pm

The area in the south of the city (Navigli, Porta Ticinese and Porta Romana) is still mainly visited in the evening (from 6pm until midnight).

Porta Venezia, Brera, Sempione, Corso Como and via Cenisio are also densely populated in the evening and night.

The university campuses (Politecnico Leonardo, Politecnico Bovisa, Bicocca) fill up during lesson hours.

Other insights
Contagious areas used at different times:
In Bicocca there is clearly a different use in contagious areas: The campus buildings are mainly visited in the early hours of the afternoon (midday – 3pm), UCI Cinema and the shopping centre from 9pm until midnight.

The effect of European cups:
San Siro is frequented in the evening (9pm-midnight).
If you tweet before the start of the match on Sunday, contributions are generated during, and at the end of European cup matches.

Mobility:
There is a noticeable difference in the use of city stations over time.
Lambrate (6am-9am), Bovisa (6am-midday), Centrale (9am-6pm) Cadorna (3pm-6pm), Greco Pirelli (3pm-6pm) Garibaldi (6pm-9pm).

WEEKENDS
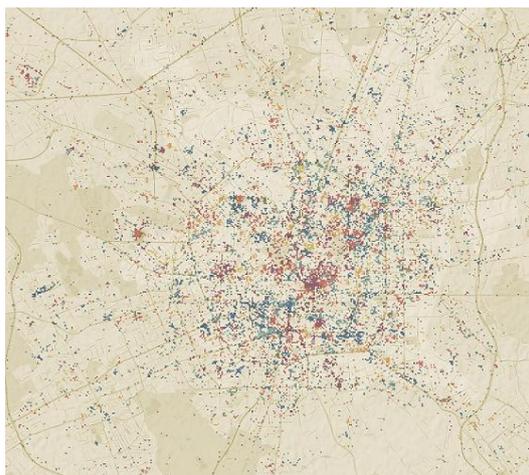
General comments
The areas are characterised by more fragmentation than in the days of the week. The places and times of contributions are more closely linked to domestic life and a multi-directional mobility, related to different free-time preferences.

There are, however, some overall observations:

The central area, specifically the area of San Babila and Duomo, the axes from Via Dante and Via Torino, as well as the gardens of Porta Venezia and Parco Sempione have a very high concentration in the afternoon hours (midday to 6pm).

The popularity of the southern area of the city (Navigli, Porta Ticinese and Porta Romana) in the evening (from 6pm until midnight) is confirmed.

University campuses (Politecnico Leonardo, Politecnico Bovisa, Bicocca) are thin on contributions compared to lessons times during the week.

Other insights
San Siro Stadium
high concentration between midday and 3pm.
People mainly contribute just before the beginning of a match.

Central Station
high concentration between midday and 6pm
Many return to the city for the start of the working week?

Breakfast out…?
high concentration between 6am and 9am
People wake up early even at the weekend in via Farini and in Brera? Commercial activities have an early start?

Staying out late in…?
high concentration between midnight and 3am
Corso Como area, Naviglio Pavese (at the height of late closures) and (INEXPLICABLY) via Cenisio, corner of via Messina.

MILAN FURNITURE FAIR
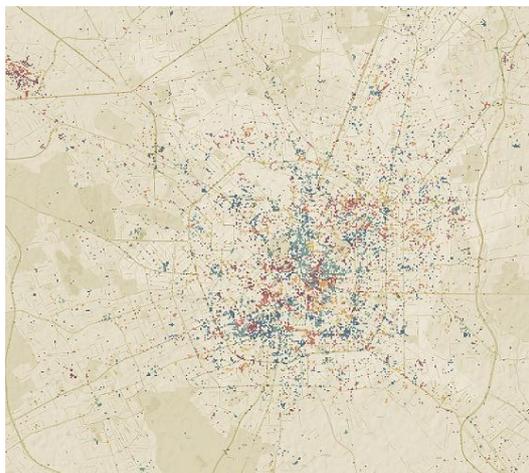
High concentration of contributions in the exhibition halls area at Rho during afternoon hours.

Increase in concentration in areas that generate evening and late night activity, proving that the city is full of events and appointments.

The central area of the city comes alive during aperitif hours (6pm-9pm). The Navigli and Porta Romana welcome a large number of people from 6pm onwards.

High concentration of contributions in the evening in typical areas of the Design Week: Tortona and Ventura.

Conclusion
Some of the insights emerging from the analysis above presented confirm already well-known city

dynamics in Milan (indicating that those information are a quite trustworthy source of information), while some other insights are even more interesting because highlights unexpected concentrations of contributions in specific areas over time.

Geographies of time is the first of a series of spatial aggregation based on Social media: since the idea is that boundaries should be drawn from geographic similarities (coincidences on type of contributions) rather than starting from actual areas' boundaries, we can retrieve geographic clusters also among other parameters according to Social Media metadata.

We are planning to build novel maps aggregating contents (what is that make people talk about an area?), pulsations (which areas share the same pulsation on contributions in a given timeframe), languages (identifying which areas share the same languages usages on Social Media contributions) among all.

Bibliography
Andrienko, G., Andrienko, N., Dykes, J., Fabrikant, S. I., & Wachowicz, M. (2008). *Geovisualization of dynamics, movement and change: key issues and developing approaches in visualization research. Information Visualization*, 7(3), 173–180
Bawa-Cavia, A. (n.d.). *Sensing the Urban*. Retrieved from
http://www.fcaa.com.br/portal/sites/default/files/licitacoes/Criar%20Licita%C3%A7%C3%A3o/SensingTheUrban-WP.pdf
Boyd Davis, S. (2009). *Mapping the unseen: making sense of the subjective image*. Retrieved from
http://eprints.mdx.ac.uk/4159/
Burigat, S., & Chittaro, L. (2008). "Interactive visual analysis of geographic data on mobile devices based on dynamic queries". *Journal of Visual Languages & Computing*, 19(1), 99–122
Castells, M. (1991). *The Informational city: Economic restructuring and urban development*. Basil Blackwell
Christian MArc Schmidt. (n.d.). *Invisible Cities: Representing Social Networks in an Urban Context*
Crampton, J. W., & Krygier, J. (2005). "An introduction to critical cartography". *ACME: An international e-journal for critical geographies*, 4(1), 11–33
Elwood, S. (2008). "Volunteered geographic information: key questions, concepts and methods to guide emerging research and practice". *GeoJournal*, 72(3-4), 133–135. doi:10.1007/s10708-008-9187-z
Graham, M. (2010). "Neogeography and the Palimpsests of Place: Web 2.0 and the Construction of a Virtual Earth". *Tijdschrift voor economische en sociale geografie*, 101(4), 422–436
Graham, M. (2011). "Time machines and virtual portals The spatialities of the digital divide". *Progress in Development Studies*, 11(3), 211–227
Graham, Mark, & Zook, M. (2011). "Visualizing Global Cyberscapes: Mapping User-Generated Placemarks". *Journal of Urban Technology*, 18(1), 115–132. doi:10.1080/10630732.2011.578412
Graham, Mark, & Zook, M. (n.d.). *Information Geographies: Online Power, Representation and Voice*
Greenfield, A., & Shepard, M. (2007). Urban Computing and Its Discontents. New York: The Architectural League of New York
Lupi, G., Patelli, P., Simeone, L., & Iaconesi, S. (2012). *Maps of babel. Urban sensing through user generated content*. Presented at the Human Cities Symposium, Brussels (BE)
Oloritun, R., & Khayal, I. (2013). *Dynamics of Human Social Networks: People, Time, Relationships, and Places*. arXiv preprint arXiv:1308.1287. Retrieved from http://arxiv.org/abs/1308.1287
Simeone, L., Lupi, G., Patelli, P., & Iaconesi, S. (2012). *Polyphonic images of the cities. Mapping new human landscapes through User Generated Content*. Presented at the Northern World Mandate, Cumulus Helsinki Conference, Helsinki. Retrieved from

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http://cumulushelsinki2012.org/cumulushelsinki2012.org/wp-content/uploads/2012/05/Visualizing-the-crisis _Cumulus2012_paper_templateNEW.pdf

Zook, M. A., & Graham, M. (2007). "Mapping DigiPlace: geocoded Internet data and the representation of place". *Environment and Planning B: Planning and Design*, 34(3), 466–482

Zook, M., & Graham, M. (2007). *From cyberspace to DigiPlace: Visibility in an age of information and mobility. Societies and cities in the age of instant access*, 241–254