Visualizing the User Generated city

Exploring the potentiality of emergent geo-social media applications as a novel source of urban knowledge

Politecnico di Milano
Dipartimento di Design Dottorato di Ricerca in Design XXVI Ciclo

CANDIDATE
Giorgia Lupi

ADVISOR
Paolo Ciuccarelli

OUTSIDE EXAMINER
Andrew Vande Moere

PHD PROGRAM COORDINATOR
Francesco Trabucco

Abstract

A massive amount of information is emerging from the digitization of contemporary cities, providing novel means of understanding our lives and the inner dynamics of organizations and societies.

City users can now provide local knowledge through a bottom-up approach, contributing information through the use of widely diffused technologies such as tablets, mobile phones and similar devices. By posting pictures, checking-in at specific places and sharing geo-referenced content as part of their everyday experiences, people are more and more making available information on how they live, use and perceive urban spaces.

This research explores and presents methods and tools to collect, analyze, and represent time-based geo-located Social Media data at the urban scale. The general aim is to investigate possible perspectives for the use of these data for urban planning and city management processes.

The research mainly question whether geo-located Social Media data can be useful in the creation of indicators of urban life, as it is perceived and communicated by the city users.

In fact, although traditional data collection methods such as surveys, interviews, questionnaires, and, more recently, data harvesting and analysis techniques (e.g. using geographical location data from mobile devices) have provided interesting insights into the social life of urban spaces, they can be nowadays complemented using geo-located Social Media data.

On one side, the research reviews **the existing literature, projects, approaches related to data-visualization and geo-located social mining techniques** used to investigated topics of urban interests and presents **new interpretative frameworks** to share this very knowledge through.

On the other side, the research presents several **design experiments** that have been conducted in collaboration with urban stakeholders at different levels and in multiple US and European cities.

Also reflecting upon these delicate issues, the research tries to maintain a critical position, exploring if and how geo-located social mining techniques can still constitute a sustainable (in the wider sense, including societal sustainability) new perspective for planning and decision-making processes and practices.

As a conclusion, some final considerations on the contribution that design, especially information and interface design, can bring to the very field are presented. Here, visualizations and interfaces are not conceived only as final outputs, but rather as pivotal points of the interpretative processes and discussion with practitioners that define new ways of understanding complex systems of information.

Introduction: a research approach merging the academy and the industry

The present research aims at understanding the contribution that design can bring to the research and practice within the urban field through gathering, interpreting and representing geo-localized Social Media data.

Since its very beginning, the research undertook an explicit approach towards the professional fields of design, with the goal **of bridging the divide between professionals and the academy**.

In a context where experimenting represents an essential condition for theory production and scholars are assuming the role of new reflective practitioners, **design can indeed provide essential theoretical and methodological contributions to the definition of new urban research practices**.

The collaborations with professionals and practitioners, and the participation in not-strictly academic research contexts have therefore paved the basis for this dissertation, with the attempt to undertake city and urban studies in a real multidisciplinary fashion. Thus, **the research draws upon several design experiments** that have been conducted with urban stakeholders at different levels and in multiple US and European cities, not only inside the framework and the connections provided by Politecnico di Milano, but taking a further advantage of the active professional role I have in the information design company (Accurat) I co-founded in 2011 for research purposes.

Within the research process the **collaboration between computer sciences, social and urban studies and design disciplines** have been leveraged; knowledge and expertise in the professional field have served the purpose of the generation of new academic knowledge.

As a result, I truly believe that a deep and constant relationship between critical analysis and practice, and between academy and the professional world should be encouraged in any doctoral design research.

As a demonstration of the particular approach that would benefit the generation of new knowledge I included some of the original contributions from the various projects I took part in. Specifically I wish to acknowledge and thanks the contributors for the literature produced within the **Telltale** and the ***UrbanSensing projects**, and the research stimuli and insights provided within the experience of the start-up **Pleens**.

Acknowledgments

Telltale is a research project conducted among three different departments of Politecnico di Milano (Design department, DAStU department of Architecture and Urban Studies, DEIB department of Electronics, Information and Bioengineering). It is a research project leveraging the collaboration between computer sciences, social and urban studies and design disciplines at Politecnico di Milano. One of the goals of the project is to design the methodological framework that defines how to extract urban knowledge from geo-referenced Social Media Data.

***UrbanSensing** is a research project funded by the European Commission within the Capacities Programme (2012-2014).

The Capacities Programme is a strand of FP7 strongly oriented toward establishing collaborative frameworks between research performers (universities, research centers) and industry (often SMEs – small and medium enterprises), funding research project with an applied component.

In other terms, the EU expects that within the scope of projects funded by Capacities, consortia composed of representatives from academia and industry work together in order to provide the Partners coming from industry with prototypes that can be transformed into products and services to be distributed in the market.

The aim of *UrbanSensing is to design and develop web platform extracting patterns of use related or concerning city spaces, through a robust analysis of geo-referenced Social Media data shared by the city users and inhabitants, specially conceived for practitioners in the field.

Although carried out by diverse teams, Telltale and *UrbanSensing shared a joint research trajectory and a common orientation. As a design researcher at Milan Politecnico and as co-founder and designer at Accurat (one of the SME partners of the *UrbanSensing project) I have been active part of the two projects and I had the possibility to consider and examine the two projects in conjunction, actively participating in both the theoretical and methodological aspects and in the design ones.

Telltale and *UrbanSensing used a design approach and **design experiments** in different phases of the process. In Telltale several practical investigations were conducted in an exploratory way with the goal of clarifying, testing, and refining the research questions and the interpretation algorithms. In *UrbanSensing the design experiments had a different and more applied purpose as the consortium and the research project itself were strongly targeted towards the exploitation of the sensing platform, in terms of both commercial potential and societal benefits.

In other terms, the two projects were conceived within the same research trajectory, but Telltale started earlier and had a more exploratory stance and therefore allowed to pave the basis for the more practically oriented explorations elaborated in *UrbanSensing.

The last external experience I've been working on during the past 3 years is a start-up called **Pleens**, that aims at brining a new product to the market, specifically conceived to let people share geo-localized narratives in an emotional way. The PhD research main trajectory finds its conclusion with the active participation in the design of an emotional interface specifically designed to foster people producing meaningful contents related to physical places.

Telltale project's team at Politecnico di Milano:

- Density Design Research Lab - Design Department: Paolo Ciuccarelli, Matteo Azzi, Giorgio Caviglia, Giorgia Lupi,
- DASTU: Fabio Manfredini, Paolo Dilda, Paolo Tagliolato,
- DEIB: Davide Eynard, Fabio Marfia, Matteo Matteucci,

***UrbanSensing** project's partners:

T-Connect from Italy, IT4All from France, the Technical University of Kosice from Slovakia, Accurat from Italy, Mobiguo from Spain, LUST from the Netherlands.

Pleens project's partners and credits:

- Editorial Direction: Filippo Pretolani
- Concept: Mafe de Baggis
- Identity, visual & Interaction Design: Giorgia Lupi
- Project Management & Problem Solving: Gabriele Rossi
- Illustrations: Michela Buttignol
- Software Analysis & Architecture: Marco Vettorello
- App development: Riccardo Paolillo e Michele Orru

A special mention and acknowledgment goes to **Paolo Patelli**, **Luca Simeone**, **Salvatore Iaconesi** and **Marco Vettorello** with whom the original research idea was shaped.

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The conception, development and completion of this Thesis would not have been possible without the support of a large number of individuals.

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01

The data city

The data city

1.1 An introduction to the data city
1.2 People-generated landscapes: potentialities of Social Media data
1.3. Conversations with Social Media expert Mafe de Baggis: why do people share? (Real life and the narrative self)
1.4 The on-and-off line
1.5 Applications targeting urban issues
1.6 Existing work
1.7 Specificities and aims of the research

1.1 IN INTRODUCTION TO THE DATA CITY

A **massive amount of information** is emerging from the digitization of contemporary cities, providing **novel means of understanding our lives** and the inner dynamics of organizations and societies. City users can now provide local knowledge through a bottom-up approach, contributing information through the use of widely diffused technologies such as tablets, mobile phones and similar devices. By posting pictures, checking-in at specific places and sharing geo-referenced content as part of their everyday experiences, people are more and more making available information on how they live, use and perceive urban spaces.

Over the past few decades, several scholars have offered descriptions that combine traditional city representations with new **informational membranes hovering above urban fabrics** (Graham, 1998; Zook, 2000).

Since the early 1990s, sociologists and economists have been looking at contemporary cities as expressions of networks and fluxes of information (Castells, 1989). Concepts like 'mediascape' (Appadurai, 1990) and 'informational landscape' (Graham, 1998; Zook, 2000) are essential in contemporary debates about cities, offering visions of places shaped and defined in terms of perspectival constructs, where digital data and information coming from multiple sources (sensing technologies, ubiquitous computing, user generated content) play an important role in shaping urban experiences. The vision of a soft-city based on concepts such as emergence, geo-bodies and intelligent machines and where physical and digital dimensions are strictly interrelated becomes an important component of contemporary urban geography (Pickles, 2004).

The underlying idea of these approaches is to view the **urban experience as tied to the multiple, fragmented and temporary layers of data and information generated by human-place interactions**. This is what can be defined as a '**data city'.**

These data can be produced either collectively or by the individual, they can be aggregated or discrete, open or protected, and constitute observation points that allow us to interpret and describe patterns of behaviors within specific temporal and spatial coordinates.

In this context, the challenge for urban studies is the integration of available digital databases with traditional data, aimed at capturing the variety of changes in urban practices. As Zook & Graham (2007) noticed, traditional methods for registering users' perceptions and activities in cities - such as surveys and ethnographic reports - are becoming inadequate to meet the need for information of our contemporary society: both because they require a considerable amount of resources, in terms of time and money, and because they are often only tied to a specific and limited time (the period of investigation).

The recent technological developments in terms of ubiquitous connectivity and the emergent participation of Internet users in terms of social interaction are leading towards **a redefinition of the possibilities of gathering and sharing first-hand information that can be analyzed to complement more traditional urban observations and surveys**. These ephemeral and overlapping layers of information demand new modes of inquiry and synthesis: **a new generation of dynamic city representations capable of defining and visualizing both physical and social environments, as well as individual and collective narratives**. This stratification of experiences leads to new kinds of geographies, partially handled by citizens themselves: a diverse sets of practices that operate outside, or alongside professional geographers (Szott, 2006). To depict the data city means to present urban spaces through visual approaches that are able to capture their flows and bring them back in the form of static or dynamic images. This can offer **new perspectives in the way city services, processes, and strategies are designed and implemented.**

FIG.1 — AiDA navigation system (access date October 2013)

1.2 PEOPLE-GENERATED LANDSCAPES: POTENTIALITIES OF SOCIAL MEDIA DATA

Among all the sources of information available at the urban scale, the research particularly focuses on **User Generated Content**. [1]

The OECD (2007) defines content as "user-generated" when it is produced by non-professionals (i.e. amateurs), as opposed to professional media producers. An interesting sub-set of user generated content is the information specifically produced and shared through Social Media services. The term '**Social Media**' refers to the means of interaction among people in which information is created, shared and exchanged, almost often in virtual communities and digital networks (Ahlqvist et al., 2008; Morgan et al., 2012). Examples of Social Media services are platforms such as Twitter, Facebook, Flickr, Foursquare, Instagram.

At present, Social Media is still growing rapidly and - as also highlighted by the 2012 Nielsen Report on Social Media[2] - it has become an integral part of our daily lives, making social networking a truly global phenomenon.

Social Media has been described as a ubiquitous tool for social interaction and we would be wrong in assuming that it is only an activity for the younger generations. Although the penetration among 1624 year olds remains the highest, it is the 25-45 year olds sector that has seen the greatest increase in usage in recent years (WAVE6 research, 2012).

If on one side there is a growing concern about **privacy,** on the other side an increasing number of people say that social networks are a crucial component of both their private life and their professional activities and as such the benefits of their use overcome any worry about privacy.

A significant number of citizens, especially in North America and Europe, are sharing more data than ever before, be this through photos, videos, or simply updating their profile or status on Social Media. Moreover, recent data from Qualcomm (2013) suggest that emerging regions including Latin America, China and India are witnessing substantially higher numbers of smartphone subscriptions than North America, Japan, Korea and Europe.

1 User Generated Content: as in the existent literature, the term here is used in its singular desinence even when it indicates multiple (thus plural) contents.

2 Nielsen report 2012: State of the Media: The Social Media Report http://www.nielsen.com/us/en/reports/2012/state-of-the-media-the-social-media-report-2012.html)

Even if the personal computer is still at the center of the social networking experience, people are increasingly looking to other devices to connect to Social Media: the average time spent on **mobile apps and the mobile web** accounts for 63% of the year-on-year growth in overall time spent using Social Media. In 2012, 46% of the users access Social Media through their smartphone; 16% connect to Social Media using a tablet. With more connectivity, people have more opportunities to use Social Media wherever and whenever they want (Nielsen, 2012). This layer of digital information that we constantly produce can be increasingly related to specific places through the Global Positioning Systems (GPS) integrated in current mobile navigation devices and to the geographic markers that some Social Media leave on user generated content. **The combination of these factors produces and disseminates an immense amount of geographical information, which can be contributed voluntarily or involuntarily.**

Physical spaces become places as they are experienced, lived, shared and communally interpreted**. These places become 'practiced places', to quote de Certeau, or in other words spaces interpreted and lived through the experiences of situated subjects** (de Certeau, 1984). These experiences are captured, shared, and communally interpreted through these Social Media applications capable of recording and georeferencing a variety of signals. This transforms human beings in potential 'sensors' that not only have the ability to process and interpret what they feel and think but also to geographically localize the information (sometimes involuntarily) and spread it globally through the Internet, thus drawing people-generated landscapes.

The research base assumption is that **by conducting an analysis of these people-generated landscapes and, more specifically, of data sets based on information extracted from Social Media we can recognize multiple interpretations of the city, as they emerge, overlap, and influence each other, unfolding from users' mental representations and spatial experiences of city spaces.**

Through the research, I investigate the potential use of the types of Social Media data that are most likely to provide precise geo-localized information, such as Twitter, Foursquare and Instagram. Although there are many Social Media platforms that provide geo-localized information, **Twitter, Foursquare and Instagram** proved to be the richest sources in terms of number of contributions for the geographic locations investigated during the research process. A basic description of the three Social Media services characteristics follows

Twitter[3] is a micro-blogging service allowing its users to publish and share short texts (140 characters), generating online conversations with other users. Twitter contributions shared through mobile devices have a precise geo-localization and time-stamp. Although Twitter contributions are not specifically related to places (e.g. Twitter activity is often independent of where it happens), interesting correlations can be identified between the types of issues that people talk about (content analysis) and the places where contributions originate. *In March 2013 Twitter counted over 200 million active users creating over 400 million Tweets each day (Twitter official blog, 2013)*

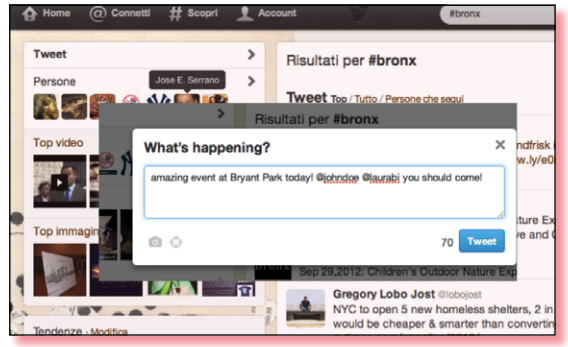


Fig.2 — Twitter app screenshot (screenshot from https://twitter.com/giorgialupi; access date November 2013)

The main use of **Foursquare**[4] is to share and show **real-time information on the geographic positioning of its users.** Places such as clubs, stores, public offices, monuments, etc. (called 'venues') are categorized and shared by the users. Users can 'check-in' at a given location just by selecting it from a list of venues their mobile application locates nearby, or by creating new venues not already present in Foursquare (e.g. a new bar or a new store). Venues are categorized by the main types of activities associated with them (categories such as: art & entertainment, food, shopping, residences, professional venues, and other places) and each user can also insert comments and pictures of the venue. *As of September 2013 the company had 40 million users and a database of 55 million locations over the world (Cnet News, 2013).*

Male and female users are equally represented and 50% of users are outside the US (Wikipedia).

3 Twitter: www.twitter.com

4 Foursquare: www.foursquare.com

Fig.3 — Foursquare app screenshot (screenshot from https://foursquare.com; access date November 2013)

Instagram[5] is a social network based on photo-sharing. The application enables users to **take a photo, apply digital filters to modify it, tag the picture, and then share it with other Instagram users**. Each picture has a precise geo-localization and time-stamp, as do all the other contributions such as users' comments on pictures. *As of September 2012, Instagram had 100 million registered users (Wikipedia).*

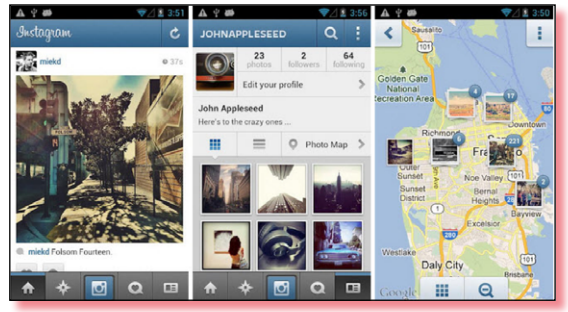


Fig.4 — Instagram app screenshot (screenshot from https://instagram.com; access date November 2013)

An in-depth analysis of existent Social Media platforms and their characteristics is presented in subchapter 2.3

5 Instagram: www.instagram.com

1.3 CONVERSATION WITH SOCIAL MEDIA EXPERT MAFE DE BAGGIS: WHY DO PEOPLE SHARE? (REAL LIFE AND THE NARRATIVE SELF)

Crucial here is to have an understanding of how to read and interpret those collective on-line identities. **Why do people share? How can we read on-line identities?**

Despite a lack of consistent academic bibliography on the topic, Dana Boyd[6]'s researches at the intersection of technology, society, and policy can help in shaping the issue. Boyd is a Principal Researcher at Microsoft Research, a Research Assistant Professor in Media, Culture, and Communication at New York University, and a Fellow at Harvard's Berkman Center for Internet and Society, and she is known for her incisive analysis of where our use of social networks is taking us. Two key points she highlighted follows:

"Every act of data analysis involves interpretation, regardless of how big or mathematical your data is. There's a mistaken belief that qualitative researchers are in the business of interpreting data and quantitative researchers are in the business of producing facts. As computational scientists have started engaging in acts of social science, it's painfully common for them to come with a belief that they are in the business of facts. You can build a model that is mathematically sound but the moment you try to understand what it means, you're engaging in an act of interpretation. You can execute an experiment that is structurally sound, but the moment you try to understand the results, you're engaging in an act of interpretation... Interpretation is the hardest part of doing data analysis. And no matter how big your data is, if you don't understand the limits of it, if you don't understand your own biases, you will misinterpret it. This is precisely why social scientists have been so obsessed with methodology. So ***if you want to understand big data, you need to begin by understanding the methodological processes that go into analyzing social data****."*

"Context Matters. There are two kinds of content that we focus on when we think about Big Data ***- that which is shared explicitly and that which is implicitly derived****. There's a nice parallel here to what sociologist Erving Goffman describes as that which is given and that which is given off. When people share something explicitly, they assess the situation and its context and choose what to share. When they produce implicit content, they're living and breathing the situation without necessarily being conscious of it****. Context still matters. It shapes the data that's produced and what people's expectations are****." (from Boyd Future of the Web conference 2010 Keynote)*

Following these standpoints and in order to gain further qualified knowledge on the very topic of Social Media behaviours and places, I've been working with the Italian expert on the subject Mafe De Baggis[7] during the whole PhD research period,

De Baggis builds communication strategies for companies and private clients, helping them understand how to use Social Media services, how to extract knowledge about their products and services perception on the net, how to deal with online communities and how to use Social Media data to create meaningful collective images of what happens online and offline. I present here a summary of our main conversations on the topic.

→ interviews with Mafe de Baggis, Milan May 2012, June 2012, November 2012.

Why do people share?

Relationship between people perception and their social life on-line.

→ **I'm not a user"**

A very interesting issue came up before I even started with the first question in the first place.

"I think that the word "User" in "User generated content" is inappropriate. Technically, a User is a person that literally "uses", a person that takes a very passive position in the conversation, a person that is the receiver of an experience or a product that has been designed for him. Within this type of research and for your purposes you should move the focus, and think in terms of conversations. It could be whatever you want but not User (and this is very related to Don Norman writings)."

Interesting here is not the arguing on the wording itself, since the PhD research then proceeded referring to the academic literature and the OECD shared and common use of User Generated Content, it is compelling to move the observational point of view in interpreting such information towards "people generated landscapes".

In fact, De Baggis continued to point out that such kind of labels put an inevitable distance from the observer (me!) and the stories. She suggested that first of all I (and thus we as researchers) have to feel part of the informational landscapes that are generated and shared every day, and not acting like the "*eye observing from high above*" (De Baggis, 2012)

6 Dana Boyd: www.danah.org/

7 Mafe de Baggis: http://mafedebaggis.it/

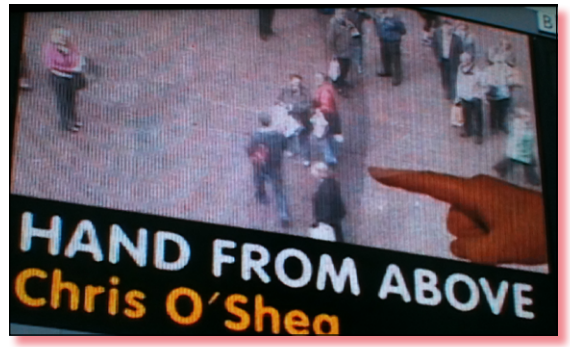


Fig.5 — Hand from above installation by Chris O'Shea, TimeSquare New York, 2011 (picture taken by author at MomaMuseum in New York, August 2011)

→ **"An interesting mapping of something half-way between reality and people's aspirations"**

First of all, information has to be understood for the very nature of the data we gather. *"Why do people share? Which people are sharing? How do we have to read them (and the content)?*

There is not a shared academic bibliography for that, and that where my main questions to her. Actually Social Media contributions don't reflect a 100% of life logging; it's not a literal transcription of reality and of people's life. Social media streams of contributions are narratives, are stories.

People don't give a like to something they don't like, while people experience things they don't like during their everyday life.

The terrific thing with those contents is that you get an interesting mapping of something that can be described as half-way between reality and people's aspirations"

→ **An existential ping?**

"Sharing. Everything always is a wish to communicate, and this happens for two distinct basic needs. The first deals with content (I have something to say, I have something to say to someone). This need to communicate contents could grow from different purposes, from making a good impression, to the instinct of telling that you like something..."

The second need we can identify is what De Baggis calls *"existential ping"*, that is basically the natural born necessity to tell the world that you exist: *"hey, world, look at me"* that translates to a set of actions that you - as a human being - can perform now not only in the physical space but also in the on-line world.[8]

8 In sub-chapter 1.4 the thesis explores the "physical (real) and the digital" worlds definitions with limits and potentialities of different approaches for the research purposes.

The diffusion of Social Media services has made this "self-expression-without-contents" incredibly at hand.

Furthermore, and according to how Social Media sharing works, now the paradigm seems to shift from *"I am therefore I have to be considered"* to *"I am* ***here*** *therefore I have to be considered"* which is very promising in terms of spatial and urban analysis. In fact, when it's not a specific content to trigger users to use the Social Media services, it is often the places and situations people are living that demand to be shared to build their online identity.

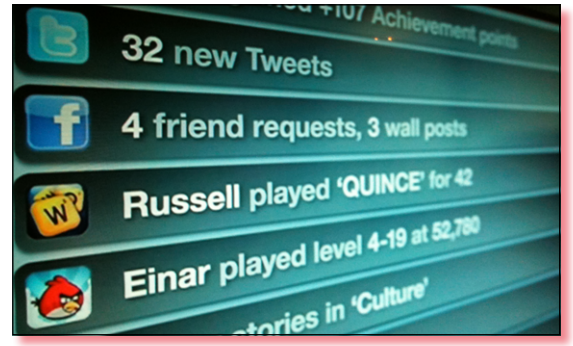


Fig.6 — Talk to Me Exhibition, Museum of Modern Art New York 2011 (picture taken by author at MomaMuseum in New York, August 2011)

→ **"With social media everything is done with a narrative purpose in mind, is it conscious or unconscious"**

Given these preliminary but interesting remarks, De Baggis suggested to always consider social media narratives like "***stories****, which writers are aware or not. People communicate what they are interested to be evaluated for from their peers, friends, colleagues or supervisors."*

And this reflects personal individualities that come out: there are people that - in "real life" - love to descript themselves as boring, and those are the ones that checks-in at every metro stations or at the supermarket, which comes completely coherent with the story behind their self-telling.

It's very easy and intuitive: people check-in where they'd like to be seen; expressing a desired relationship with other people.

→ **"Relationship versus content?"**

"Each communication process has to be considered from both the side of the content and the side of

Fig.7 — Talk to Me Exhibition, Museum of Modern Art New York 2011
(picture taken by author at MomaMuseum in New York, August 2011)

the relationship it aims at building. We can find an easy interpretation in the theory of the "pragmatic of communication": very often when individuals don't understand each other during a conversation it's much more because of the nature of the relationship they're establishing, rather than because of the content."

Tweets, posts and check-ins have to be observed with both these lenses (content and relationship), especially because social media allow people to communicate even when they don't have actual contents to tell.

→ **"Social media has not genetically changed our identity"**

A big misunderstanding with the common idea of Social Media is the one that describes the online world filled by people that suddenly begin to write in blogs, to hold interesting twitter profile or to take stunning pictures in improbable situations and places.

In fact, there is an inevitable continuity to what people did before going online and to what people wished to do: *"it is thus much more probable that you (as a person) can have an active blog if you were writing on paper during the 90's; or that you check-in at a new bar every night if you were likely to tell people about your busy and active life before you subscribed to Foursquare"*

Technology enhance people to do things that they could do even before: *"If I am a curious person I'd listen to strangers' conversation at the cafes, now Twitter allows me to listen to thousand of conversations, and to correlate or analyze them"*.

→ **"Talking about the city, you can intercept interesting projections on people's dreamed days"**

"If you follow an individual through social media you will get an edit of moments, only days with no downtimes."

This interesting note confirms the preliminary remarks of the research: geo-referenced Social Media data can partially answer only a specific subset of urban issues, that have to be carefully selected starting from the very nature of the data production modalities.

→ **"The physical and the digital, validations processes"**

"According to the very nature of the data it's possible to extract insights on how resident, locals, tourists and commuters perceive a specific area, and personally I think it's very promising. This inevitably would require a parallel on-field validation process (e.g. measuring for a specific area the "intensity" of tweets compared with the actual density of the place in that moment).

Talking about pubs and cafes: there are areas from where people interact a lot in the digital sphere - (trending spots from which people usually tweet, take pictures and check-in frequently) and places from where actually people don't share (places that might be dense and crowded but silent as digital presence). What does it mean? Where are people from in those places? Could we find any indicator? What it's interesting is the eventual coexistence or complete difference from who's here and who's far (introducing a new concept of proximity?)"

1.4 THE ON-AND-OFF LINE

It is important now to reflect upon how the power of Social Media is entering dramatically into our everyday lives and in addition with the near ubiquity of new technologies such as mobile phones, it is forcing us to conceptualize the digital and the physical: *"the on- and off-line*. But some have a bias to see the digital and the physical as separate.

The Social Media theorist Nathan Jurgenson[9] coined the term digital dualism: digital dualists believe that the digital world is "virtual" and the physical world "real." This bias motivates many of the critiques of sites like Facebook and the rest of the social web, Jurgenson (2011) fundamentally argues this digital dualism is a fallacy. Instead, he proposes that the digital and physical are increasingly meshed, and wants to call this opposite perspective that implodes atoms and bits rather than holding them conceptually separate augmented reality. In *"Towards Theorizing An Augmented Reality,"* (2009) he discussed geo-tagging, street view, face recognition, the Wii controller and the fact that sites like Facebook both impact and are impacted by the physical world to argue that "digital and material realities dialectically co-construct each other." This is opposed to the notion that the Internet is like the Matrix, where there is a "real" (Zion) that you leave when you enter the virtual space (the Matrix) -an outdated perspective as Facebook is increasingly real and our physical world increasingly digital (Jurgenson, 2009).

According to Jurgenson's analysis dualists theorists and books (such as Turkle's "Alone Together", Carr's "The Shallows", Morozov's "The Net Delusion", Bauerlein's "The Dumbest Generation", Keen's "The Cult of the Amateur", Siegel's "Against the Machine" and Lanier's "You Are Not a Gadget") argue that the problem with social media is that people are trading the rich, physical and real nature of face-to face contact for the digital, virtual and trivial quality of Facebook. The critiques stem from the systematic bias to see the digital and physical as separate; often as a zero-sum tradeoff where time and energy spent on one subtracts from the other.

Jurgenson proposes an alternative view picturing our reality as both technological and organic, both digital and physical, all at once. In his descriptions we - as

9 Contributing Editor for The New Inquiry, researcher for Snapchat, and a graduate student in Sociology at the University of Maryland working on a dissertation on surveillance on social media.

human beings - are not crossing in and out of separate digital and physical realities, but instead we live in one reality as opposed to be separated across these two spheres as some dualistic "first" and "second" self, but is instead an augmented self.

Our Facebook profiles, Instagram streams and Foursquare maps mostly reflect who we know and what we do offline, and our offline lives are impacted by what happens on Facebook (e.g., how we might change our behaviors in order to create a more ideal documentation).

Most importantly, research demonstrates what Social Media users already know: "we are not trading one reality for another at all, but, instead, using sites like Facebook and others actually increase offline interaction. This is not zero-sum dualism." (Jurgenson 2011).

As the famous Network Society theorist Manuel Castells stated [10] : "*Nobody who is on social networks everyday (and this is true for some 700 million of the 1,200 million social network users) is still the same person. It's an online/offline interaction, not an esoteric virtual world.*"

Castells suggested the terminology "Hybrid space" in one of his LSE lectures[11], which explains strong communicative relationships between the internet space and the physical space. Castells introduced "Hybrid space" as a public sphere process to exchange public opinions and consolidate the identity of the collective actions by exposing its characteristics to public. While Castells regards "Hybrid space" as a formless and multi-layered process, the "augmented reality" concept of Jurgenson could be seen an outcome by the interactions between on and off worlds (Yoo, 2012).

10 http://www.uoc.edu/portal/en/sala-de-premsa/actualitat/entrevistes/2011/manuel_castells.html

11 Manuel Castells "Social Movements in the Age of the Internet " http://www.youtube.com/watch?v=rXGgvPGdu34

1.5 APPLICATIONS TARGETING URBAN ISSUES

Decision-making processes at a urban scale are normally nourished by two types of knowledge: **institutional knowledge**, that is, knowledge possessed by urban institutions in different forms (documents, statistical data, plans, reports, speeches, etc.) and **local knowledge** held by different groups of citizens that look at the urban environment through their daily experience, filtered by their personal aptitudes and skills (Healey 2007).

The interaction between these two sources of knowledge allows the decision-making system to work. The interplay between institutional and local knowledge also depends on the specific configurations of power and authority that allow (or do not allow) dialogic processes between the different kinds of knowledge.

While institutional knowledge is identifiable, since it is reported, documented, and stored within each institution, local knowledge is distributed across different individuals and social groups and for this reason it can be less easily retrieved and operationalized.

In the last decade, **the need for an increasing public participation** has made its way into planning initiatives - such as open meetings, co-design sessions, digital collaborative platforms - in order to try to gather this local knowledge. The reason why decision making processes tend to be more open to the public is not only due to the pressure exercised by the social demand of local communities to participate to public decisions, but also to the fact that localized knowledge is considered to be essential in solving the problems in our complex urban society where the top down recipes do not work anymore (Innes and Booher, 2010). However, dealing with larger publics - even thousands of diverse people – and gathering their local knowledge(s) requires new tools and techniques. **Emerging cartographic practices have proposed new models to represent and describe the city, which stress the collaborative dynamics of the processes** (Crang 1996, Schein 1997, Cosgrove 1999, Duncan and Duncan 2003 among others).

A set of participatory platforms allowing individuals to share their experiences and ideas about public spaces is emerging: *Neighborhood information System, Boston Citizens Connect, Crimebase Philadelphia's Neighborhood information System, Urban API, Bikeshare rides in Boston, Citysourced, UrbanSim, London City Dashboard, Live Singapore, Public Information Map, City Tracking* (links to the websites of these projects are listed in the References section).

These and similar experiences focus on specific areas of urban interest that can potentially be investigated through geo-located Social Media analysis. In the next sub-chapter a consistent review of the state of the art is presented.

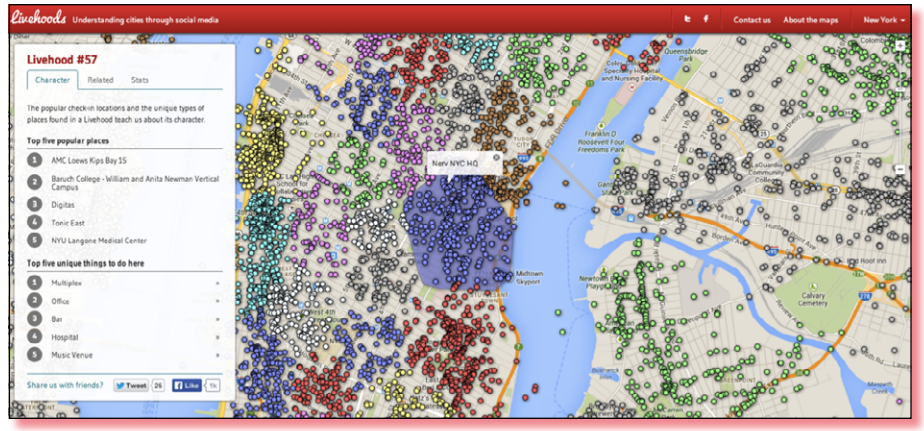


Fig.8 — Livehoods app screenshot (access date October 2013)

1.6 EXISTING WORK

Several projects have tried to reflect on the potential of these new data sources. Mapping projects based on different kinds of geo-located user generated content and Social Media data have been conducted both by research institutions (e.g. *CASA* at the University College London, *SIDL Lab* at the Columbia University, *Senseable City Lab* at the Massachusetts Institute of Technology, *Urban Age* at the London School of Economics) and independent scholars and design firms (e.g. Christian Nold, *Stamen Design*).

Following is a presentation of the most relevant case studies focusing on digital data gathering and representation at the urban scale for urban planning and decision making purposes, only a small part of the projects analyses User Generated Content.

LIVEHOODS

Livehoods is a research project from the School of Computer Science at Carnegie Mellon University. It presents a methodology for studying the dynamics, structure, and character of a city on a large scale using social media and machine learning. Using data such as tweets and check-ins, the team aimed to discover social structures within the city with machine learning. Livehoods allows its users to investigate and explore how people use the city, shedding light onto the factors that come together to shape the social texture of city life, including municipal borders, demographics, economic development, resources, geography, and planning. The hypothesis underlying their work is that the character of an urban area is defined not just by the types of places found there, but also by the people who make the area part of their daily routine. To explore this hypothesis, given data from over 18 million foursquare check-ins, they introduce a model that groups nearby venues into areas based on patterns in the set of people who check-in to them. By examining patterns in these check-ins, users can learn about the different areas that comprise the city and the social dynamics, structure, and character of cities on a large scale.The researchers call the resulting areas Livehoods. Like neighborhoods, Livehoods are a representation of the organizational structure of the city. However, Livehoods are different from neighborhoods: they give an on-the-ground view of a city's structure, reconceptualizing the dynamics of a city based on the way people actually use it. Livehoods might prove useful for city governments, local organizations, businesses, and anyone looking to learn more about a city.

Link: http://www.cmu.edu/
Link: http://livehoods.org

BORDERLINE. REDRAWING THE MAP OF GREAT BRITAIN FROM A NETWORK OF HUMAN INTERACTIONS

By mining an enormous database of telecommunications data, MIT researchers and colleagues at Cornell and University College London divided Great Brit-

ain into regions with strong internal information connections but weaker connections to adjacent regions. The research project proposes a novel, fine-grained approach to regional delineation, based on analyzing networks of billions of individual human transactions. Given a geographical area and some measure of the strength of links between its inhabitants, it shows how to partition the area into smaller, non-overlapping regions while minimizing the disruption to each person's links. The method has been applied on the largest non-Internet human network, inferred from a large telecommunications database in Great Britain. The partitioning algorithm yields geographically cohesive regions that correspond remarkably well with administrative regions, while unveiling unexpected spatial structures that had previously only been hypothesized in the literature. The researchers also quantify the effects of partitioning, showing for instance that the effects of a possible secession of Wales from Great Britain would be twice as disruptive for the human network than that of Scotland.

Link: http://senseable.mit.edu/network/

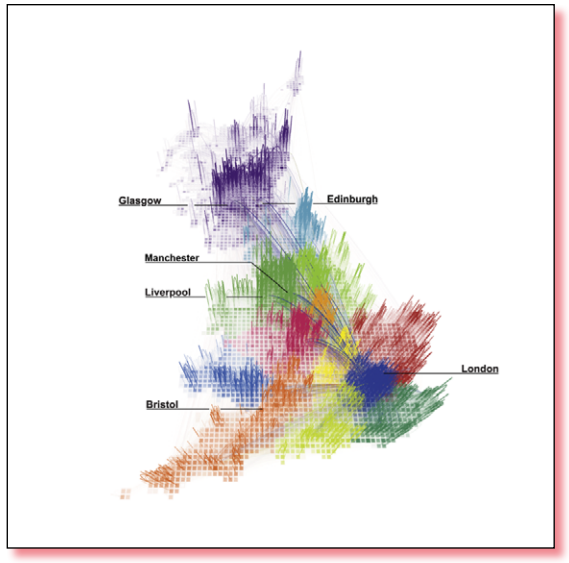


Fig.9 — Borderline map (access date October 2013)

REVISIT

Revisit is a real-time visualization of the latest twitter messages (tweets) around a specific topic. It provides a sense of the temporal dynamics in the twitter stream, and emphasizes the conversational threads established by retweets and @replies. Revisit aligns all twitter messages for a search terms along a timeline.

Link: http://moritz.stefaner.eu/projects/revisit

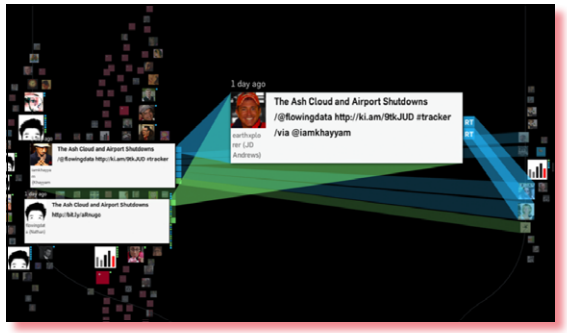


Fig.10 — Revisit Screenshot (access date October 2013)

WE FEEL FINE

At the core of We Feel Fine is a data collection engine that automatically scours the Internet every ten minutes, harvesting human feelings from a large number of blogs. Blog data comes from a variety of online sources, including LiveJournal, MSN Spaces, MySpace, Blogger, Flickr, Technorati, Feedster, Ice Rocket, and Google. We Feel Fine scans blog posts for occurrences of the phrases "I feel" and "I am feeling". Behind open exploration, it doesn't offer the user clues for interpretation.

Link: wefeelfine.org

Fig.11 — We Feel Fine app screenshot (access date October 2013)

TRENDSMAP

Trendsmap.com is a real-time mapping of Twitter trends across the world.Behind open exploration, it doesn't offer the user clues for interpretation.

Link: trendsmap.com

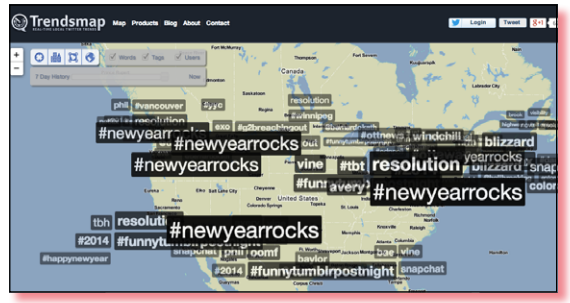


Fig.12 — trendsmap app screenshot (access date October 2013)

NEIGHBORHOOD INFORMATION SYSTEM

The Philadelphia Neighborhood Information System is a family of interactive applications that allow users to find information about their neighborhood. The NIS makes information publicly available and user-friendly, inviting planners, the City, community-based organizations, and all concerned citizens to research where they live, and to ask questions about how their neighborhood compares to others, and what they might be able to do to change things.

Link: http://www.cml.upenn.edu/nis/

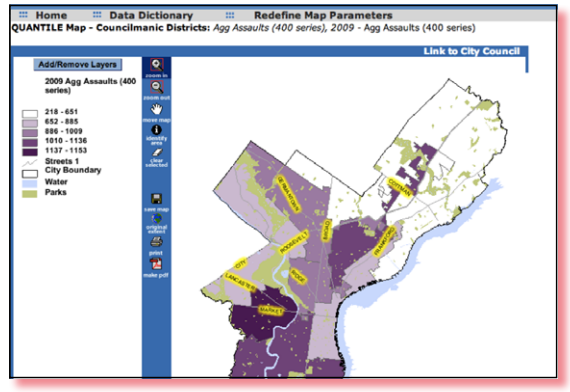


Fig.13 — Neighboorhood information system app screenshot (access date October 2013)

CITIZENS CONNECT

The city of Boston has released an iPhone app that enables residents to report problems as they encounter them on the ground: the Citizens Connect iPhone App provides a lightweight interface into the City of Boston's Constituent Relationship Management System (CRM). The intention is to help constituents easily report a variety of different service requests including "Removing Graffiti", "Filling Potholes", "Fixing Traffic lights".

Link: www.cityofboston.gov/mis/apps/iphone.asp

Fig.14 — Citizens Connect iphone app screenshots (access date October 2013)

URBANAPI

The urbanAPI project aims to support activities such as issue identification, policy analysis, consultation, decision and evaluation in urban planning and land management policy. For this purpose, a policy metamodel, a formalised vocabulary, a set of rule languages to define data integration and abstract simulation models are introduced. The urbanAPI toolset allows the fast development and deployment of participative policy support applications. These applications can be used for decision support, conflict management, analysis and visualisation and rely on innovative interaction platforms.

The system relies on direct participation of citizens and users instead of a passive participation like the one used in the *UrbanSensing Project. As far as the project is just started (September 2011) we don't have any other information regarding the real involvement of users and the technologies used inside the project.

Images not available online

(access date October 2013)

Link:http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_LANG=EN&PJ_RCN=12245668&q=47CAD51A96679EB2B0E72666A990F1E1&pid=0&type=pro

SEECLICKFIX

Many cities, especially in North America, have used SeeClickFix to increase citizen engagement and citizen satisfaction, through greater transparency and responsiveness. Through SeeClickFix citizens can report and monitor problems in their community using their iPhone, Android, or Blackberry device. The service makes accessible for everyone to communicate concerns to government in real time. Users can submit problems to their local government and provide detailed informa-

tion such as title, description, or image using their camera or photo gallery; use the GPS in their smartphone to pinpoint the exact location of their problem; view, comment on, vote to fix, or update issues already reported by their neighbors; share your issue by posting to Facebook, Twitter, and more; receive messages whenever someone interacts with issues they submitted or followed.

Link: http://seeclickfix.com/

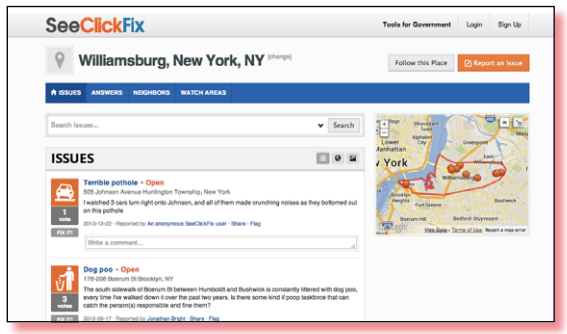


Fig.15 — SeeClick fix web app screenshot (access date October 2013)

BLIGHTSTATUS

BlightStatus provides universal and user-friendly access to official, real-time information about abandoned properties, making it easier for city staff and community groups to allocate resources, organize effectively, and make timely, strategic decisions to improve the quality and value of their communities. BlightStatus is a tool meant to help address the enduring problem of blighted properties that has vexed residents and officials in New Orleans since before Hurricane Katrina devastated the city. The searchable mapping tool reveals when a property was inspected and just what its problems were (shattered windows, broken gutters, missing roof tiles). Residents can then track open cases all the way through their court hearings, judgment, and resolution.

Link : http://blightstatus.nola.gov

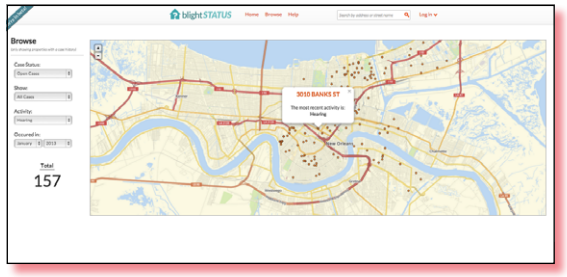


Fig.16 — Blight Status app screenshot (access date October 2013)

HIGH INJURY CORRIDORS

San Francisco's Department of Public Health publishes a wealth of data and maps. One project in particular has had a significant impact. San Francisco's High-Injury Corridors map tracks data on pedestrian injuries across the city. But instead of mapping individual collisions, the tool weights pedestrian deaths more heavily than other injuries and highlights injury-prone corridors instead of intersections. It is an important tool in identifying the city's most dangerous streets for pedestrians.

Link: http://sfgov.maps.arcgis.com/apps/OnePane/basicviewer/index.html?appid=26c723bc512948c6bf9103fb73e83ffe

Fig.17 — High-Injury corridors web app screenshot (access date October 2013)

BIKESHARE RIDES IN BOSTON

Boston's Hubway bikeshare system published historic trip data in 2012 and invited developers to turn the information into something useful with a data visualization challenge. The works featured on their website give valuable insights about what to do with simple datasets.

Link: http://hubwaydatachallenge.org/

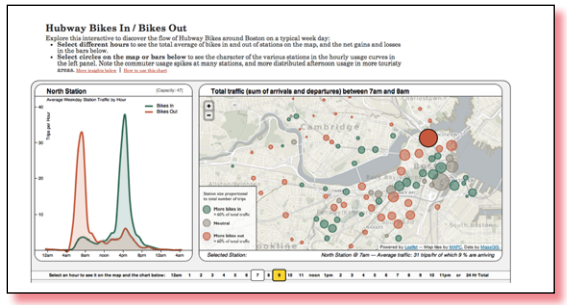


Fig.18 — Bikeshare rides in Boston, screenshot of one of the winners app (access date October 2013)

ADOPT A HYDRANT (CODE FOR AMERICA)

Boston published data on the location of hydrants around the city, and Code for America helped to build

an app on top of the data allowing local citizens to "adopt" a hydrant and volunteering to dig out hydrants during snow storms.

Link: http://adoptahydrant.org/

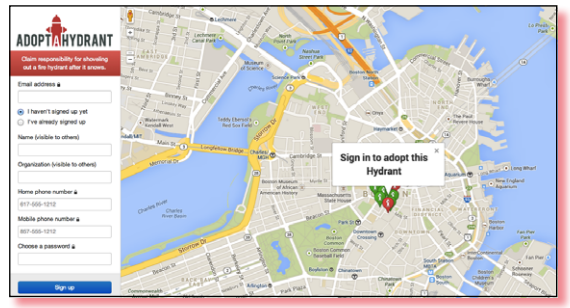


Fig.19 — Adopt a Hydrant web app screenshot (access date October 2013)

FIXED SPEED CAMERAS IN BALTIMORE

Baltimore has dozens of fixed speed cameras around town. This map and dataset on Baltimore's open-data portal identifies the intersection, coordinates and even driving direction (southbound, eastbound, etc.) for all of them.

Link: https://data.baltimorecity.gov/Transportation/Baltimore-Fixed-Speed-Cameras/dz54-2a

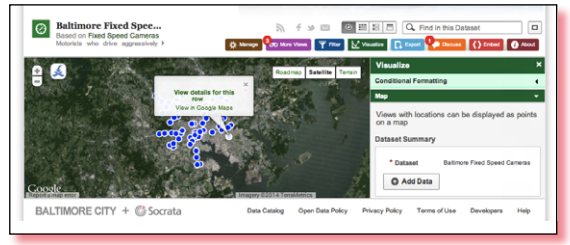


Fig.20 — Fixed speed cameras in Baltimore web app screenshot (access date October 2013)

DATA.GOV: EMPOWERING PEOPLE

Data.gov is an initiative of the United States Government. Its purpose is to increase public access to high value, machine-readable datasets generated by the Executive Branch of the Federal Government. Data.gov is leading the way in democratizing public sector data and driving innovation. This movement has spread throughout cities, states, and countries. Data.gov provides descriptions of the Federal datasets (metadata), information about how to access the datasets, and tools that leverage government datasets. The data catalogues will continue to grow as datasets are added. Federal, Executive Branch data are included in the first version of Data.gov. Data.gov enables the public to participate in government by providing downloadable Federal datasets to build applications, conduct analyses, and perform research. The data provided by Data.gov are intended to be used by analysts and developers. They are raw material and do not provide clues for interpretations. Indicators have to be defined. Moreover these data have an institutional origin and are not generated by the users, although they can be used by the city users.

Link : www.data.gov

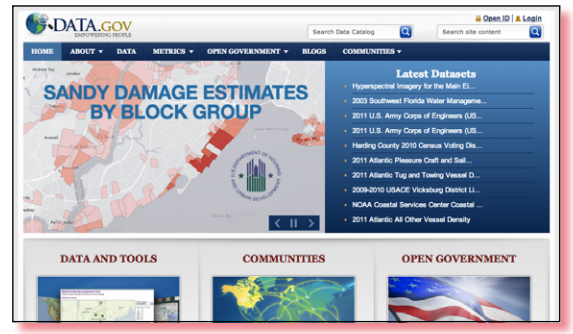


Fig.21 — Datagov web platform screenshot (access date October 2013)

CITYSOURCED

CitySourced is a real-time mobile civic engagement platform. So far most people are using it to report potholes, but it has much potential as a free, intuitive tool empowering residents to identify civic issues ranging from public safety to environmental issues and report them to City Hall. This is a tool for active participation and doesn't offer the opportunity for the interpretation of data that is there, generated from non-proactive city users and inhabitants, who are anyway expressing judgments, without being requested.

Link : http://citysourced.com

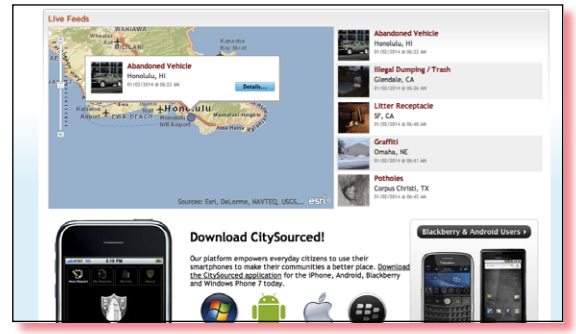


Fig.22 — Citysourced web platform screenshot

(access date October 2013)

URBANSIM

UrbanSim is a software-based simulation system for supporting planning and analysis of urban development, incorporating the interactions between land use, transportation, the economy, and the environment. It is intended for use by Metropolitan Planning Organizations (MPOs), cities, counties, non-governmental organizations, researchers and students interested in exploring the effects of infrastructure and policy choices on community outcomes such as motorized and non-motorized accessibility, housing affordability, greenhouse gas emissions, and the protection of open space and environmentally sensitive habitats.

Link: http://www.urbansim.org/

Images not available online

(access date October 2013)

LONDON CITY DASHBOARD

CityDashboard aggregates simple spatial data for cities around the UK and displays the data on a dashboard and a map. It is a website, created by the CASA research lab at UCL.It is showing data from a number of providers, which currently include: Department for Environment Food and Rural Affairs, National Oceanic and Atmospheric Administration, OpenStreetMap (& Pawel's Static Maps API), British Broadcasting Corporation, London School of Economics, Yahoo! Developer Network, Port of London Authority, Transport for London, Yahoo! Finance, UCL CASA, MapTube, ScotRail, Twitter.

Fig.23 — London City Dashboard web app screenshot (access date October 2013)

CURRENTCITY

This platform provides a data management system, a visualizations interface and data analysis tools to detect flows and patterns of city use using data streams from telecom providers.

Link: http://currentcity.org

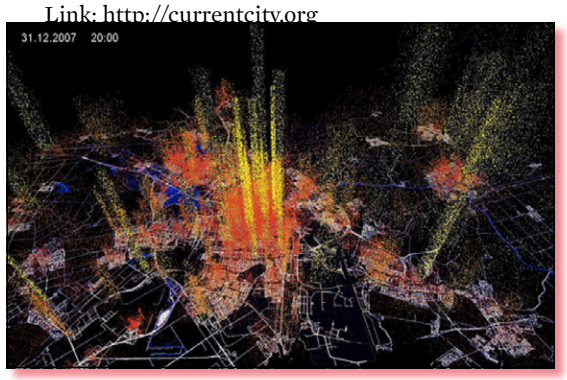


Fig.24 — "Visualizing new year's eve text messaging", Amsterdam 2011, part of the Currentcity platform (access date October 2013)

AIDA (AFFECTIVE INTELLIGENT DRIVING AGENT)

The AIDA project is a platform comprising of a personal robot and an intelligent navigation system. It analyzes the driver's behaviour in order to extract the potential sets of goals that the driver would like to achieve. The system understands the city on a number of levels: physical, social, and commercial. This provides the foundation for a social and intelligent driving assistant, that helps the driver achieve his goals and helps the city perform better through interaction between both entities.

Link: senseable.mit.edu/aida

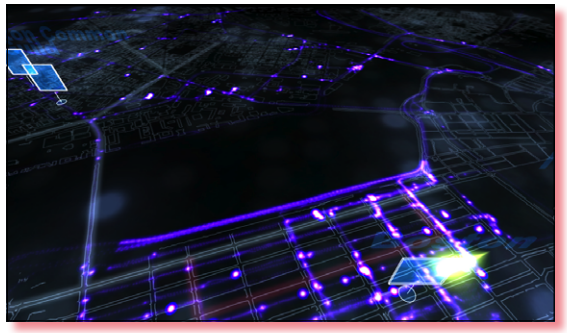


Fig.25 — AIDA navigation system (access date October 2013)

LIVE SINGAPORE!

This project gives people access to up-to-date information about urban dynamics, allowing them to take decisions that are more in sync with their environment. LIVE Singapore! explores the development of an open platform for the collection, elaboration and distribution of a large and growing number of different kinds of real-time data that originate in a city. The first platform prototype uses real-world data from operators of cellphone network, taxi fleet, public transport, seaport, airport and others. Being this platform a tool for developers, it doesn't provide a ready to use tool, but rather an infrastructure for collaboration and communication, to foster further research and experimentation.

Link: http://senseable.mit.edu/livesingapore/index.html

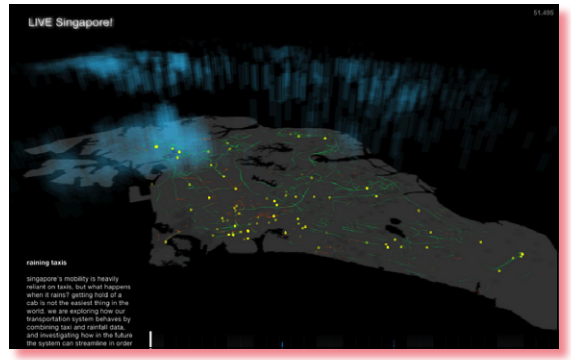


Fig.26 — Live SIngapore "Raining Taxi" project map (access date October 2013)

CITY TRACKING

CityTracking is an on-going project by the information design company Stamen, which owes its origin to a grant from the Knight News Challenge. CityTracking is intended to be a public, open source project that takes data about cities and lays it open for examining from many angles so it can be optimized for use by city personnel, journalists, and the public (including businesses). Along the way Stamen will release server-side code bases, mapping algorithms, managed datasets, APIs and API specs, and new views on data. Stamen is doing this work in public, in close dialogue with their audiences.

Link: http://citytracking.org/

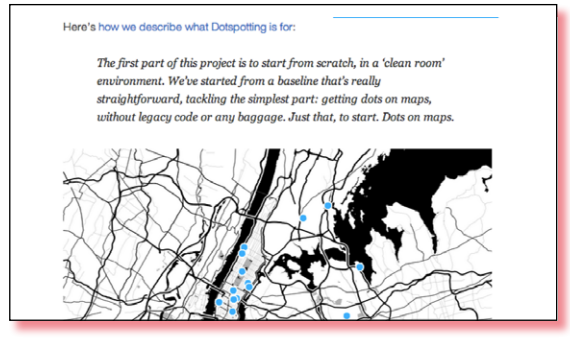


Fig.27 — Dotspotting Stamen map, within City Tracking project (access date October 2013)

THE WORLDS' EYE

The project retrieved vast numbers of photos taken by thousands of users in the most photographed cities in the world (Barcelona, New York, Rome) and uploaded to Flickr. Using timestamps, coordinates, and tags provided by users, Senseable City Lab designed geo-visualizations that reveal the movements of people through the points of interest of the three cities, such as monuments, museums, theatres, etc.

The project also produced several indicators that could be used to compare the evolution of the attractiveness of different city areas. Reflecting upon the results emerging from *World's Eye*, the New York Municipality refined its strategy to develop one of its waterfronts (Girardin et al., 2008).

Link: http://senseable.mit.edu/worldseyes/visuals.html

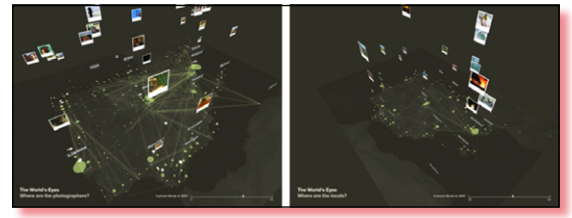


Fig.28 — The world's eye visuals (access date October 2013)

GEOGRAPHY OF BUZZ

The project has been developed by the Spatial Information Design Lab at Columbia University, mapped the cultural epicenters of Los Angeles and New York by surveying 300,000 snapshots taken from the Getty Images archives relating to cultural events such as parties, openings, and premieres (Fig. 2.3). From their analysis it emerges for example that the 'buzziest' neighborhoods in New York (i.e. areas presenting the highest number of contributions on Social Media according to a specific topic) are central and populated areas such as Times Square and SoHo and not the blooming artsy and newly gentrified areas. In an interview with the New York Times (2009), Williams – one the authors of the project - stated that: "We're going to see more research that's using these types of finer-grained data sets, what I call data shadows, the traces that we leave behind as we go through the city. They're going to be important in uncovering what makes cities so dynamic." In the same interview, Currid – another author of the project - added: "People talk about the end of place and how everything is really digital. In fact, buzz is created in places, and this data tells us how this

happens."(Currid, 2009)

Link: http://www.nytimes.com/2009/04/07/arts/design/07buzz.html?pagewanted=all&_r=0

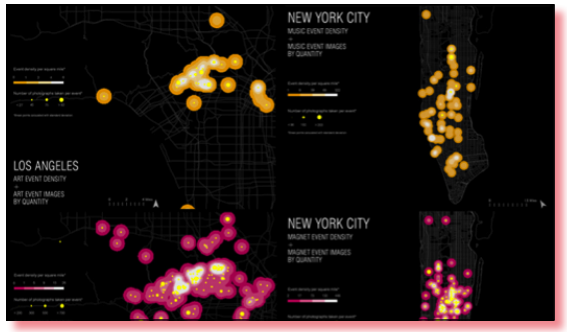


Fig.29 — Geography of Buzz visuals (access date October 2013)

PHOTOTRAILS

Phototrails is the result of collaboration between the department of History of Art and Architecture at the University of Pittsburgh, the Software Studies Initiative at California Institute for Telecommunication and Information, and The Graduate Center, City University of New York.

Phototrails analyzes user-generated data (such as Instagram pictures) using algorithms to detect visual patterns, dynamics and similar structures. Using a sample of 2.3 million Instagram photos from 13 cities around the world, Phototrails shows how temporal changes in the number of shared photos, their locations, and visual characteristics can uncover social, cultural and political insights about people's activity.

Link: http://phototrails.net/

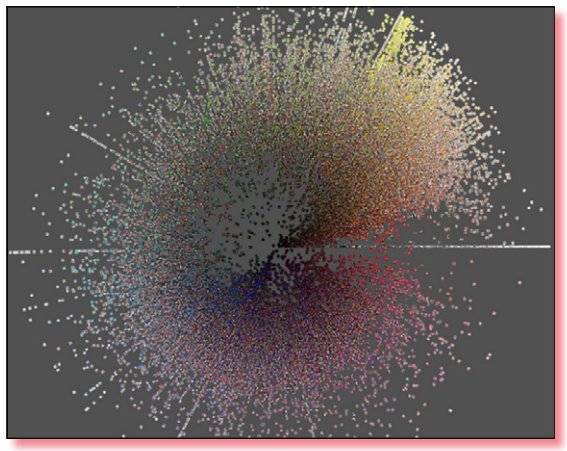


Fig.30 — Phototrail visual

(access date October 2013)

1.7 SPECIFICITIES AND AIMS OF THE RESEARCH

The research trajectory departs from the experiences presented above and **provides a framework for the use of Social Media data as a means of investigating urban dynamics**.

The research questions how to properly use those Social Media services technologies study urban dynamics and how to integrate these new kinds of data with all the other available (e.g. direct observation, quantitative and statistical data) focusing on specific urban issues.

Thus, the general aim of the research is that one of **providing a consistent state of the art review and a proper framework to gather, analyze and represent geo-localized Social Media data.**

Within the main trajectory of investigation, several **design experiments** have been used at several stages to address different goals. At an initial stage, the design experiments had a more exploratory stance and allowed to clarify, test and refine the research questions, the technological architecture of the sensing platform, the interpretation algorithms and the visualization strategies. At a later stage, the design experiments were instead oriented to collaboratively develop meaningful ways of representing these data not only for an immediate reading, understanding and interpreting of the amount of information collected, but with the further aim of understanding how to possibly provide urban stakeholders with actual tools to use in their everyday job.

The following objectives of the research will be addressed within the following chapters:

> *Explain the methodology and present a theoretical model to gather, interpret and analyse the Social Media information;*
> *Review the state of the art of data-visualization strategies depicting geo-referenced territorial data, with the aim of identifying some key learning that can give important hints for the design and implementation of dynamic tools for urban stakeholders;*
> *Document the design experiments conducted across these different stages as a means to reflect upon the potential and the shortcomings of Social Media data analyses as a source of urban knowledge.*

02

Method: a framework for using and interpreting user generated content

Method: a framework for using and interpreting user generated content

2.1 Methodological framework
2.2 Investigating topic of urban interest to be explored through geo-referenced social media data
2.3 “Evolution through time, connected areas and neighborhoods identity”: conversations with urban stakeholders
2.4 Identification and analysis of the main sources of information
2.5 A matrix crossing topic of urban interest with geo-referenced social media meta-data
2.6 Other open data sources to be integrated
2.7 Working in the field: evaluating and assessing our approach

2.1 METHODOLOGICAL FRAMEWORK

As highlighted in the previous chapters, Social Media data differs from conventionally produced geographic information in several aspects, including the source of the information, the technologies for acquiring it, the methods and techniques for working with it, and the social processes behind its creation. This chapter is an attempt at **designing a methodological framework that suggests how to produce information related to the urban environment from Social Media data**.

The literature review and the case studies analyzed in the previous chapter helped in the positioning of the research trajectory within the broader space of existing research.

The main characteristic of the **methodology** that the PhD process adopted are:

> It is tied to two long-term projects (Telltale and *UrbanSensing), where I collaborated with several Partners both from academia, industry and government. The two projects relied on funding from Italian government and the European Commission, the aims and specificities of the projects are highlighted in the introduction and in Chapter 5.
> It uses design experiments as a fundamental component at several stages of the process.
> It adopts co-design processes to engage relevant stakeholders at different phases and to assess the potential of our research and the interactive platforms we created for the design experiments.

The **research trajectory** unfolded in several phases:

> Literature review, which has been conducted at an initial phase of the research and then repeatedly revised over time. The literature review allowed to identify relevant existing projects and researches, and to position the research within the current research landscape.
> Identification and classification of existing visualization strategies in Social Media data, through a taxonomy that also presents underexplored areas of intervention (the taxonomy will be presented in the next chapter)
> Finalization of the main research questions.
> Identification of a process and design of a methodological tool to analyze Social Media data and to extract urban indicators.
> Definition of the requirements to design a web platform able to perform Social Media data analyses for final stakeholders.
> Test of the platform and assessment of the process to analyze Social Media data and extract urban indicators.

Design experiments have been conducted throughout the course of the PhD investigation.

Several researchers have demonstrated **the potential of design experiments in research-oriented design** (Brandt et al. 2011; Koskinen et al. 2011; Gaver 2012).
The idea that experiments play a central role in the activity of design practitioners was also proposed by Schön, who pointed out how that design experiments are different from experiments in science (1983). Schön offers a categorization of design experiments that reflects the different role that experiments can play in different phases of the project (exploratory, move testing and hypothesis testing). Schön describes as follows the the categories: ”Exploratory experiment is the probing, playful activity by which we get a feel for things. It succeeds when it leads to the discovery of something there” (Schön 1983: 145), in move-testing experiments “we take action in order to produce an intended change” (ibid.: 146) or to assess a solution by making a move (like in a chess game), whilst an “hypothesis testing experiment succeeds when it effects as intended discrimination among competing hypotheses” (ibid.: 146).

Eriksen et al. further elaborate on this idea by describing how **the design experiments had different functions at several stages of their research:** at the beginning, to position (and re-position) their study within a methodological framework and subsequently to formulate exemplars and arguments (Eriksen et al. 2013).

As highlighted before, design experiments played an important role at different stages of the research. At an initial phase, the design experiments had a more exploratory stance and allowed to clarify, test and refine the research questions, the technological architecture of the tools that could be designed for final stakeholders, the interpretation algorithms and the visualization strategies. At a later stage, the design experiments were aimed at creating instances of the platform within the *UrbanSensing project and testing them with a wide array of stakeholders.

2.2 INVESTIGATING TOPICS OF URBAN INTEREST TO BE EXPLORED THROUGH GEO-REFERENCED SOCIAL MEDIA DATA

An **initial selection of topics of urban interest** has been done through the critical review of existing works and taking into deep account the profile of the people that actually use Social network services. This preliminary selection has been supportive for the conversations I opened with urban stakeholders, and it identified a choice of main areas of interest that could be described as follows:

CHARACTERIZATIONS OF GEOGRAPHIC AREAS

What is it that makes people talk about an area? (e.g. Its theatres? Its food scene? It's shopping scene? It's night life?)

What are the keywords or sets of keywords that recur more frequently when users tweet from specific locations? Can these sets of keywords offer a characterization of these geographic areas as they are perceived by its' inhabitants or temporary users?

TEMPORAL DIMENSION

How do users contributions on Social Media change over time (on a daily, weekly, monthly and yearly basis)?

Contemporary urban analyses are increasingly focused on micro and interstitial investigations to explore the temporary, precarious, and conflicting meanings attributed by specific groups to places with which we often maintain a familiar relationship: a neighborhood in our city, a park, an event, a series of paths. Thus, bringing a temporal dimension into those data gives us the possibility to compare their distribution and their peaks over time and to identify patterns.

The temporal dimension also allows us to trace users' movements over time, thus detecting different patterns for different categories of users, such as tourists or city inhabitants. Where do people come from? How do different categories of users distribute themselves within the city in normal days or during a special event?

PLACES IDENTITIES AND RELATIONSHIPS AMONG GEOGRAPHIC AREAS

Which are the most mentioned city places in Social Media? Which places are never mentioned and why? Where and when do people recognize a territory as peripheral? Which are the boundaries of the actual "center" of the city, as named by people? How can we define and how do people name areas in transition?

Moreover, analyzing the profile of users that contribute on Social Media is a promising method to intercept and predict characteristics of urban places, such as gentrification areas, as well as emergent places.

Furthermore, how can we intercept emergent links between different areas of the city? Which are the patterns of mobility of certain groups of citizens that inhabit or cross specific places?

EMERGING BEHAVIORS

Very often people are not offered what they need from public institutions and administrations. This leads to emergent bottom-up initiatives meant to answer eluded questions, needs and desires. Can these bottom-up initiatives be identified through Social Media analysis?

Is there any conversation between these initiatives and the local structures of government? Is it possible to discover the lack of infrastructures and services of a city by analyzing users' online complaints? In Milan there are no buildings officially used as a mosques. Where do people talk about religion?

POLITICAL ATTITUDES: ACCEPTANCE / FEELING TOWARD LOCAL POLICIES AND URBAN INTERVENTIONS

How does the population (social network users) react to new policies? The concept of customer satisfaction is often used to categorize the ways in which these reactions are expressed. Two primary indicators can be applied: one determining the 'attitude' (e.g. Is the general feeling toward the introduction of a new pedestrian area positive or negative? Are people happy with the new bike lanes?), as well as one that attempts to gauge a more interpretative contents of text on a discursive level (e.g. How are people talking about a new proposed policy intervention? What terms are associated with issues of public interest such as the quality of the public transportation service? Do citizens agree on the evidence produced by the institutional decision makers about the need of the new intervention? Do they conversely prefer a different approach to the problem? If so, which? Moreover, does the whole of the population react in the same way? Can we enlighten differences among different ethnic groups, social groups, profiles and gender, ages, or from people who inhabit different parts of the city?)

SIGNS OF COMMUNITY AND TERRITORIES DEFINITION

Beyond the most explicit and rational part of peoples' beliefs, convictions and desires, there is a more intangible part of knowledge that has to be identified by exploring different dimensions of urban life. One of these is the ties to the urban communities. In every European city, there are areas with strong character and identity. It's clear to everyone where and what a historical center is, how to define an urban park or a hilly countryside. But how can we define and how people name areas in transition? For example the terrain vague of areas that used to be rural and are now neglected, areas of suburban fragmentation, areas characterized by enclosed technological infrastructures that often disappear from the mental representations the inhabitants build to navigate and communicate their environment. What is the impact of new infrastructures on how people communicate a rural environment? What is the impact of abandon and neglect on how people see rural fringes within a metropolitan area?

The discourse analysis tool could also be used to create certain typologies of active and non-active citizens. As multi-locality, international and transnational as well as "cosmopolitan" identities are being expressed among citizens, often more than one at a time, it brings into to mind the notions of who is part of a global identity and what is it comprised of. For instance, the ways in which people represent themselves in reacting to threats or disasters, issues such as migrant integration or social justice, economic immobility, constructions of "others" or identifications of "sameness" can be traced and interconnected. The transnational identity of mobile youth through university, workers both in and out of their countries of origin, for instance, and their representations in the local media, neighborhoods and art have created both social and new policy challenges.

SENTIMENTS/EMOTIONS ABOUT PLACES

Through the application of sentiment analysis techniques within the textual analysis of UGC, it will be possible to identify generic sentiments from the citizens toward their cities, specific neighborhoods within the cities or single urban infrastructures and urban projects. Sentiment analysis will allow to extract information about, on the one hand, users' judgment and evaluation, classified according to their polarity (positive, negative, or neutral) and, on the other hand, about the affective/emotional state of the writing author, e.g. happiness, fear, etc. While there is extensive research about sentiment analysis per se, and a growing interest for applying sentiment analysis to UGC and social networks, the application of sentiment analysis to spatial data has not been investigated yet.

MIGRATION

The notion of migration has undergone significant shifts, coming to signify imaginaries on the move which are not necessarily linked to geographical displacement. Conventionally, migration refers to a spatial movement within physical space from one environment to another, from one country to its neighbor, or from one island to another continent an ocean away. *How to address the relationship between migration and digital technologies across national contexts and ethnic belonging?*

After this initial selection of urban field of interest a set of open questions emerged:

- *How to validate these main domains of application?*
- *It is possible to build a set of indicators (knowledge patterns) to be used to derive useful knowledge from Social Media data regarding the above domains? Which operations have to be performed on the data to extract that knowledge?*
- *How can this data be validated, in order to verify if they are significant and accurate proxies of common perceptions toward city spaces?*
- *How to integrate such data with other source of information from traditional media, from direct observations and questionnaires, from the municipalities' statistical offices?*

Consequently a set of conversations with urban researchers and stakeholders at various level started.

2.3 "EVOLUTION THROUGH TIME, CONNECTED AREAS AND NEIGHBOURHOODS IDENTITY": CONVERSATIONS WITH URBAN STAKEHOLDERS

From January 2012 to September 2013 various conversations, interviews and contextual interviews with practitioners and potential users have been conducted.

Among others, I interviewed the following individuals:

> Silvia Botti (Principal assistant at the Cultural Department of Milan Municipality),
> Enrico Cocchi (Chief for Strategic Development at Regione Emilia Romagna),
> Patrizia Martello (founder and ethnographic researcher at Memethic Lab),
> Carlo Masseroli (former Chief of Urban Planning Office of Milan Municipality),
> Fabio Manfredini (urban researcher at the DAStU, Milan Politecnico) in Italy;
> Adam Greenfield (founder and managing director of Urban Scale, New York),
> Marion Kalmer (Urban researcher at Stuttgart University),
> Jeff Ferzoco (Creative Director of New York City Regional Plan Association),
> Christopher Goranson (Scientific Director of Parsons Institute for Information Mapping and former GIS expert at New York City Public Health Department),
> Jody Byron (team leader of the Housing, Economic and Infrastructure Planning Division of the NYC Department of City Planning) in New York.

Moreover I've been involved in the ENERGIC (European Network Exploring Research into Geospatial Information Crowdsourcing) COST domain international project, which focus is on software and methodologies for harnessing geographic information from the crowd. Although the project focus is broader rather than the pure Social Media data analysis, I found the possibility to participate in this conversation interesting for the research purposes of narrowing and perfecting the topics of urban interest.

As a remark for the **multidisciplinary and practice oriented approach, all of the conversations above have been fundamental in setting the scope of the research, refining the priorities, defining the design experiment to perform and ultimately understanding how urban practitioners of different kind would benefit of such new information, visualizations and tools.**

While the sub-chapter 2.4 will present a consistent organization of those urban discoveries and a matrix crossing topics of city interests with the Social Media metadata available, in this sub-chapter I highlight the most interesting ideas that emerged from the interviews and some common comments and focuses that most of them highlighted.

During my research period in New York I had the possibility to deliver a public presentation of my PhD research at the New York City Public Health department and at the New York City Department of City Planning, and to be connected with various experts and practitioners in the field such as Adam Greenfield, Jeff Ferzoco and Marion Kalmer.

Interesting feedbacks emerged, I found a common interest for **places definition and perception,** with several overlapping questions that all of them considered compelling:

> Is it possible to identify **local identity nucleus** based on social media feeds? Can we compare **municipality boundaries with boundaries defined by similar activities on Social Media data**?
> How do people perceive **their own neighborhood environments**? How is seasonality influencing?
> Which **terms** are used to describe an area or a place?
> Can we capture and **represent gentrification** of a neighborhood? How are locations utilized - and how to static populations (e.g. those in housing developments) change or utilize social media?

The neighborhoods area definition according to more dynamic parameters seemed quite central in all of the conversation. As an example, Jeff Ferzoco (Creative Director of New York City Regional Plan Association) pointed out: *"the general approach to defining neighborhood boundaries has always been rooted in uses that support the needs of local, social and mobile applications from local search to real estate. We define boundaries using thousands of sources–convention and visitor bureaus, chambers of commerce, the hospitality industry, real estate, city planning, local media, historical conventions and expert knowledge. The broad collection of sources is critical, as facts alone cannot answer these questions.*

If a point intersects two (or more) neighborhoods, there's no reason it can't be associated with multiple neighborhoods. The GIS-types might start to have convulsions, but don't mind them. There are always neighborhoods that are culturally dominant–SoHo has a long history and NoHo was 'born' in 2003. Our data models this dominance that can permit an application to reference only the dominant neighborhood. In this way, the application can tell you the most important neighborhood, but the underlying data doesn't impair you from thinking otherwise.

Neighborhoods are also functions of density–there are many areas where there simply may not be an informal reference to a given region. With low urban density, there might not be any real reason to define a 'downtown' if people don't refer to the area. Just as large swaths of the world are uninhabited, there are many desolate areas that are not represented by neighborhoods. Same goes for local knowledge–if neighborhood boundary data is intended for only residents of (say) Williamsburg, it makes sense to consider only that constituency. If the intent is to serve a broad base of users–maybe families who relocate, French tourists visiting, who knows how they will come to understand the meaning of Williamsburg. Same applies for Alphabet City, a sub-segment of the East Village in Manhattan. Should it be removed from a definition of NYC neighborhoods because it is not au courant? We say non! It's all about the user and how data is represented.

The interesting thing is that in areas of high urban density, some neighborhoods will intersect. A prime example is SoHo and NoHo in Downtown NYC– Houston St is effectively the dividing line, so if one is on Houston St, does this mean you are in neitherneighborhood, SoHo only, NoHo only or both neighborhoods? In this case, we should represent an overlap of SoHo and NoHo, reflecting the inherent fuzziness."

Another common topic of interest converged on the possibility to learn about specific **moblity patterns of people living/ working in certain areas** through Social Media data. Researcher and urban practitioner Marion Kalmer (University of Stuttgard, visiting in New York and collaborator of the Audi Urban future initiative) pointed out how the usage of available geo-localized information from Social Media services could be of great benefit for mobility related urban studies. Specifically, Kalmer's interest focused on finding new ways to learn about specific moblity patterns of people living/ working in certain areas, to see **how far digital organized mobility is spreading, and to see the differences among movement patterns related to time** (day-night, summer-winter, weekdays and weekends) through such novel sources of information. Kalmer linked to the digital organized forms of movement and its relevance: *"Where does digital organized movements fit the conventional urban mobility network? This network was established over decades as combination of diverse transportation means with different local emphases and spatial standards. Each urban type represents a specific composite and accentuation of transport means, indicated in the local modal split. Digital organized movement is transforming the existing net by superimposing, challenging and even replacing it in parts. Digital organized mobility is only relevant in certain areas; but there it is unfolding its own logic. The challenge to observe and depict urban movement through data from open platforms with User Generated Content seems bright. As digital activities get automatically replenished by their statement of place, those data can be filtered according to different location-based contents. They inform either directly or with the help of particular indicators. If properly analyzed, geo-tagged and User Generated Content (UGC) coming from Twitter, Facebook, Foursquare, Flickr can be useful in the creation of meaningful, real time indicators of people's perceived and communicated urban experience. These data are in so far bound to a peculiar logic as they are not statistically representative in the conventional sense. Not all groups of persons are similarly participating in social networks as social, demographic and economic parameters determine the accessibility and acceptance. On the other hand these platforms attract large numbers of users. In a rather narrative representation of urban practices those data are able to enrich urban cartography with a direct capture through the multiple array of singular contents from the bottom-up."*

In Milan, principal assistant at the Cultural Department of Milan Municipality Silvia Botti interestingly described geo-localized Social Media data as an **unprecedented resource to understand how people (citizens, temporary users and tourists) live the cultural scene of the city**. And this seems to be particularly confirmed by the very nature of the data production (e.g. from mobile devices, while experiencing the city, to share "cool" places and situations like public events) and the users' main profiles (young or mid-age on average, well educated and acculturated, active in the participation of the public activities) for the cultural domain. The contribution that a consistent analysis and representation of dynamic data from Social Media in the city has been recognized from Botti as two-fold:

> From one side **to listen and monitor how Institutional cultural locations** (e.g. Museums and exhibitions) **and temporary events are performing, and** thus understanding how many people normally go, if they are residents or tourists, if they are Italians or foreigners, how this evolves through time and how the cultural venues and events in the city are effectively recognized and used as a net.
> From the other side, **to recognize emergent cultural urban sub-scene**: the non-institutional design, fashion and art related micro-system of events that are extremely difficult to map with an analogic observation. To this extend, interesting seems also to decipher how the terms "culture" is explicitly written by people on Social Media services: which are the most frequently related contents? Where and when is it mostly used? Botti found also compelling the **possibility to relate the observed phenomena described**

above with the very morphology of the city and its' offer in terms of public services, to get a better understanding of how elements such as the availability of public transportation, free wi-fi spots, lively scene of bars and restaurant may influence how citizens and temporary users live the cultural scene of the city. A last stimulating idea was brought up at the end of the conversation: is it possible **to identify a group of people** that regularly frequent and influence the cultural scene of the city through Social Media services and to understand not only how they perceive and comment the cultural activities, but also **where else do they go and what else do they talk about?**

Also Former Chief of Urban Planning Office of Milan Municipality Carlo Masseroli confirmed a deep interest on the data, and opened a broader perspective that confirmed the absolute necessity of having **dynamic tools to perform customized queries on geo-refereced Social Media data, rather than only representations of the answers to specific urban topics.** In fact, from a decision making and planning perspective the most important value that this research process can bring to the urban planning environment is the design and development of a flexible platform, able **to answer precise (and customizable) questions in the very moment they are generated from the daily practice.** While Masseroli found the definition of a pre-set of urban questions useful and mandatory to define the characteristic of a working prototype of the platform, it pointed out that this is not central for the real implementation of new planning perspective. **A dynamic system to perform evolving queries on geo-localize Social Media data, and to spatially and visually aggregate those new images of the city with any kind of geo-referenced data-set available** would be the ideal scenario to effectively improve the decision making processes and planning practices for nowadays cities. As Masseroli explained, there are no standard urban questions to list, there are daily needs for knowledge about how people live, use and perceive public spaces and public services that constantly shift, evolve and change according to the evolution of the city itself.

Ethnographic researcher Patrizia Martello, founder and researcher at Memethic Lab in Milan, draw the attention on certain micro-logical aspects of **the relationship between the users, the places they share from, and the content they share** which appears to be crucial for a correct formulation of the urban design questions. According to her suggestions, it would be interesting to **extract a specific "entity"** (e.g. a name of a place, institution or brand) from Social Media feeds content a**nd monitor a set of parameters related to it,** in order to have a better understanding of what we could expect from these information, even before setting a determined urban area to investigate. As an example: which are the places, events or topic able to attract the specific target of users of Social Media in the city? And consequently, which are the areas and places left or missing? What are people sharing (which pictures, which emotions) from these specific places? Which are the patterns of linked places or linked topics in a city? Can we define concentrations of ethnic groups in certain areas or sharing at a certain time of the day, or period of the week? Which are the public spaces that pulse the most? And, as a conclusion, how can we use those analyses **not only to answer pre-determined questions, but to generate new ones**?

A set of **indicators** has been developed starting from the initial selection of meaningful design questions and the further refining that came from the conversations with practitioners. Such **design questions have been used to define ontologies, to structure hierarchically types of knowledge about the urban realm by subcategorizing them according to their relevant qualities under subject indexes.**

Social Media, and the social networking services offered by Twitter, Foursquare and Instagram are the main source of information for the PhD research. By crossing each of the design questions with the information each source can provide, some preliminary indicators have been defined.

Integration with other sources of information (among others: local open data, transportation data, logs on mobile applications) will be considered for each specific urban question. After the identification and selection of specific urban questions (i.e. issues related to urban dynamics each city's stakeholders have to deal with) to be explored through analyses of Social Media Data, every relevant information source has been analyzed.

This research process also brought to the definition of the design guidelines for an easy to use platform able to provide stakeholders the possibility to directly interact with the data, as the interviews suggested, within the *UrbanSensing project.

2.4 IDENTIFICATION AND ANALYSIS OF THE MAIN SOURCES OF INFORMATION

A core element of the research trajectory was to identify, implement and test a process to analyze Social Media data and produce indicators related to urban dynamics. The main question is **how such data sources can be interpreted to get consistent and actionable insights for researchers and practitioners interested in the urban environment**.

This question helped in shaping a process where at first existing Social Media data streams and the possibilities offered by each of them in terms of data offered, licensing options, APIs have been tested.

The investigation also took into account how and where users share, post, check-in, and tweet and what categories of people are currently using Social Media in a consistent way.

To identify the best data sources for this research trajectory I relied on the Telltale and *UrbanSensing projects and the possibility to collaborate with informatics engineers. During the first explorations we took into consideration a huge list of possible data sources and then we narrowed down to Social Media data and in particular Twitter, Instagram and Foursquare being the most interesting according to both Telltale and *UrbanSensing purposes.

Some of the very well known and used Social Media sources (e.g. Facebook) are technically limited, either because their current API doesn't give us the basis we expect, or because we could only get a small part of what we need. In the example provided, Facebook allow to explore user posts only where the privacy of the post is set to public. Moreover, some sources are specifically (or statistically) targeting other countries that the ones we need.

At last, some sources won't be usable because of legal reasons: the "terms of use" of these services are too strict for project's needs.

To narrow down the Social Media services to focus on, within the *UrbanSensing project the following **analysis of data pools** has been done on these dimensions:

Technical type of source:

> API: social networks and websites often give their data through a source-specific documented protocol, called *Application Programming Interface* (API)
> RSS/Atom: news sites and blogs almost always use this technique to publish new articles/posts in a standardized form
> Open-data: more and more public institutions freely offer their data (statistics, polls, surveys, etc.) without restriction from copyright or other licensing mechanism.

Content type the data-source provides:

> text (messages, opinions, comments, tips, ...)
> pictures (photos or paints)
> geolocation information (maps, addresses, places, ...)
> numbers (statistics, historical or geographical data)

Usefulness/priority of sources regarding pragmatic purposes of this project:

some sources will give a high volume of useful data, others could give high quality data with a lowest quantity, and more generally speaking, some sources seem inevitable while others could be somewhat redundant with others.

Source **popularity**:

defined with the Alexa rank, a worldwide web-traffic global ranking over 30 millions sites.

Geolocation quality (when relevant):

some sources will provide very precise geo-location (e.g. GPS granularity) while others will only give city or country level geo-location .

Real-time or not (when relevant):

a few API sources can offer real-time updates while the vast majority cannot.

The following **criteria** have been used to assess the usefulness of sources:

> All the major usable API sources, especially if they offer real-time or geo-located features: the biggest social networks and UGC sites can give a huge quantity of data which can be useful, even if their quality is variable. This quantity can be an indicator in itself and will help us detecting temporal changes. If, furthermore, those sources provide geo-located data, it will reveal useful to draw density maps. In the same way, real-time datasets will helps us drawing real-time maps.
> Different types of data: The project aims to compare, both temporally and geographically, different types of data, merged and filtered on one single map. There is therefore a need to get as much types of data as possible, on the same timeframe and the same geographic area. Thus, we need not only text content, but photos, points of interests, geo-located statistics and historical numbers (as well as local news or any other local data).
> UGC with good user profile metadata: User Generated Content are created by people, who describe themselves with a name or pseudo, a biography, and sometimes links to their other web content; they can also provide any other information they want to share with their readers/followers. This information can be very useful for us: it can tell us where those people are from, what language they speak, how old they are, etc.

I relied on the *UrbanSensing project and the collaboration with software engineers to identify the characteristics of each Social Media data stream, and to study how to extract urban indicators from such data streams, applying several data mining strategies and techniques.
More specifically, this process was articulated in the following steps:

> Identify and map Social Media streams and their specific characteristics,
> Define topics of urban interest to be investigated,
> Identify questions to investigate the selected topics,
> Define a way to explore these questions analyzing specific subsets of data from suitable Social Media streams, also selecting indicators,
> Collect and interpret the data,
> Define how to visually represent the results.

For example, in case we want to explore dynamics related to how inhabitants and tourists interpret and live a city and its *landmarks* (i.e. features that are easily seen and recognizable, such as the 'Eiffel Tower' in Paris) we could use Social Media data to study the concentration, granularity, intensity of contributions related to specific geographic and temporal dimensions. Some potential questions related to this topic could be:

> Which are the areas of the city from where people contribute the most?
> Is it possible to identify existing and new landmarks of the city?

In order to investigate these questions, we could analyze the following dimensions of Social Media data:

INSTAGRAM

> Amount of photos in a specific geographic area,
> Text mining analysis of the description of the photo,
> Amount of geo-located contributions within that area in a pre-defined time lapse,
> Number of likes on pictures for each geographic area,
> Compared analysis of geo-tagged information and users' profile information,
> User profiling according to places she contributed the most from,
> User profiling according to numbers of comments and likes.

TWITTER

> Amount of times the geographic area is mentioned by unique users,
> Amount of geo-located contributions within that area in a pre-defined time lapse,
> Compared analysis of geo-tagged information and users' profile information,
> Users' profiling according to language or place of origin,
> User profiling according to number of tweets and followers,
> Text mining analysis of the tweets.

FOURSQUARE

> Number of check-ins for each venue in a pre-defined time-lapse,
> Categories of check-ins per specific area,
> Compared analysis of geo-tagged information and users' profile information.

This example represents only a portion of the dimensions that could be analyzed to answer the above-mentioned questions.

More detailed cases will be presented in the next sub-chapter together with a **methodological tool that have been designed to support the research process of the PhD and to share the knowledge: a working matrix crossing urban questions with data and metadata from geo-referenced Social Media data showed potentially interesting relations and opportunities with regard to the possibility to answer to the design questions.**

2.5 A MATRIX CROSSING TOPIC OF URBAN INTEREST WITH GEO-REFERENCED SOCIAL MEDIA META-DATA

A core element of this process was a matrix I designed and developed that have been used within both Telltale and *UrbanSensing, where questions of urban interests are crossed with types of information that specific Social Media data offers. Starting from wider areas of urban interest and after the discussions with the different stakeholders, I identified and selected specific **topics of inquiry** (i.e. issues related to precise urban dynamics cities' stakeholders have to deal with, such as 'mobility') to be explored through analyses of Social Media data.

In the matrix, most common Social Media streams are presented in their specificity, related behaviors, types of available data (e.g. geo-localization, time-stamp, information on user profile) and granularity. These features are coupled with potential areas of urban inquiry that could be investigated through them.

1 TOPICS OF URBAN INTEREST

This area is dedicated to the **revisited list of topics of urban interest** I selected after the initial draft and following presentation to the stakeholders I interviewed. Topics are grouped into **macro urban areas** aggregating the more specific i**ssues** and **open questions** thematically.

As an example, the macro-category "fruition of territories" is split into two issues: "landmark ands point of interest" and "way of using public spaces". Then each issue is explained through a set of more precise questions, to present the specific topics it deals with. For instance, the first issue "landmark and points of interest" is further explained through the following interrogations: *"Is it possible to identify some novel landmarks? Which are the places from where people contribute the most? Which are the most depicted places in the city, and what does it means? Is there any difference between places photographed by locals and by tourists?"*

2 CENTRAL PART

The central part of the matrix is where the **selected Social Media services** are named (Twitter / Foursquare / Instragram / Flickr), it constitutes **the bridging part of the matrix with an empty column dedi-**

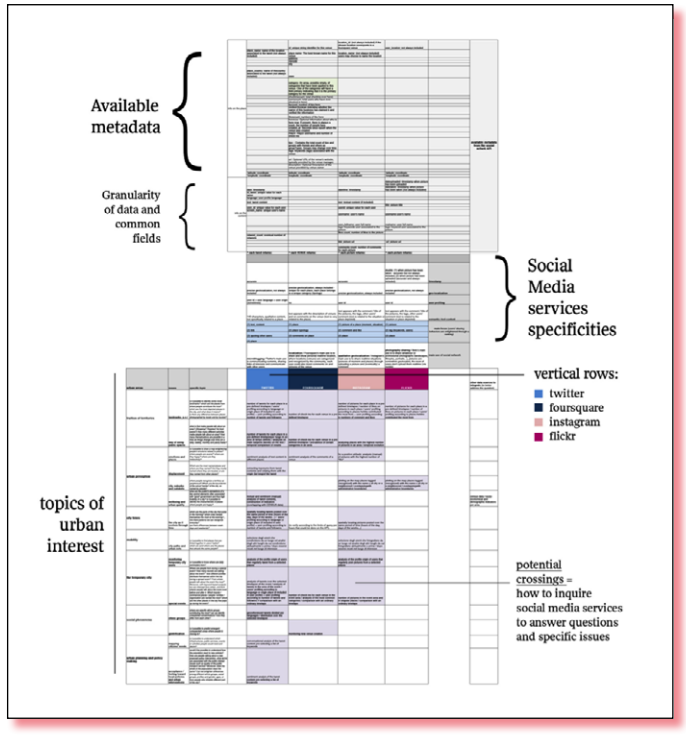


Fig.31 — matrix crossing topic of urban interest with geo-referenced Social Media data [see Appendix for bigger version]

accurate		accurate	double: (1) when picture has been taken - accurate but not always included; (2) when picture has been uploaded (accurate and always included)	**timestamp**
precise geolocalization, not always included	precise geolocalization, always included - unique for each place, each place belongs to a unique category (tipology)	precise geolocalization, always included	precise geolocalization, not always included	**geo-localization**
user id + user language + user origin (sometimes)	no	user id	user id	**user profiling**
140 characters, qualitative content, not specifically related to a place	text appears with the description of venues and on comments on the venue (text is very related to the place)	text appears with the comment / title of the pictures, the tags, other users' comment (text is related to the situation or place depicted)	text appears with the comment / title of the pictures, the tags, other users' comment (text is related to the situation or place depicted)	**semantic: text content**
(1) text, content	(1) place	(1) picture of a place (moment, situation)	(1) picture	**main focus** (users' sharing behaviors are enlightened through a ranking)
(2) link	(2) place typology	(2) comment and like	(2) tag (keywords, users)	
(3) quoting other users	(3) comments on place	(3) place	(3) place	
(4) place				
microblogging / Twitter's main use is communicating contents, sharing links of interests and communicate with other users.	**localization** / Foursquare's main use is to share and show personal realtime location, where locations (venues) are categorized and recognized by the community, each user could also insert comments on and pictures of the venue	**qualitative geolocalization** / Instagram's main use is to share realtime situations (pictures of moment and places) through uploading a picture and (eventually) a comment	**photography sharing** / flickr's main use is to share amateour or professional photographs (landscapes, lifesyles, portraits...), pictures are somewhen geolocated, the most of users don't upload them realtime (via mobile)	**main use of social network**
TWITTER	FOURSQUARE	INSTAGRAM	FLICKR	

Fig.34 — zoom 03 Social Media Services specificities

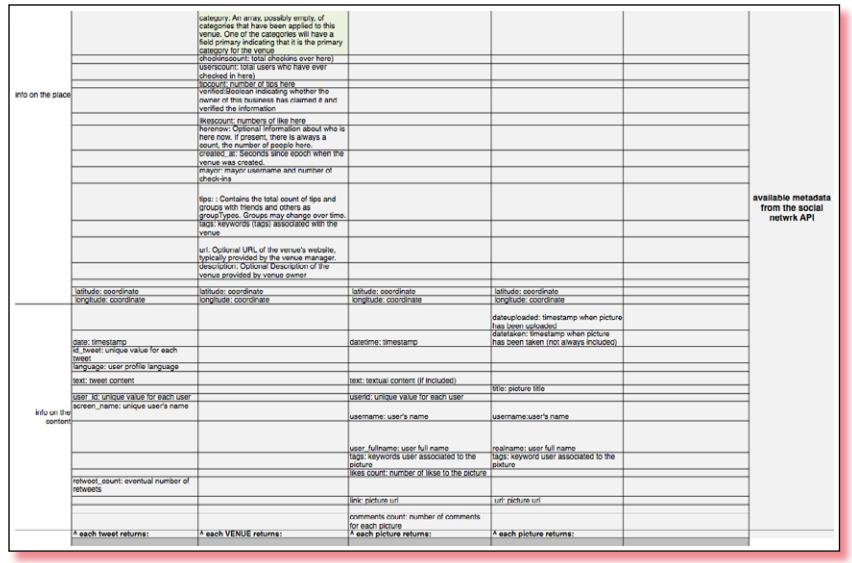


Fig.35 — zoom 04 Available metadata

cated to other geographical sources of information to integrate that is meant to be filled each time a specific need for knowledge is highlighted. The original matrix included also the social media service Flickr to the list, while at a following research stage it occurred that Instagram is actually the most proper data-source to gather qualitative information about people's usages of places. In fact, Flickr users seem to most likely use the Social Media services through web applications rather than mobile devices (official Wikipedia Flickr page, Sept 2012), while Instagram is only available as an application for mobile devices. This reflects a slightly different usage of the two services:

> Flickr offers a more reflective image of the city, since the upload of geo-located picture is often subsequent to the shoot. Typically a Flickr user takes pictures and the selects the best ones and finally he uploads some of them on the website.

> Instagram users can only upload a picture right after its' caption, and each picture is geo-referenced by default. For this reason this social media proposes an instantaneous image of the city and captures active moments of urban life.

3 SOCIAL MEDIA SERVICES SPECIFICITIES

In this part the Social Media services are explained according to their **main usage** to deliver the idea of what is different from the social behavior users keep. This area of the matrix compare the 4 Social Media services according to their main focus and use, geo-localization and time-stamp accuracy, user profiling and textual content analysis that is possible to perform.

4 AVAILABLE METADATA

The upper part of the matrix organize **the meta-data** each Social Media service make available through its API, to compare them and suggest the differences between the meta-data fields that the API returns. The data are organized into two big groups**: information on the place** (e.g. geo-localization characteristics, place name, address and category), and **information on the content** (user id, user profiling, external links to original pictures and text contents)

urban areas	issues	specific topic		TWITTER	FOURSQUARE
fruition of territories	landmarks, p.o.i	*is it possible to identify some novel landmarks? which are the places from where people contribute the most? which are the most depicted places in the city, and what does it means? is there any difference between places photographed by locals and by tourists?*		number of tweets for each place in a pre-defined timelapse / users' profiling according to language or origin place (if included in user profile) + user profiling according to number of tweets and followers	number of check-ins for each venue in a pre defined timelapse
	way of using public spaces	*what is that make people talk about an area? (Shopping? Theatres? Its food scene?) How many different activities make people talk about an area? How many thematizations are possible in a How do things change over time (on a daily, weekly, monthly and yearly base)?*		number of tweets for each place in a pre-defined timelapseper luogo in un arco di tempo definito / analysis on main subjects (words) on the text / temporal comparison of results	number of check-ins for each venue in a pre defined timelapse / prevalence of certain categories in an area
urban perception	emotions and places	*is it possible to draw a map enlightening people's emotions related to places? where people are scared? where are they happy? where are they melancholy?*		sentiment analysis of text content in different places	sentiment analysis of the comments of a venue
	displacement	*Which are the most named places and where are they named? Are they mostly named where they are located, or are they named from other places?*		extracting toponyms from tweet contents and relating them with the origin (lat long)of the tweet	

Fig.36 — zoom 05 Potential crossings

5 POTENTIAL CROSSINGS

Finally, this area of the matrix **merges the topic of urban interest with the meta-data availabilit**y, returning indications on how to answer to the questions through the 4 Social Media Services.

As an example, for the issue "City, suburbs and outskirts" that returns the topics of **"***Where people recognize a territory as peripherical?*

Which are the boundaries of the actual "center" of the city, as named by people?" the matrix displays the following indications:

> **Foursquare**: Where we see the strongest drop of check-ins compared to an area with high check-in rates, we have the actual limit (city areas more or less used).
> **Instagram** / **Flickr**: Plotting on the map places tagged (recognized) with the name of a city or a neighborhood (overlapping with administrative boundaries).

This matrix has been conceived as an **internal working tool** that helped us organizing and merging all the information and the specific needs we run into during our design experiments. This tool has also been a basis to discuss and present the potentialities of this work to different kinds of stakeholders in the initial stage of the research process, as well as an internal organizational document to set up the *UrbanSensing platforms.

It is important to acknowledge here that **this matrix has been crafted based on my research objectives and it would be incorrect to present the matrix as such as something that can be directly exported and used in other research projects**.

What proved to be beneficial was that the matrix acted as an **early stage tool to orient and feed the discussion upon potential ways to inquiry Social Media data**. It is also a **potentially new design approach to those kinds of address aiming at crossing qualitative and quantitative information from different fields** (in this specific case qualitative urban questions with quantitative metadata produced from digital devices).

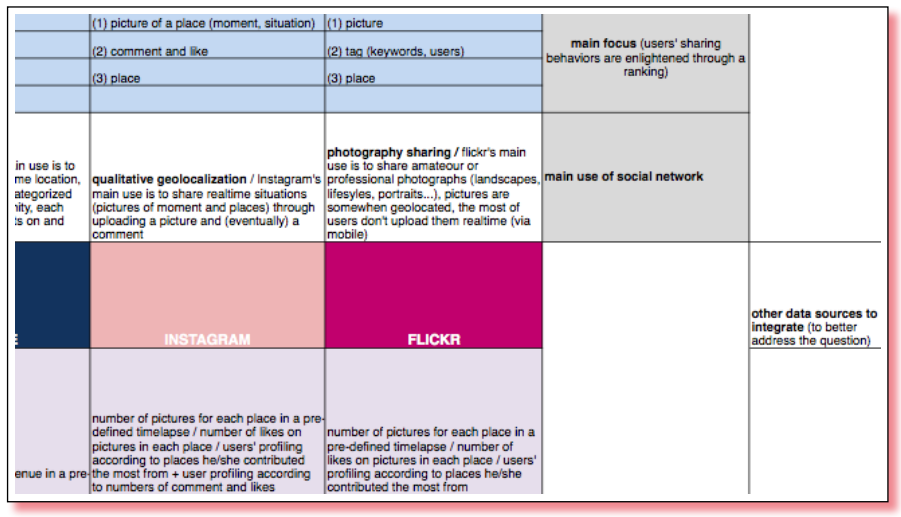


Fig.37 — zoom on other data sources to be integrated

2.6 OTHER OPEN DATA SOURCES TO BE INTEGRATED

Data streams from the social web can be integrated with **other data sources** in order to extract more robust indicators.

The matrix presents an empty column following parallerly the topics of urban interest; this column that have been added to point out the possibility to integrate geo-referenced data from other sources or applications to each specific questions according to the need for knowledge at hand.

Within the *UrbanSensing project we have analyzed several **Open-data**[12] **sources** to be directly integrated in the platform to permit users to perform integrated analysis and queries.

In fact, Open data are freely available to everyone to use and republish as they wish, without restrictions from copyright, patents or other mechanisms of control, and they are currently gaining popularity with the rise of the Internet and World Wide Web and with the launch of open-data government initiatives, such as Data.gov.
The more important Open data sources that have been identified follows:

> Wikipedia,
> Data coming from Institutions (e.g. ISTAT, EUROSTAT, The U.S. Census Bureau, Socrata, Data.gov),
> Factual,
> Google N-gram,
> GeoNames,
> Yahoo! GeoPlanet™ Data,
> Windows Azure Marketplace,
> Amazon Web Services. Public Data Sets,
> The Data Hub,
> Data coming from mainstream media (e.g. New York TImes, The Guardian, Corriere della Sera, Repubblica, El Pais, BBC).

The mapping process included four main steps:

> Identification of potentially interesting sources, among the ones found by web research and by reading similar research projects,
> First classification of sources, following technical and general categories (social / news / local / global /...) criteria,
> In depth analysis of chosen sources: benefits and limitations are studied in the context of this particular project,
> Global mapping and ranking following our main functional needs (quality/quantity of data, geographical features, royalties/privacy, etc.)

We conducted a series of workshops and sessions with the potential stakeholders of the platform to identity interesting sources to be included in the first release of the software.

12 Open data is the idea and philosophy that certain data should be freely available to everyone to use and republish as they wish, without restrictions from copyright, patents or other mechanisms of control. (Auer et all, 2007)

2.7 WORKING IN THE FIELD: EVALUATING AND ASSESSING OUR APPROACH

Another important methodological issue to face in the research process is how to assess **the results of the work**. In the past few years, an interesting debate arose in the community of design researchers, with scholars advocating for reseach-oriented design to exhibit *"a level of extensibility and verifiability"* (Zimmerman et al. 2008). They claim the adoption of standard and actionable metrics, whilst others argue that "*design research community should be wary of impulses towards convergence and standardization, and instead take pride in its aptitude for exploring and speculating, particularizing and diversifying, and - especially - its ability to manifest the results in the form of new, conceptually rich artifacts*" (Gaver 2012: 937). As Gaver points out, theory generated in design practice is "*provisional, contingent, and aspirational*" and these characteristics "*limit the potential 'extensibility and verifiability' of design theory*" (Gaver 2012: 941).

As the design approach plays an important role in the research, this contribution can be seen in terms of conceptual work or knowledge emerging from the descriptions of the design experiments. **Reflecting upon the design experiments allowed to identify potentialities and drawbacks of both the approach and the use of geo-located social mining techniques in urban design, planning and management**. Key learning and issues have been distilled through an in-depth analysis of each design experiment and the two overall projects Telltale and *UrbanSensing.

In other terms, the design experiments were the catalysts that sparkled the conversations among the Partners in Telltale and *UrbanSensing or the final users (mainly from academia, industry and government institutions) in participatory processes, where for example the key elements of the technological platform or some preliminary visual designs have been sketched out in a collaborative way, or where some instances of the platform have been assessed through usability testing.

These conversations to assess the potential and drawbacks of the approach together with the stakeholders have been ignited and sustained through different methods:

> **Co-design sessions,** quick-and-dirty prototyping, scenario testing, paper prototyping (based on IDEO method cards): between 2011 and 2013, 8 sessions of co-design have been conducted (in Milan, The Hague, Barcelona) engaging stakeholders from industry, practitioners (architects and urban planners) and public government.

> **Several presentations and focus group sessions** were organized across 2012 and 2013. These activities addressed diverse audiences and unfolded through an articulated set of private and public presentations of the technological platform of *UrbanSensing and several design experiments. Some of the venues of these presentations were: Tavoli Expo Milano, the New York City Planning Department, the New York City Public Health Department, the Cumulus Conference in Helsinki, the Human Cities Symposium in Brussels, the Future of Security Conference in New York, the Madrid Municipality. The first aim of these sessions was to determine whether or not the information produced by Telltale and *UrbanSensing can represent an indirect indicator of what happens in urban spaces in terms of distribution of activities, people behaviors and temporary city usages. Due to their fine spatial and temporal resolution, these data cannot be validated with conventional information that is usually available at the spatial level of administrative boundaries and, in most of the cases, only on an annual basis. For this reason, it is more fruitful to consider Social Media data as clues of urban phenomena that must be interpreted by means of expert knowledge and certainly by means of conventional GIS layers, that can help in the reading the spatial distribution emerging from social traces. The aim of these sessions was to evaluate these elements together with experts and stakeholders external to our projects.

> **Usability testing of the *UrbanSensing** prototype were carried out at several stages of the projects - in order to test the platform and its functionalities - and they were mainly based on protocols such as free navigation and talking aloud (quote), where users are let free to explore the interface and express their thoughts and feelings while using it.

METHOD: A FRAMEWORK FOR USING AND INTERPRETING USER GENERATED CONTENT

03

Visualizing the data city

Visualizing the data city

3.1 Visualizing geo-referenced data
3.2 Related work
3.3 A taxonomy of geo-referenced data-visualization
3.4 Interpretation and design insights
3.5 Discussion and scenarios of use

3.1 VISUALIZING GEO-REFERENCED DATA

In the last few years, cartography has been slipping from the control of the elites that have exercised dominance over it for several hundred years (Crampton and Krygier 2005), the ability to make a map, even an interactive 3D map, is now available to anyone with a home computer and an internet connection, due to cartography's latest "technological transition," (Perkins, 2003) with several free and easy-to-use tools bringing mapping technologies directly to the people.

Today, the global geo-services industry collects, shares, and analyzes data on an unprecedented scale. It is valued at as much as $270 billion per year and employs 500,000 people in the United States, according to a recent report from Google (Oxera, 2013).

One of the more peculiar examples is the recent success of the online service CartoDB[13], a cloud-based geospatial database allowing users with basic understanding of web programming to create and customize maps based on uploaded data (e.g., tables, KLM, and Shapefile) in an easy and intuitive way.

"*Managing your map is now easier than ever. When finished, publish your maps with a click. Make your data public, share the link, or use our simple embeddable widgets. Customize the appearance of your map with just a few clicks. For advanced styling, use the map style editor and access the full power of CartoCSS, the cascading styles sheet language for maps. You can even create maps without a background if you would like. Join multiple datasets to extract new insight.*"

Not only does the production of maps seem to be more and more within everyone's reach, but we are concurrently witnessing the emerging revolution of "big data": an abundance of information generated by individuals, infrastructure, and the natural world that has fundamentally changed the way companies, organizations, and media interact with information.

The emergent phenomenon of data-journalism (i.e., a journalistic process based on analyzing and filtering large data sets for the purpose of creating stories to reach new levels of service for the public, thereby helping consumers, managers, and politicians to understand patterns and make decisions based on the findings) is a characteristic example.

Within this context, **the ubiquitous presence of maps, whether static, dynamic, or interactive, is plain for all to see**: many online news sites, such as the New York Times, have created and featured interactive maps to lay out stories of different types and genres. These cover a variety of topics, from political issues (e.g., maps of election-related information), environmental issues (e.g., real-time tracking of natural disasters), socio-demographical subjects, and even entertainment-related stories, providing their readers with daily, geo-referenced narratives to browse on maps.

This combination of vast, geo-referenced information availability, the ease of technological diffusion, and the hot topic of presenting stories and contents through data-visualizations are leading to the **production of maps by almost any designer or programmer intrigued by mapping's potential.** Thus, the traditional ideas of what a geographer does and who a geographer is are being overturned.

Despite a tradition of mapping best practices that have been formalized and shared throughout the mapping community, there is now a **need to update such knowledge**. In fact, with the new attributes possessed by datasets (e.g., availability, volume, and timestamps) and with the new desire among map producers to have real-time, interactive, and very quick presentation of their maps, a comprehensive new classification of mapping possibilities is needed to explicate what does make sense and what does not.

Part of the PhD research process took the challenge of turning information into knowledge through the design and production of a **taxonomy that provides a systematic classification of visualization techniques of geo-reference data, and produce a vocabulary to more concisely discuss concepts in this area.**

The contribution of this classification space is twofold:

> **Classifying existing visualization techniques to define a common language**, which will be especially useful in light of the rapid progress that is occurring in this domain.
> By identifying and organizing the various aspects of visualization, this work should also help the mapmaking community to address the right design questions and to **envision future visualization techniques** for geo-referenced data display within dynamic and interactive interfaces.

This chapter will provide an accurate description of the methodology, so that **similar studies and outcomes** can be easily re-applied to other categories of visualizations, such as temporal datasets, network-based datasets, hierarchy-based datasets.

13 Cartodb: www.cartodb.com

3.2 RELATED WORK

It is extremely difficult for non-expert visualization practitioners to perform the visualization part of visual analytics; mapping data to visual form requires knowledge of data-visualization techniques, information design, and the task domain.

Poor graphic designs can obscure the data and its meanings, and if people are not trained and key principles are still being discovered, the production of misleading data-visualizations is risky (Bertin, 1983)

Common sense taxonomies of data-visualizations formally aim to:

> Enable users (e.g., readers and designers) to share a common language,
> Provide an overview of specific visualizations' strategies according to questions at hand,
> To guide both users (i.e., people outside the visualization community) seeking to understand the products they see and use, and designers that might have trouble finding visualization ideas in the literature if they are not categorized in a meaningful way.

The analysis of geo-referenced visualizations presented in this thesis is based on several academic approaches to classification that have been selected and crossed them according to the research purposes, as it will be explained in the following paragraphs.

Former authors' work that has been have analyzed are:

> Edward Segel's and Jeffrey Heer's "Narrative Visualization: Telling stories with Data" ,
> Jeffrey Heer's and Ben Shneiderman's "Taxonomy of interactive dynamics for visual analysis",
> William Bevington's "A visualization-based taxonomy for information representation",
> Jacques Bertin's "Semiology of graphics",
> John Campbell's "Map Use and Analysis",
> Robert Harris' "Information Graphics: A Comprehensive Illustrated Reference",
> Melanie Tory's and Torsten Möller's "Rethinking Visualization: A High-Level Taxonomy",
> Darius Pfitzner's, Vaughan Hobbs', and David Powers' "A Unified Taxonomic Framework for Information Visualization".

During the research process I **collected a wide range of projects representing geographies at different scales** (e.g., specific places, neighborhoods, cities, regions, and wider territories) and then attempted to identify and express the design features they share. In such projects, the use of information visualization is aimed at user-enablement concerning insights, analysis, and decision making about different issues at the territorial and urban scales.

I selected web-based maps grounding on the following criteria:

> Representation of **geography** (i.e., map) included;
> Projects released on the web during the **last five years**, to provide a contemporary panorama of the most commonly used visual techniques;
> Projects that have been **communicated** (i.e., posted, linked, shared, or reviewed) the most during the past year (2012), assuming that this could be a criteria to decree a sort of success.

(The comprehensive collection of case studies can be found online here: http://www.scoop.it/t/urban-sensing, a dump of the website is included in the Appendix chapter)

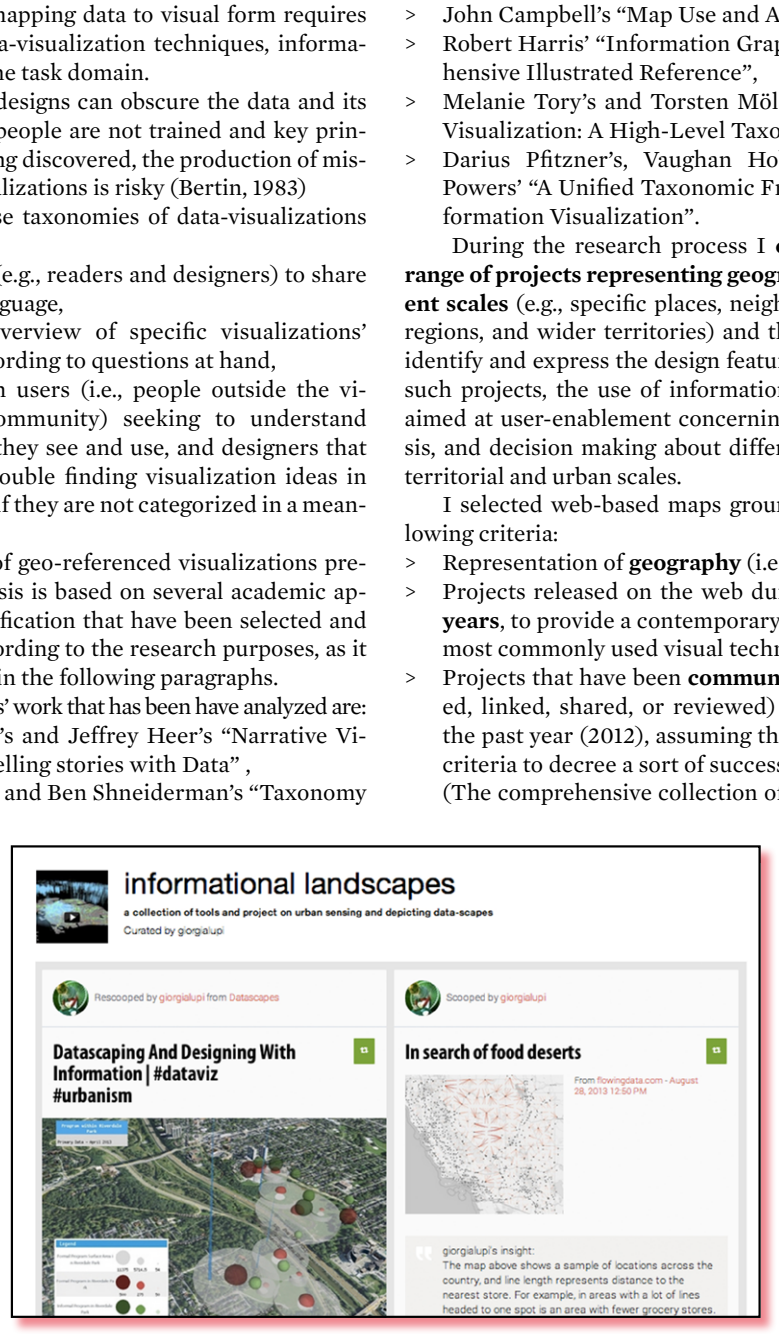


Fig.38 — Informational Landscapes homepage screenshot (curated by Giorgia Lupi) (access date November 2013)

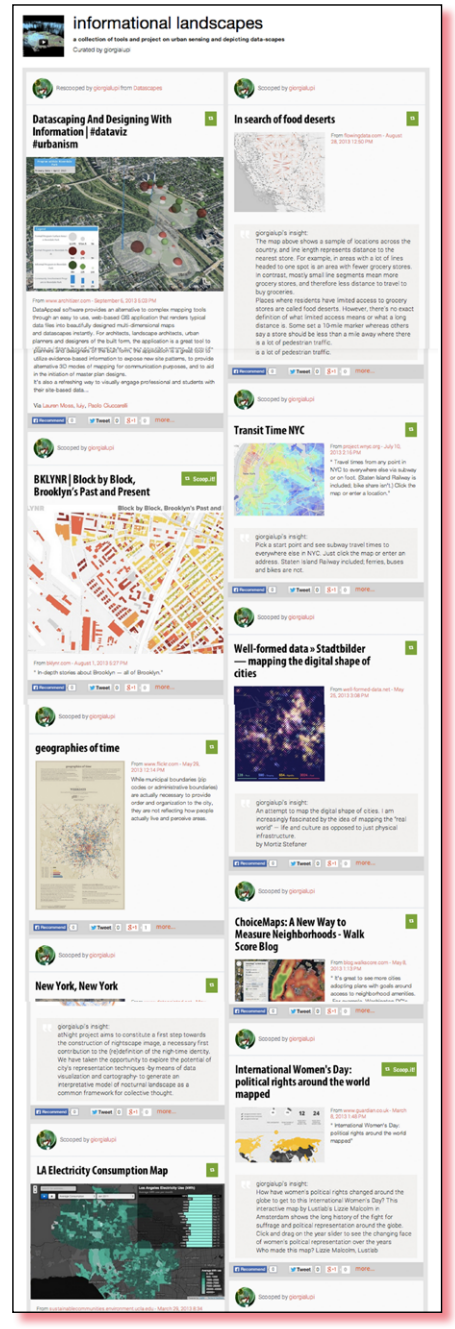


Fig.39 — Informtional Landscapes longer screen-roll[14] (access date November 2013)

The main classification through which case studies can be interpreted regards the opportunity users have to interact with data and contents, meaning that we are grouping visualizations into static images, motion graphics, and interactive interfaces.

Design-wise, I identified possible **aims** (i.e., specific goals that these projects have been produced for) that have been summed up into three main brackets:

> Informative (i.e., visualizations with the primary purpose of providing or disclosing information about a potential hot, newsworthy, or previously unclear topic),
> Decision making (i.e., visualizations aimed at providing readers with hints or clues on a given topic, guiding users to produce a final choice by customizing parameters or selecting a course of action among several alternative scenarios),
> Narrative (i.e., visualizations balanced between the narrative flow intended by the author, which is imposed by graphical elements and the interface, and story discovery on the part of the reader, which often occurs through interactive exploration (Segel and Heer, 2010) with no explicit decision making or informative purpose).

In the following paragraphs I present three selected case studies respectively representing **static images, motion graphics, and interactive maps** with an exemplary data-visualization approach (e.g., introducing uncommon visual models while still being able to convey contents in a powerful way), to give a sense of the kind of visualizations that I analyzed and interpreted.

Static maps

Even though inclusive glossaries of specific techniques for static maps already exist, I have selected a certain number of non-interactive maps to derive and classify such visual elements (both for the base map and the contents' display onto maps) as are useful in defining guidelines for both motion graphics and interactive visualizations.

1 MILLION DOLLAR BLOCK
http://www.spatialinformationdesignlab.org/projects.php?id=16

This project consists of a series of static images designed and produced with an informative purpose.

Using data from the criminal justice system about the two million people locked up in jails and prisons, the Spatial Information Design Lab and the Justice

14 See Appendix for the complete list of analyzed case studies

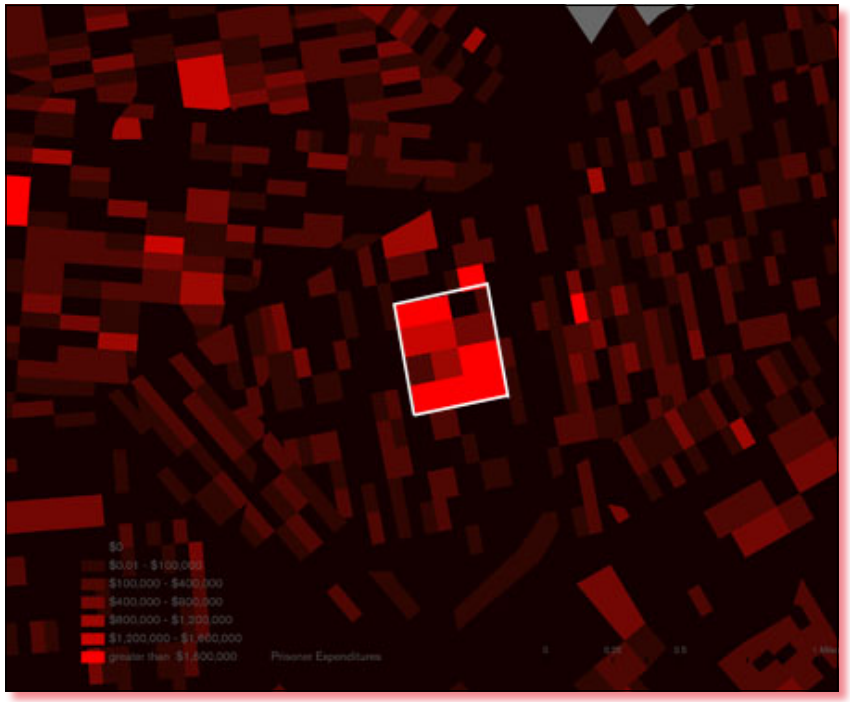


Fig.40 — Million Dollar Blocks project
by Spatial-information-design Lab
(access date June 2013)

Mapping Center have created maps of these "million dollar blocks" and of the "city-prison-city-prison" migration flow in five of the nation's cities.

From a content point of view, the maps suggest that the criminal justice system has become the predominant government institution in these communities, and that public investment in this system has resulted in significant costs to other elements of our civic infrastructure — e.g., education, housing, health, and family.

Clearly, although the million dollar blocks are their focus, the maps indicate that this question cannot be answered at the level of the block alone.

The project creators propose to treat prisons and jails as an urban exostructure. No matter how physically removed they are from the neighborhoods of the people they hold, they remain firmly rooted as institutions of the city and as everyday parts of life for the people, impacting their homes, social networks, and migrations. The maps are both a picture and a design strategy, the picture is an aggregate situation.

The design strategy is to start from the block and build, incrementally, new networks which might inform this crippled urban infrastructure. In this way, these maps depart radically from the maps and statistical analyses that fueled mid-twentieth century urban renewal and policing projects.

Motion graphics visualizations

Motion graphics visualizations can be described as interfaces that allow users to follow a visual narrative: they vary from videos displaying geography-related stories through time, to videos displaying multiple-contents (e.g., statistics and numbers) with geography-based visualizations, to animations displaying interfaces yet to be built.

2 LIVE SINGAPORE
http://www.youtube.com/watch?v=2aEPkyOBtRo

LIVE Singapore! can be described as a series of different animations aiming at narrating various scenarios involving the city of Singapore.

The project consists of both the development of an open platform for the collection, and the combination, fusion, and distribution of real-time data originating from a large number of different sources, thereby providing people with access to a range of useful real-time

information about their city.

After an initial process of data analysis from several data streams, six visualizations have been delineated that investigate different areas of interest and relevance to the city of Singapore, with the aiming of providing greater understanding of some of the city's dynamics.

Content-wise, the visualizations display vehicular traffic, the effects of the weather on taxi routes, temperatures in different areas of the city correlated with energy consumption, city dynamics when a special event (e.g., the formula one grand prix) is occurring, Singapore's mobile phone penetration per block, and import and export data from the container port and the airport. We can identify a particular effort toward the diversification of visual models and metaphors in use among the six different visualizations according to the topics that they deal with.

Visualizations are presented through both static images and an inclusive video displaying how singular values behave through time, prototyping the final real-time platform.

Interactive visualizations

Design-wise, interactive interfaces represent the most interesting part of case studies I collected. This group can be described as maps that allow users to actively explore datasets through the visualizations themselves. Interactivity could vary from a basic selective-display level (e.g., viewing and analyzing specific contents), to a more active data exploration (e.g., filter-

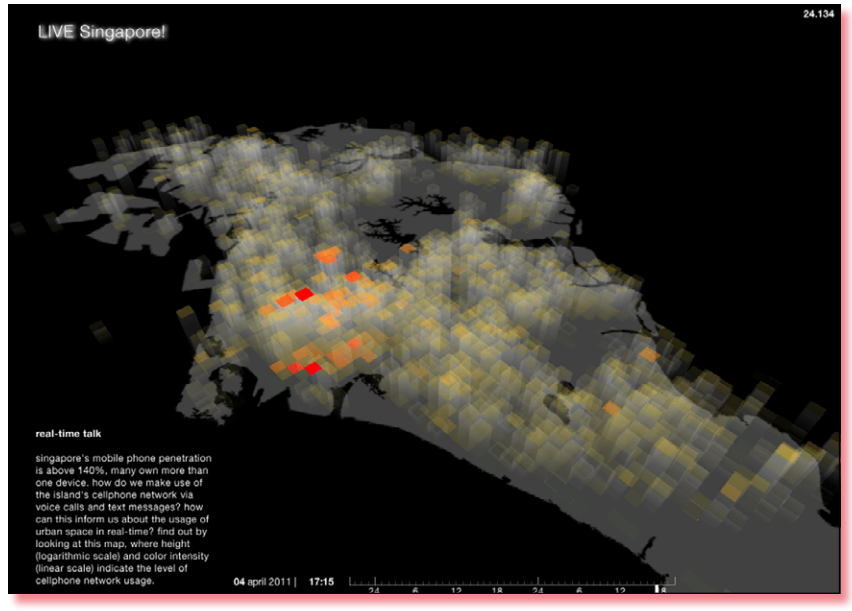


Fig.41 — LIVE Singapore! by Senseable City
Lab, MIT (access date June 2013)

ing, sorting, deriving values, and customizing views).

3 RENTONOMY
http://www.rentonomy.com/maps/discover

This project is an exemplar case study of interactive visualization with a decision-making purpose. Rentonomy is an easy-to-use site that looks at the city of London in a totally new way, giving citizens the ability to compare the city's areas according to several parameters in order to find the right area to live. They describe it as "A London encyclopaedia: an interactive London Area Map will provide the information citizens need to make an informed decision when it comes to choosing your next home."

While the site's interactivity is very basic (with a main, simplified base map used to directly explore and compare neighborhoods, and an area in the upper-right side of the visualization that is reserved for setting search parameters and displaying areas' information) a high level of information is conveyed. Comparisons are extremely intuitive and well-displayed throughout the interface, al-

lowing users to easily gain insights into the topic.

3.3 A TAXONOMY OF GEO-REFERENCED DATA-VISUALIZATION

During the research process, I have collected more than 200 of the sorts of case studies introduced before, these case studies have been used then to systematically explore new possibilities for geographical visualizations.

There are many ways to organize these kinds of information: most visualization taxonomies are based on the type of data involved, while other visualization design systems address usability issues in more detail by including user objectives (and sometimes user input) in the design process.

Primary use of this taxonomy includes **classifying, analyzing, and finding similarities and differences between the spatial visualizations; I thus categorized visualization techniques based more on their design model rather than their type of data**. This is because users will choose visualization techniques that match their ideas and intentions.

The final aim of this part of the research work is, through observation and interpretation of patterns and clusters, and by using under-explored approaches, to provide designers with a **comprehensive vocabulary of the possibilities for spatial visualization at the urban and territorial scales**.

An iterative approach has been adopted to build the final matrix that I present.

> A preliminary selection of case studies and first qualitative interpretation established a starting point for exploration. Case studies have been sorted out to compose an archive of records regarding visual models (i.e., elements used to display data) and interactive interface types (i.e., ways users can explore data) that is as heterogeneous as possible; this gave me the ability to apply a first bottom-up (i.e., directly from case studies) identification of categories.

> I secondarily compared the initial set of categories with academic definitions provided by previous scholars. The topic at hand (geo-referenced data and interactive interfaces) led me to rely on five main bibliographical references:

- Edward Segel's and Jeffrey Heer's "Narrative Visualization: Telling stories with Data", 2010,
- Jeffrey Heer's and Ben Shneiderman's "Taxonomy of interactive dynamics for visual analysis", 2012,
- William Bevington's "A visualization-based taxonomy for information representation", 2008,
- Jacques Bertin's "Semiology of graphics", 1983,
- John Campbell's "Map Use and Analysis", 2000,
- Robert Harris' "Information Graphics: A Comprehensive Illustrated Reference", 2000,

> When taken together, these sources cover the most of categories I found.

> I finalized the main classification by adding those groups of elements we derived from case studies analysis to academic categories (see figure X).

> A final version of the matrix has been built through a consequent re-selection of case studies, this time with the aim of covering the wider range of topics at the territorial scale. These vary from economic, political, environmental, and entertainment, to the more novel disciplines of interpretation of city dynamics through user generated contents (see figure X).

> Lastly, the final organization of the design space (i.e., design space as defined by Jeffrey and Heer 2010) contains four main divisions of features:

1) "Data handling," referring to original data attributes such as harvesting, source, and aggregation,
2) "Interface," referring to the visual structure that communicates the main features of the data and expresses: whether the visualization is bi-dimensional or tri-dimensional; whether it is static, motion-graphics, or interactive; and which scale of territories it explores (i.e., a specific place, neighborhood, city, country/region, or the entire world),
3) "Data display," referring to the general architecture of the main data visualization displayed. Given that a substantial internal division aims at identifying how contents (i.e., specific data) are superimposed and displayed on the geography (i.e., map), we identified three main design spaces:

- Base: geographical features and attributes of the "base map" (Both Bevington 2008 and Harris 2010 define a base map as:

"a basic map on which attribute data is superimposed to form most statistical and descriptive maps. As a general rule, the amount of information on a base map is kept to a minimum so as not to detract from the attribute information conveying the major theme of the map");

- Superficie, referring to the design space of contents' display. Superficie analysis is divided into: main value variation, shape of individual elements, and individual element variation;
- Extra, referring to statistics' presentation, indicators, and time's exploration, if any;

4. "Interactivity," referring to the different ways a user can explore the visualization, including:

- Data view and specification (i.e., filter, sort, explore singular content, search, and derive values for models),
- View manipulation (i.e., navigate, select, and customize view),
- Process and exporting options (i.e., insert own data, record analysis, share on social media, and annotate patterns),
- Interactive elements specification (i.e., interaction on main visualization, through menus, through other windows such as buttons, check buttons, and slides).

Case studies that I interpreted using previous categories are primarily grouped according to the topic that the data refers to (i.e., environment, population, mobility, safety, places perception, places use, entertainment, emergency, politics, trend topics, education, health, and economy). Further information about specific places the projects describe and main goals they were trying to achieve are provided in the matrix as well.

Bigger sizes of the images can be found in the Appendix.

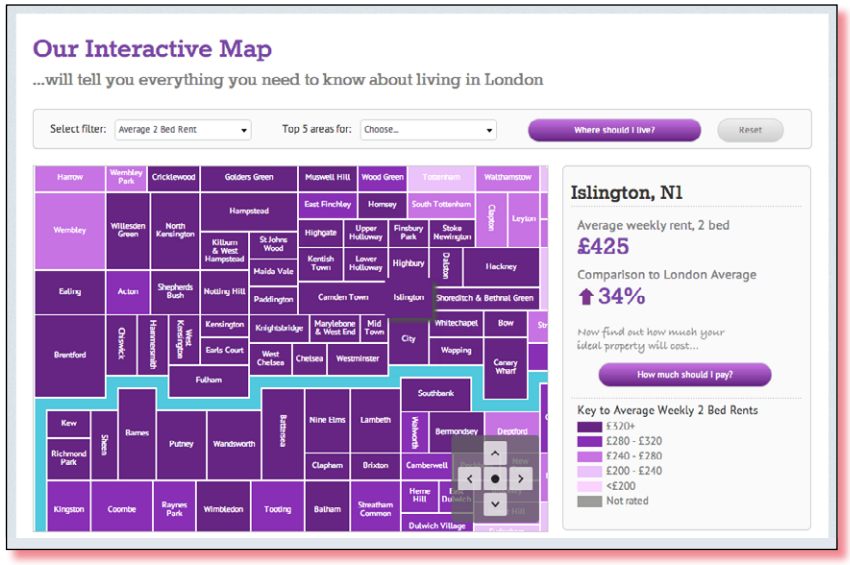


Fig.42 — Rentonomy (access date June 2013)

case study	ISSUES	place	aim
	ENVIRONMENT		
Live Singapore / urban energy	energy	Singapore	narrative
London Air Pollution	pollution	London	informative
urbmet	energy	(world)	informative
NYC building energy	energy	New York	informative
mapping urban tree density	green	Vien	informative
windmap	wind	USA	narrative
waste facilities	reclycling	USA	informative
Groundwater in movement	water	(world)	informative
	POPOULATION		
Maps of Babel	ethnicity	Milan	narrative
Mapping America, every block	ethnicity	USA	informative
Growing Switzerland	demographic	Switzerland	narrative
Mapping wikipedia	ethnicity	world	informative
The world popoulation by lat+long	demographic	world	informative
Interactive maps of London surnames	demographic	London	narrative
Local and Tourists	city users	several cities	informative
	MOBILITY		
Metrography	travel time	London	decision making
Timemaps	travel time	Amsterdam	decision making
Live Singapore / raining taxi	taxi routes	Singapore	narrative
Live singapore / isochronic	travel time	Singapore	narrative
Sense of patterns	taxi routes	Vien	entertainment
London Time travel maps	travel time	London	narrative
Bikeshare map	bikeshare	several cities	decision making
Map your moves	migration	New York	informative
	SAFETY		
Oakland Crime Spots	reported crime	severl cities	informative
Stop and Frisk	police stops	New York	informative
Seattle Police Incident	police stops	Seattle	informative
trulia crime maps	crime	several cities	informative
311 complaints in NYC	311 call	New york	informative
Million dollar blocks	city prisons	New york	informative
How fast is LAFD where you live?	rescue	Los Angeles	informative
	PLACES PERCEPTION		
The Mood of Europe	mood	EU countries	informative
Hate VS Love	mood	USA	narrative
The world's eyes	depicted places	Spain	narrative
Ssighteeing heatmap	depicted places	world	narrative
Invisible cities	tales from places	NewYork	narrative
MyBlockNYC	tales from places	NewYork	informative
	ACTIVITIES		
Live singapore / realtime talk	phone activity	Singapore	narrative
A week on foursquare	landmarks	New York	informative
Urbanmobs	phone activity	EU cities	narrative
New York talk exchange	phone activity	New York	narrative
Livehoods	area clustering	USA cities	informative
	ENTERTAINMENT		
Netflix rental patterns	movie rent	USA cities	narrative
Museum of the Phantom city	art	New York	narrative
Design week tweets	special event	Milan	informative
this is art	art	Derbyshire	narrative
	EMERGENCY		
Hurricane tracker	hurricane	USA	informative
Flooding and Flood zones	flooding	New York	informative
Northern Italy Shakes	hearthquake	Italy	informative
	POLITICS		
Public opinion Tool / PIM	elections	USA	decision making
CNN home and away	conflict causalities	USA, Afg, Iraq	informative
forecast of congress	elections	France	decision making
presidential campaingn stops	elections	USA	informative
	TREND TOPICS		
Mapping kony	singular topic	world	informative
Trendsmap	trends	world	informative
Mapping the buzz	trends	NYC, LA	informative
thanks-friday	topics	New York	informative
anatomy of a protest	singular topic	New York	informative
	EDUCATION		
Dust	school choice	USA cities	decision making
GreatSchools	school choice	New York	decision making
Schooloscope	school choice	UK	decision making
	HEALTH		
Idao public health district	public health	Idaho, US	informative
massive health	food health	world	informative
healthmap	public health	USA, Canada	informative
	ECONOMY		
Financial Footprint	financial transactio	Spain	narrative
Live singapore / hub	import export	Singapore	narrative
Us import and export	import export	USA, world	narrative
rentonomy	rent price	London	decision making
TOTAL			

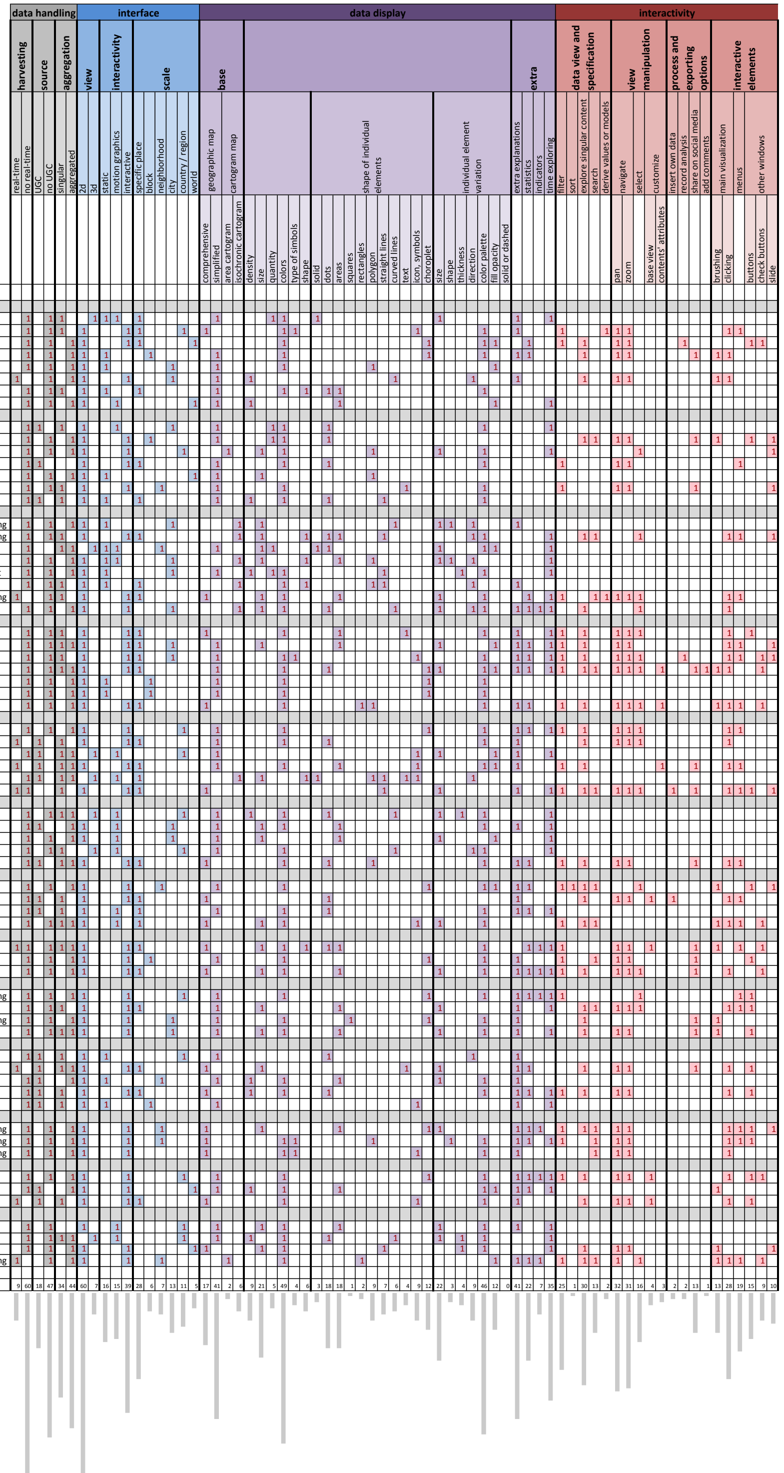


Fig.43 — Categories definition: bibliographical validation of qualitative initial set of categories according to: J.Campbell, R.Harris, J.Heer and B.Shneidermann, J.Bertin, W.Bevington. [see Appendix for bigger version]

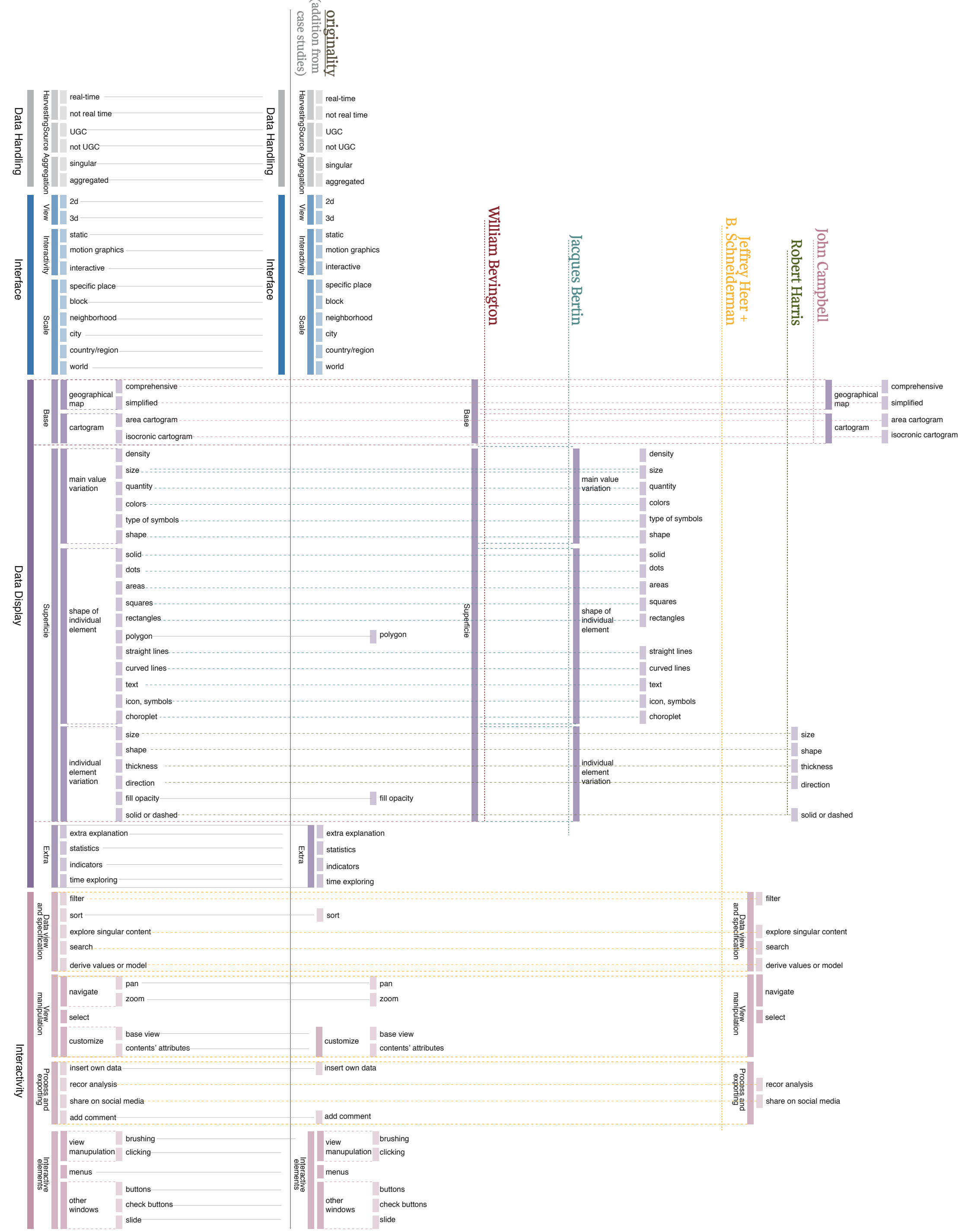


Fig.44 — Design space analysis of geo-referenced data-visualizations. Case studies are mainly grouped by topics of interest and are further explained through the places they describe and the goals for which they have been built. [see Appendix for bigger version]

3.4 INTERPRETATION AND DESIGN INSIGHTS

An elementary pattern's detection can be observed in the bar charts at the bottom of each column. By comparing totals within each of the macro-categories, some recurrences throughout case studies can be observed, I visually underlined those elements to compare with thicker cells' borders.

As for the way the projects handle the data:

> The majority of the projects (50 out of 56) visualize off-line data rather than real-time information.

> Only a few projects (16 out of the total) deal with User Generated Content.

As for the data displaying:

> Almost 90% of the projects rely on bi-dimensional visualizations rather than using 3D techniques.

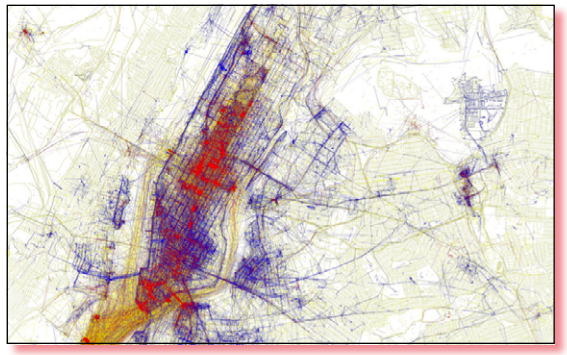


Fig.45 — Local and Tourists project by Eric Fischer, New York, 2010 http://www.flickr.com/photos/walkingsf/sets/72157624209158632/

> The majority of base maps are "simplified" (45 out of 56), and they do not convey all the geographical features and details; they mostly represent administrative boundaries, infrastructure, and landmarks.

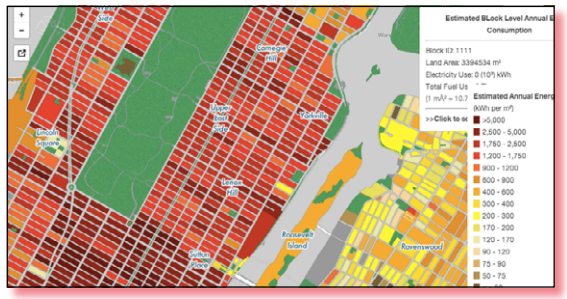


Fig.46 — NYC building energy project by Modi Research Group, 2012 http://www.visualizing.org/visualizations/new-york-city-building-energy-map

Only a few projects (11 out of the total)—mostly professional interfaces that support urban planners in decision-making activities—present comprehensive maps (with more attributes and details).

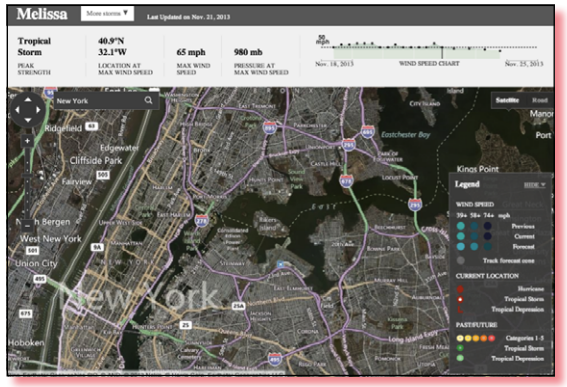


Fig.47 —] Hurricane tracker project by Weather.com, 2010 http://www.weather.com/weather/hurricanecentral/tracker/2012/sandy

> The most frequent strategy to mark variation in content (e.g., different kinds of data) is to use different colors (this especially applies to those topics and case studies that aim at comparing different values and variables or at grouping con-tent into categories).

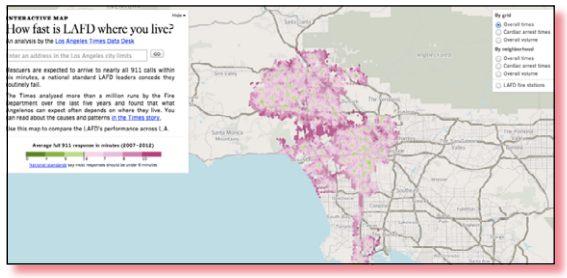


Fig.48 — How fast is LAFD where you live? project, by Los Angeles Times Data Desk, 2012 http://graphics.latimes.com/how-fast-is-lafd

> The size of graphic elements appears as the second most-used visual strategy to signal differences in content (this is especially common in mobility-related topics and economy-related topics).

Fig.49 — Stop and Frisk project, by New York times, 2010 : http://www.nytimes.com/interactive/2010/07/11/nyregion/20100711-stop-and-frisk.html

> Other general considerations:

> To display variations in values or parameters, several techniques are used. Individual elements change their color palettes or sizes, or they are presented with different opacity or thicker outlines.

> As for the representation of individual elements on a map, dots and simple geometric shapes are the most recurrent choices. Choropleths (i.e., areas drawn from existing geographies such as administrative boundaries) are another quite common element.

> Almost all visualizations provide extra explanations such as an "about page," a descriptions of data sources, an explanation of the visualization aim, or some hints on the process.

> Many of the visualizations (more than 50%) let users explore the phenomena (content) through time.

> Legends mostly recur on printed data visualizations.

As for the user interface:

> The majority of our case studies present some interactive components at the user interface level.

> In terms of interaction models, almost all the case studies offer the ability to explore content by panning and zooming. Most of the projects make use of zoom-scale functionalities that let users explore specific places (e.g., singular blocks or buildings).

> The content can be mainly explored by filtering or by exploring singular attributes (e.g., displaying extra information on a singular element on the map by hovering over it or clicking on it). Only a few visualizations provide users with the ability to search for specific issues or places (12 out of 56). This mainly applies to those visualizations that depict large portions of territories or compare several cities.

> User interface shows consistent behavior across most of the case studies, and it is usually organized through horizontal menus (usually positioned at the bottom of the visualization) or through side menus, such as specific windows (pop-ups or widgets), that allow users to filter and sort content.

Underexplored possibilities can be noticed by looking at semi-empty columns in the table representing the taxonomy. Few of the case studies:

> Let the users insert their own data that the engine can process and display (only 4 case studies allow for this possibility).

> Record the analysis, giving users the ability to save and reopen previous queries or comparisons (only two case studies allow for this possibility);

> Add comments to open discussions and debates (only two case studies out of 56 give this possibility).

> Allow the users to access the data sources (only two case studies out of the total give this possibility).

> Allow the users to visually customize the base views (e.g., dis-playing only specific features such as infrastructures) or con-tent views (e.g., modifying colors, sizes, and the opacity of elements).

By **further analyzing the taxonomy**, we can also notice the following:

> Mobility-related projects (usually presenting urban travelling times) are very often displayed through geographic distortions of base maps (i.e., isochronic cartograms spatially rep-resenting the time-distance relationships between a central place and its associated places), while almost no project replaces geographical maps with cartograms.

> Visualizations with a strong narrative dimension sometimes use 3D representations and adopt underused "individual elements shapes" (such as text and icons as the main representational technique for content).

> Informative visualizations mainly explore safety, emergency, trendy topics, and health-related topics. Interestingly, interactivity happens here mostly through the main visualization (e.g., exploring contents by directly clicking or hovering on the map) rather than by means of menus or other windows.

> A promising direction for further development is the cross-platform dimension of the visualizations. In fact, the recent diffusion of tablets and mobile phones have seen the adoption of new touch-based interaction models (also based on the commonly used actions of tapping, holding, swiping, and dragging). Few of the case studies make use of these interaction models.

3.5 DISCUSSION AND SCENARIOS OF USE

In this chapter, I **presented a taxonomy of geo-referenced data visualization systematically exploring the set of possibilities and clarifying visualization techniques for geographical visualizations**.

This framework addresses all the major factors involved in the design and exploration of geo-referenced base data sets.

These results will help in identifying successful insights for design practices by: explicitly naming specific operations a user may wish to perform on data, through which I hope to facilitate their use and application, and by identifying recurring design patterns and underused approaches that I believe will help in the development of novel tools.

As a first attempt, the taxonomy has been tested within the *UrbanSensing project. As highlighted before, the final goal of the project is to build and release an intuitive visualization platform able to guide users (e.g., stakeholders with urban interests) through the process of performing specific queries on geo-referenced social media data, and represent results through geography and time. **A first prototype has been designed according to the taxonomy's interpretation**. In Chapter 5 a more detailed explanation of the design process of the *UrbanSensing interface will be provided.

As the introduction highlighted, the topic of geo-referenced data-visualizations is incredibly mature for future works of different kind.

As experienced with the *UrbanSensing project, this taxonomy could be used to derive important design guidelines for interactive interfaces that display geo-referenced data: a further step of this research could be the formal expression of specific, guiding principles for the design of such visualization according to topics, aims, and interactivity constraints.

Another promising direction for further development of this work could be the **integration of different kinds of devices** (e.g., devices other than laptops and desktops) in hosting interactive interfaces. In fact, the recent diffusion of tablets and mobile phone invites experimental visualization techniques and more intuitive interactions with information. These operations, such as filtering, sorting, zooming, and brushing, should not be adapted only to new screens, but considered with regard to the specific gestures on which these devices base their displays (e.g., tapping, holding, swiping, and dragging).

Within the future development of this work, a further macro-category dedicated to the tools (e.g., programming languages, online services, and software) with which to build visualizations can be envisioned, suggesting to users the most appropriate ones to choose according to their specific needs.

References:
case studies included in the taxonomy
(access date June 2013)

GENERAL TOPIC: ENVIRONMENT

1. **Live Singapore / urban energy :** http://senseable.mit.edu/livesingapore/images/energy_lg.png
2. **London Air Pollution:** http://londonair.org.uk/LondonAir/Default.aspx
3. **Urbmet:** http://urbmet.org/
4. **NYC building energy:** http://www.visualizing.org/visualizations/new-york-city-building-energy-map
5. **Mapping urban tree density:** http://www.visualizing.org/visualizations/mapping-urban-tree-density-hexagonal-grids
6. **Windmap:** http://hint.fm/wind/
7. **Waste facilities:** http://www.visualizing.org/visualizations/us-waste-facilities
8. **Groundwater in movement**: http://www.visualizing.org/full-screen/37111

GENERAL TOPIC: POPOULATION

9. **Maps of Babel:** http://giorgialupi.wordpress.com/2012/05/12/maps-of-babel/
10. **Mapping America, every block**: http://projects.nytimes.com/census/2010/explorer
11. **Growing Switzerland:** http://www.lucguillemot.net/growingswitzerland/index.html
12. **Mapping wikipedia**: http://wikiproject.oii.ox.ac.uk/mapping_wikipedia/
13. **The world popoulation by lat+long:** http://bigthink.com/strange-maps/563-pop-by-lat-and-pop-by-long
14. **Interactive maps of London surnames:** http://names.mappinglondon.co.uk/
15. **Local and Tourists:** http://www.flickr.com/photos/walkingsf/sets/72157624209158632/

GENERAL TOPIC: MOBILITY

16. **Metrography:** http://www.looksgood.de/log/2012/02/metrography-london-tube-map-to-large-scale-collective-mental-map/
17. **Timemaps**: http://app.timemaps.nl/map
18. **Live Singapore / raining taxi:** http://senseable.mit.edu/livesingapore/images/raining_taxis_lg.png
19. **Live singapore / isochronic:** http://senseable.mit.edu/livesingapore/images/isochronic_lg.png
20. **Sense of patterns:** http://casualdata.com/senseofpatterns/
21. **London Time travel maps:** http://www.oskarlin.com/2005/11/29/time-travel
22. **Bikeshare map**: http://bikes.oobrien.com/
23. **Map your moves:** http://moritz.stefaner.eu/projects/map%20your%20moves/

GENERAL TOPIC: SAFETY

24. **Oakland Crime Spots**: http://oakland.crimespotting.org/
25. **Stop and Frisk** : http://www.nytimes.com/interactive/2010/07/11/nyregion/20100711-stop-and-frisk.html
26. **Seattle Police Incident:** http://public.tableausoftware.com/views/SeattlePoliceIncidentData2011-2012_0/IncidentMap?:embed=y
27. **Trulia crime maps:** http://www.trulia.com/crime/
28. **311 complaints in NYC:** http://www.visualizing.org/visualizations/nyc-311-composite
29. **Million dollar blocks:** http://www.spatialinformationdesignlab.org/projects.php?id=16
30. **How fast is LAFD where you live?** : http://graphics.latimes.com/how-fast-is-lafd/#11/34.1647/-118.5895

GENERAL TOPIC: PLACES PERCEPTION

31. **The Mood of Europe:** http://www.locusinsight.com/assets/files/demos/Report_moe_V8/atlas.html
32. **Hate VS Love:** http://brunosan.github.com/Twitter-MapBox/
33. **The world's eyes:** http://senseable.mit.edu/worldseyes/index.html
34. **Sighteeing heatmap**: http://www.sightsmap.com/
35. **Invisible cities:** http://www.christianmarcschmidt.com/invisiblecities/
36. **MyBlockNYC:** http://myblocknyc.com/#/welcome

GENERAL TOPIC: ACTIVITIES

37. **Live singapore / realtime talk:** http://senseable.mit.edu/livesingapore/images/hub_sm.png
38. **A week on foursquare:** http://graphicsweb.wsj.com/documents/FOURSQUARE-WEEK1104/
39. **Urbanmobs**: http://www.urbanmobs.fr/en/france/
40. **New York talk exchange:** http://senseable.mit.edu/nyte/movies/nyte-globe-encounters.mov
41. **Livehoods:** http://livehoods.org/maps/nyc

GENERAL TOPIC: ENTERTAINMENT

42. **Netflix rental patterns:** http://www.nytimes.com/interactive/2010/01/10/nyregion/20100110-netflix-map.html
43. **Museum of the Phantom city**: http://phantomcity.org/
44. **Design week tweets**: http://giorgialupi.net/2012/07/01/design-week-tweets/
45. **This is art**: http://www.wearemudlark.com/derbyarts/

GENERAL TOPIC: EMERGENCY

46. **Hurricane tracker:** http://www.weather.com/weather/hurricanecentral/tracker/2012/sandy
47. **Flooding and Flood zones:** http://project.wnyc.org/flooding-sandy-new/index.html
48. **Northern Italy Shakes:** http://www.tableausoftware.com/public/gallery/northern-italy-quakes

GENERAL TOPIC: POLITICS

49. **Public opinion Tool / PIM:** http://piim.newschool.edu/tools/votingtool/
50. **CNN home and away:** http://edition.cnn.com/SPECIALS/war.casualties/index.html
51. **Forecast of congress:** http://www.visualizing.org/visualizations/forecast-congress
52. **Presidential campaign stops:** http://www.washingtonpost.com/wp-srv/special/politics/2012-presidential-campaign-visits/

GENERAL TOPIC: TREND TOPICS

53. **Mapping kony:** http://www.zerogeography.net/2012/03/mapping-kony2012-on-twitter.html
54. **Trendsmap**: http://trendsmap.com/
55. **Mapping the buzz:** http://www.nytimes.com/interactive/2009/04/06/arts/20090407-buzz-maps.html
56. **Thanks-friday**: http://www.accurat.it/viz/thanksfriday/
57. **Anatomy of a protest:** http://uxblog.idvsolutions.com/2012/05/twitter-anatomy-of-protest.html?goback=.gde_80552_member_112864887

GENERAL TOPIC: EDUCATION

58. **Dus**t: http://www.densitydesign.org/research/dust/
59. **GreatSchools:** http://nbcscorecard.greatschools.org/schools/NY/2952.html
60. **Schooloscope**: http://berglondon.com/

projects/schooloscope/

GENERAL TOPIC: HEALTH

61. **Idao public health district:** http://healthandwelfare.idaho.gov/Portals/_Rainbow/InstantAtlas/CrudeDataReport/atlas.html
62. **Massive health**: http://data.massivehealth.com/
63. **Healthmap:** http://www.healthmap.org/en/

GENERAL TOPIC: ECONOMY

64. **Financial Footprint:** http://senseable.mit.edu/bbva/
65. **Live singapore / hub:** http://senseable.mit.edu/livesingapore/images/hub_sm.png
66. **Us import and export:** http://www.visualizing.org/visualizations/us-imports-and-exports-nominal-dollars-1985-2011
67. **Rentonomy:** http://www.rentonomy.com/maps/discover

04

Design experiments

Design experiments

- Instagram, Foursquare and Twitter compared (Milan, 2012)
- Maps of Babel, the city of languages (Milan, 2012)
- Visualizing the crisis, contents' analysis (Rome, 2012)
- Do it yourself GIS (Milan and Rome 2012)
- Urban Stories: individual patterns of mobility (Milan 2013)
- Geographies of Time Milan (2013)
- Geographies of Time New York (2013)

As marked before, design experiments have been conducted throughout the course of the PhD investigation and played an important role at different stages of the research.

At an initial phase, the design experiments had a more exploratory stance and allowed to clarify, test and refine the research questions, the technological architecture of the tools that could be designed for final stakeholders, the interpretation algorithms and the visualization strategies.

At a later stage, the design experiments were aimed at creating instances of the platform within the *UrbanSensing project and testing them with a wide array of stakeholders.

(1) FINDING PATTERNS: INSIGHTS ON THE CITY

INSTAGRAM, FOURSQUARE AND TWITTER COMPARED (MILAN, 2012)

Maybe should add another introduction to TellTale?

A first analysis of different Social Media services has been conducted gathering data from Twitter, Foursquare and Instagram focusing on the city of Milan and representing a 3-week long period in 2012.

Three posters have been designed and produced comparing the three Social Media services illustrating spatial concentrations, temporal trends and a further specific attribute for each one.[15]

15 Instagram, Foursquare and Twitter compared: Matteo Azzi, Giorgio Caviglia, Giorgia Lupi

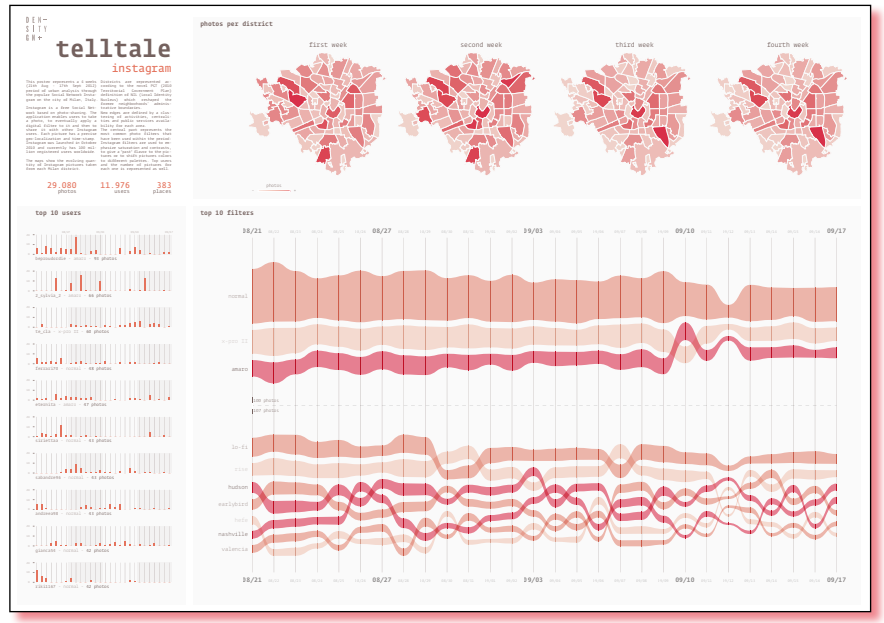


Fig.50 — Poster, Instagram (2012)

Figure (x) represents a three-week long (21th August - 9th Sept 2012) urban analysis of the city of Milan through Instagram, where each picture captured by the user has a precise geo-localization and time-stamp.

The map shows the evolving quantity of Instagram pictures taken from each district of the city. Districts are represented according to the novel PGT (Territorial Government Plan approved in 2010) and the current definitions of NIL (Local Identity Nucleus), which reshaped the former administrative boundaries of Milan according to similarities in clusters of activities and public services availability for each area. The central trends visualized in the poster show the most used digital filters within the period, since in Instagram diverse filters are used to emphasize saturation and contrasts, to give a “past” flavor to the pictures or to shift pictures colors to different palettes. Top users and the number of pictures for each one are represented as well.

Similar experiments have been implemented based on data streams coming from Twitter and Foursquare during the same period.

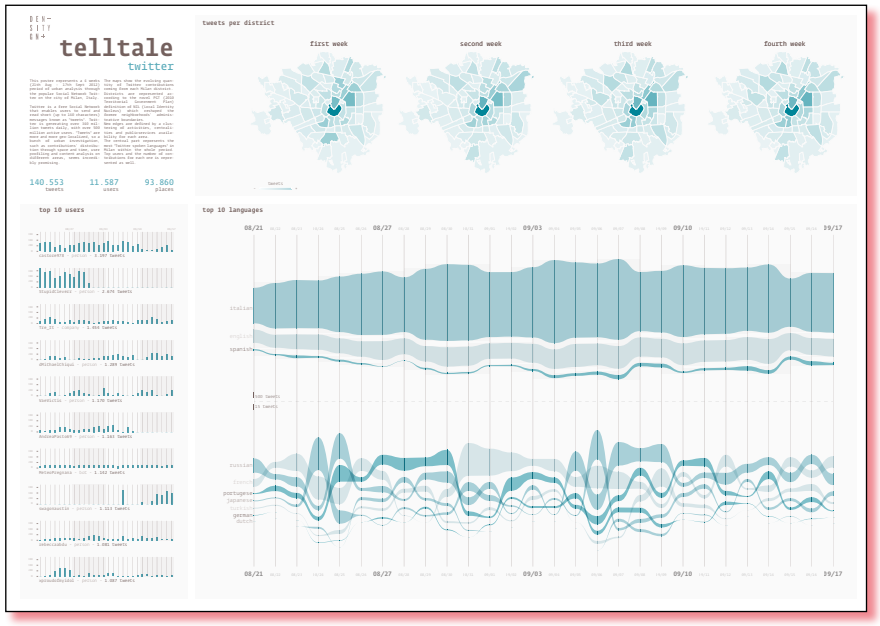


Fig.51 — Poster, Twitter (2012)

Figure (x) represents the same 3-week period of urban analysis through tweets on the city of Milan, Italy.

The maps show the evolving quantity of Twitter contributions coming from each NIL. The central part of the posters represents the different languages used to write the tweets, revealing their quantities and time peaks and trends within the whole period. Top users and total number of contributions for each user are also represented.

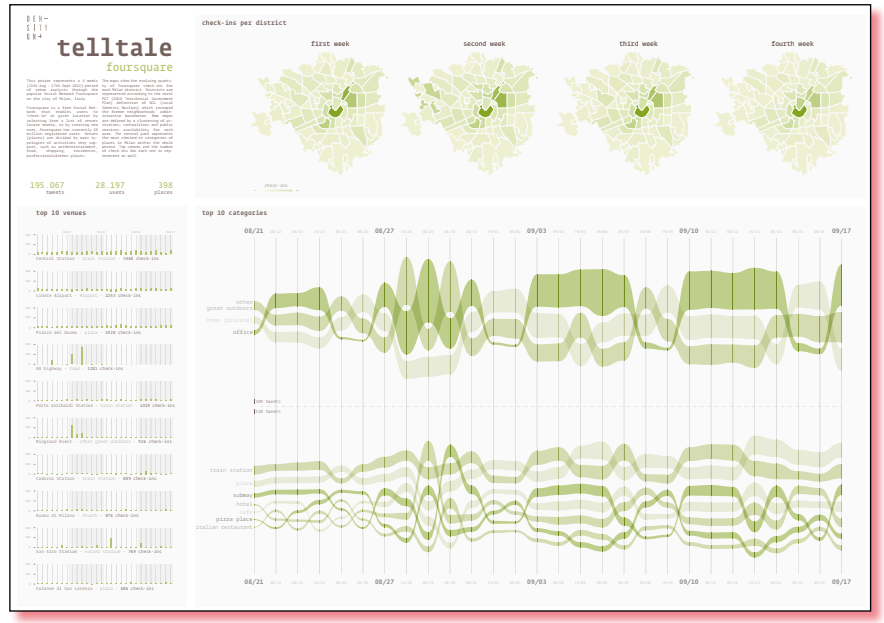


Fig.52 — Poster, Foursquare (2012)

Figure (x) represents an analysis of the same period using Foursquare.

The map shows the evolving quantity of Foursquare check-ins for each NIL. The central trends represent the most checked-in categories of places in Milan within the whole period.

From the data-visualization created from Twitter we can notice how the concentrations of contributions remain quite consistent through the entire period analyzed: areas presenting the most active users are the central touristic, commercial, and financial neighborhoods as well as the area around the central station. Areas where university facilities are located come immediately after, while residential zones present fewer tweets.

It is interesting to notice that areas which we know as being very lively and highly frequented by citizens and city users (tourists and commuters) present a high concentration of contribution, thus confirming the assumption that Twitter geo-referenced data can be a suitable tool to observe urban clusters of people through time.

The top 10 languages used within the period are analysed as well: obviously Italian is far the most spoken language and English comes right after, whereas unexpected peaks of Portuguese and Russian occasionally appear through time.

The concentration of Foursquare check-ins per district mostly confirms the clusters of contributions emerging from Twitter adding extra information on the typology of areas.

Interestingly, Instagram concentration of pictures per district returns quite different results: in fact some peripheral neighborhoods present a constant high number of uploaded photos (the only relevant venue we can recognize within them is the football stadium).

REFLECTIONS

This first experiment allowed to test the first instance of the technological architecture of Telltale project for the data gathering and processing, and some visualization strategies. The experiment started a **dialogic process with researchers and practitioners in urban design and planning.** Their feedback on the initial experiment was positive, but their impression was that there was the need to integrate the platform with additional data in order to enrich the level of urban analysis. This led to their involvement on the project with more in depth spatial and temporal analysis. The urban planning research department of Milan Politecnico (DAStU) started to integrate tweets, Foursquare venues and check-ins and Instagram pictures with more traditional data: comparing the number of tweets per area with the resident population, or comparing the number of non-Italian tweets with the number of foreign resident per area, and exploring how these correlations evolve through time. Their investigations showed that the Social Media data we collected confirm existing city dynamics and can be integrated other data traditionally used in urban studies.

MAPS OF BABEL, THE CITY OF LANGUAGES (MILAN, 2012)

Maps of Babel is the first design experiment conducted in *UrbanSensing in 2012 (Lupi et al. 2012).[16] In this experiment, language is used as a main analytical tool and expression of cultural diversity in order to visualize distribution of city inhabitants and visitors in Milan.

We extracted geo-referenced contributions within the city of Milan with the aim of understanding **patterns in the many ways groups that speak different languages live the city,** and the public spaces, in terms of:

> Spatial distributions (in the city in general and within specific districts and places);
> Temporal distributions (difference between the time of the day, or the days of the weeks, or relating with precise events in terms of distribution of spoken languages).

At this stage, the system was based on the following components:

16 Maps of Babel: Giorgia Lupi, Paolo Patelli, Luca Simeone, Salvatore Iaconesi

Fig.53 — Screenshot from Maps of Babel (2012).

> A harvesting engine that collects real-time data streams from geo-localized UGC (mainly Twitter);
> A text-mining engine to detect in which language the users tweeted their content and a data-clustering layer;
> A web user interface that allows performing specific searches within pre-defined domains (especially selecting time-based parameters);
> A web-based visualization engine developed in Processing.

Within the experiment a time-based visualization using the Processing open source programming language and integrated development environment has been created. From the visualizations it is possible to understand the spatial and temporal distribution of the production and subsequent sharing of content over the considered social media and within the city.

The figure shows the position of geo-located tweets in Milano in a two-week period.

Colours denote the eight most adopted languages (yellow = Italian, green = English, bright green = Indonesian; pink = Spanish, light pink = French, blue = Dutch; light blue = Portuguese; red = Japanese).
Some notes on patterns that can be found:

> Central squares, commercial streets and the central railway station are the areas from which people contribute and share the most, while parks quite lack of contributions;
> The 3 most important university premises and the soccer stadium are peripheral areas with a good concentration of tweets; no significant clusters of tweets seem to emerge from peripheral shopping malls;
> The Western (mostly residential) part of the city and the central financial district lack of contributions.

The temporal coordinates allow to trace how the same spatial areas change over time: day/night, specific time of the day, specific days or specific periods (e.g. how does the concentration of contributions written in the same language from a specific area of Milan change during important holidays like the Ramadan?).

An important assumption of the project was that specific languages are used by specific ethnic groups (e.g. Indian language is used by the Indian population in Milan, Arabic language by the Arabs); in this way we thought that it was possible to understand how different populations live the city and talk about it.

Maps of Babel proposed a set of methods to quantify and qualify the interrelation between people, topics and places, combining explicit footprints, left by citizens using digital media, and implicit references coming from other sources. In its first instance, Maps of Babel is oriented **towards the investigation of multi-cultural patterns of use of perception of the city. The language is used as a main analytical tool and as a main expression of cultural diversity.**

The actual utility of such experiments becomes clear if related with the fact that the city of Milan is quite new to the multicultural dimensions: different ethnic groups are not properly integrated, and we still don't know how they use and live the city. By finding patterns of spatial or temporal use of the city related to diverse cultures we can also **gain insights on how to plan new services, infrastructures and policies.**

These kinds of experiments seem also particularly interesting within the perspective of planning and monitoring how big international events unfold within the city, such as the **Expo2015.**

Maps of Babel also shows **new ways of presenting the data collected**: the approach uses visualization processes as an integrated method in social researches; **visualizations are seen not just as outcomes of research projects, but as fundamental aspects of their analytical phases too. The aesthetic quality is also important for attracting the attention of the stakeholders, to activate dialogues and foster imagination.**

Being the first experiment within *UrbanSensing, the intention with Maps of Babel was to:

> **Try out the architecture of the platform** and see if it could fit within the scope of EU project;
> **Reflect on the visualization strategy**, also based on the taxonomy I presented in Chapter 3;
> Create a very early prototype of the interactive platform and share it with professionals external to the team in order to gather initial feedback.

REFLECTIONS

A couple of critical elements highlighted by this design experiments were:

> The number of contributions for each language also depends on the distribution of smart phones and the attitude towards user generated content. We are not convinced that the percentage of people commonly using geo-located tweets is the same across different ethnic groups;
> It might be the case that some people choose to tweet in different language in different moments. Imagine the case of an Arab family that moved in Milan 15 years ago. The young adolescents of the family want to tweet in Italian when they are going out with their friends from school and tweet in Arabic in some other circumstances, for example when they are with their family. The language can therefore be a very imprecise way of localizing ethnic and cultural differences.

Another critical component emerged from some reactions we got when we showed the platform to some external people. The reaction of the audience

was of interest, but we acknowledged that:

> The user interface was not enough user-friendly and intuitive;
> In some cases, people without a strong background in interactive cartography, cannot easily imagine that the same technological engine can produce different visualizations for different contexts.

Based on these reactions **I started the process of re-design of the user interface** (see images below for a first attempt)

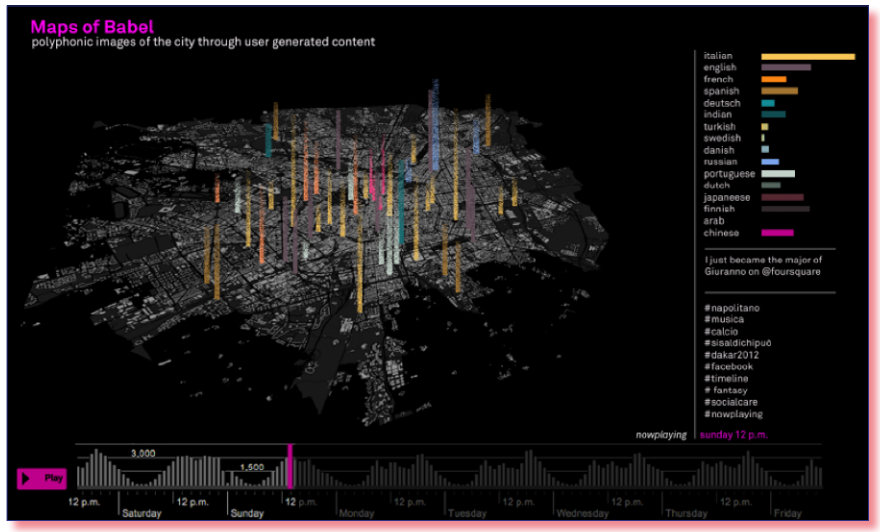


Fig.54 — Attempt to re-design the user interface after gathering first external feedback (2012).

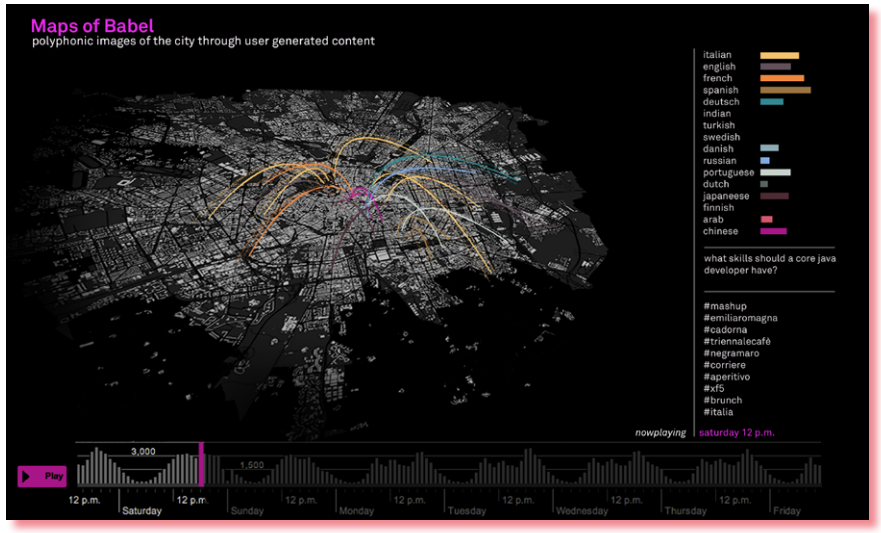


Fig.55 — Attempt to re-design the user interface after gathering first external feedback (2012).

By reshaping the user interface and presenting a three-dimensional vision of the city highlights **spikes of concentration of contributions**. This re-design also included more information such as **statistics on languages, the most frequently used hash tags and the possibility to interact with the timeline and explore specific time periods.**

Moreover, within this first re-design process I also attempted to understand whether adding a third dimensional view of the map could benefit other kinds of visualizations of Social Media data. In Figure (x) below it is presented a mock-up for a visualization I called "Placetalking" that aimed at identify where and when people talk about specific places of the city in order to enlighten eventual interesting patterns.

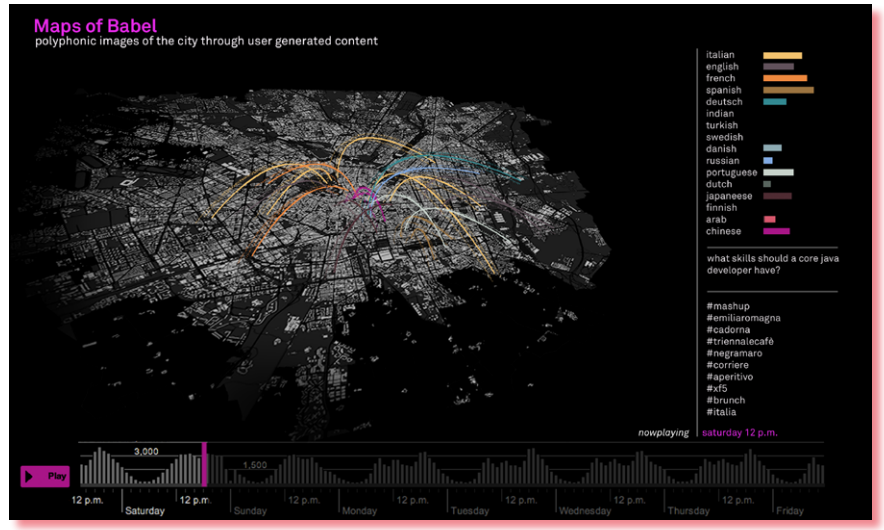


Fig.56 — Attempt to re-design the user interface after gathering first external feedback (2012).

VISUALIZING THE CRISIS, CONTENTS' ANALYSIS (ROME, 2012)

Visualizing the crisis is a design experiment conducted within the *UrbanSensing project.[17] It explores the potential of text mining methods applied to geo-localized Social Media data in order to **extract and analyze the emotional reaction of Italian people to the current political crisis,** at the time (2011-2012).

The project started analyzing users' emotional temperature in the two major Italian cities (Rome and Milan) in November 2011, when Silvio Berlusconi lost his parliamentary majority and Mario Monti was nominated Prime Minister.

The idea behind the project was to create a **framework to continuously listen and monitor urban actors' emotional reactions and enhance their sense of agency and their responsiveness during the current period of political and economical transformations in Italy**.

More specifically, Visualizing the crisis aimed at analyzing users' narratives, emo-

17 Visualizing the Crises: Giorgia Lupi, Paolo Patelli, Luca Simeone, Salvatore Iaconesi

tions, memories as crystallized into real time information streams coming from social platforms (Twitter, Facebook, Foursquare). The social media streams have been investigated in the Fall/Winter 2011-2012 during an intense period of economic and political transformations in Italy after Berlusconi's government collapse. Mario Monti, a former European Commissioner, was asked to lead a new government in Italy in order to implement reforms and austerity measures.

The design experiment is another instance of the *UrbanSensing engines, with a specific focus on **text mining strategies to extract users' emotions as expressed into the wider sociopolitical Italian context.**

The idea started from the work of Christian Nold, that focused on in-depth research of technological tools in order to unravel their social and political layers, and on building socially constructive, bottom-up devices, that take the form of practical tools such as in the *Bio Mapping* project (Nold 2009). Bio Mapping is a research project based on biometric sensors that can be worn by users provided with a GPS device able to trace their paths through the city, and that register some parameters (e.g. emotional status in to specific places and situations) and publish them as user generated content on specific emotional maps. This project explores tools that allow people to selectively share and interpret their own bio data. Within this framework, Nold thus investigates how the perceptions of a community in an environment change when they become aware of their own intimate emotional status.

In the past decades the research on emotions has progressively grown in scale and importance, involving fields such as psychology, anthropology, biology, philosophy, history and sociology. And powerful debates arose between confronting parties, establishing oppositions among universalists/relativists, biology/culture, nature/nurture, materialism/idealism, positivism/interpretivism, individual/social, body/mind, reason/passion, rationalism/romanticism, in a dualistic approach that is deeply interconnected with the Cartesian Dualism typical of the Western intellectual tradition (Lutz, Schwartz, & Miles, 1992).

For the scope of our project, **emotions have been categorized according to a simplified version of Plutchik's scheme** (Plutchik, 1991).

During the experiment, we built a collaborative emotional profile by means of textual interactions: these were analyzed using a lexicon database that was created by extending Plutchik's classification in an "emotional thesaurus": words were structured in graphs showing weighted relationships, with the arcs marked with the definition of the lexical constructs describing the syntactical contexts in which specific words could be considered as relevant in terms of the identification of emotional states.

Based on these theoretical premises, we decided to instantiate Visualizing the crisis as a platform to actively evaluate some of the strategic and technological findings that emerged from the scientific literature and to test them in a specifically contextualized research setting.

The observations started the first days of November 2011 analyzing users' **emotional temperature in the two major Italian cities** (Rome and Milan) when Silvio Berlusconi lost his parliamentary majority and Mario Monti was nominated Prime Minister.

Information has been analyzed **crossing both temporal and spatial dimensions**.

In fact, bringing a temporal dimension into those data systems gives us the possibility to compare emotional peaks and recognized patterns to specific events. Moreover, visualizing the spatial location of such data gives us the possibility to discover unknown aspects of the relation between citizens' profile and specific areas. For instance, within our early exploration during the peak of the political crisis (10th, 11th, 12th November) we could unexpectedly discover meaningful cluster of "constructive reactions".

In order to construct a tool able to focus on the operational level of the city and its everyday aspects, the project has then been developed analyzing a **larger dataset during the whole month of January**, when the new established Prime Minister unveiled a radical and ambitious package of spending cuts and tax increases, including deeply unpopular moves like raising the country's retirement age.

The measures are meant to slash the cost of government, combat tax evasion and step up economic growth, to eliminate its budget deficit by 2013. Thus, during our January full-month extraction, we could relate patterns of emotions to both specific areas within the two cities and also to specific political events.

In order to **define the linguistic keywords associated to key political events**, we carried out a daily study of the news agenda of the most important Italian newspapers (Corriere della Sera, La Stampa, La Repubblica). This study allowed us to extract a list of meaningful keywords related to main sociopolitical events (such as 'crisi economica', 'articolo 18', 'sciopero sindacati', 'manifestazione'). When the original content contained geographic coordinates we could also plot the final emotional output on a map.

Below there are two specific examples of queries performed during the research project through the Visualizing the crisis platform.

JANUARY 18, 2012

EVENT:

Mario Monti visits David Cameron in London and discusses his goals: labour market reform, flexsecurity and the Danish model along with the fight against tax evasion.

SOCIOPOLITICAL KEYWORDS RELATED TO THE EVENT:

Monti, Cameron, Lavoro, Occupazione, Licenziamenti, Legge, Evasione, Danimarca, Flexsecurity, Articolo 18, Riforme.

- Geographical outcomes emerging from the platform Visualizing the crisis:

Milan: We noticed a high concentration of positive feelings around the very center of the city of Milan (where banks and financial companies are located) along with other more sporadic spikes around other business and media hubs (Porta Garibaldi, Cologno Monzese, Corso Sempione/Certosa, Rogoredo...). We could then notice a progressive shifting towards more negative feelings in the industrial clusters around the city (Sesto San Giovanni, Rho/Pero, San Donato...). Even more interestingly though, we could identify an averagely positive reaction around lower and middle class residential neighborhoods probably suggesting evidence of the unexpected hope the government change brought even to the groups of people more affected by the hardness of the economical measures.

JANUARY 23, 2012

EVENT:

Nation wide strike of taxi drivers causes many traffic problems in major Italian cities. The drivers protest against a liberalization of the market proposed by the government as one of the key reforms in order to contain the effects of the economical crisis.

SOCIOPOLITICAL KEYWORDS RELATED TO THE EVENT:

Monti, Governo, Riforme, Liberalizzazioni, Decreto, Categorie, Licenze, Tassisti, Taxi, Sciopero, Traffico, Servizio Pubblico.

GEOGRAPHICAL OUTCOMES EMERGING FROM THE PLATFORM VISUALIZING THE CRISIS:

Rome: We noticed an average negative reaction, evenly spread across the city, slowly fading to more neutral feelings from the center towards the outskirts.

Higher concentrations along tourist routes and city landmarks suggest disappointment especially among visitors and taxi users, as if the negative feelings were directed towards the strike itself other than the government and the reforms. Furthermore, the research highlighted the usage of specific ironic hashtags (e.g. #menotaxipertutti) related to negative UGCs and addressing the strike as a source of disaffection.

In these two examples, Visualizing the crisis helped us to understand how cities react to political and eco-

ig.57 — Visualizing the crisis. Geo-located UGC and related emotions shared within the city of Rome on January 18th, 2012 - Visual experiment 1

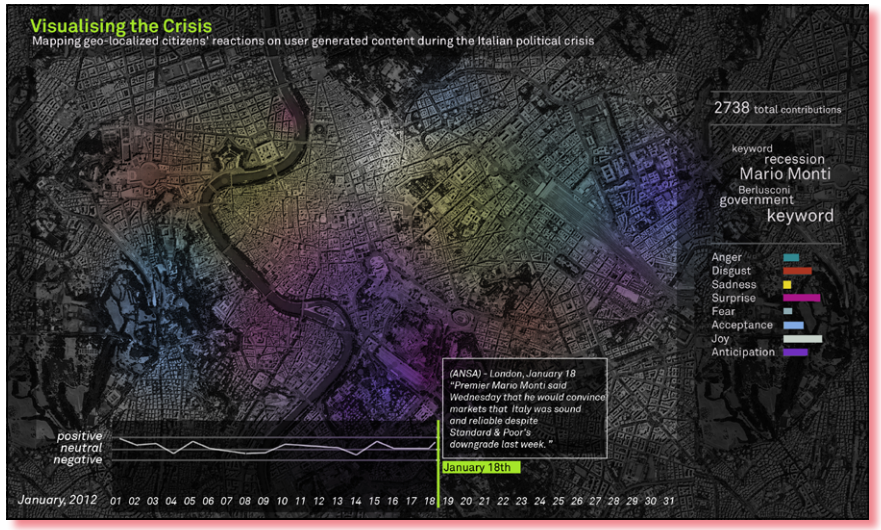


Fig.58 — Visualizing the crisis. Geo-located UGC and related emotions shared within the city of Rome on January 18th, 2012 - Visual experiment 2

nomic events, relating citizens' emotions to specific sociopolitical circumstances and to specific spatial and temporal coordinates.

Two early visual representations (based on the city of Rome) are enclosed below.

These visualizations are **screenshots coming from a map-based interface that can be dynamically explored through a timeline** (in this case, the month of January). The timeline points out relevant political events and the basic emotional temperature of the city measured and returned in terms of positive, neutral and negative. Moreover, the visualizations show the geographic distribution of sentimental patterns (spots or concentrations); a color legend is presented on the right part of the screen and the legend also dynamically communicates the number of UGC related to each emotion mapped.

The visualizing engine therefore allows users to navigate in multiple ways:

> Across space, using the same navigational functionalities as in Google Maps;
> Across time, offering the opportunity to navigate, save and compare different moments and periods;
> Through specific content filters (offering the opportunity to select the kind of emotions to display).

This experiment helped to add functionalities to the *UrbanSensing data processing and visualization engine through a prototype that has been built specifically for the design experiment.

In this case, the prototype of the platform developed was based on the following components:

> A harvesting engine that collects real-time data streams from geo-localized UGC streams (Twitter, Facebook, Foursquare, Flickr);
> A text-mining engine which combines Wordnet semantic graphs with the definition of relevant syntactical structures to filter significant data from general streams;
> A data-clustering layer using Wordnet ontologies to reassemble data across themes and topics;
> A machine learning system based on networks of evaluation functions and procedures that allow the system to learn how to improve lexical relations and the evaluation functions themselves, based on users' feedback;
> A conversational analysis engine that traces real-time interactions among users (through their interactions on the UGC);

> A web interface that allows users to perform specific searches within pre-defined domains (e.g. show all the content related to 'prayer' within the domain of 'religion');
> A visualizing engine that generates dynamic informative representations on top of multiple types of geographic visualizations (such as Google Maps, OpenStreetMap, and custom mapping solutions based on multiple open source platforms) relating data to a timeline of events.

The information harvesting engine is composed by an abstraction layer in which several plugins can be connected to implement harvesting functionalities built to integrate the specific features of different social networks. For example: the harvesting plugin built for the Twitter social network is created around the Streaming API; the Facebook harvesting plugin is built combining the Open Graph API with specific applicative function calls to the wider set of APIs offered by the social network provider to access the content and metadata exchanged by users, in compliance with existing Terms of Service Agreements and national laws on privacy and copyright.

These two examples show how each connected social network needs specific actions to be performed and strategies to be enacted, both at a technical level and from the points of view of law, ethics and the respect of the terms and conditions which rule the ways in which we can access data publicly posted on social networks, including the use and processing of such information.

As an example, on the theme of **privacy**, the system was created to **avoid storing sensible, private information: each identification string** (such as the ID strings provided by Facebook and Twitter) is processed before being saved in the system using an anonymization policy which uses a one-way, irreversible algorithm (Naor & Yung, 1989) which allows the system to maintain the possibility to correctly analyze and cluster individual data, but avoids being able to map the information back to social network users (thanks to the unidirectionality of the algorithm and, thus, the impossibility of transforming a system ID back into a Social Network ID), to eliminate the possibility of privacy infringement.

A data model is handled at the level of the abstraction layer to store all captured data: each plugin processes the specific data formats provided by each of the social networks to adapt them to the abstraction layer, and maintaining other anonymized meta-data which could be made available by some, but not all, of the social networks to be accessible should it be needed if specific elaborations benefit from it.

The data is also processed using a series of procedures whose aim is to raise the quality level of the data itself, and to discard information which can be interpreted as spam, blacklisted or incorrectly formatted. Some specific processes are used as antispam and blacklisting, in which a series of commercial antispam procedures are applied to content to identify and exclude spam, and a series of blacklists available and configurable directly in the system are applied, to eliminate content which is not "desirable" (because of previously identified malicious users, unreliable information sources and specific cases in which a certain source is known to produce low quality content). The system also performs some **normalization procedures** (Kotov, Zhai & Sproat, 2011; Liu, Jiang, Wei & Zhou, 2011), in which a **large database of Named Entitie**s is used to identify and correct the names of places, landmarks, locations, events and other notable entities which might have been incorrectly spelled, abbreviated or quoted. Finally, another crucial component of the system are the **geoparsing** (Freire, Borbinha, Calado & Martins, 2011; Shi & Barker, 2011) and geo-referencing procedures, in which a reference GIS system, including the POIs (Points of Interest) of the geographic Named Entities contained in the database used at the previous step, is used to attribute standard coordinates to contents;

The collected information is then processed to classify it according to the configured goals and strategies.

Goals are described in terms of syntactical constructs which the captured content must comply to. The constructs are described in terms of control strings using regular expression format and including extended tokens which link to the system specific functionalities. These special tokens relate the constructs to the topic domains for which the system's semantic sensibility is configured. Each token is composed of two parts: a series of Wordnet-contained keywords and the instructions to traverse Wordnet semantic graphs.

The first element contains a series of words which describe the keywords which are most relevant to the current construct in defining the topic for which we want the system to be sensible to. These words should be contained in the Wordnet semantic network or in one of its certified translations, as they will be used as starting points for traversal of Wordnet's graphs to verify the adherence of each content to the desired semantic context.

The second element is composed by a list of "graph traversal instructions". Wordnet semantic networks are described as graphs connecting words through arches whose labels describe the relation, consequence or connection from one word to the other from a se-

mantic point of view. Some arches bring to synonyms of words, some other arches connect to possible usages of words. The second element of the tokens describes which paths (synonyms and word usages) can be considered as compliant to the topic we wish our system to be sensible to. In the processing stage, whenever a word among the ones from the first element of the token is found in the content, each sentence of the content is processed from there onward: if the sequences of relevant terms comply with at least one of the configured traversal paths of Wordnet semantic graphs, then the content is considered as being relevant for the specific topic. In other words, Wordnet acts as both an ontology and a thesaurus that allow the emergence of semantic patterns of interest.

By configuring the system it is, thus, possible to create the basis for a strategy to create clusters information which can highlight which harvested contents are relevant to the topics of interest.

Results of the analysis are sent to a machine learning subsystem which analyzes clusters and overlays them to Wordnet semantic graphs and to previously collected knowledge elements to identify recurring patterns and naturally emerging clusters (for example in the case in which the collected knowledge fits not only the configured clusters but also other Wordnet sub-graphs beyond a certain threshold of network coverage). These identified clusters are highlighted on the system's interfaces to suggest possible additional or alternative configurations, thus establishing a semantic expert system that can be used to fine tune the overall system performance and the quality of the analyzed data.

All information is sent to the following stages of the system's architecture in which the following processes take place:

> Conversation analysis, in which the interrelation information of contents (message, reply, comment, forward, share) is used to describe the types of relations that occurs between places and clusters;
> Search and data traversal and mining functionalities, in which interfaces allow users to traverse and search all data, meta-data and knowledge elements (relations, grouping, relevance) to gain a better understanding of how the harvested information relates to the configured analysis strategy
> Information visualization stages, in which data is offered in standard formats (XML-RPC, JSON, CSV, Database tables) which can be used by information visualization components to represent information through real-time or offline indexes, interactive infoaesthetic representations, interactive maps, graphs, and standard graphs such as histograms, pie charts, line graphs, scatter graphs.

REFLECTIONS

The main objective of the first phase of this research project was to build a prototype of a platform for social media data harvesting, parsing, analysis and visualization and this milestone has been achieved. Now, further and thorough investigation is needed in order to assess the potential of the platform and to refine its core engine.

A more elaborated model to extract emotions from UGC is also needed. Both the classification of emotions we currently use and the process that infers emotions from the user generated texts need to be further developed. A more solid theoretical grounding that combines recent advancements in psychology of emotions and linguistics would give a significant contribution to the text mining engine.

A greater attention to ambient features of city spaces and to their social connotations will provide deeper insights into those environmental aspects that influence localized networks and interactions.

Finally, a specific research path should also be aimed at improving the visualization engine.

DO IT YOURSELF GIS

This design experiment produced a prototype for an educational toolkit (DIY GIS) to learn and teach some important elements of urban design, planning and management; DIY GIS has been developed within the *UrbanSensing project.[18]

DIY GIS aimed at developing a platform that addresses geographic mapping as a process that is subjective (of a projection of the user- inhabitant's imagination) as well as objective (of the territory as a concrete structure). The platform applies text mining and conversation analysis to geo-localized user generated content (real-time data coming from Twitter, Facebook, Foursquare, Flickr) in order to return meaningful visual images and maps about citizens' perception of public services, urban public spaces, and of the city as a whole. This platform has been **developed and tested in some workshops with students in the field of architecture carried out in 2012** in order to assess its education potential.

From an educational point of view the platform itself can be considered a sort of **toolkit that allows students to harvest, connect, analyze and interpret real-time data streams and to visually represent them in a personalized way**. The students had to **actively configure this toolkit** in order **to perform queries and design maps that are meaningful for the specific place under analysis and for their objectives**. The idea behind the experiment was to create a platform that automatically harvests real-time data from UGC streams, applies text mining functionalities, extracts key elements and plots them on a map. The platform is composed of several components and each of them has to be completely configured by users. Users have to identify the urban indicators they want to map, the connectors they want to use (Twitter, Foursquare, Flickr in this case) and the linguistic components they want to extract. The platform plots the results on a basic map (based on Google Map API), but users can also export XML files from the platform and use them on their own GIS (Geographic Information System). Users can also combine data extracted from the platform with external data sets (e.g.. urban morphology, architectural types, city budget, opportunities, public services) in order to study correlations between indicators and variables.

The platform itself can therefore be considered as a sort of **basic urban design, planning and management toolkit that requires to be assembled and configured according to the users' needs.** In order to stress the idea of the toolkit we called the platform DIY GIS (Do It Yourself Geographic Information System). The main components of the system are all customizable: a harvesting engine that collects real-time data streams from geo-localized UGC; a text mining engine and a data clustering layer; a web interface that allows users to perform specific searches within pre-defined domains; a visualizing engine. The plugin architecture has been designed in order to allow the connection to multiple Social Networks.

Keyword based analysis have been enhanced by both configuring syntactical templates to capture only the more relevant content and by adding a semantic layer to first expand the terms to which the system is sensible and, then, to use formal ontologies to cluster all the collected text into themes and topics. A machine learning engine constitutes a median stage in which both automatic and human-powered procedures train the system to more intelligent content recognition schemes: positive and negative examples are provided to a neural network which progressively provides deeper insights about the relevance of selected content to the overall filtering schemes.

The educational potential of DIY GIS is tied to this high degree of flexibility. In order to make the platform work in a meaningful way, the students have to actively seek the right indicators to be mapped and the right data streams to be combined and analyzed, reflect on the potential (and the limits) of the text mining engine and identify the right queries to map the indicators, learn some basics elements related to current GIS and how to assemble them using the DYI GIS toolkit, focus on visualization techniques and theories, especially related to cartography and collaborative mapping processes.

The DYI GIS toolkit has been designed and developed in 2012 and used within a first workshop with some students at the Faculty of Architecture at University La Sapienza in Rome, Italy in Marc 2012. During the workshops, the students had to actively configure the toolkit in order to perform queries and design maps that were meaningful for the specific place under analysis. The educational purpose behind the project was to make urban planning and architecture students understand the importance of determining the relationships between public spaces, people's patterns of social activities and situated information enlightening citizens perceptions. Students have been divided in teams; each team had to design and develop actual urban planning projects able to improve the urban experience of citizens of diverse urban areas.

18 Do it yourself GIS: Giorgia Lupi, Paolo Patelli, Luca Simeone, Salvatore Iaconesi

More specifically the assignment for the students was therefore to try to **define people's reaction on UGC and to plot this reaction on a map that highlights the spatial and temporal unfolding of the event**.

The students had to carry out several activities to reach their goals:

> Define original, hybrid, qualitative and quantitative indicators, relying on heterogeneous data sets that could be useful in addressing different stakeholder's needs (decision makers, practitioners, different categories of citizens);
> Compare hints given by real time data with official static maps and with the reports of the events offered by several stakeholders (municipality, police, media)
> Define how to visually represent the indicators on a map;
> Apply the results on the assigned urban project;
> Propose in a final report how to embody this analysis and these observations as an effective part of their future urban design, planning and management skills.

Therefore, the assignment required not only a theoretical and operational work on the toolkit, but also a sort of meta- reflection on the potential of the toolkit in their future activity as urban designers and planners. The students were working in groups (4-5 students for each group) and each group was granted about 2 weeks in order to complete the assignment. The workgroup also contributed to develop some important meta-skills (Klopfer, 2008) such as engaging in sustained reasoning, managing complexity, and browsing information structures and evaluate information, collaborating with other students, communicating to other audiences.

A sample of works produced by students during the workshop is presented below.

a. The perceived safety map

This project aimed at unveiling the perception of safety in different zones of the city. The analysis has been carried out through a selection of the geo-tagged contributions (Twitter + Facebook + Flickr + Foursquare) that denote 'fear'. The results were then split by gender / time of the day / days of the week in order to find further meaningful insights. Students used these results for a project regarding public lighting for the city of Milan.

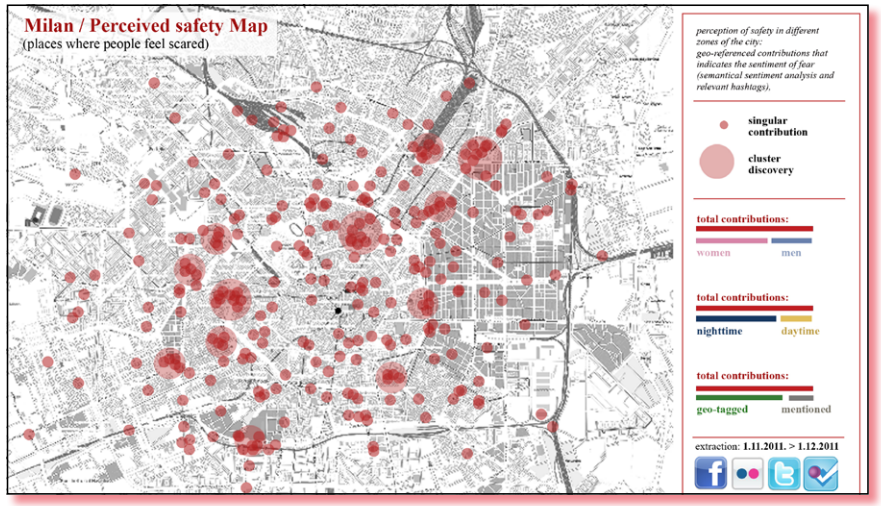


Fig.59 — the perceived safety map

b. dentity and boundaries of the perceived city

This project aimed at comparing the administrative boundaries of a city with the actual limits perceived by the people. The analysis gathered geo-referenced data in the area of Paris using the Flickr API, only selecting the images tagged by the users with the word "Paris". The visualization plotted the data on the map and drew a geometry of the perceived limits of the city. The perceived Paris was noticeably different from the administrative one. Further analyses were carried splitting and comparing pictures taken during the day (the daytime perceived Paris), and during the night (the nighttime perceived Paris). The results were used for an urban planning project related to the re-qualification of specific urban areas.

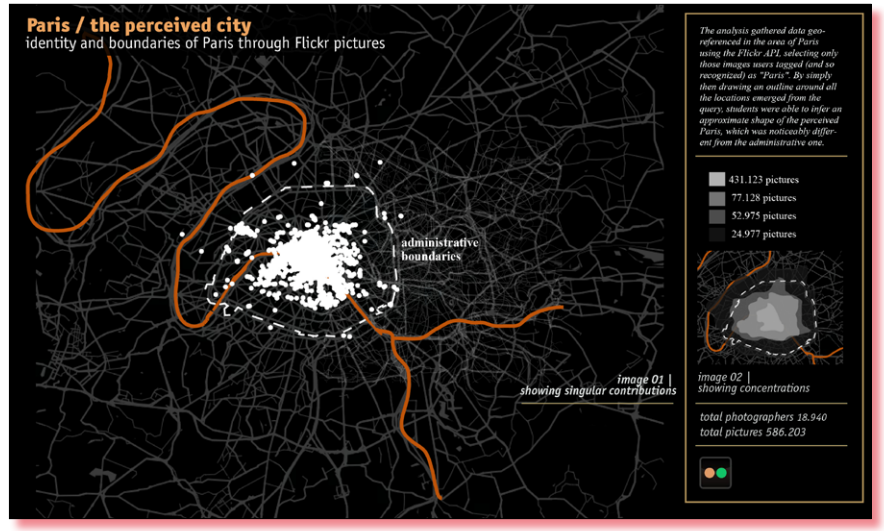


Fig.60 — the perceived city

c. Where are commuters from?

This query aims at discovering geographical clusters of the origin of daily commuters of Milan. Data has been gathered for 1 month from Foursquare, Facebook and Twitter taking into account only those users that usually (at least 15 days per month) post daily contributions from 2 distinct places: a first place within the boundaries of Milan, a second place outside the city . These commuters' profiles were then plotted on the map only using the second location, which students recognized as the commuters' hometown.

This way meaningful patterns of origin have been identified and visualized.

The results have been used by students for a public service concept project regarding the improvement of the transport system.

The information harvesting and processing engine was an early prototype of the technology already described within Visualizing the Crises design experiment and further explained in the *UrbanSensing platform in the next sub-chapter.

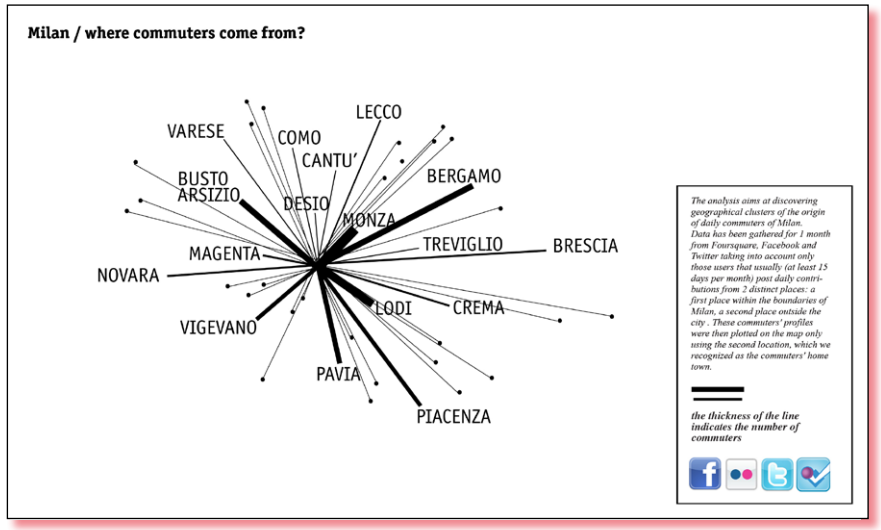


Fig.61 — where commuters come from?

URBAN STORIES: INDIVIDUAL PATTERNS OF MOBILITY (MILAN 2013)

Urban Stories is an attempt to visualize spatial patterns of individual uses of the city through geo-referenced tweets. It relies on geo-referenced public tweets collected in a one-month period (from February 23th to March 23th, 2013) and focuses on the Municipality of Milan and it has been conducted within the TellTale project.[19] The experiment uses tweets from 2013 active users who enabled the geo-localizing service on Twitter and tries to unveil the movements of individual users through the city.

The visualizations display **the chronological connection between tweets coming from the same user during the selected time period, each line representing a "supposed" path connecting consequent tweets from the user**.

The interactive interface is designed so that it is possible to **look for specific users' name from the menu or visualize paths of unknown people in Milan**; the visualizations also show temporal clusters and spikes of tweets at a level of single user.

The users we display in the map have been manually selected from the total database according to the following criteria: those users presenting less than 8 contributions (tweets) in the whole month have been removed, together with those users presenting a huge number of contributions originating from a singular place (such as bots or commercial services).

REFLECTIONS

One of the first goals of this experiment was to assess the quality of data coming from Social Media. This experiment allowed us to track key sources of Social Media production and therefore we found that data streams can be highly affected by components such as - for example - a station transmitting tweets containing updates on the weather every few minutes or bots tweeting commercial offers. This showed us how important it is to critically evaluate the quality of social data streams before using them as a source of urban analysis. This critical evaluation of data streams is a process that is not always performed in existing projects on Social Media mining.

19 Urban Stories: Matteo Azzi, Giorgia Lupi

The experiment has been also conceived to explore issues related to privacy. In fact by explicitly showing individuals' path on the map we also aimed at generating awareness about the public availability of the personal information we share every day on Social Media services.

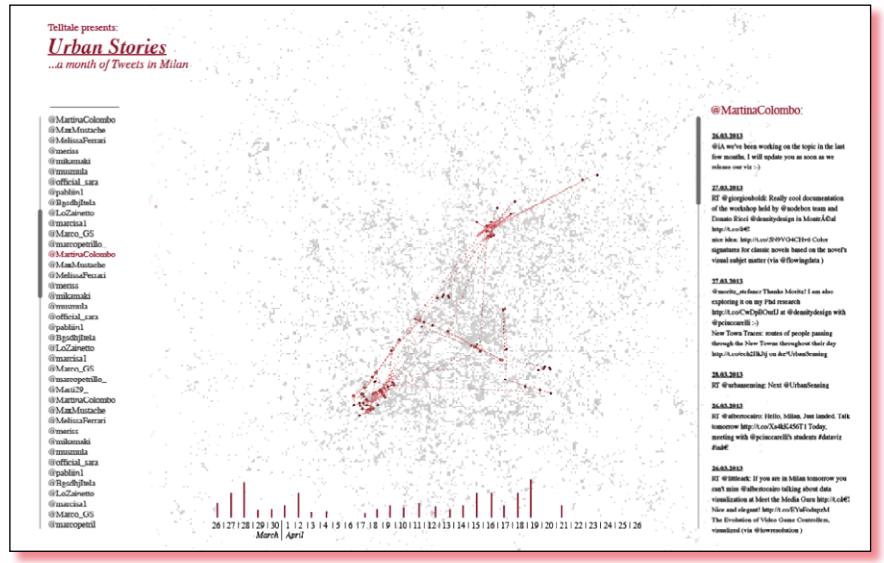


Fig.62 — Screenshot from Urban Stories (2013)

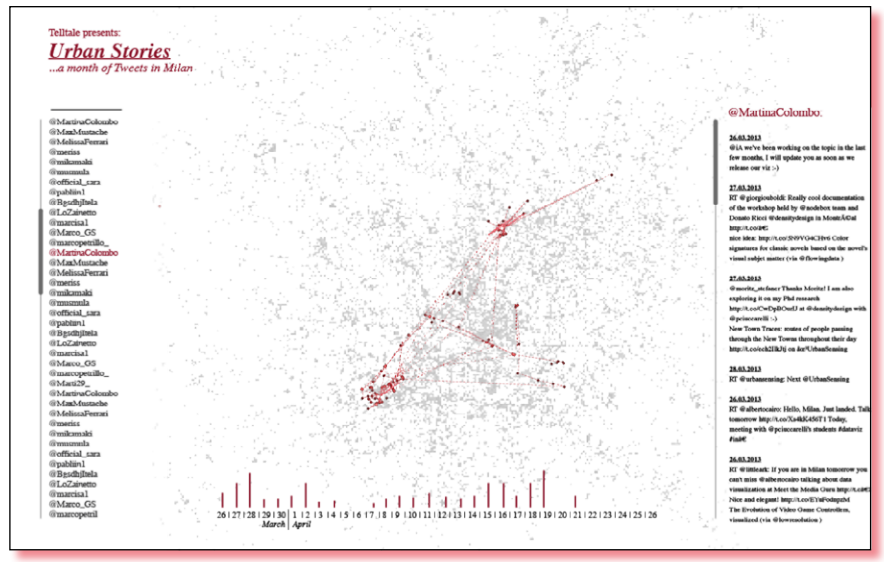


Fig.63 — Screenshot from Urban Stories (2013)

GEOGRAPHIES OF TIME MILAN (2013)

At an intermediate stage of the *UrbanSensing project, after the first months of researches and testing, it became critical to find a way to limit the scope (data sources, content analysis, visual models) of the first iteration, to test the different part of the system and the platform functionalities.

We therefore decided to carry out an experiment focused on **spatial aggregations** (we can call them 'spontaneous geographies') **and aimed at identifying areas in the city whose boundaries are defined from similarities in local uses.** While municipal borders (postal codes or administrative boundaries) are necessary to provide order and organization to the city, they might not always reflect how people live and use urban areas.

The specific goal here was to build novel **maps where different areas in the city are created based on different patterns of use** (activities) **on Social Media.** Similarities in the use of Social Media allowed defining and representing new boundaries for the city neighborhoods. By measuring Social Media activities (e.g. profile of people sharing from a place, characteristics of the venues of the place, intensity of Social Media activities according to distribution of timestamps in a single place, typology of pictures people take in different areas, etc.) in specific places of the city we aim at identifying some initial clustering operations highlighting similarities and drawing novel boundaries of those areas.

Geographies of time is the first of a series of spatial aggregations based on Social Media. **Areas are defined and colored according to the time period of the day they present the highest level of contributions from the users**. We compared weekdays, weekends and a special week (the Milan design furniture fair).[20]

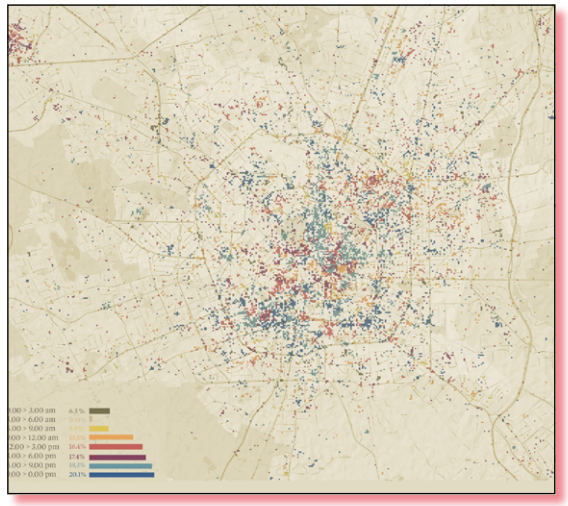


Fig.64 — Geographies of time, weekdays

WEEKDAYS

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.

Some of the patterns we identified are:

> San Babila, Duomo, Missori, Porta Garibaldi, and Repubblica - the business areas where administrative centres, banks and large company headquarters are located - 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 populated in the evening (from 6pm until midnight). Porta Venezia, Brera, Sempione, Corso Como and via Cenisio are also crowded in the evening and night.

> The university campuses (Politecnico Leonardo, Politecnico Bovisa, Bicocca) show spikes of Social Media activity during lesson hours.

Other insights:

> In the Bicocca we can see a different use in contiguous areas: the campus buildings are mainly visited in the early hours of the afternoon (midday – 3pm), the nearby UCI movie theatre and the shopping centre from 9pm until midnight.

> Mobility. There is a noticeable difference in the use of bigger railways stations at different times of the day. Lambrate (6am-9am), Bovisa (6am-midday), Centrale (9am-6pm) Cadorna (3pm-6pm), Greco Pirelli (3pm-6pm) Garibaldi (6pm-9pm).

20 Geographies of time Milan: Giorgia Lupi, Simone Quadri, Gabriele Rossi, Marco Vettorello

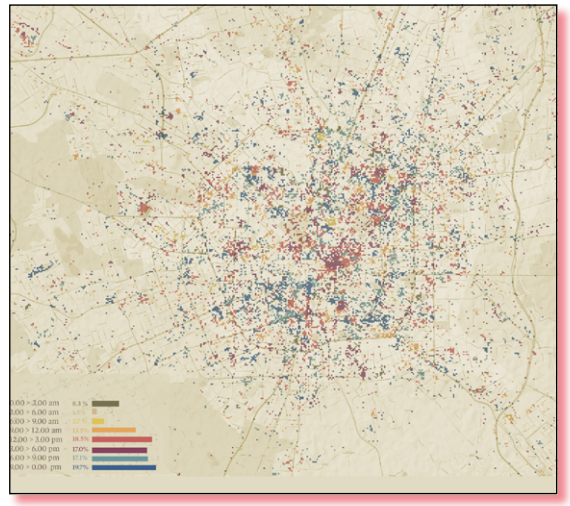


Fig.65 — Geographies of time, weekends

WEEKENDS

The areas are characterized 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 preferences for leisure and free time activities. There are, however, some general observations:

> The central areas, specifically San Babila and Duomo, the axes from Via Dante and Via Torino, as well as the parks of Porta Venezia and Parco Sempione have a very high concentration of Social Media activity 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) present very few contributions if compared to the weekdays.

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

> On Sunday, from the Central Station there is a high concentration between midday and 6pm, since city inhabitants return to the city for the start of the working week.

> Some central areas such as via Farini and Brera show a high concentration of Social Media activity between 6am and 9am.

> Corso Como, Naviglio Pavese and (inexplicably) via Cenisio, corner of via Messina, present a very high concentration of tweets between midnight and 3am.

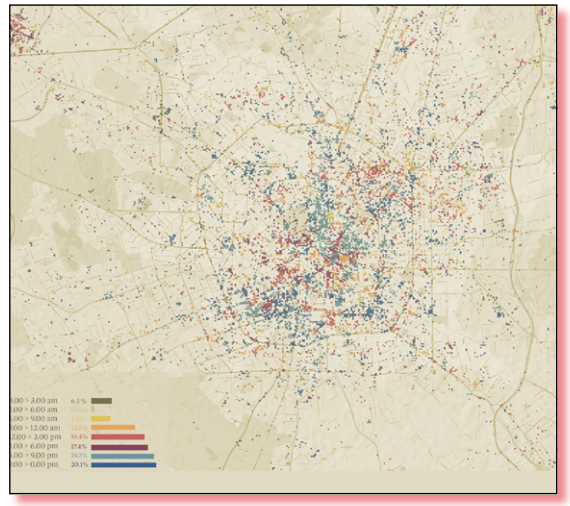


Fig.66 — Geographies of time, design week

MILAN FURNITURE FAIR

As expected, there is a high concentration of contributions in the exhibition halls area at Rho during afternoon hours.

Other findings:

> Increased concentration of Social Media activity in areas that generate evening and late night activity, showing that the city is full of special events.

> The central area of the city becomes alive during aperitif hours (6pm-9pm).

> The Navigli and Porta Romana welcome a large number of people from 6pm onwards.

> In the evening, there is a high concentration of contributions from typical areas of the Design Week: Tortona and Ventura.

REFLECTIONS

> Some of the insights emerging from the analysis above presented simply confirm already well-known city dynamics in Milan. Some of the comments received in some co-design sessions touched upon this element: some people complained that the results of the analysis could have easily been expected and therefore the research did not provide significant contributions to our understanding of the city. We see this critique from a different perspective: **the fact that the outcomes coming out of the sensing platform are aligned with well-known city dynamics demonstrates the potential of our analysis and the process.**

> Geographies of time's results confirmed us that in most of the cases more complex **spatial aggregations of Social Media data are needed** if we want to gather insights on specific questions of urban inter-

est. The simple concentration of contributions is not enough to evaluate complex urban phenomena and there is the need to harvest more and more granular information through more articulated methods such as the text analysis techniques presented above. From another perspective, to fully explore the urban topics detailed in the matrix presented in Chapter 4, we need to expand the algorithms and the strategies to analyze data in our sensing platform.

> Whilst the previous experiments relied upon representation strategies already used in existing projects and as such already mapped on the taxonomy of data-visualizations we presented in Chapter 3, we built Geographies of time trying to **explore some of the most under-used but promising spatial aggregation and visual models we found among case studies**. Here, each little square gets the color of the time span with most contributions inside the square itself and in the 25 squares around it. We introduced this tolerance to eliminate noise and anomalies, with the purpose of weighting geographical proximity, highlighting areas (emerging from Social Media) behaving in the same way.

GEOGRAPHIES OF TIME NEW YORK (2013)

The experiment has been repeated on the city of New York collecting data in the month of July 2013.(21) As expected the number of tweets in New York is incredibly higher. Thus we introduced a spatial approximation we called **"tolerance method" that helps the systems finding geographically contiguous areas sharing the same behavior.**

The 2 different analyses, weighted (tolerance 1) and not weighted (tolerance 0), help in getting a more detailed view of the phenomena observed.

The weighted views (images where the spatial tolerance has been introduced) are useful in **showing similar behaviors of quite large areas**, and thus drawing possible neighborhood boundaries based on daily times of activities.

21 Geographies of time New York: Giorgia Lupi, Simone Quadri, Gabriele Rossi, Marco Vettorello, Federica Fragapane

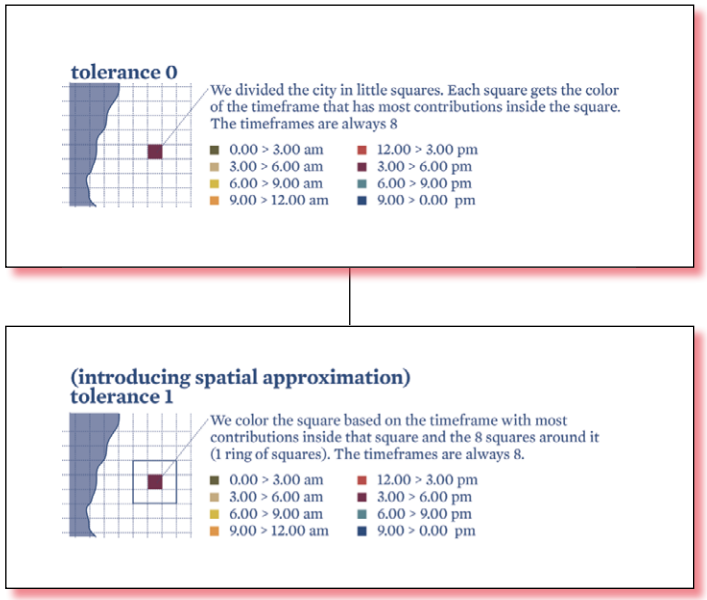


Fig.67 — Geographies of time New York, explanation of the process

Fig.68 — Geographies of time New York, weekdays tolerance 0

Fig.69 — Geographies of time New York, weekends tolerance 0

Fig.70 — Geographies of time New York, weekdays tolerance 1

Fig.71 — Geographies of time New York, weekends tolerance 1

The **not weighted views** (images with no tolerance) are useful to gain insights on which are the **hot spots that play the leading role in determining at what time a specific place is used.**

For the city of New York the observations are based on the weighted map (tolerance 1 square), while non-weighted map have been used to understand what places are driving the overall trend. Some behaviors can only be interpreted if looking at the 2 maps alternatively.

Fig.72 — Geographies of time New York, tolerance 0, comparing weekdays and weekends and highlighting unusual clusters and main differences

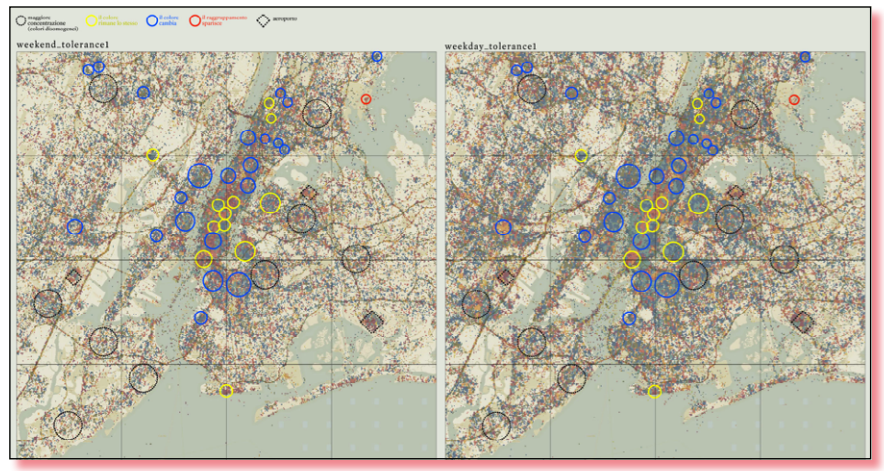


Fig.73 — Geographies of time New York, tolerance 1, comparing weekdays and weekends and highlighting unusual clusters and main differences

Since my knowledge of New York City is not as deep as for Milan, I here tried to notice and point out differences and special concentrations in areas rather than providing interpretations of urban phenomena

MANHATTAN

> Harlem, Upper West Side and Upper East Side: the users contributions on Twitter are evenly distributed across the daily hours on weekends, whilst on weekdays the areas are mostly animated on evenings
> North East Central Park is mostly lively in the mornings, especially on weekends
> 5th Avenue and 56th (where the Apple Store is located) are mostly lively at daytime, especially on weekends
> Times Square is mostly lively between 6-9pm, especially on weekdays
> East Village is mostly lively on late evenings during weekdays whilst the users contributions are evenly distributed across the daily hours on weekends
> SoHo-Broadway mostly alive on afternoons during weekends, shifting towards a bigger concentration on evenings during weeknights
> Wall Street is extremely homogenous: mostly alive during the whole afternoon in the weekends, presenting peaks in the after-lunch hours on weekdays

BROOKLYN

> While Williamsburg changes only slightly from weekends to weekdays (mostly active at night, especially on weekdays) we can see how in Greenpoint the concentration of contributions is much higher at daytime (afternoon) during weekends
> Cobble Hill / Carroll Gardens are mostly alive during evenings on weekdays
> Clinton Hill / Prospect Heights are mostly alive during evenings and early morning on weekdays
> Red Hook is lively on weekend afternoons and on weekdays evenings

BRONX

> The YANKEE Stadium presents two peaks: it is very active after lunch on weekends and between 6-9 pm on weekdays

QUEENS

> Astoria is mostly alive during the evenings on weekdays
> Citi Field presents two spikes: it is very active after lunch on weekends, and between 6-9 pm on weekdays

STATEN ISLAND

> Si Ferry is mostly alive in the early mornings and late afternoons during weekdays

NEW JERSEY

> Hoboken is mostly alive on early evenings and early mornings on weekends, and on late evenings on weekdays
> Downtown Newark is mostly alive on early mornings on weekdays

05

Designing tools for decision making: *Urbansensing

Designing tools for decision making: *UrbanSensing

5.1 The project
5.2 The platform architecture
5.3 Main innovations
5.4 The interface design

5.1 THE PROJECT

During the past 2 years, the active participation in the *UrbanSensing proposal's draft and the design work on the project has played a fundamental role in the development of the PhD research.

As remarked in the introduction, *UrbanSensing is a research project funded by the European Commission within the Capacities Programme (2012-2014). The Capacities Programme is a strand of FP7 strongly oriented **toward establishing collaborative frameworks between research performers (universities, research centers) and industry (often SMEs – small and medium enterprises)**. The idea is to fund research project with an applied component. In other terms, the EU expects that within the scope of projects funded by Capacities, consortia composed of representatives from academia and industry work together in order to provide the Partners coming from industry with prototypes that can be transformed into products and services to be distributed in the market.

This dimension strongly influenced the orientation of the project and also the research trajectory. In *UrbanSensing, the research process unfolded through continuous confrontation among the project's Partners: three research performers (T-Connect from Italy, IT4All from France and the Technical University of Kosice from Slovakia) and three SMEs (Accurat from Italy, Mobiguo from Spain, LUST from the Netherlands). As the SMEs were also eager to test the commercial potential of the project, they also engaged in a quite fertile conversation with subjects external to the consortium, but interested in buying the service offered through the platform (e.g. architects and urban planners both from private companies or municipalities, real estate companies, companies organizing events, etc.).

As described in previous chapters, various conversations with different stakeholders and several design experiment have been conducted during the first year of the project (October 2012-October 2013) in order to define the requirements of the UrbanSensing platform.

If compared to the Telltale project, which goals of Telltale are set within a more theoretical and research oriented realm, the expected output of *UrbanSensing is an actual tool: **an easy-to-use web-based platform that allows users to perform different queries, selecting for example the geographical location or specific keywords for the text mining analysis.**

Therefore, if taken together the two projects pursue the ambitious aim to address simultaneously:

> The computational ability to extract meaningful information from digital native sources;
> The urban sensibility on catching the behaviors of the city;
> The design attitude to visually communicate complex and relevant issues and to develop actual tools for practitioners.

5.2 THE PLATFORM ARCHITECTURE

The *UrbanSensing architecture is **modular** and based on **several elements** that **can be personalized to create specific instances of the platform**:

> An acquisition engine that collects data streams from UGC and other, sources and integrates them into a single knowledge base,
> A text-mining engine and a data clustering layer,
> A web-based component, accessible via browser that allows final users to perform specific searches within pre-defined domains through an easy-to-use user interface,
> A visualization layer that shows the information using multiple visual representations,

In terms of data flows, the architecture relies on two processes:

> One that fetches data from multiple sources and, using several techniques (including crawling), integrates them into a common data model and indexes the information in the knowledge base,
> The other one that queries, filters and aggregates the data.

The system architecture has been designed in order to allow the **connection to multiple data streams:**

> Social Media Data (mainly Twitter, Foursquare, Instagram and Flickr),
> Open Data (such as Wikipedia, data coming from ISTAT, EUROSTAT and other institutions, Factual, Google N-gram, GeoNames, ...),
> Data collected through existing applications.

Several **languages** are supported by the system and a module for both automatic and manual translation is also provided.

5.3 MAIN INNOVATIONS

As specified in the previous chapters, there are a lot of different software solutions already used for urban planning. The main issue is that they rely on static data coming from governmental or manually surveyed data sets, or on data coming from users, which are already aware of the possibility of contributing information using digital tools and networks.

The **use of a dynamic flow of social data** is a huge advancement over this current practice as described in the following sections.

The *UrbanSensing assumption is that by conducting an analysis of data sets based on text data extracted from geo-referenced Social Media data there is the possibility to recognize multiple stories, as they emerge, overlap and influence each other, unfolding from city users' mental representations and spatial experiences of city spaces.

The aim is to constantly extract indications on urban emotions and well-being through a real time harvesting on social media generated content and to combine them with data sets (e.g. urban morphology, architectural types, city budget, opportunities, public services).

We can resume the main innovations provided by *UrbanSensing in the following list:

> A text mining engine which combines WordNet semantic graphs with the definition of relevant syntactical structures to filter meaningful data from general streams,
> A harvesting engine that collects real-time data streams from geolocalized UGC streams,
> A data clustering system that uses WordNet ontologies to reassemble data across themes and topics,
> A machine learning system that will allow the system to learn how to improve lexical relations based on users' feedback,
> A conversational analysis engine that traces real-time interactions among users (through their interactions on the UGC),
> A web interface that will allow users to perform specific searches within pre-defined domains (e.g. show all the content related to 'prayer' within the domain of 'religion'),
> A visualizing engine that will generate dynamic informative representations on top of standard Google Maps visualizations,
> A keyword based analysis enhanced by both configuring syntactical templates to capture only the most relevant content and by adding a semantic layer to first expand the terms to which the system is sensible and, then, to use formal ontologies to cluster all the collected text into themes and topics,
> A machine learning engine as an intermediate stage between automatic and human- powered procedures able to train the system to more intelligent content recognition schemes: positive and negative examples will be provided to a system which will progressively provide deeper insights about the relevance of selected content to the overall filtering schemes,
> A series of data cleansing procedures of multiple types (see above) to maximize data quality and the degree of certainty of interpretation in terms of emotions and behaviours expressed by the captured data,
> A Lightweight Expert System approach at the middle stage of processing, providing a tool for generative strategic intelligence, with an extensive set of features dedicated to its advanced fine tuning and possibility for adaptation to evolving contexts,
> A mutually interactive set of visualizations which allow operators to move back and forth between different analytical approaches, leveraging the benefits of each of them toward the creation of valuable interpretations of the expressions and behaviours of users in social networks,
> Combination of user profiles information an geospatial data to generate several levels of analysis based on selected target groups (residents, tourists, age groups,...) ensuring inclusion of minor groups,
> Filters to filter a social spam and ensuring the data validity,
> An approach focusing on the support of multilingualism at different levels,
> Options and parameters used to configure the content harvesting functionalities will accept multilingual content,
> The support of the WordNet versions available in different languages to perform the semantic network analysis which is at the base of the first stages of the natural language processing features of the system,
> The datasets, visualizations, maps and all other filtering and handling options be applicable to contents expresses in specific language sets,
> Comparative research and visualizations will be executable among content written in and/or related to different languages.

To have a more service-oriented perspective on the innovative factor of the platform **I interviewed representatives of the 3 SMEs involved in the *UrbanSensing project (Accurat, Lust and Mobivery) to investigate which potentialities they mainly envision after having tested the prototype in use** (September 2013).

Gabriele Rossi, managing director at Accurat, reports that the tools developed thanks to the *UrbanSensing research are first of all an out-of-the-box solution to merge these new and dynamic urban geographies expressed through Social Media or web posts with completely different sources of data (open public data, environmental data, proprietary sources...) into a single layered visualization, draw hypotheses on the urban environment and quickly investigate and verify them through a simple interface. Rossi argues that: *"From our perspective as a data driven design consultancy, the main potentiality of a project like *UrbanSensing lies in the fact that its software platform now provides to different kinds of practitioners, professionals and companies an effortless access to a previously hard to get layer of information regarding places and their uses. Being able to access easily and in real time such a vast pool of people opinions, interests, comments, memories, ideas and insights about the places the live everyday opens up an unexplored sea of possibilities to ask questions to citizens and get immediate answers from them. Our company works with clients from different fields and markets, such as banks, start-ups, agencies, NGOs, publishers or foundations, designing with them visual narratives, tools and interactive platform that help them make sense of the data to make better informed decisions.*

In helping this very broad spectrum of clients we daily face the need of integrating the different sets of information they own, they buy or they have access to, designing the ways to make them work together in an environment that can support decision making processes.

For example, we are working with a brand that imports beverages, targeting young adults in nightlife spots in cities all over Italy; their marketing team has no problems in dealing with the cities they know well, but it is impossible for them to have the same knowledge on more than 20 cities throughout the country. Being able to explore with them how different cities behave at different time of the day and quickly dig into visualizing and analyzing the contents produced in a specific timeframe and weekday lets us discover how the nightlife evolves in places over weeks, months and years. This is helping them understand where to plan specific marketing interventions, to measure their impact and return on investment and to create comparative analyses of their effect. More than this, by integrating this geographical information with the sales in different bars and clubs we are able to get even more precious insights about the opinions and tastes of their target audiences, instantly matching product sales with rich demographic and behavioral information.With another client we are working on using Social Media data to understand how college students explore ad live the city

of Milan; the client is a constructor looking for untapped opportunities for student housing in the places student desire the most. By filtering only the Social Media activity coming from city campuses from 9am to 6pm on weekdays we are able to anonymously intercept aggregated data on students and look for their contributions in other parts of the city at night and during weekends.

Are they commuting? From where? Where do they hang out at night? What movement patterns distinguish students from different campuses in the same city? What do they talk about after classes? What places seem to stimulate them the most? Crossing this information with the position of services such as libraries, parks, movie theaters and nightlife spots help us instantly providing our client with a reading of the city that was unthinkable before."

A slightly different interesting perspective has been underscored by Jeroen Barendse, principal at Lust: "*Lately, there have been a lot of uproar all over the world, in which public spaces play a prominent role. The outrage of protesters comes together at places like Tahrir Square in Cairo, Egypt and lately at Istanbul's Taksim Square. In the case of Istanbul, the cause of the protests is in fact a result of bad urban planning in Gezi park. *UrbanSensing has the potential to sense how for instance protest movements arise, what the millions of people packed together in cities are thinking and feeling, and use that to improve the city, take action, or maybe just listen to it and let it sink in.*

Geo-located Social Media data like tweets don't contain much content in itself, but the quantity of it makes it that you can distill interesting and unexpected patterns out of it. One of the great benefits over using other media, is that its almost unfiltered, and therefore also less coloured. From all the comments that people make about a subject, you will have all kinds: pros and cons. This has the possibility to paint a much richer picture, in less time and less effort."

Javier Lima, COO of Mobivery, sees a big potential in the platform, but also identifies some challenges: "*There are endless possibilities. *UrbanSensing is meant to be a platform to manage a huge amount of information coming from Social Media, open data and mobile apps in such a way that you can literally perform data mining in a fast, friendly, visual, almost real time way." This huge amount of information also poses some risks: "Although *UrbanSensing will be hosted on the cloud, with a much higher processing capacity and the possibility to scale the whole platform if needed, there might be still the need of significant investments in order to have a system able to manage increasing quantity of data*".

This is a serious issue where both technical and economic components play a big role also in potentially limiting the access to these kinds of analysis.

5.4 THE INTERFACE DESIGN

Almost all of the experiments reviewed in chapter 4 have been presented to practitioners and researchers external to the team. A quite common reaction – especially from practitioners - was the desire to try the platform, tinker with data and play with different visualization tools.

The *UrbanSensing platform design has been then oriented towards the creation of an '**urban sketching tool'**, a prototype of the user interface that would give users the possibility to **intuitively set up the scene, define visual layers, select and import data, perform basic operations** (filtering, clustering, aggregation, statistics...) **directly on the map, assign visual styles and automatically publish visual analysis of the processed information.**

The platform runs around the idea of a **main geographic view** based on an initial graphical layer (a selected map of the geographical location of interest at the moment of the creation of a new project) and additional content layers corresponding to the imported geo-referenced Social Media data plus any other geographic datasets the users might want to overlap.

The design process has been iterative with intermediate mock-ups that have been regularly presented and tested with the SMEs partners and with external stakeholders.

I personally designed the functional and graphic layout of the interface's steps I will present.

The first steps of the interface design based directly from the review of the selected case studies and from the taxonomy of geo-referenced data-visualization presented in chapter 3 and aimed at categorizing the operations a user might need to perform, as highlighted in the following figure:

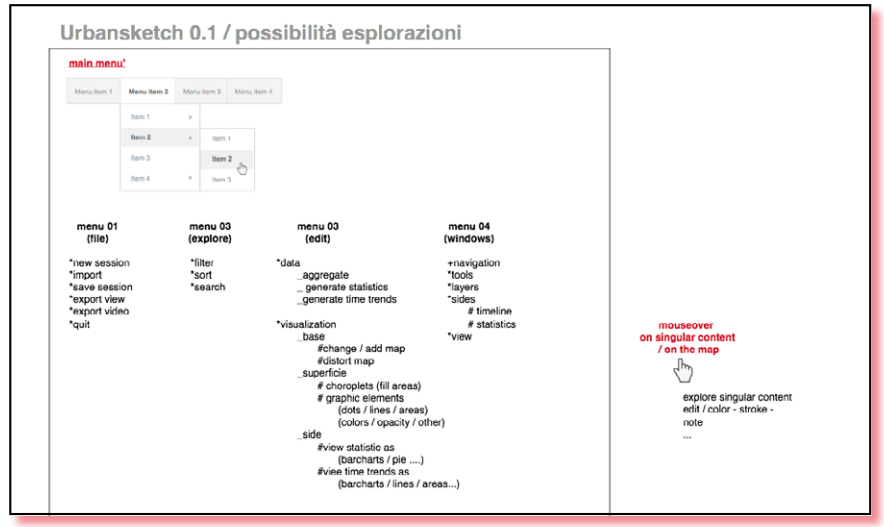


Fig.74 — *UrbanSensing, Urban Sketching tool prototype, menus and operations

A further exploration of menus, tools and layering options for the interface has been developed and presented to the partners:

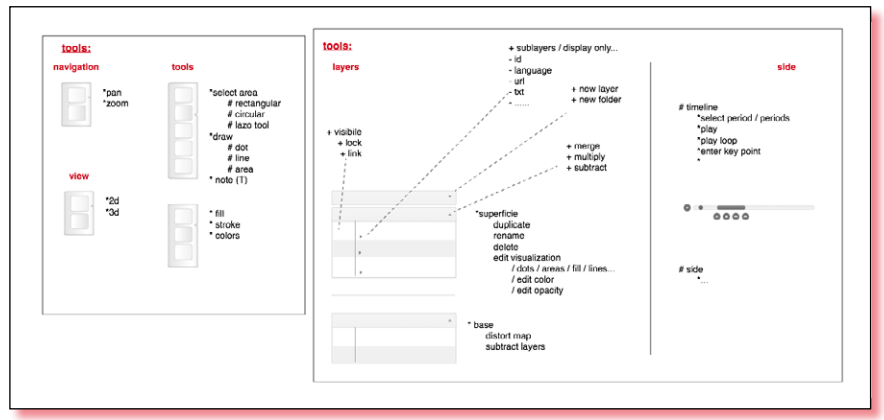


Fig.72 — *UrbanSensing, Urban Sketching tool prototype, menus and operations

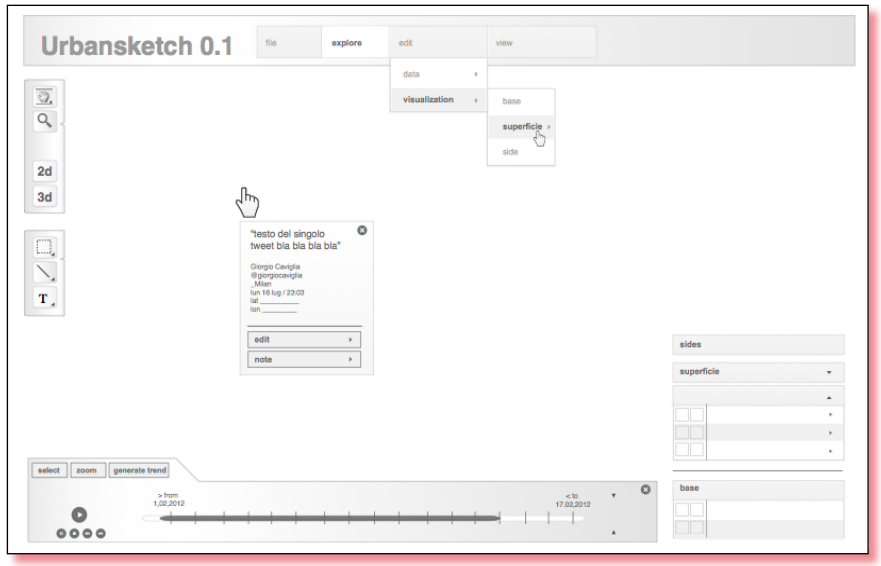


Fig.76 — *UrbanSensing, Urban Sketching tool prototype, main interface visual exploration

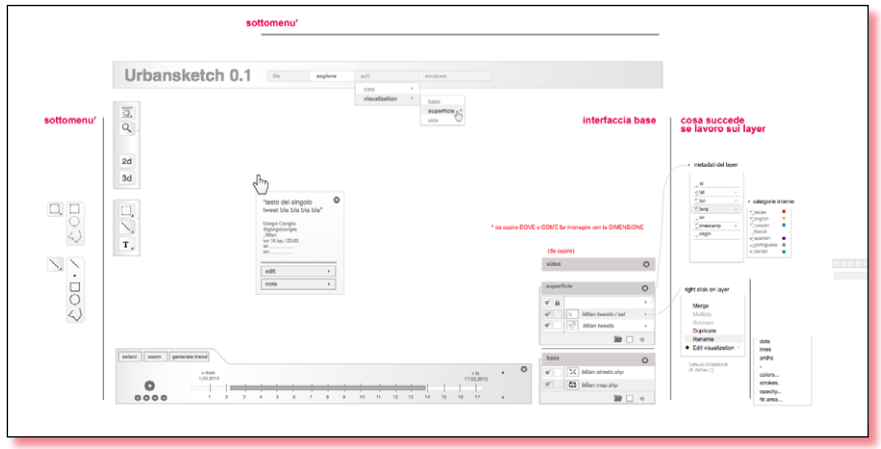


Fig.77 — *UrbanSensing, Urban Sketching tool prototype, main interface visual exploration

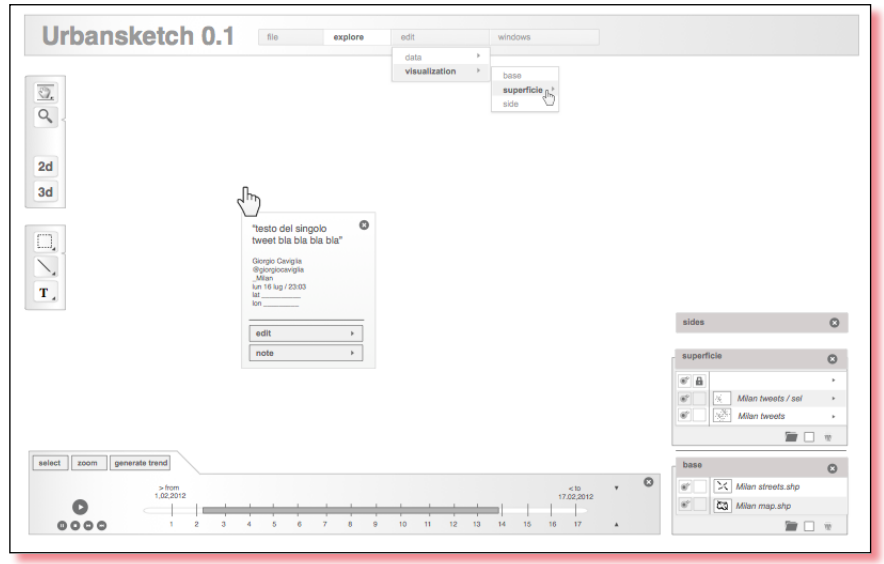


Fig.78 — *UrbanSensing, Urban Sketching tool prototype, main interface visual exploration

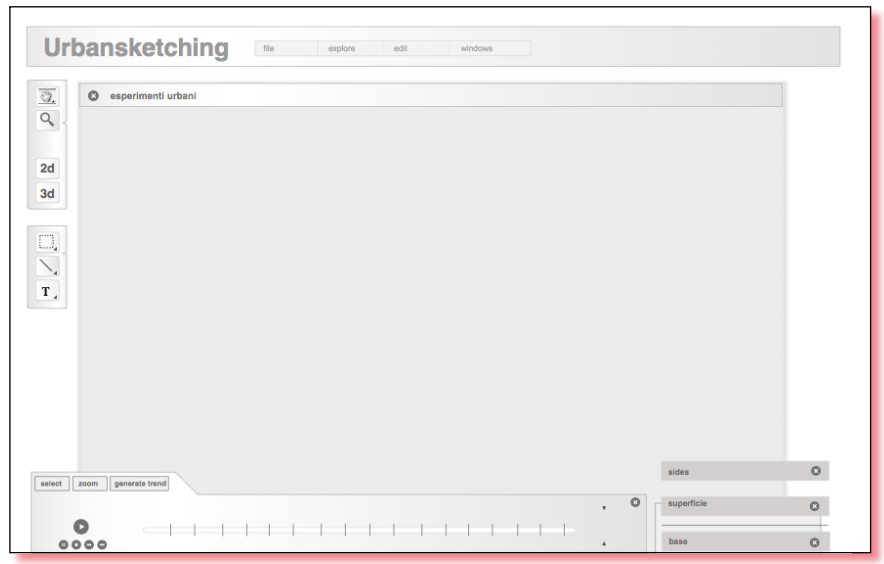


Fig.79 — *UrbanSensing, Urban Sketching tool prototype, new project layout

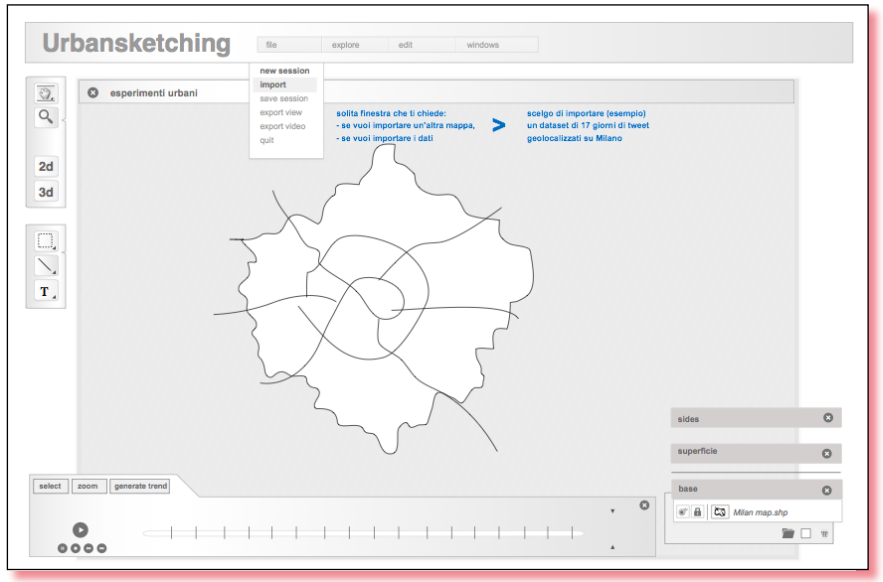


Fig.80 — *UrbanSensing, Urban Sketching tool prototype, map view

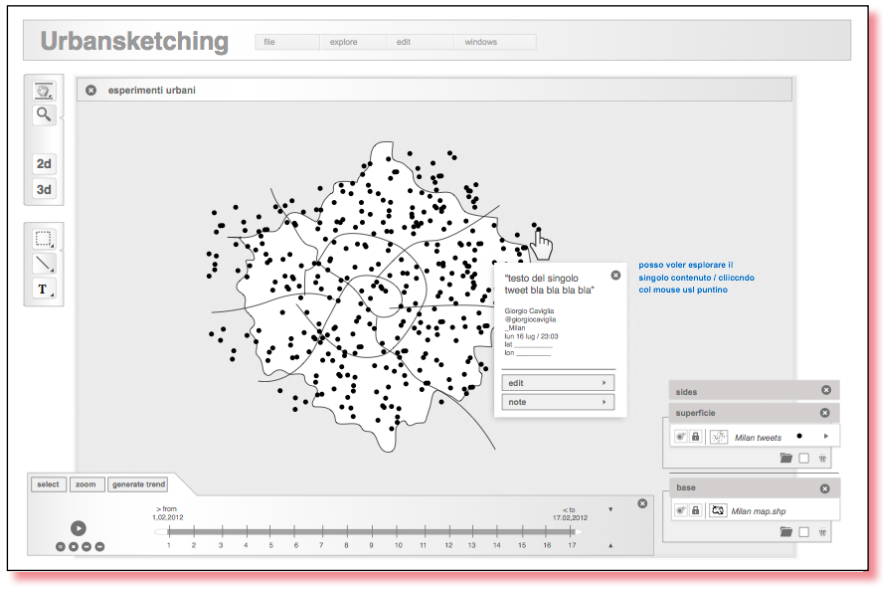


Fig.81 — *UrbanSensing, Urban Sketching tool prototype, importing contents from the Social Media streams

After a first session of conversations and comments on the first mock-ups, all the partners agreed to design and prototype a web interface allowing mainly the users to perform operations with data such as importing, selecting, filtering, sorting, inquiring. A second layer of interaction allows users to analyze contents (e.g. keyword based queries, place related based queries, sentiment analysis on data), to perform statistical analysis, to aggregate data, to overlap data (e.g. integrate and compare data analysis with other data sources). Finally, the users have the possibility to personalize, save, share and export the visual representations. The platform allows users to coordinate multiple views (e.g. 2d map view, 3d view, time series, statistics), to easily get back to original data, and to export views and data.

At this point of the project we started to conceive **the main elements of the user interface of *UrbanSensing** as:

> Menu (basic functions related to the project)
> Main view (access to map and visualizations)
> Source panel (enriched data pools to be used as sources for the project)
> Layer panel (Photoshop-like arrangement of different visual layers)
> Filters / Operations panel (list of filters, operations, effects to be applied)
> Style panel (style properties to be applied for each layer)
> Tools panel (for operations on the main view, like selection of a specific area)
> Statistical analysis panel (to add a pre-set of statistical analyses)
> Timeline (to select suitable time intervals for the analysis and visualization)

Assuming the core-system will provide the visualization engine with datasets already enriched with tags based on sentiment analysis and context recognition, the visualization platform will be structured as a publishing tool. **The workflow will be logically divided in 2 phases**, so that the operator will be able to:

> Set up the scene, define visual layers, select and import data, perform operations (filtering, clustering, aggregation, statistics...), assign visual styles, and define options of visualization and interactivity
> Save and automatically publish an interactive web map and statistics with preset data selections and limited functionalities that can be used by a non-expert audience to explore the contents

The aim of this workflow is to allow SMEs to use the platform as a sketching tool to perform queries and mathematical and visual operations among different sets of data, in order to create interactive products with specific functionalities that can be used for:

> Displaying to the client the results of an analysis done by SME on the platform itself
> Allow the client to explore a complex (but pre-selected) set of data and perform his own analysis on a real-time stream of information
> Create web applications for the general public for the purpose of entertainment or divulgation
> Create static hi-res maps for publishing/consulting purposes
> Create easily post-produce able editable dynamic (mov) or static (svg) maps

Consequently, I implemented and revisited the design of the platform as presented in the next sketches and as highlighted in the following brackets:

Basic platform structure

The elements of the interface are:

> **Menu** (basic functions related to the project),
> **Main view** (map, visualizations),
> **Source panel** (enriched data pools to be used as sources for the project)
> **Layer panel** (layer arrangement, Photoshop like),
> **Filter / Operations panel** (stackable filters/operation/effects, layer metaphor),
> **Style panel** (style properties for the layer),
> **Tool panel** (for operations on the main view, like selection),
> **Statistics panel** (option to add statistics based on layers to the main view before publishing),
> **Timeline** (time controls).

Precise features of the singular visual components are listed as follows:

Menu

> Option to save and archive the project,
> Export current view as a svg,
> Export total time-lapse as a mov,
> Export selection of time-lapse as a mov,
> Publishing tool, to create an interactive visualization from the project.

Main view

Every geographic view will have:

> A background layer (map, shape files for areas...),
> A number of content layers (visual representations of data),
> Option to import the data source, selecting from a list of the available pools,
> Option to import shape files and link them to the data source,
> Sources can be arranged and managed,
> Sources can be viewed as a table for exploration.

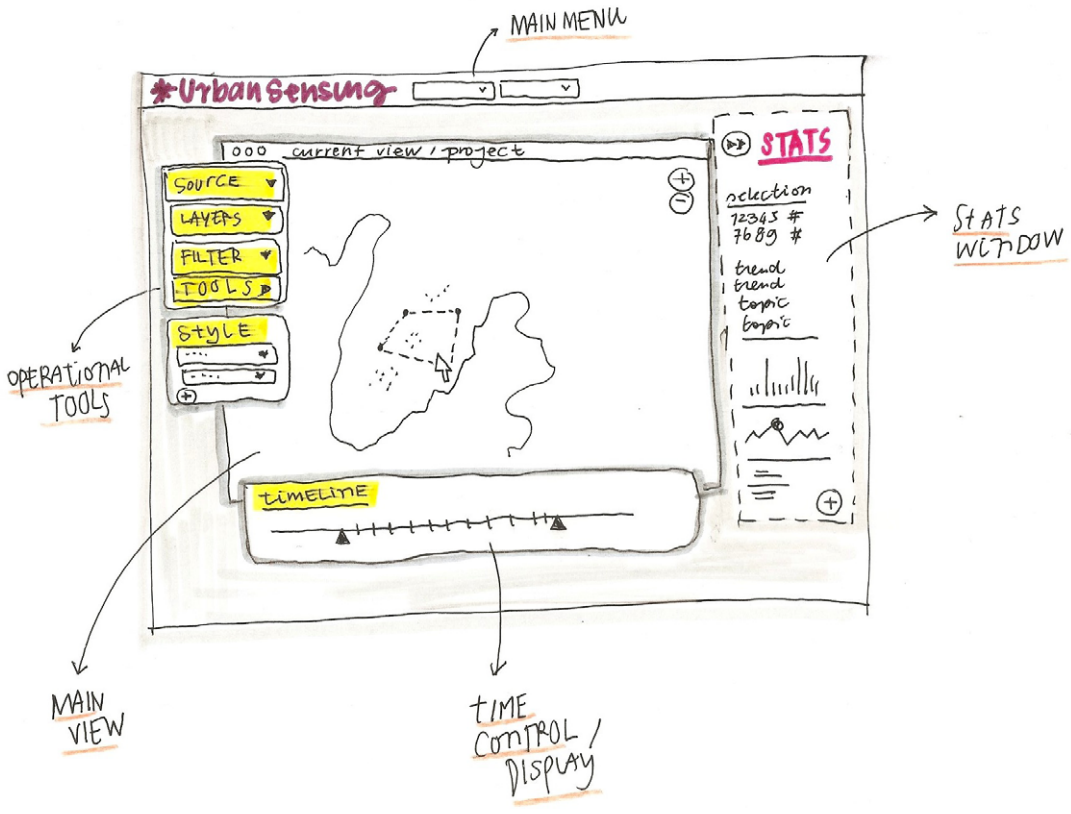


Fig.82 — Preliminary sketch of the platform's main view

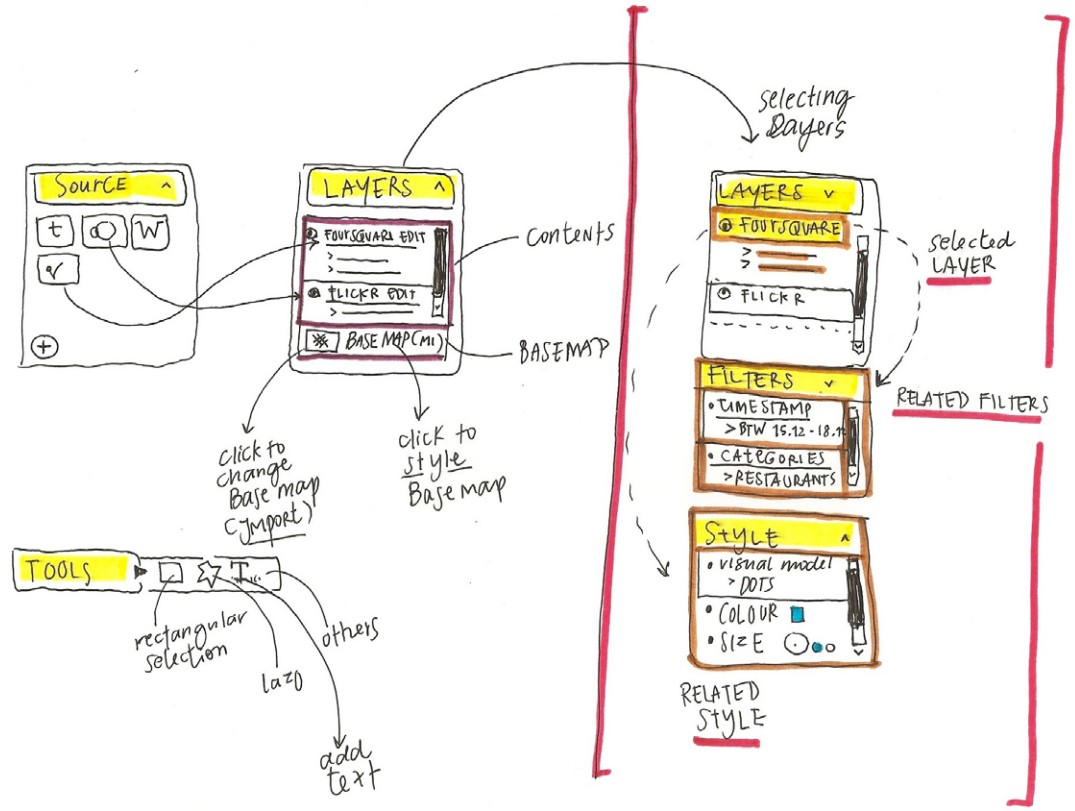


Fig.83 — Preliminary sketch of the structure of the platform panels. Source panel

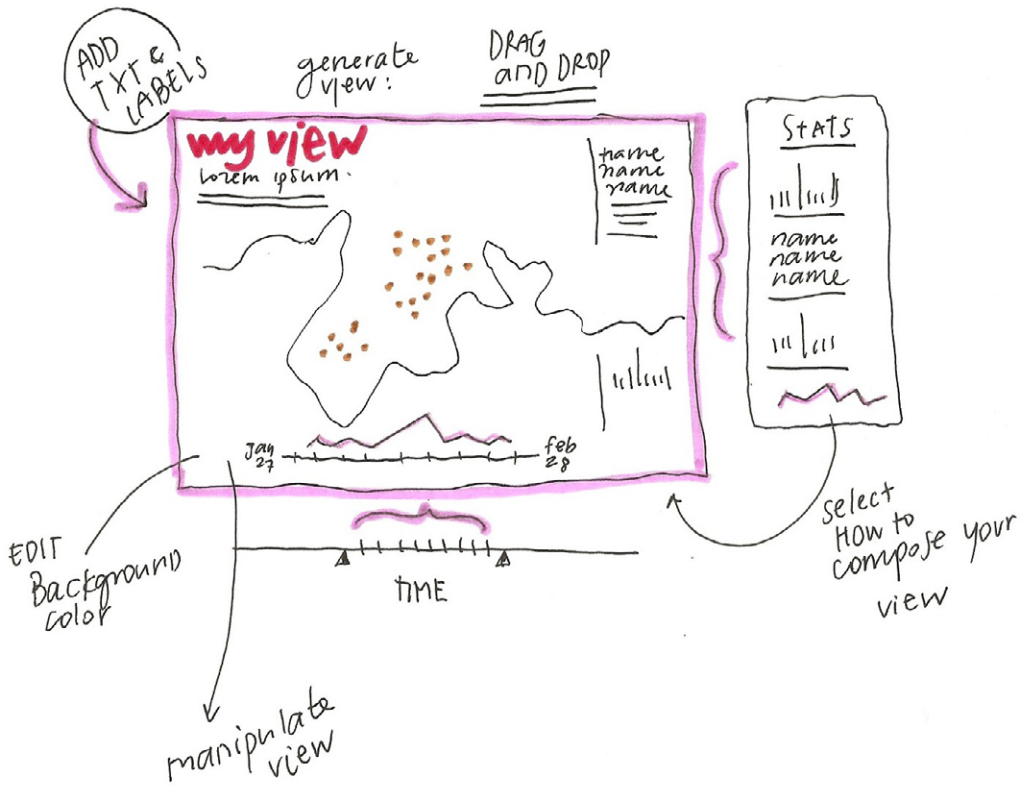


Fig.84 — Preliminary sketch of an interactive view

Layer panel

> - Sources are dragged from the Sources panel to the Layer panel,
> - Each dataset will be imported on a new layer,
> - Data sets containing LAT/LONG for each entry are automatically plotted on a map,
> Data sets containing TIMESTAMPS are automatically organized over a dynamic timeline,
> Data sets containing references to specific shape files for georeference (i.e. neighborhoods) will be automatically displayed on the shape file itself,
> Layers can be toggled on and off,
> Layers can be rearranged and grouped,
> Layers can be duplicated and styled/selected/filtered differently (see later).

Filter panel

> When a layer is selected, its filter/operations attributes are displayed here, on stackable interface (Effects panel on After Effects as a functional reference),
> The dataset source of the layer can be filtered with mathematical operators for all of its attributes (including sentiment and context),
> The available filters are selectable from a list and then added and customized
> (i.e. show me only this period of time, show me everyday between 7pm and 10pm, show me only the contributions in English, show me only who has a positive sentiment, chow me only who's talking about Obama positively...),
> Datasets can be aggregated and clustered depending on spatial criteria (square or hexagon grids, proximity, similarity of attributes...),
> Datasets can be aggregated and clustered depending on content criteria (attributes, sentiment, context...),
> An optional nodal/visual query interface will be available as a filter to allow complex queries and combinations of different datasets on a single layer. (i.e. show me only the contributions from this dataset that share this characteristics with this other dataset, match these two datasets on this attribute, filter only the most 50 used words from this datasets and assign geo-reference based on this clustering method...).

Style panel

> When a layer is selected, his style attributes are displayed here (Like the stroke/fill/color panels on Illustrator),
> The visual metaphors available for the dataset (plot, bubbles, heat map, areas, hexagons, vectors...) can be assigned to the layer,
> Each layer can be styled (colors, sizes, opacity, strokes, tags...) through a style editor, assigning values based on the data attributes.

Tool panel

> Different selection tools are available,
> Multiple specific areas can be selected with graphic tools on the main view inside a layer (lasso, polygonal lasso, areas on a shape file),
> Different selections can be saved and stored as vector bezier on the layer itself (like layer masks in After Effects).

Statistics

> One or more widget with statistics can be dragged in the scene,
> The source of the statistics is a layer, visible or not,
> The statistics can be created an excel-like interface (bars, scatter plots, time trends, pie charts).

Timeline

> Timeline is shown if at least one layer contains time-stamp attribute (automatically recognized),
> The timeline can be toggled off to display the total aggregation,
> The timeline is playable and the speed can be changed,
> It is possible to display over the timeline one ore more time trends or bar charts, related to data one or more layers (statistic widget),
> Timeline is shown if at least one layer contains time-stamp attribute (automatically recognized),
> The timeline can be toggled off to display the total aggregation,
> The timeline is playable and the speed can be changed,
> It is possible to display over the timeline one ore more time trends or bar charts, related to data one or more layers (statistic widget).

The **design approach of visually sketching and mock-upping interfaces has been fundamental for all the stages of the project** to guarantee an open dialogue and a constant collaboration with both the developers and the final stakeholders (SMEs). After these rudimental sketches have been discussed and presented to all the partners, I started designing digital versions of the mock-ups of the platform to test elements' organizations, locations and style within the interface.

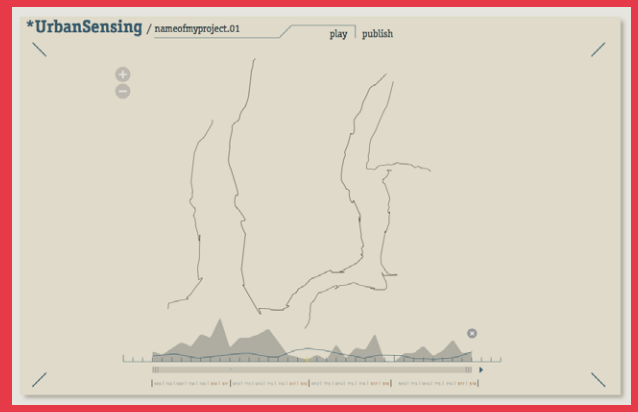


Fig.85 — *UrbanSensing, interface design, main geo-temporal view

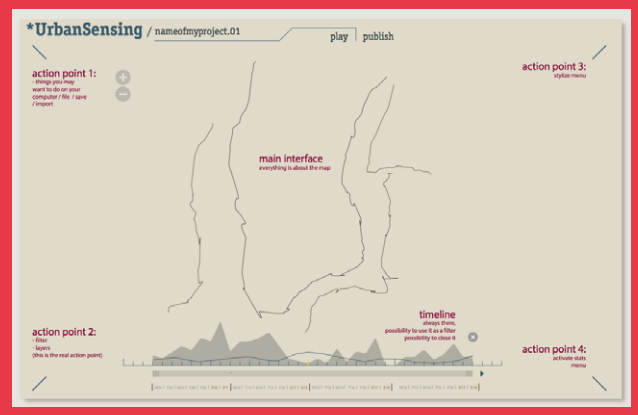


Fig.86 — *UrbanSensing, interface design, main geo-temporal view and action points

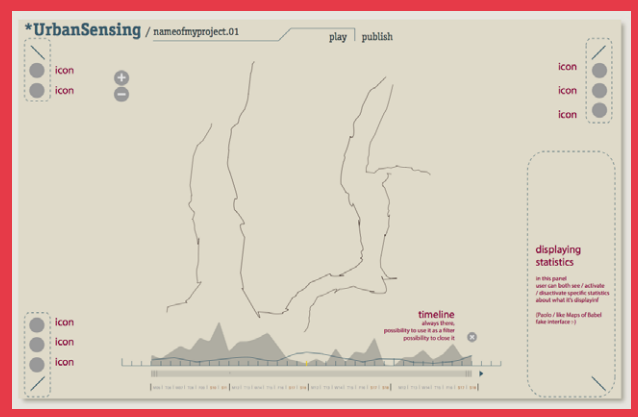


Fig.87 — *UrbanSensing, interface design, main geo-temporal view and action points

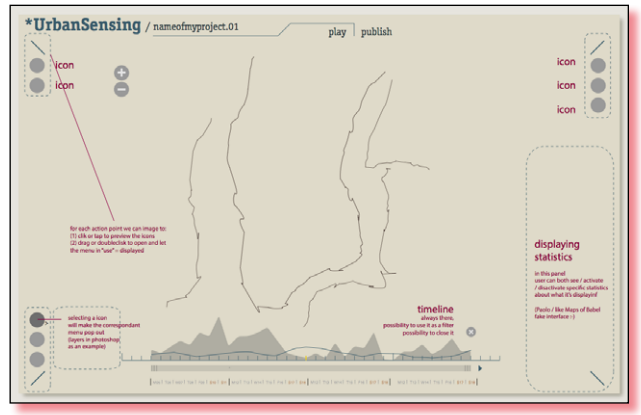


Fig.88 — *UrbanSensing, interface design, main geo-temporal view and action points

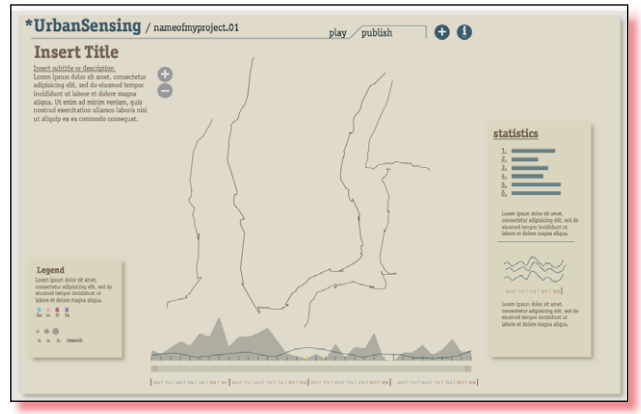


Fig.89 — *UrbanSensing, interface design, “publish” view

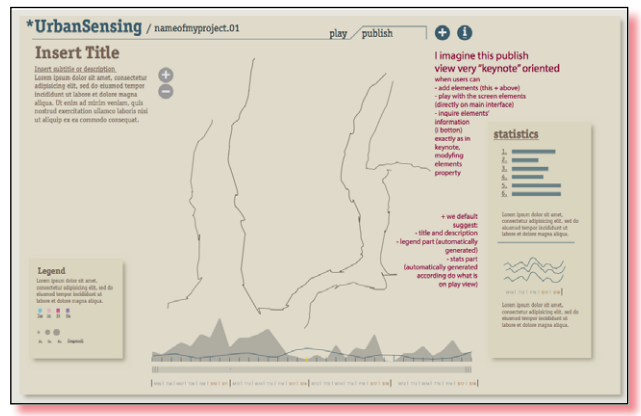


Fig.90 — *UrbanSensing, interface design, “publish” view

In the following mock-ups I started to implement the touch-points idea with actual maps and functions for the menus.

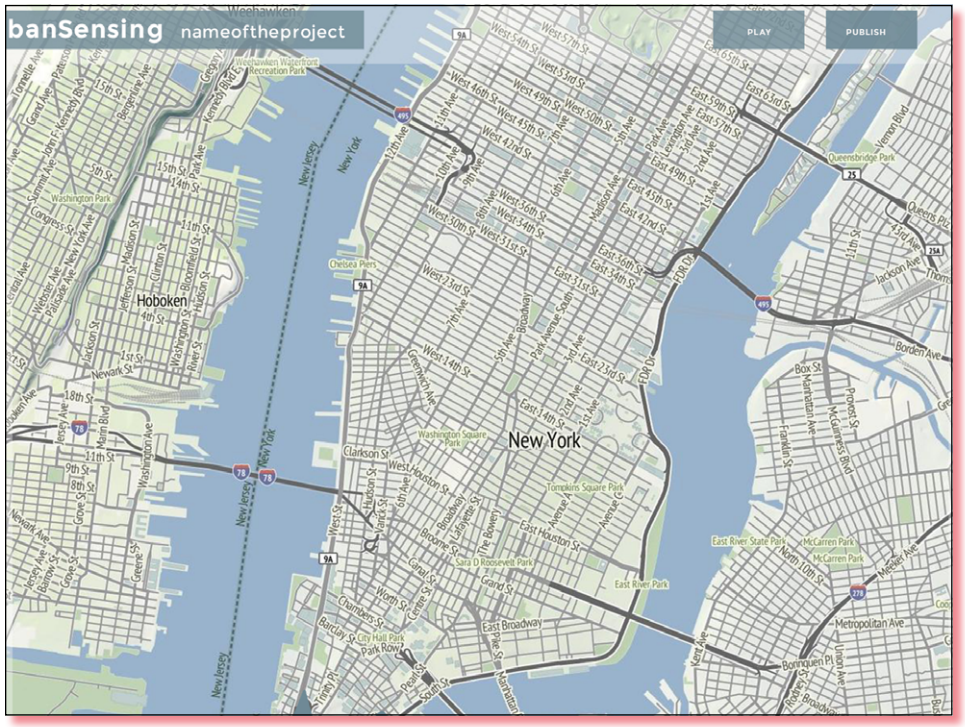


Fig.91 — *UrbanSensing, interface design, graphic layout

Fig.92 — *UrbanSensing, interface design, graphic layout

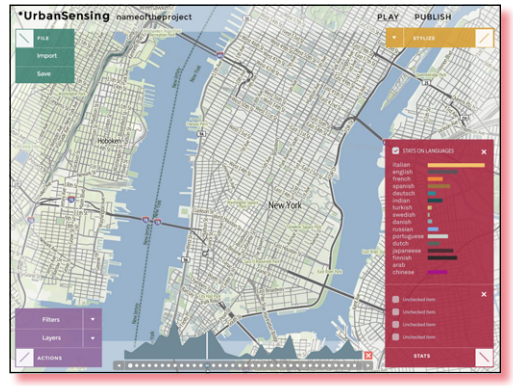


Fig.93 — *UrbanSensing, interface design, graphic layout

Fig.94 — *UrbanSensing, interface design, graphic layout

Fig.95 — *UrbanSensing, interface design, graphic layout

All of the mock-ups have been shared with the research performers and the SMEs partners of the project, and they have been used to produce the final version of the platform that will be released at the end of the 2 years, in September 2014. In parallel a draft-working prototype has been developed to test the data gathering and processing engines, and some basic filtering and plotting operations with the data.

The current version of the platform[22] (October 2013) is presented in details as follows.

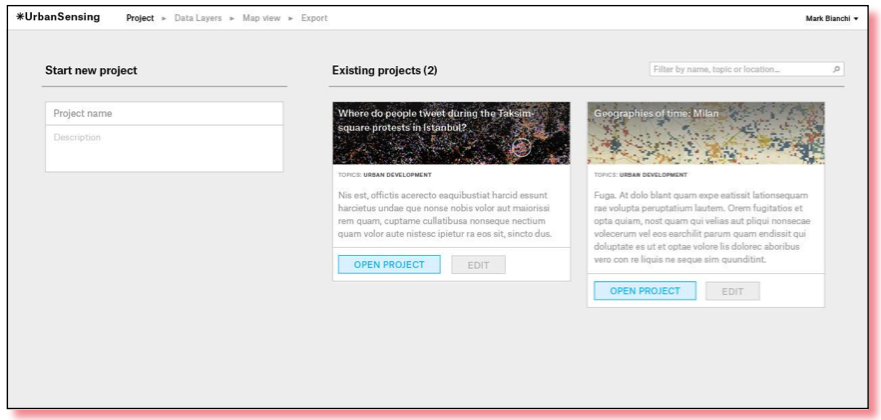


Fig.96 — *UrbanSensing prototype - main page / create new project (October 2013)

As the user accesses the main interface, he can either open an existing project previously created within the system or start a new one. For each new project users are asked to write a title, a short description and some tags, to make it easily understandable for future users.

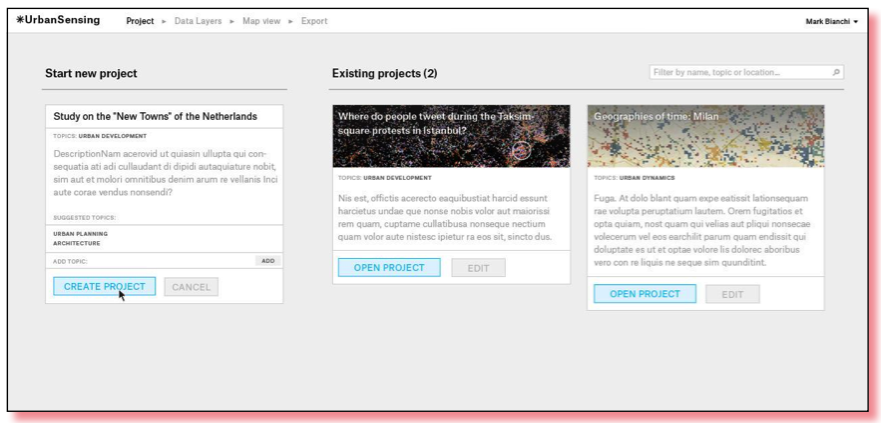


Fig.97 — *UrbanSensing prototype - main page / adding tags (October 2013)

22 The current version of the platform has been designed and developed with the precious help of Alex Piacentini and Marco Vettorello (Accurat)

After the creation of a project, users can choose to add existing layers of contents to the project (previously dumped geo-referenced Social Media data) or to create a new data layer, by simply visually selecting the source (e.g. Twitter, Instagram or Foursquare), the time period (a time interval or a specific day to analyse) and the location (which city or specific geographic area).

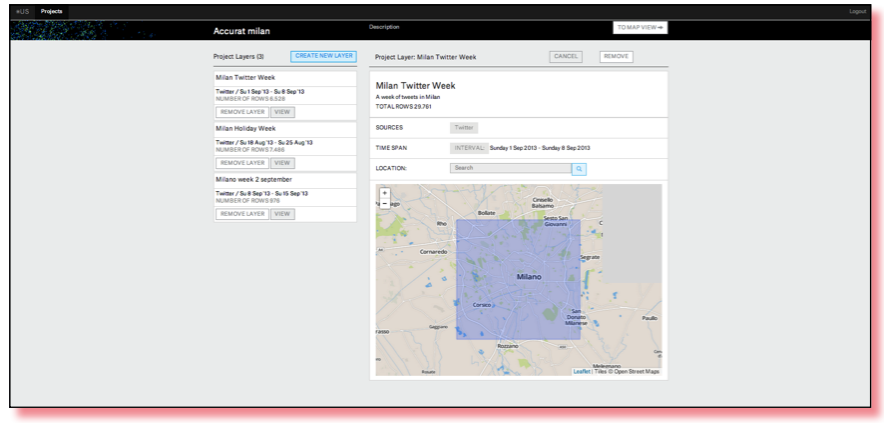


Fig.98 — *UrbanSensing prototype - data layer, geographical and time filter (October 2013)

The users can then jump to the main map-based view, where they can perform more analytical queries, applying different kind of filters, and add other sources of geographic information to correlate to each layer.

Fig.99 — *UrbanSensing prototype - map view (October 2013)

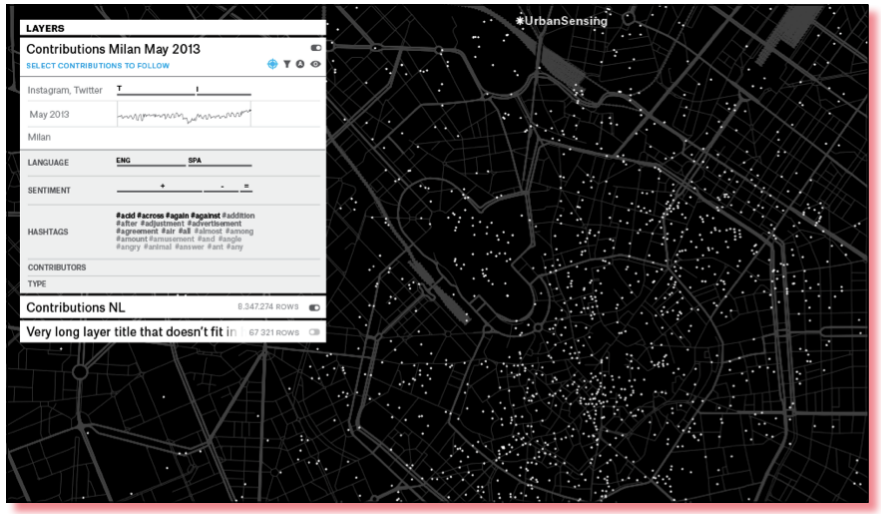


Fig.100 — *UrbanSensing prototype - map view
(October 2013)

Each layer can be filtered through the following functions:

> "Time spans" a very simple time-filter that allows the selection of a precise time-interval or multiple intervals (e.g. only night-times, only weekdays, only week-ends) within the pre-imported one, directly in the main platform environment.

Fig.101 — *UrbanSensing prototype - map view,
time-span filter, zoom (October 2013)

> "Where else" The idea behind this specific function comes from the Urban Stories design experiment; it allows to select a subset of anonymized contributors directly from a specific geographic area and use this subset to filter the data from the whole city in order to follow contributors' movements and highlight where this group of anonymized users generated other content before and after the selected initial contribution time. All the contributors' ID and their generated contents

are properly anonymized and follow the usage licences of each data source and it is not possible to reconstruct a user identity either from the current displayed information or from the backend system.

Fig.102 — *UrbanSensing prototype - map view,
"where else" filter, zoom (October 2013)

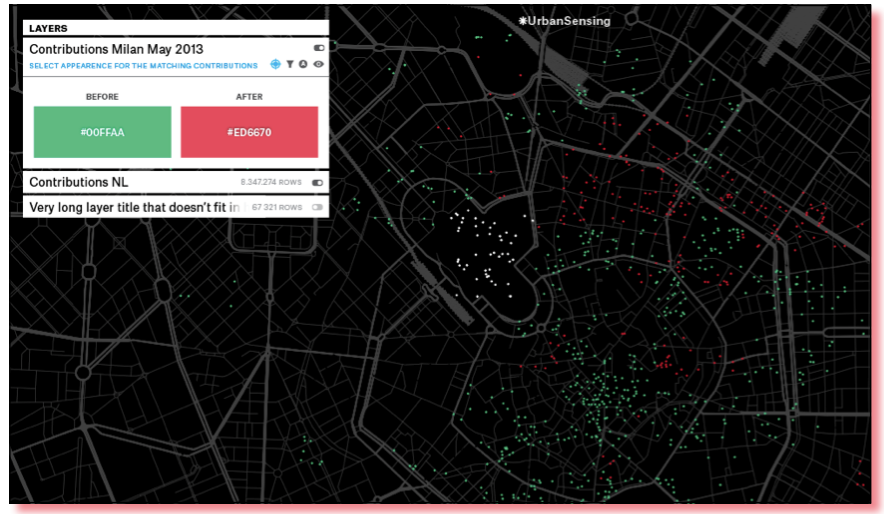


Fig.103 — *UrbanSensing prototype - map view,
"where else" filter, zoom (October 2013)

> "Geographies of" This filtering operation contains a set of more complex queries whose idea originated from the design experiment Geographies of time. In this case, the platform looks for similarities in different areas of the city based on patterns of contributions on Social Media (e.g. patterns based on time intervals, sentiment analysis, languages, type of places, recurrent contents, type of filters used in pictures and other parameters the user of the platform can retrieve from

the Social Media meta-data or from additional data streams).

The platform uses a strategy of analysis based on an grid: initially, a very small grid is created all over the interested geographic area; when a cell inside the grid contains at least one contribution the system would then calculate the aggregated function for the selected parameter, when necessary applying a tolerance range to decrease the granularity of the results in order to discover spatial patterns.

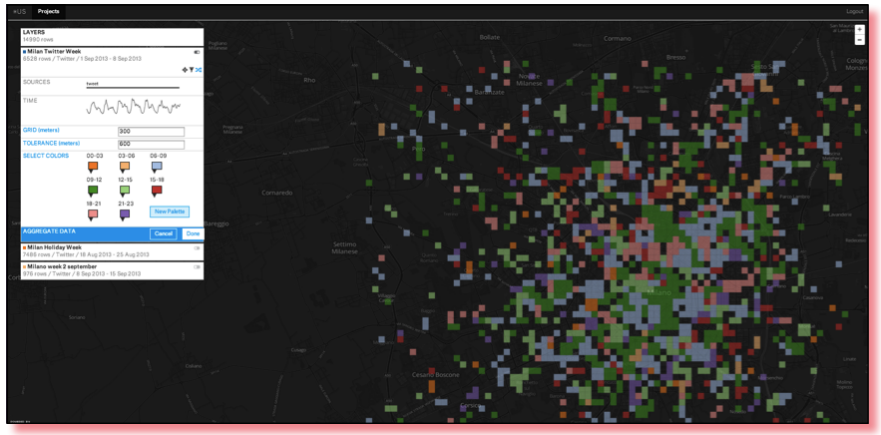


Fig.104 — *UrbanSensing prototype - geographies of time" filter, zoom (October 2013)

Users can control the grid, increasing or decreasing both the size of the cells and the tolerance range, and generate several color palettes to apply in order to highlight similarities and differences among areas as displayed in the following screenshot.

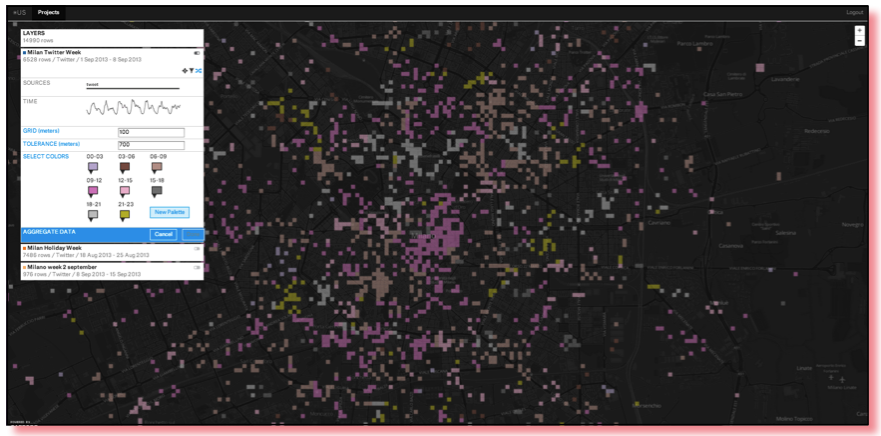


Fig.105 — *UrbanSensing prototype - geographies of time" filter, zoom (October 2013)

This **Urban Sketching Tool** has been used and is currently used by a quite large number of practitioners and researchers.

Some usability tests have been conducted in Milan following a protocol based on free navigation and thinking aloud. The platform has been tested in September 2013 with 10 users (practitioners and researchers, quite balanced in terms of gender and age). The users offered critique and constructive feedback on the functionalities of the platform and the user interface, highlighting some its shortcomings like the navigation menu not always intuitive and some problems with the information flow related to the creation of new layers.

The chance to observe the platform as used by this initial group of users convinced us that the technological platform should be as open as possible to the many different needs, desires and perspectives of analysis of the users. **Instead of providing the platform with a predefined set of analytical tools, we are now oriented towards the creation of a system that allows the final users to define both their own indicators and the research strategies to measure those indicators.**

06

Fostering people to share meaningful contents: Pleens

Fostering people to share meaningful contents

6.1 Pleens, where places tell stories (the project)
6.2 Background and benchmarks
6.3 The user experience and interface design
6.4 Scenarios and future works

6.1 PLEENS, WHERE PLACES TELL STORIES (THE PROJECT)

A further parallel activity has been undertaken during the research period with the aim of understanding if and how **customized concept and design for check-in based mobile application can foster people to share more meaningful contents regarding their attachment to and usage of places**.

Pleens is a project designed and developed in collaboration with Mafe de Baggis (the social media expert I've been collaborating with ever since the beginning of my PhD) and Gallizio editore (an Italian publisher focused on short narratives) with the help of Accurat (the Italian information company I co-founded in 2011). Since 2011, I've been actively participating to the project form both a **research and design point of view, being leader of the visual and interaction design for the first test version of the mobile application that has been developed**.

The idea behind Pleens draws upon different considerations on the way we tell, share and read stories and narrative nowadays.

From one side, and as has been highlighted before, **physical places can be imagined and depicted as palimpsests** (Szott, 2006): multiple stories of different kind and genres overlapping on the same maps, on the same cities, on same parts of these cities. Even if the virtual space had initially been conceived as an alternative to the physical world, we now everybody know that virtual connections and virtual spaces, such as any mobile applications we browse on our iPhones, can be conceived as an additional layer of function and access that maps onto physical place.

The digital and the physical are merging, overlapping and enriching each other more and more (Jurgenson 2013), and in this sense, physical locations can be seen as novel points / places to publish and read our stories (and memories, messages, thoughts and emotions) onto.

And, as human beings, we always aspired to leave a trace on places, we tell stories to mark places, we mark places to tell stories, to keep these stories and explore them later, to share these stories with the people we love (De Baggis, 2012).

From the other side, more and more companies need geo-referenced information about their users or potential clients to understand their habits and intercept trends and behaviors they can leverage.

As we see, existent geo-localization based applications such as Foursquare are not 100% able to satisfy this big need; are not capable to highlight those habits and intangible feelings.

Is it possible to draw evolving maps full of meaningful contents, sourced by people actively living and experiencing places?

Is it possible to provide people the possibility to literally write their emotions, habits, and paths on map, and then return interpreted meaningful data to companies who are struggling for them?

Is it possible to build an immersive and narrative experience of physical and digital creation and navigation of stories in places? Is it possible to do it in an evocative and immersive way?

"Pleens is a tool to discover stories, journeys and products told starting from the place you, or your friends, are in when you launch an app: what really matters is not geography or proximity but narration. Geo-localized stories may include suggestions for tryouts and purchases, provided they are related to the narration and to the emotional context.

Geography based stories have a beginning but not an end, they are not written by a conscious author but by a community emotionally involved in a very special social object: their own personal memories, linked to a specific place (the love-in). "

A strong parallel with narratives (and books we all love to be immersed in) exists. From this perspective we can describe Pleens **as an attempt to define a new language of expression for short stories deeply related to places: a back-up platform to ease the fragmented writings of feelings and emotions tied to the geographical dimension.**

Several reasons justify the need for new modalities of producing and consuming narratives, and this mainly concerns with how our lives and habits as human beings radically changed during the past decade. We are constantly moving, transiting the city spaces daily, and our time-intervals are more and more narrowed down to small chunks.

Not only traditional books seem to be inadequate as for their physical characteristics, and traditional forms of writing (fiction books and novels) require a constant level of attention that more and more it's becoming impractical to keep nowadays.

From a narrative perspective, stories of all kind are very tight to places: places where we read those stories, and places where these stories take place. Places that can be thus seen as novel spaces for publishing.

Pleens originates from the need to intercept and capture these evolving needs.

The commercial markets Pleens mainly refers to are **editors, tourism and the entertainment industry.**

Every kind of industry that cares about the geographical component embedded in the selling experience of any products will incredibly benefit to have information about how people bind their memories,

emotions, dreams to places in order to offer meaningful products and experiences to customers, based on what they actually do and share rather than relying on other less direct forms of business intelligence.

The envisioned business model of Pleens is based on monitoring and trading geo-marketing insights on data that the application will be able to retrieve and analyze; a lighter market we begun to explore, as a starting point, is providing people actual products able to remind recall their emotional trips, their selected "love-in".

As highlighted in previous chapters, Twitter, Fousquare and Instagram are exceptional tools to read collective behaviours related to physical spaces, but how does a platform specifically conceived with these aim would work?

During the whole conception and development of it, **we've always been picturing Pleens like a "world" rather than a mere mobile application**;

a world that we begun to explore through a publishing tool, letting users record and share their emotional stories on places they are feeling this emotions in.

As regards for the PhD research trajectory, this experience is a starting point to discover how people can actively create contents, even if in form of very short stories, tied to places. stories, tied to places.

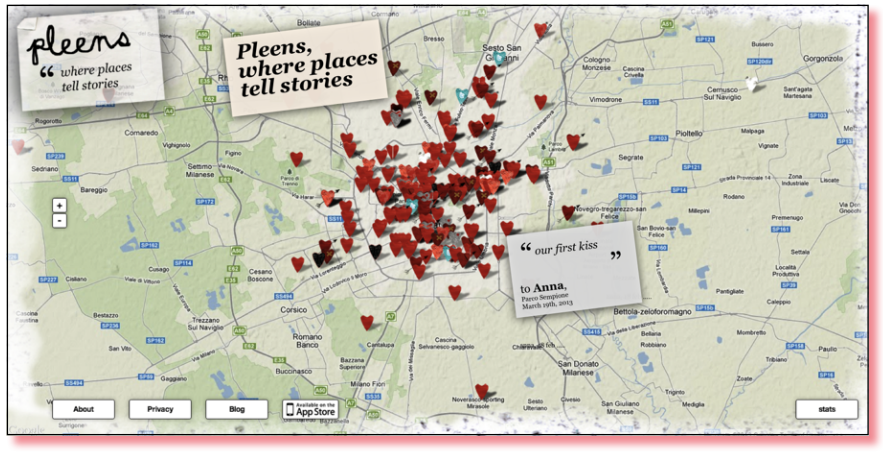


Fig.106 — Pleens, the web-app

6.2 BACKGROUND AND BENCHMARKS

In the past decades the research on emotions has progressively grown in scale and importance, involving fields such as psychology, anthropology, biology, philosophy, history and sociology. And powerful debates arose between confronting parties, establishing oppositions among universalists/relativists, biology/culture, nature/nurture, materialism/idealism, positivism/interpretivism, individual/social, body/mind, reason/passion, rationalism/romanticism, in a dualistic approach that is deeply interconnected with the Cartesian Dualism typical of the Western intellectual tradition (Lutz, Schwartz, & Miles, 1992).

To date, the most common way of gathering qualitative feedback from citizens on their response to architectural design and urban policies is through subjective measurements, such as face-to-face interviews, and questionnaires (Bishop, 2003).

Other approaches, though, are emerging across the disciplines: the artist Christian Nold in his project Bio Mapping (2004) created "emotional maps" for large urban cities such as London, Brussels and San Francisco.

Christian Nold's work focused on in-depth research of technological tools in order to unravel their social and political layers, and on building socially constructive, bottom-up devices, that take the form of practical tools such as in the Bio Mapping project. Bio Mapping is a research project based on biometric sensors that can be worn by users provided with a GPS device able to trace their paths through the city, and that register some parameters (e.g. emotional status in to specific places and situations) and publish them as user generated content on specific emotional maps. This project explores tools that allow people to selectively share and interpret their own bio data. Within this framework, Nold thus investigates how the perceptions of a community in an environment change when they become aware of their own intimate emotional status.

Nold collected Galvanic Skin Response data, physiological responses commonly measured to objectively trace emotional arousal levels (Dindo & Fowles, 2008; Meehan, 2001) from approximately 200 voluntary participants, as they were walking around their cities, equipped also with a handheld Global Positioning System (GPS) device. Nold then "mapped" the GSR data at locations corresponding to the GPS route using coloured dots to produce "arousal" maps of the participant's experience.

Bio Mapping functions as a total inversion of the lie-detector, which supposes that the body tells the truth, while we lie with our spoken words. With Bio Mapping, people's interpretation and public discussion of their own data becomes the true and meaningful record of their experience.

This concept of a personal database of our own future possibilities is an alluring alternative vision for technology that resonates with Bio Mapping and runs counter to the way biometric technologies are currently being thought about.

Marcel van der Drift, in the text 'A Future Love Story' within the Emotional Cartography collections of essays by Christian Nold, extends this vision towards a not too distant future, where mobile phones sense and log our emotional state, sending the information to other people's phones. In this world, "self-reflection" on personal emotional behaviours is almost universally enforced by a mixture of technology, design and social peer pressure. The central question that emerges from the story is a question of choice. Who will interpret all these huge amounts of body/emotion data? Will it be interpretation software, other people's reactions or our conscious mind?

Perhaps, the most important aspect of **Emotional Cartography is the way in which it creates a tangible vision of places as a dense multiplicity of personal sensations, which we are not normally aware of** (Nold, 2009). The complexity and diversity of these experiences present a fundamental challenge to all our formal notions of the represented environment. Furthermore, the bottom-up process of identifying communal matters of concern, starting from personal sensations, suggests the possibility of an alternative body politic of place.

Geographic maps often appear to be among the more objective kinds of graphics. We think of them as representing in a rather direct way something in the world. However, as semioticians from Pierce and Saussure onwards have pointed out, words, maps or even pictures do not represent things, but shared ideas of things. Even so, the very form of a map, with its way

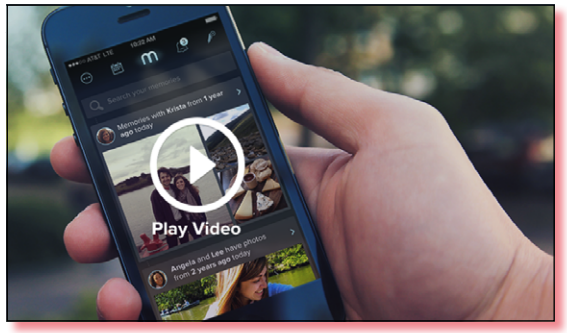
of viewing the world from an equal distance above all places, seems to carry a sense of objectivity. Contrast this with the strongly located stance of a perspective view: in such a view it is obvious that we are looking at

one viewpoint – literally and perhaps metaphorically – onto a scene. It is a place seen by an observer, while a map shows a place that seems to exist independently of being looked at.

To this regard, a conspicuous number of mobile applications with purposes of binding subjective contents to places and situations has already been designed, developed and launched in the market.

A review of the most promising one, and the explanation of Pleens' specificity follows:

→ **Yourmemoir**
http://www.yourmemoir.com/
"The Best Way to Collect, Share, and Relive Your



DESCRIPTION

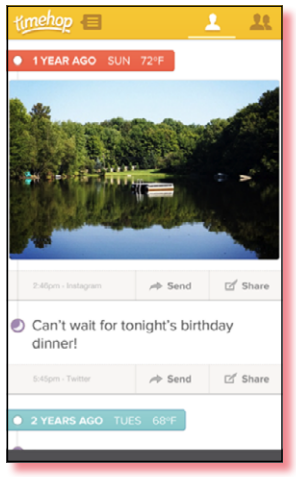
"Memoir is a mobile application that transforms your photos, the places you go, and your social media into memories that can be relived when they're most interesting to you"[23]

Memoir automatically finds photos from when you and your friends were together - in the present and from the past. As soon as you request them, the photos your friends choose to share with you become part of your Memoir. Within Memoir you can find memories and photos by people, places, dates, context, and more no tagging or organization required.

CONTENTS AND PLACES

Although it's interesting as a benchmark for mobile storytelling tied to time and places, the Memoir application is not meant to be a first hand sharing tool.

→ **Timehop**
http://timehop.com/
"A time capsule of you"



DESCRIPTION

As in the Memoir app, Timehop main's usage is to see your photos and updates from this exact day in history. Timehop shows old photos and posts from Facebook, Twitter, Foursquare, Instagram, Flickr and your camera roll photos.

CONTENTS AND PLACES

Although it's interesting as a benchmark for mobile storytelling tied to time and places, the Timehop application is not meant to be a first hand sharing tool.

→ **Findery**
https://findery.com/

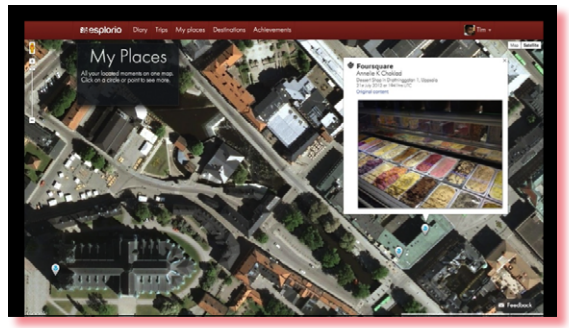
DESCRIPTION

Findery, the new location-based note sharing start-up from Flickr and Hunch co-founder Caterina Fake. Findery is a web-based tool that lets you take photos and notes from specific locations and tag them on a map anywhere in the world for other people to see and discover.

CONTENTS AND PLACES

Although the concept of Findery is very interesting, there is no mobile-application for the service, thus users can't share photos and notes in the moment and in the place they are taking them.

→ **Esplor.io**
http://home.esplor.io/



DESCRIPTION

Esplor.io is a web application that lets you record your travels, share your experiences and discover new places, instantly creating and sharing trips from moments already recorded on your other social networks.

CONTENTS AND PLACES

Although it's interesting as a benchmark for mobile storytelling tied to time and places, the Esplor.io application is not meant to be a first hand sharing tool; furthermore there is no mobile-application for the service, thus users can't share photos and notes in the moment and in the place they are taking them.

→ **Nostalgiqa**
http://nostalgiqa.com/

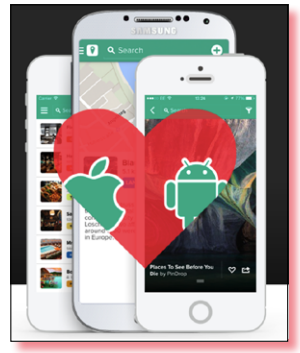
DESCRIPTION

Nostalgiqa is an iPhone Social media app that enables you to capture your memories and share them (or compile them privately, if you wish) with other users of the app.

CONTENTS AND PLACES

The concept behind Nostalgiqa is quite close to Pleens. Though, the Nostalgiqa interface is directed by an imposed structure that inhibits the instant wish to share contents related to places: the structure is that a "Memory" is made up of one or more "Fragments." Therefore, each fragment must have a parent memory and the sharing mechanism is strictly related to this imposition.

→ **Pindrop**
http://pindropapp.com/



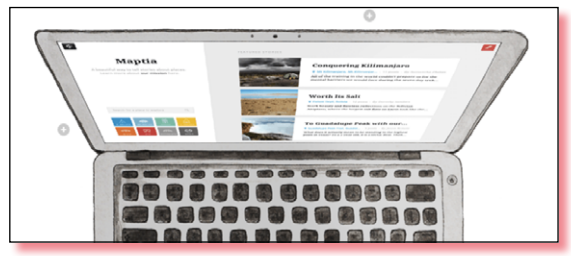
DESCRIPTION

Pin Drop is an iPhone app and website which helps people mark locations that matter to them. Users can drop their own pins or they can take inspiration from the curated lists feature. Each pin can then be assigned to multiple categories allowing users to build up a library of their favourite locations.

CONTENTS AND PLACES

Although it's interesting as a benchmark for mobile place-recording, Pin Drop user experience and interface is like Foursquare's: a check-in based app with sequential operations to be performed and no emotional sharing feature or storytelling features integrated.

→ **Maptia**
https://maptia.com/



DESCRIPTION

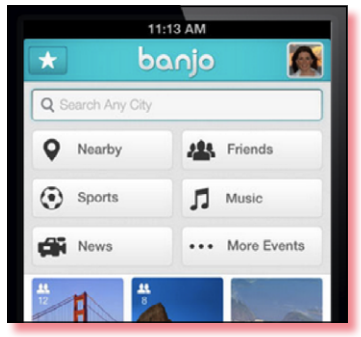
Maptia is a web service to write stories about places, with the general aim of building inspirational maps of the world.

CONTENTS AND PLACES

Although it's interesting as a benchmark for mobile storytelling tied to time and places, the Maptia application is not meant to be a first hand sharing tool; furthermore there is no mobile-application for the service, thus users can't share photos and notes in the moment and in the place they are taking them.

23 http://www.yourmemoir.com/

→ **Banjo**
http://ban.jo/



DESCRIPTION

Banjo is an online way to explore what's happening anywhere in the world right now. It is a real time discovery across social networks, Banjo integrates the largest social networks to provide an on-the-ground view of what's happening anyplace at anytime.

CONTENTS AND PLACES

Banjo is not meant to be a first hand sharing tool but it rather is an aggregator of second-hand contents.

In all of the presented platforms **geo-localization can be seen as an accidental and temporary feature, it's not the core of the sharing behaviour**.

Pleens conceives "the place" as indissolubly linked and tied to the story and the narration, like if it can be described as a piece of self written on a wall: something able to let us identify ourselves, rather than practical geographical information or a comment on a local spot.

Collective perceptions and the several meaning people attach to places are as fundamental as the personal geographic narratives; for this reason an emotional cartography is hardly represented by a map crowded of pins to click on: the story, rather than the support has to be the heart and the center of the whole user experience. **Pleens aims then at delivering both a rich, emotional and compelling sharing experience** (i.e. providing new sentimental way of digitally link narratives to places) **as well as a stunning discovery process, where users should get lost among the overlapping stories hovering geography and time.**

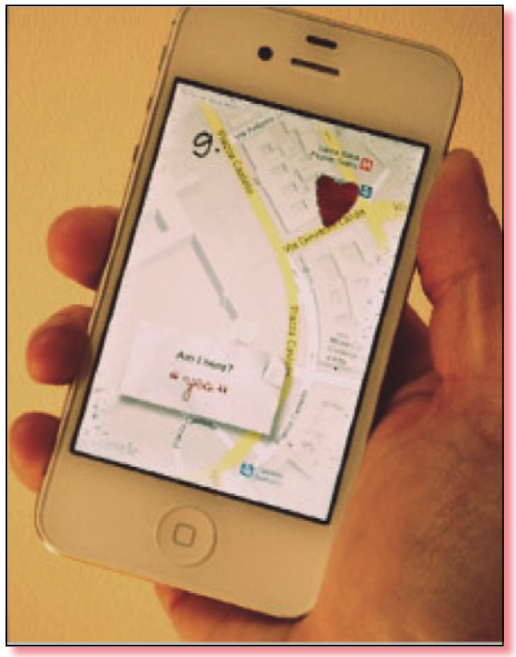


Fig.107 — Pleens: screenshot of the working application

6.3 THE USER EXPERIENCE AND INTERFACE DESIGN

As feelings are not quantifiable, as feeling are instinctive, as feelings never deal with numbers and sequential operations, we tried to design a very emotional interface with the idea that the aesthetic gesture and interaction should by themselves enhance and foster the willing to actually use it.

Thus, we see Pleens not as a check-in app, Pleens is not only about dropping a bookmark on a map, it is the unfolding of a narrative plot on the map, with the focus on the narrative passage able to overcome both the timeline and the mosaique of a social media interface. Unlike the plot of a novel, it has neither a beginning nor an end; it starts where you are (or where you are dreaming to be) and it develops in any directions. The individual position on the map is the "Once upon a time" which evolves through what we call the "place-line": a series of links self-enfolding as you move or click.

Fig.108 — Pleens user experience main steps

The design main stages explanations and the current version of Pleens-app's description follow.

The basic feature we designed and developed for the first Alpha version of Pleens focuses around the impulsive and emotional sharing of emotions related to places in the very moment you (user) feel this emotion and in the very place you are. Whether you are loving, hating or feeling passionate or disappointed when you are experiencing a place and you feel the urge to tell it to your beloved, to a friend with whom you were with in the place or just record this emotion for yourself; Pleens lite (alpha version we released in late 2012) lets you do this.

In Pleens, the "dedication" system refers to (and aims to establish) an "affective-tuning" at the time being. Thus, the user experience and the interface design are orientated **towards the impulsive need of sharing the emotion or a message related to a place: now, and here.**

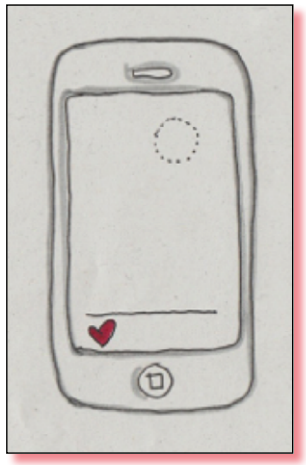


Fig.109 — First sketches, Pleens homepage

I used sketches a lot to visually imagine and share the design of Pleens Lite.

When you open the application a “white-paper” environment with a “pulsing” little red heart ready to be thrown out in space welcomes you. The layout is very plain and simple, but few elements have been introduced to suggest users how to play with it in the first place:

- The “pulsing” hearth inviting to be touched
- A very light visual reminder of where the heard should end up being (which after some testing has been removed, since users already understood what to do).

Fig.110 — First Sketches, throwing the hearth

The user experience of Pleens Lite can be described as follow:

> You simply throw a hearth,
> It falls on the map exactly recognizing where you are,
> You can choose which kind of heart just landed on your map... (is it about love? is it about passion? is your heart a broken one?)
> You can then dedicate it to anyone and add your own message, or just keep it and record it for yourself.
> And of course you can explore where and when your hearts have been beating.

Fig.111 — First sketches, exploration

In this first idea I was trying to explore possible ways of emotionally binding two profiles: the beloved one who you are mainly dedicating your Pleens to.

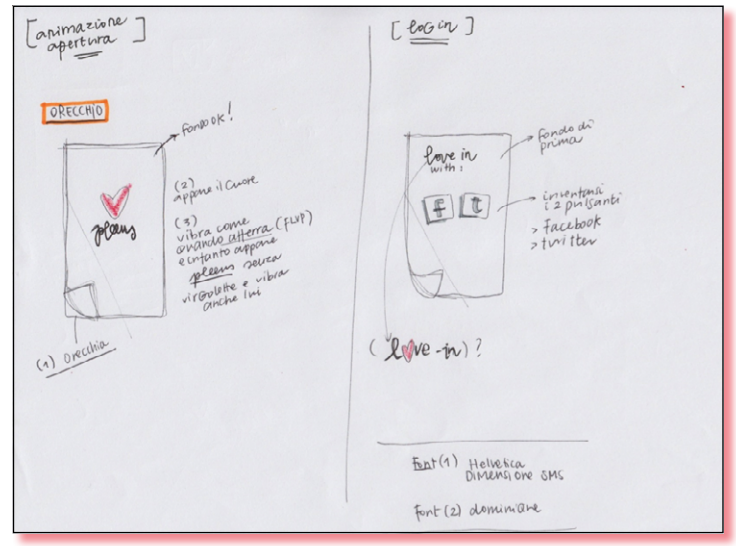


Fig.112 — Second Sketches iteration: opening the app

After the main user experience idea was designed and discussed with the partners, I then started to design each stage of the application, keeping in mind the very purpose

of distinguish Pleens from all the others geo-referenced related mobile apps, with a user experience and interface able to foster the creation of meaningful contents itself.

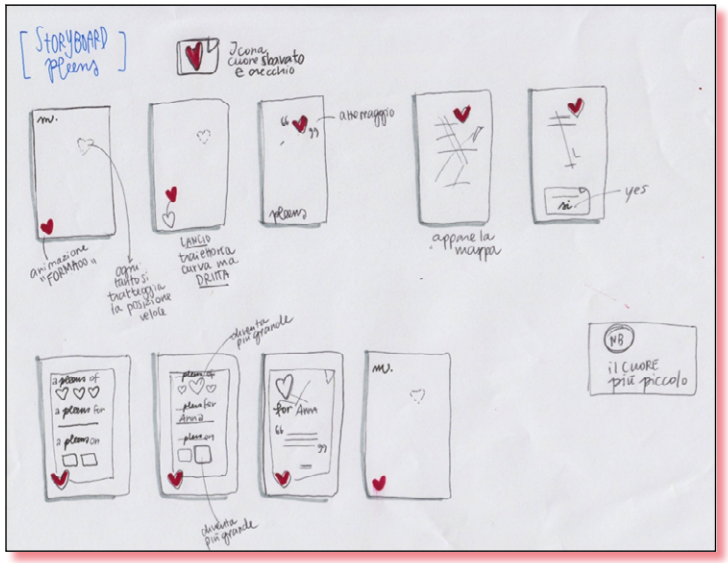


Fig.113 — Second Sketches iteration: Storyboard revised

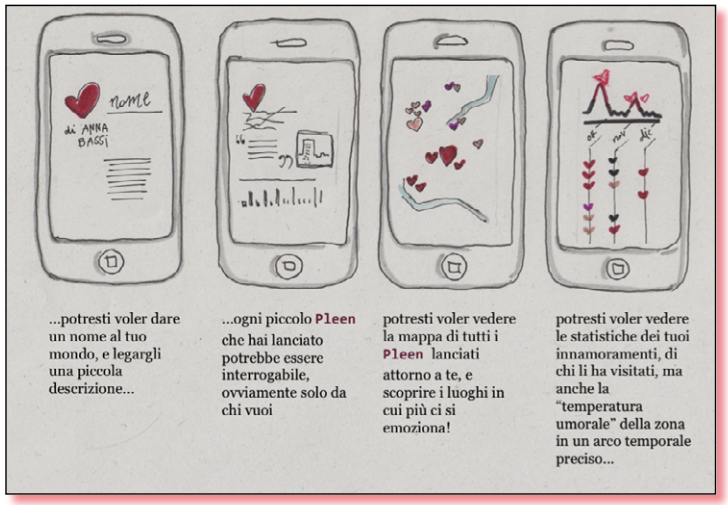


Fig.114 — Second Sketches iteration: visual exploration of other possible views

Even if within Pleens Lite we developed only the basic interaction possibility, I also started to imagine which possible other aggregations or explorations of the thrown hearth could be designed.

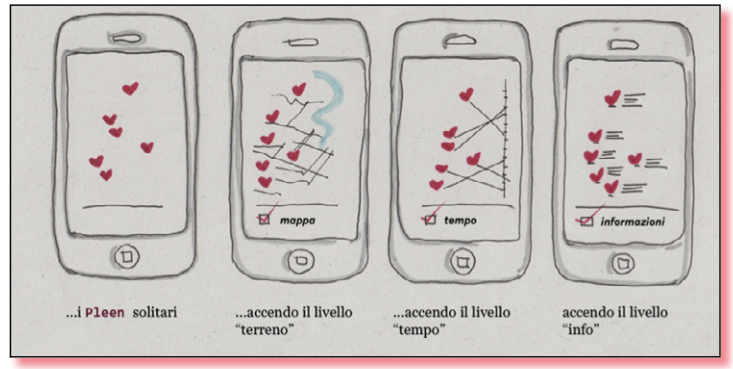


Fig.115 — Second Sketches iteration: visual exploration of other possible views

Fig.116 — Second Sketches iteration: visual exploration of other possible view

The user interface design attempted to create an “anti-check-in” like experience, no buttons and menus, no sequential operation to express your feelings and urge to share content.

Fig.117 — Third Sketches iteration: the visual language and flavour of the application

Once the User Experience was clear and approved, I started to conceive the visual mood and flavor Pleens should have had. After some initial sketches we paired up with Illustrator Michela Buttignol[24] for the visual layout. The bold choice of having an illustrator designing and defining the visual flavor of a mobile-app was driven again from the aim of keeping this digital experience as emotional as possible.

24 www.michelabuttignol.com

Fig.118 — Pleens visual design, exploration on the hearth shapes and colors[25]

We started by visually exploring the very element of the heart, and showed the digital drafts to several people of different ages and background to get their feedbacks and “emotions”.

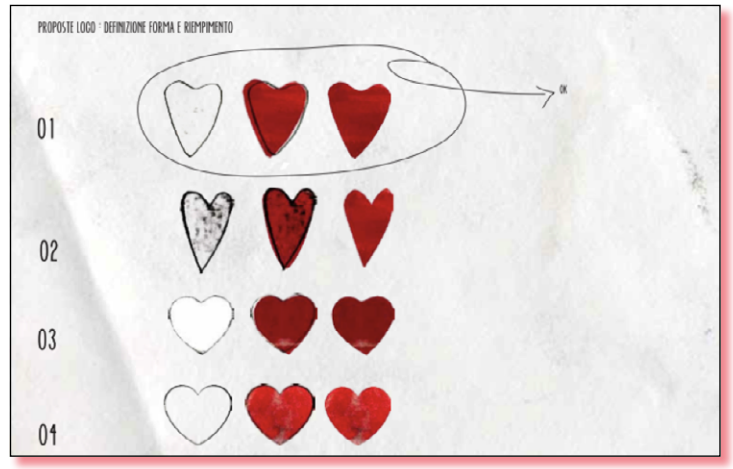


Fig.119 — Pleens visual design, exploration on the hearth shapes and colors

25 illustrations by Michela Buttignol

Fig.120 — Pleens visual design, visual identity

After a first selection of four main shapes, we all agreed on the selection of one of them that became the visual identity of Pleens.

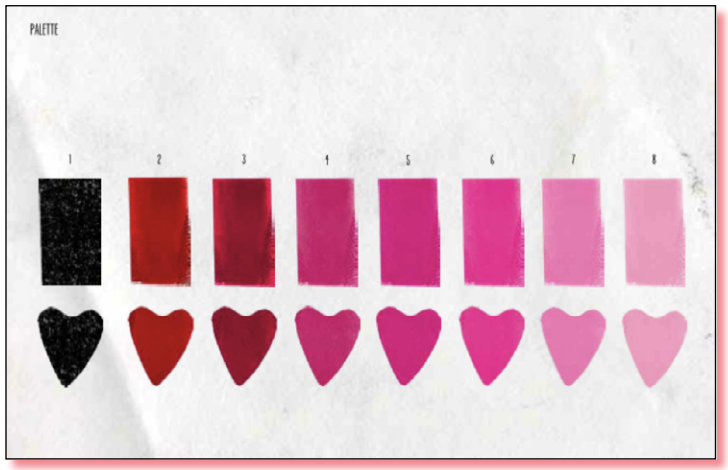


Fig.121 — Pleens visual design, colors exploration

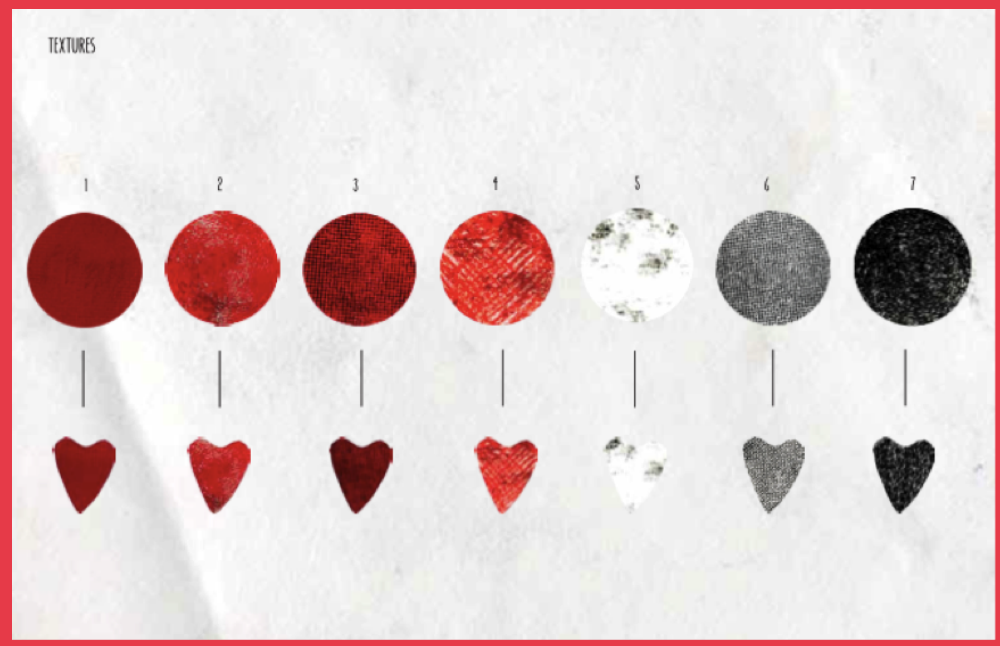


Fig.122 — Pleens visual design, textures exploration

Fig.123 — Pleens visual design, hearth “status” exploration

Since the heart shape is central for the overall user experience we deeply explored many possible declinations.

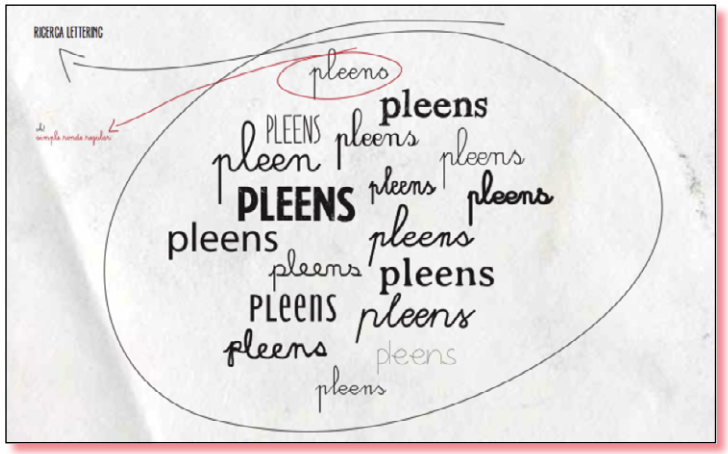


Fig.124 — Pleens visual design, fonts exploration

The font we used for the application is hand-designed as well.

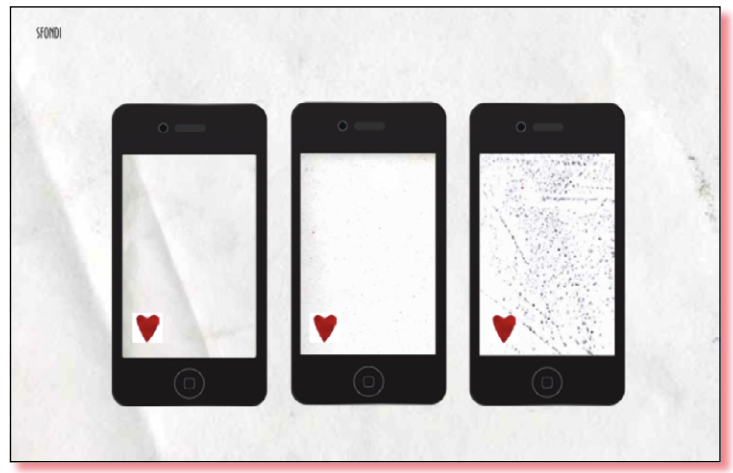


Fig.125 — Pleens visual design, backgrounds exploration

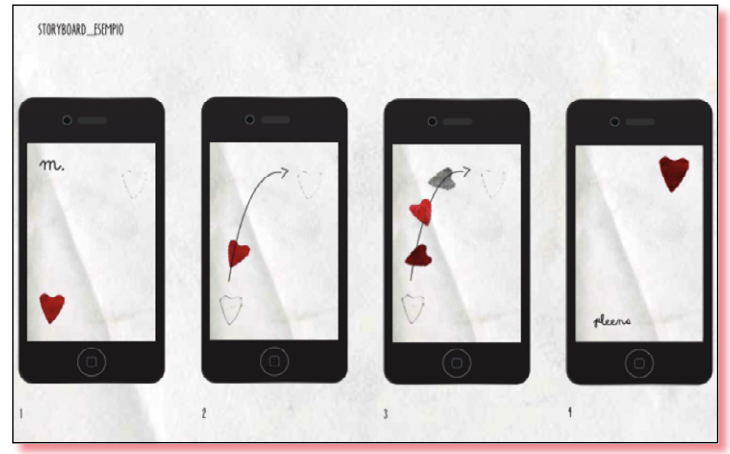


Fig.126 — Pleens visual design, digital storyboard 01

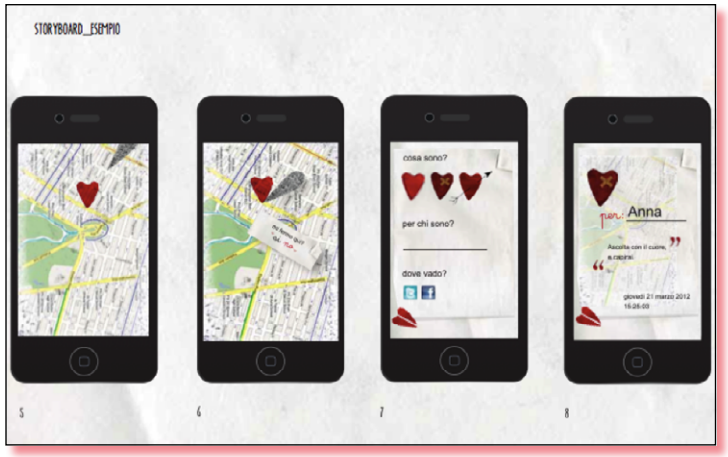


Fig.127 — Pleens visual design, digital storyboard 02

After the look and feel of the application has been decided, we started to develop the digital version of the storyboard for the interaction. Some details were added here such as a little “letter” indicating your name’s initial, which function as the access to the personal settings.

Fig.128 — Pleens visual design, hearth types exploration

Once the hearth has landed on the map, you have the possibility to change its mood just by clicking on it, until you find the right one.

Fig.129 — Pleens visual design, the thumbnail and icon of the mobile application

Fig.130 — Pleens visual design, Facebook and Twitter connector

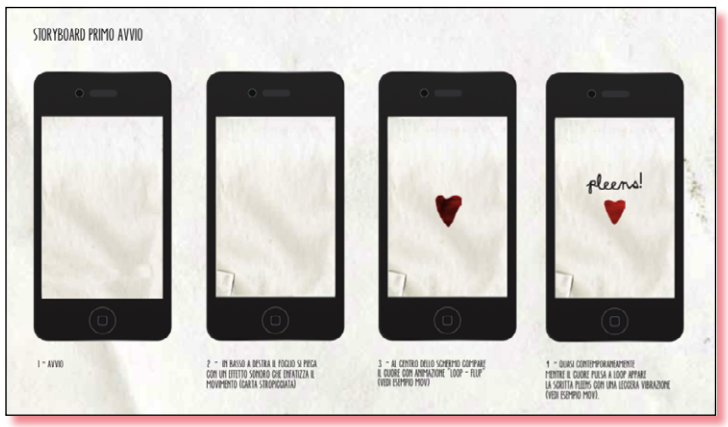


Fig.131 — Pleens visual design, launch of the application storyboard

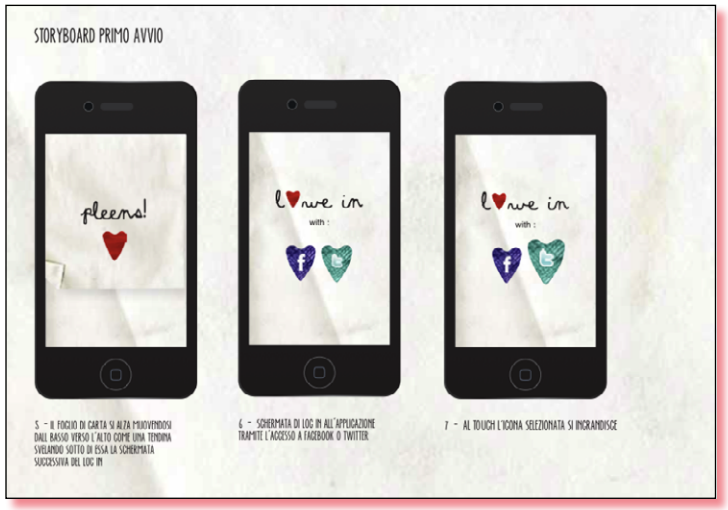


Fig.132 — Pleens visual design, first “love-in” screens

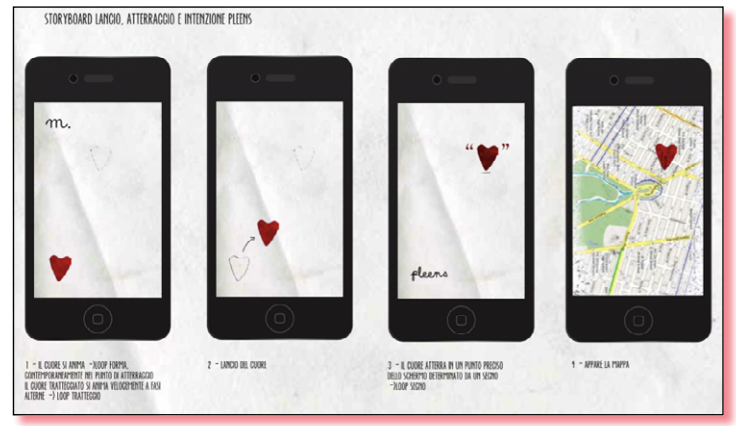


Fig.133 — Pleens visual design, final storyboard digital design

Fig.134 — Pleens visual design, final storyboard digital design

Pleens Lite is a native iPhone app that lets the user log in with a Twitter or Facebook profile and link a small message to a specific place, detected via GPS. The message is then sent along with the coordinates of the place to the Pleens datastore, and can be shared on Twitter, Facebook or via email.

Each message can be linked to an emotion, represented by different versions of the Pleens heart. The user can also access a map that displays all of his/her love-ins privately.

Screenshots of the current Pleens Lite working version follows.

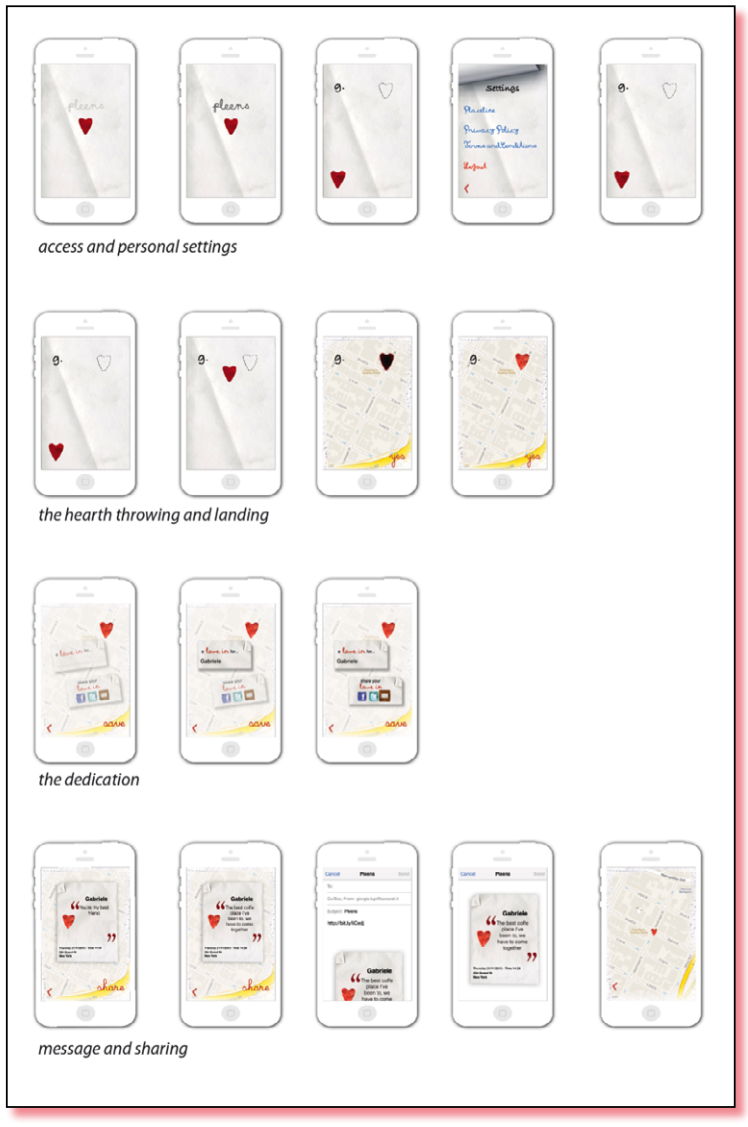


Fig.135 — Pleens visual design, the working app

Fig.136 — Pleens the web-app

We currently can monitor where, when, and what people share through a web application.[26]

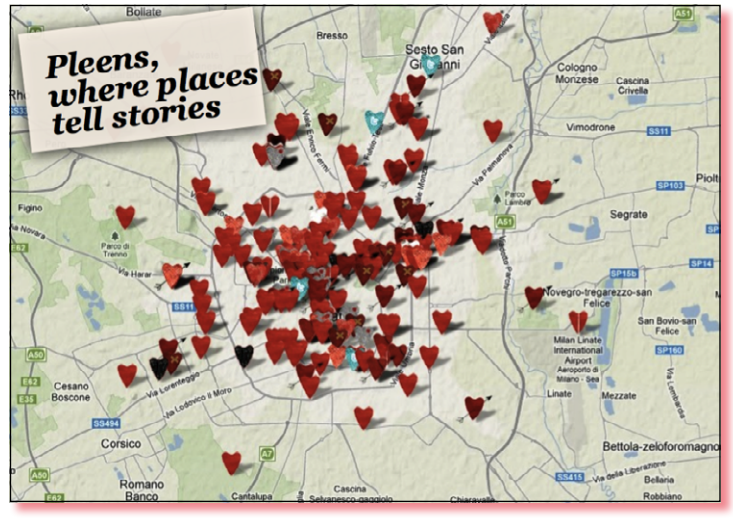


Fig.137 — Pleens the web app, screenshot on Milan

26 http://love.pleens.com/

Pleens lite is a limited functionality version we used to test the people's behaviours, their comments and feedback on the user experience and a potential market.

During 2014 we are planning to develop a second version of Pleens with more functionalities thanks to our involvement, along with Regione Trentino Alto Adige, Trento Rise and Engineering, in a E.U. funded research project.

6.4 SCENARIOS AND FUTURE WORKS

Pleens is a mindset, a way to reinvent storytelling in the uprising world of data design and performative algorithms.

"[We are living] a world in which algorithms are no longer or are not dimply instructions to be performed, but have become performing entities: actualities that select, evaluate, transform, and produce data. In this world, algorithms construct the digital spatio-temporalities that program architectural forms and urban infrastructures, and thereby modes of living. (...) These performing entities - algorithms - expose the internal inconsistencies that correspond to the proliferation of increasingly random data within it. Instead of granting the infallible execution of automated order and control, the entropic tendency of data to increase in size, and thus to become random, drives infinite amount of information to interfere with and to reprogram algorithmic procedures. These entropic bursts of data within computation add new information to the recursive functions of control, without becoming simply incorporated or used by the system (i.e. by transforming dissipative energy into information). This also means that algorithms do not exclusively channel data according to preset mechanisms of binary synthesis (0s and 1s), as they also enumerate the indeterminate zone between finite states. This new function of algorithms thus involves not the reduction of data to binary digits but the ingression of random quantities into computation: a new level of determination that has come to characterise automated modes of organisations and control. (...) My contention is rather that there is a concrete culture, an aesthetic and a mode of thought, specific to the computational production of new probabilities."

Luciana Parisi, "Contagious Architecture - computation aesthetics and space"

We like to think of Pleens as an enhancer of the generative logics through which digital data can reprogram the observed world; an algorithm able to embrace the irreducible and the unknown, and thus generate a fluid way of discovering.

The map/memory-based storytelling of Pleens will be unfolded in two ways:

- On desktop computers the navigation can be performed going from one point to another according to chronological or relevance criteria ,

- On smartphones and tablet it will notify you with a voice message, an alert or a vibration any time you are geographically close to significant place for yourself.

Users will be fed with stories depending on how close they are to significant places, on what is on their calendar, on the speed of their steps, on the weather, and on the time of the day and the time of the year.

Pleens allows you to create a bubble in which you can be contemplating your love or complaining about it, marking places and meeting other people's stories.

It can be a private bubble, a bubble for just two people or a public one, you can experience it just following the lives of others, you can invent it or recreate a story that you like.

We can then describe Pleens with 3 simple sentences:

"Pleens give people a reason to tell and share geolocalized memories"

"Use Pleens to remember where you were when significant things happened"

"If places could speak they'll ask you to tell stories on Pleens"

What you are doing is re-interpreting, creating new narratives from re-interpretation of a space of your city or the cities you visit, you are layering new meaning onto a place, publishing new emotional stories onto this place, writing on the physical world.

Pleens is a project in development: we have delivered a first release Pleens Lite for iOS 6 with those limited functionalities I enlightened and in the meantime we are dreaming of endless possibilities.

→ **credits**

Editorial curation: Filippo Pretolani @gallizio (gallizio editore)

Idea and Concept: Mafe de Baggis @mafedebaggis (gallizio editore)

Corporate identity, visual & Interaction Design: Giorgia Lupi @giorgialupi (Accurat)

Project Management & Problem Solving: Gabriele Rossi @gabrieleru (Accurat)

Illustrations: Michela Buttignol @michelabuttignol

Software Analysis & Architecture: Marco Vettorello (Accurat)

Application development: Riccardo Paolillo e Michele Orru

07

Reflections

Reflections

7.1 Considerations and methods
7.2 Shortcomings
7.3 Conclusions

7.1 CONSIDERATIONS AND METHODS

Throughout the entire research trajectory, I have instantiated a continuous conversation with a wide range of researchers and practitioners in urban design, planning and management.

The **insights emerged during these conversations structured the research process,** whose goal was clearly defined over time as the one of creating an open and flexible Urban Sketching Tool (and its pluggable, customizable qualities) that will offer practitioners and scholars the chance to further explore this field.

This software platform is not a finite product, but a collection of tools designed specifically to perform information-driven explorations of the urban environment: **data visualizations and interactive interfaces thus appear as essential tools** not only to explore and make sense out of big and heterogeneous amounts of data, but **to foster the generation of new questions among stakeholders** and to facilitate the dialogue between urban practitioners and the analysts that have a direct access to the raw data.

These considerations are based on the many insightful observations that arose during the different stages of the research, and **my role in this process has always been the one of a facilitator**; a designer who provides decision makers with the right tools to discover and test on the field the potential of User Generated Contents for any possible kind of urban analysis.

In order to shape these tools, as documented in the research, **several experiments** have been conducted, mainly during the development of the Telltale and *UrbanSensing projects. During the research process the ultimate goal of the experiments soon became the one of learning from real results what practices proved to be more successful and applying these very specific insights to the design of the rules that guided the development of the interfaces.

In this closing chapter I'm going to share my thoughts and comments regarding my discoveries, the problems I encountered and the possible solutions, the open questions and the shortcomings of the research, in the attempt to shade a light over the possible role of design in such processes and practices.

The direct experience with researchers and practitioners within the urban field and the consequent discussion of the processes involved in the development of tools to **generate new knowledge**, seen in the previous chapters, have led in fact to a **reconsideration of the role of design** and the nature of its collaboration with urban practitioners and computer scientists.

During the whole research process, the design experiments, the visualizations and the prototypes of interfaces have never been conceived only as final outputs, but rather as **important steps of the interpretative processes and discussion with practitioners**.

One of the key questions related to the process of analysis that lead to the experiments was how to identify a set of universal methods that can be used in different contexts to extract useful information from geo-referenced Social Media contributions. Different urban contexts and specific research questions and approaches require a careful reflection upon which indicators to extract from Social Media data and what strategies of analysis to apply.

When the research started it was oriented in **elaborating a set of guidelines;** the two methodological tools I presented in the previous Chapters (the matrix crossing topics of urban interest with metadata of Social Media services and the taxonomy of geo-referenced data-visualizations) both tried to elaborate them. These guidelines indeed offered insights on how to start the research process and have been **the grounding foundation for the conception and the design of the user interface of the *UrbanSensing platform**.

Specifically, the matrix helped in **organizing and merging all the information** and specific needs we run into during the design experiments and set up the initial goals for the platform in regard to the operations (such as specific queries and filters to apply) that users might need to perform.

The taxonomy of geo-referenced data-visualizations assisted in **suggesting the possible interaction models** and visualization strategies for different sets of information.

An **information design perspective** has then been tested and adopted during the whole research process:

- On a large scale, it implied choosing relevant contents and organizing them into separate directories by audiences and purposes,

- On a medium scale, it meant organizing the contents in brackets and building tools able to highlight relevant crossing points and clusters of information, making sure that all the information follows the organization principle, and producing tools (the matrix crossing meta-data with topic of urban interest, and the taxonomy of geo-referenced visual data) able to foster conversations among the partners,

- On a fine scale, it included the development of actual visualizations and interfaces' prototypes within the design experiment, to test the relevance of the data and to generate new knowledge.

Moreover, **sketches and fast visualizations and interfaces prototypes** have been crucial to foster the dialogues and to continuously exchange interpreta-

tions, models and ideas to move to the next step.

To this regard, the design approach and methods (such as fast prototyping and building visual tools to organize information) could be seen as the platform that allowed not only answering to some pre-defined questions, but more interestingly to generate new ones.

I used **hand-drawing** and sketching as a quick-feedback method to present scenarios within several collaborative sessions with developers and urban researchers.

I can argue that the act of drawing, the very production of a sketch or diagram in the context of scientific work is not free of cultural values and norms. It is a high-tension act, an act that demands the focusing of attention as well as a whole range of intellectual and practical techniques.

Drawings are thus snapshots of a process of knowledge product; a type of knowing that is based on a continuous interaction between making and observing, asking the correct questions and prototyping answers; that represents the most **valuable and distinctive contribution that design can to offer** to the urban fields for the time being.

The feedback collected from the researchers and practitioners engaged in these activities and first design experiments identified the possible **scenarios** for the types of analysis that can be performed through a visual analysis of this specific kind of data:

> Providing urban designers, planners, managers with data useful to identify some city dynamics, at least related to the segment of population that uses Social Media,
> Complementing traditional social research methods (qualitative and quantitative) with an easy-to-use tool that can be configured to analyze specific geographic areas and time periods,
> Supporting the exploration and the generation of new questions about the city, by the use of an interactive web platform where visualizations are conceived as a fundamental part of the investigation process, capable of grasping the attention of city's stakeholders, while stimulating the dialogue about the city current state and stretching the imagination on its possible futures,
> Helping a wide set of city stakeholders to discuss and share research findings through visualizations conceived to be coupled with languages commonly used to communicate urban plans and accessible to the a public of non-experts.

7.2 SHORTCOMINGS

The conversations over the experiments provided also interested feedback on the critical aspects of this approach: doubts arose regarding central aspects such as the **protection of individual privacy and the potential misuses of information,** the potentialities and foes of active participation and awareness, the **sampling representativeness** and generalizability, the **technical infrastructure limits** in handling big amounts of data, the limited **availability of connectivity**, and more in general the **effectiveness** of this type of data in highlighting unexpected and emergent behaviors.

These worries, problems and shortcomings highlighted through the first experiments provided the base for a more critical approach in the design of the visual solutions that drive the interaction in the platform.

Another quite commonly raised issue in discussions about the use of Social Media data is the **privacy**. In most of the design experiments we used data coming from users who were not aware of our project. In the experiment Urban Stories we showed how single user's movements in the city could be quite easily tracked. Although we fully respected the guidelines offered by each Social Media platforms in terms of privacy policy and in some cases we applied anonymization techniques, the platform could be easily used as an instrument of surveillance. The main issue here is that for the users it is impossible to recognize or control their interaction with the *UrbanSensing platform (Galloway 2004). As Galloway argues, making our platform 'visible' to the public and making people aware of its functionalities would be the first step to counteract the current unbalanced relationship.

The privacy and surveillance issue is also related to the current discourses about the 'smart cities' (Mitchell 2005, Foth 2009, Shepard 2011). One of the approaches – often the one sustained by private companies working in the IT and consulting field – is to see the potential of urban informatics as a way of monitoring, controlling and seamlessly operating the city. The idea of cities controlled by these sorts of urban operating systems has been presented in several envisioning videos such as the Productivity Future Vision (2011) produced by Microsoft. This techno-centric, top-down vision has been recently criticized (Greenfield and Shepard 2007; Ratti and Townsend 2011). As Ratti and Townsend argue: "Rather than focusing on the installation and control of network hardware, city governments, technology companies and their urban-planning advisers can exploit a more ground-up approach to creating even smarter cities in which people become the agents of change" (Ratti, Townsend 2011: 44).

In a way, we see how Social Media data analyses could be a component of a more ground-up approach, but at present they are still too 'invisible' to the final users to be used as a tool of collaborative, active intervention in the city making and administration.

How results coming from Social Media analyses could be used by people and institutions working on urban design, planning and management is also affected by another important element. Some previous projects – such for example the Customer Relationship Management System (CRM) developed in Boston under the administration of Mayor Menino – illustrate how technological platforms can harvest citizens' notifications on Social Media, for example complains about potholes or graffiti (Crawson and Walters 2013). In this specific case, citizens can use Twitter (@CitizensConnect or @NotifyBoston) to open a communication thread with the city administration. The CRM of the city of Boston gathers all these notifications, sends them to the specific department in charge of the problem and produces notices of follow-up and work completion. This CRM sets a collaborative platform where the users can actively contribute to the city administration by signaling problems. There is a clear intentionality here: users are aware of the CRM and deliberately decide to contribute.

In the case of the design experiments, we do not only collect users' contributions related to the context of their use and perception of the city, but all kinds of contributions, such as private comments or conversations with friends that are completely unrelated to urban issues. In most of the contributions collected in our platform, there is no intentionality from the users to post a tweet, share a picture on Instagram, check-in at Foursquare as actions that influence urban planning and management processes. This lack of intentionality can undermine the potential of our platform as a bottom-up component for participatory processes.

Another important shortcoming of platforms oriented towards Social Media data analyses has been clearly identified by Jeroen Barendse, founding partner of LUST, one of the SMEs participating to *UrbanSensing: "You can analyze a lot, but not everything is of course quantifiable. Therefore the system needs to take that into account, and play with the awareness of that in order to create for instance meaningful narratives".

Barendse also points out that these kinds of platforms should take into account the engagement of the final users as a crucial component of the process**. These platforms should therefore be carefully and repeatedly tested** – also in contexts of use – **to see if they can be integrated in the daily workflow of final users such as urban planners or city administrators**.

Another problematic area is connected to the **distribution of devices** (mostly smartphones and tablets) **that allow posting geo-referenced contributions on Social Media.** Not all the city inhabitants and users have equal access to technologies and skills to post such contents. The Portio Research (March 2013) shows that at the end of 2012 in Europe only 30% of the population used mobile apps. In North America, the percentage was even lower (18%). As the already cited 2012 Nielsen Report on Social Media shows, younger generations are the ones who are more familiar with Social Media platforms and use them on a regular basis. These users do not represent the entire spectrum of city inhabitants and users. There are serious concerns that - due to cultural, social, economic factors – the regular contributors on Social Media cannot fully represent the whole diversity of urban experiences.

Whilst in the future it is foreseeable that the market penetration of mobile devices will increase and thus a larger share of population will be able to use Social Media, doubts remain that a sustained and balanced participation of more and (presently) less influential subjects will be achieved. The increasing number of devices connected to Internet will definitely **intensify the gravity of issues related to privacy and surveillance.**

Another issue is **the need to have robust and scalable technological infrastructure**s in order to install and run the platform. In order for the *UrbanSensing engine to collect and process large quantities of data, powerful machines and therefore significant investments in terms of economic resources are needed. This can constitute an important barrier for the use of the platform.

Another factor that affects the accuracy of geo-located Social Media analyses are the specific settings of the mobile devices through which the users access Social Media platforms. In some cases, for example, some users might prefer to post on Social Media platforms only when they are connected to a WIFI network. Not all the users have data plans with mobile operators that allow a constant Internet connection. In some situations, users still have to pay high prices for Internet access. Tourists visiting a foreign country might not always have data plans that allow Internet access at reasonable costs. In these cases, they might still travel with their smartphone and use it for example to take pictures or notes to be shared at a later stage, when they access a WIFI network (typically, either a free or public one or the one at their hotel). Obviously, the distribution of these WIFI networks in the city affects the geographic dimension of Social Media analyses as a large number of contributions might emerge in areas where accessible WIFI networks are located. **Further iterations of our technological platform will try to take this factor into consideration, for example map-**

ping the positioning of free WIFI networks in the areas we are investigating.

On the overall, the most frequent critique that emerged from the initial feedback was related **to the quality of insights offered by the analysis** on the city of Milan and, more specifically, to the fact that some of the insights emerging from the analysis **simply seemed to confirm already well-known city dynamics** (i.e. most lively areas in specific moments of the week and of the day).

During the initial co-design sessions for the *UrbanSensing project we mostly presented the platform to researchers and professionals with a high level of knowledge about the city dynamics and therefore we fully understand their concerns. In these cases, we argue that the algorithm behind the *UrbanSensing platform can still offer novel insights to these users by monitoring differences in city practices or uses (producing automatic alerts when new behaviors emerge, for example unusual spikes of tweets in a specific area). In any case, we acknowledged the critique that more complex spatial aggregations of Social Media data are needed if we want to gather insights on specific questions of urban interest.

The simple concentration of contributions is not enough to evaluate complex urban phenomena and there is the need to harvest more and more granular information, also from different sources (time-stamps, Open Data, data from mobile applications or distributed sensors...).

7.3 CONCLUSIONS

As a result of the research I am deeply convinced that processes behind the collection, analysis and visual representation of Social Media data have **the potential to let multiple voices and perspectives emerge at an urban level** and – in this perspective – the platform and the analyses presented in the thesis can lead to more inclusive processes of urban design, planning and management. In order for this potential to be fully exploited, it is important to maintain a critical approach and accurately ponder the many open issues of this research domain.

From a research perspective, most of these comments I received actually **validated the potential of these data-visualizations to capture existing city dynamics**.

The fact that many known specific aspects of how a city is lived were faithfully highlighted by our experiments represents an important validation of the possible uses of Social Media data in urban analysis.

Moreover, a broader public that not necessarily possesses a prior knowledge of the investigated city dynamics can also access the results produced by the platform and benefit from its analyses. Most importantly, the platform and the analyses approach can be easily adopted by different institutions and subjects and replicated in different contexts, thus helping in comparing different cities or geographic areas.

In conclusion, we can state that for more inclusive and harmonic decision-making processes (Healey 2007), it is necessary to get to a balanced interplay between the institutional knowledge possessed by urban government authorities and the local knowledge held by different groups of city users that look at the urban environment through their daily experience. This equilibrium depends on the condition that all the city stakeholders have access to adequate forms of expression, investigation and critique. Possibly, the Telltale and *UrbanSensing platforms are a first step to implement tools that gather and foster conversations across these different kinds of knowledge trying to level up some existing asymmetries.

This confirms that **any platform we can design for these kind of analyses should be conceived as a flexible environment** where – instead of having sets of pre-defined indicators – **users can plug their own data streams, decide their strategies of analysis, their indicators, how to map them and how to visualize them.**

It is here that the real potential of Social Media data analysis and visualization emerges: not as a series of easy recipes to be automatically (and uncritically) applied in different contexts, but as a set of tools that must be applied with a carefully personalized research strategy.

Designing sound interfaces to allow practitioners to perform their query is of course an interesting challenging for designers to adopt, but the possibility to participate in the definition of new knowledge and new questions, as well as the design of shared languages to communicate trough seems definitively more compelling.

Thus, designers, developers and urban practitioners shouldn't limit their collaboration in a co-participate design of tools, **since the tool is not the very goal**. They instead should start sharing their languages, the ways they operate on a daily base, their interpretative angles creating new forms of thinking that can be generated only if the different approaches and skills are exposed and integrated; and the two main projects (Telltale and *UrbanSensing) I actively participate in as a designer strongly confirm this statement.

Moreover, they demonstrated that it's impractical to avoid temporal overlaps between the research activities: **in such complex projects the research proceeds through experiments, observations, the posing of some questions, the proposing of some answer and the fine tuning of the previous questions in a constantly iterative process.**

Appendix

Appendix

[1] Big version of the matrix presented in Chap 2 (Fig.31 — matrix crossing topic of urban interest with geo-referenced Social Media data)
[2] Entire catalogue of case-studies collected on scoop.it online
[3] Big version of the taxonomy presented in Chapter 3 (Fig. 43 - Categories definition: bibliographical validation of qualitative initial set of categories cording to: J.Campbell, R.Harris, J.Heer and B.Shneidermann, J.Bertin, W.Bevington.)
[4] Big version of the design space presented in Chapter 3 (Fig 44. - Design space analysis of geo-referenced data-visualizations)

[1]

Big version of the matrix presented in Chap 2 (Fig.31 — matrix crossing topic of urban interest with geo-referenced Social Media data)

Available metadata

Granularity of data and common fields

Social Media service specificities

info on the place		id: unique string identifier for this venue	location_id: (not always included) if the chosen location corresponts to a foursquare venue	user_location: not always included		available metadata from the social netwrk API
	place_name: name of the location associated to the tweet (not always included)	place name: The best known name for this venue.	location_name: (not always included) users may choose to name the location			
		address				
		zipcode				
		city				
	place_country :name of thecountry associated to the tweet (not always included)	state				
		category: An array, possibly empty, of categories that have been applied to this venue. One of the categories will have a field primary indicating that it is the primary category for the venue				
		checkinscount: total checkins ever here)				
		userscount: total users who have ever checked in here)				
		tipcount: number of tips here				
		verified Boolean indicating whether the owner of this business has claimed it and verified the information				
		likescount: numbers of like here				
		hereInow: "Optional information about who is here now. If present, there is always a count, the number of people here.				
		created_at: Seconds since epoch when the venue was created.				
		mayor: mayor username and number of check-ins				
		tips: : Contains the total count of tips and groups with friends and others as groupTypes. Groups may change over time.				
		tags: keywords (tags) associated with the venue				
		url: Optional URL of the venue's website, typically provided by the venue manager.				
		description: Optional Description of the venue provided by venue owner				
	latitude: coordinate	latitude: coordinate	latitude: coordinate	latitude: coordinate		
	longitude: coordinate	longitude: coordinate	longitude: coordinate	longitude: coordinate		
info on the content				dateuploaded: timestamp when picture has been uploaded		
	date: timestamp		datetime: timestamp	datetaken: timestamp when picture has been taken (not always included)		
	id_tweet: unique value for each tweet					
	language: user profile language					
	text: tweet content		text: textual content (if included)			
				title: picture title		
	user_id: unique value for each user		userid: unique value for each user			
	screen_name: unique user's name		username: user's name	username user's name		
			user_fullname: user full name	realname: user full name		
			tags: keywords user associated to the picture	tags: keywornd user associated to the pixture		
			likes count: number of likse to the picture			
	retweet_count: eventual number of retweets					
			link: picture url	url: picture url		
			comments count: number of comments for each picture			
	*** each tweet returns:**	*** each VENUE returns:**	*** each picture returns:**	*** each picture returns:**		
	accurate		accurate	double: (1) when picture has been taken - accurate but not always included; (2) when picture has been uploaded (accurate and always included)	**timestamp**	
	precise geolocalization, not always included	precise geolocalization, always included - unique for each place, each place belongs to a unique category (tipology)	precise geolocalization, always included	precise geolocalization, not always included	**geo-localization**	
	user id + user language + user origin (sometimes)	no	user id	user id	**user profiling**	
	140 characters, qualitative content, not specifically related to a place	text appears with the description of venues and on comments on the venue (text is very related to the place)	text appears with the comment / title of the pictures, the tags, other users' comment (text is related to the situation or place depicted)	text appears with the comment / title of the pictures, the tags, other users' comment (text is related to the situation or place depicted)	**semantic: text content**	
	(1) text, content	(1) place	(1) picture of a place (moment, situation)	(1) picture	**main focus** (users' sharing behaviors are enlightened through a ranking)	
	(2) link	(2) place typology	(2) comment and like	(2) tag (keywords, users)		
	(3) quoting other users	(3) comments on place	(3) place	(3) place		
	(4) place					
	microblogging / Twitter's main use is communicating contents, sharing links of interests and communicate with other users.	**localization** / Foursquare's main use is to share and show personal realtime location, where locations (venues) are categorized and recognized by the community, each user could also insert comments on and pictures of the venue	**qualitative geolocalization** / Instagram's main use is to share realtime situations (pictures of moment and places) through uploading a picture and (eventually) a comment	**photography sharing** / flickr's main use is to share amateour or professional photographs (landscapes, lifesyles, portraits...), pictures are somewhen geolocated, the most of users don't upload them realtime (via mobile)	**main use of social network**	

Urban Questions

urban areas	issues	specific topic		TWITTER	FOURSQUARE	INSTAGRAM	FLICKR	other data sources to integrate (to better address the question)
fruition of territories	landmarks, p.o.i	*is it possible to identify some novel landmarks? which are the places from where people contribute the most? which are the most depicted places in the city, and what does it means? is there any difference between places photographed by locals and by tourists?*		number of tweets for each place in a pre-defined timelapse / users' profiling according to language or origin place (if included in user profile) + user profiling according to number of tweets and followers	number of check-ins for each venue in a pre-defined timelapse	number of pictures for each place in a pre-defined timelapse / number of likes on pictures in each place / users' profiling according to places he/she contributed the most from + user profiling according to numbers of comment and likes	number of pictures for each place in a pre-defined timelapse / number of likes on pictures in each place / users' profiling according to places he/she contributed the most from	
	way of using public spaces	*what is that make people talk about an area? (Shopping? Theatres? Its food scene?) How many different activities make people talk about an area? How many thematizations are possible in a Ho do things change over time (on a daily, weekly, monthly and yearly base)?*		number of tweets for each place in a pre-defined timelapseper luogo in un arco di tempo definito / analysis on main subjects (words) on the text / temporal comparison of results	number of check-ins for each venue in a pre-defined timelapse / prevalence of certain categories in an area	analysing places with the highest number of pictures in an area / temporal evolution		
urban perception	emotions and places	*is it possible to draw a map enlightening people's emotions related to places? where people are scared? where are they happy? where are they melancholy?*		sentiment analysis of text content in different places	sentiment analysis of the comments of a venue	for a positive attitude: analysis (manual) of pictures with the highest number of "like"		
	displacement	*Which are the most named places and where are they named? Are they mostly named where they are located, or are they named from other places?*		extracting toponyms from tweet contents and relating them with the origin (lat long)of the tweet				
	city, suburbs and outskirts	*where people recognize a territory as peripherical? Which are the boundaries of the actual "center" of the city, as named by people?*				plotting on the map places tagged (recognized) with the name o af city or a neighborood / overlappingwith administrative boundaries	plotting on the map places tagged (recognized) with the name o af city or a neighborood / overlappingwith administrative boundaries	
	wellbeing and urban quality	*what are the public's perceptions of a few central elements often associated with "good"government and thus high livability of a city? Is it possible to identify the characteristic of places where people are happy?*		textual and sentiment (manual) analysis of tweet contents, construction of indicators (overlapping with CENSUS data)				census data / socio-economical and demographic indicators per area
city times	the city as it evolves through time	*which are the parts of the city that pulse in the morning? which ones reveals themselves the most at the evening?; Are there patterns we can recognize everyday? are there differences between week-days and weekends?*		spatially locating tweets posted over the same period of time (hours of the day, days of the weeks...) / users' profiling according to language or origin place (if included in user profile) + user profiling according to number of tweets and followers	(to verify according to the limits of query per hours that could be done on the API)	spatially locating pictures posted over the same period of time (hours of the day, days of the weeks...)		
mobility	city paths and urban nets	*is it possible to find places that are linked together in users' habits? which are (and where are) the places that attracts the same people?*		selezione degli utenti che condividono da un luogo ed analisi degli altri luoghi da cui condividono abitualmente o prima / dopo essersi recati nel luogo di interesse		selezione degli utenti che fotografano da un luogo ed analisi degli altri luoghi da cui fotografano abitualmente o prima / dopo essersi recati nel luogo di interesse		
the temporary city	monitoring temporary city users	*is it possible to know where are daily commuters from?*		analysis of the profile origin of users that regularly tweet from a selected places		analysis of the profile origin of users that regularly post pictures from a selected places		
	special events	*Where are people from during a special event? How many tourists are talking about the event? how different profiles distribute themselves within the city during a spread event? From where people talk about the event the most? Moreover, with keyword based analysis we can intercept how (when, and from where) people talk about the event even before and after it. Which brands / commercial places / people / entities / organization are named the most? which are the other places in the city that popp up during the event?*		analysis of tweets over the selected timelapse of the event / analysis of tweets in the area of the event / users' profiling according to language or origin place (if included in user profile) + user profiling according to number of tweets and followers // comparison with an ordinary timelaps	number of check-ins for each venue in the event area / analysis of the most common categories / comparison with an ordinary timelaps	number of pictures in the event area and in singular places / comparison with an ordinary timelaps		
social pheonmena	ethnic groups	*where are specific ethnic groups contributing the most? can we identify unexpected concentrations? how they differ from each other?*		georeferenced tweets divided per languages / distribution over the selected timelapse				
	gentrification	*is it possible to predict emergent (unexpected!) areas where people is moving to?*			monitoring new venue creation			
urban planning and policy making	mapping citizens' needs	*is it possible to understand which infrastructures, public services, events or activities people would need and desire?*		conversational analyis of the tweet content pre-selecting a list of keywords				
	acceptance / feeling toward local policies and urban interventions	*would it be possible to understand how the population react to new policies? How are people talking about a new proposed policy intervention, what terms are associated with the public interest issues such as quality of the public transport service? Moreover, does the whole of the population react the same? Can we enlighten differences among different ethnic groups, social groups, profiles and gender, ages, or from people who inhabits different part of the city?*		sentiment analyis of the tweet content pre-selecting a list of keywords				

foursquare categories

- Arts & Entertainment
- College & University
- Food
- Professional & Other Places
- Nightlife Spots
- Residences
- Great Outdoors
- Shops & Services
- Travel & Transport

vertical rows:

- twitter
- foursquare
- instagram
- flickr

potential crossings = how to inquire social media services to answer questions and specific issues

APPENDIX

[2]

Entire catalogue of case-studies collected on scoop.it online

→ **Datascaping And Designing With Information | #dataviz #urbanism**
Publication date Sep 5, 2013

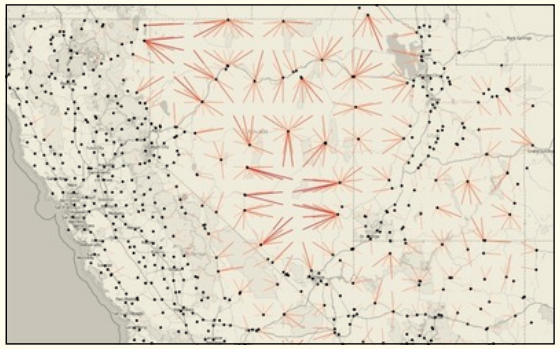
DataAppeal software provides an alternative to complex mapping tools through an easy to use, web-based GIS application that renders typical data files into beautifully designed multi-dimensional maps and datascapes instantly. For architects, landscape architects, urban planners and designers of the built form, the application is a great tool to utilize evidence-based information to expose new site patterns, to provide alternative 3D modes of mapping for communication purposes, and to aid in the initiation of master plan designs.

Link: http://www.architizer.com/blog/datascaping-and-designing-with-information/#.UesmO2TOt4U

→ **In search of food deserts**
publication date Aug 28, 2013

In search of food desert represents the distance between grocery stores in a sample of locations within the US. For example, in areas with a lot of lines headed to one spot is an area with fewer grocery stores. In contrast, mostly small line segments mean more grocery stores, and therefore less distance to travel to buy groceries. Places where residents have limited access to grocery stores are called food deserts. However, there's no exact definition of what limited access means or what a long distance is. Some set a 10-mile marker whereas others say a store should be less than a mile away where there is a lot of pedestrian traffic.

link: http://flowingdata.com/2013/08/27/in-search-of-food-deserts/



→ **Block by Block, Brooklyn's Past and Present**
publication date Aug 1, 2013

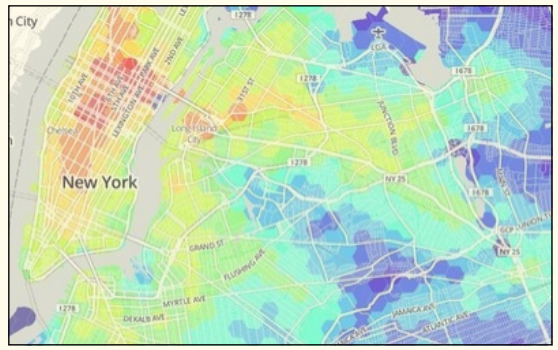
Brooklyn's Past and Present is an interactive visual tool to explore depth stories about Brooklyn 's buildings through time. The database displays 320,000 buildings in Brooklyn, plotted and shaded according to its year of construction. The result is a snapshot of Brooklyn's evolution, revealing how development has rippled across certain neighborhoods while leaving some pockets unchanged for decades, even centuries.

link: http://bklynr.com/block-by-block-brooklyns-past-and-present/

→ **Transit Time NYC**
publication date Jul 10, 2013

Transit Time is an interactive data visualization displaying travel times from any point in NYC to everywhere else via subway or on foot. New York city map is divided into 2,930 hexagons and the system calculates the time it would take to travel by subway and walking from the center of each hexagon to every other using OpenTripPlanner and the MTA's subway schedule data. Each trip has been simulated as starting at 9 a.m. on a weekday.

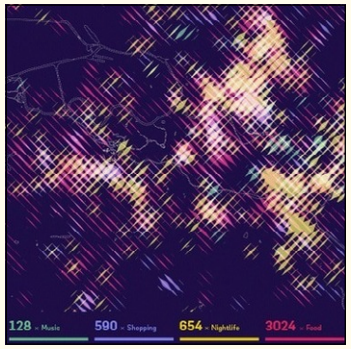
link: http://project.wnyc.org/transit-time/#40.73061,-73.98674,12,1450



→ **Well-formed data » Stadtbilder — mapping the digital shape of cities**
publication date May 25, 2013

The maps show an overlay of all the digitally marked “hotspots” in a city, such as restaurant, hotels, clubs, etc. collected from different service like yelp, or foursquare. What they don’t show are the streets, the railroads, the buildings, in fact the main idea was to portray the living parts of the cities as opposed to the technical/physical infrastructure you usually see on maps. The only exception are the rivers and lakes, because author felt they help a lot in orienting on these fairly abstract maps.

link: http://well-formed-data.net/archives/920/stadtbilder-mapping-the-digital-shape-of-cities



→ **ChoiceMaps: A New Way to Measure Neighborhoods - Walk Score Blog**
publication date May 8, 2013

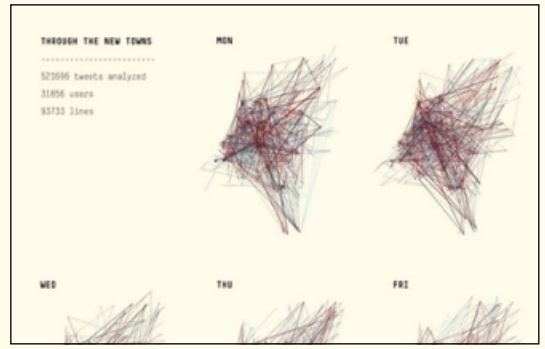
ChoiceMaps is an interactive interface that measure walkability index by blocks in the cities of New York, Washington DC, Chicago, and Seattle. To perform this analysis, the system uses the Travel Time API to compute 32,000,000 walking times for 8.2 million people to over 21,000 restaurants, in real time. Aggregated trends can be visualized as well, and Walk Score can be used to track the percentage of residents who can access various amenities — and how this changes over time, highlighting whether a neighborhood is becoming more or less walkable or how public transit service is increasing or decreasing.

link: http://blog.walkscore.com/2013/04/choicemaps-new-way-to-measure-neighborhoods/

→ **New Town Traces | *UrbanSensing**
publication date May 6, 2013

The visualization shows the routes of people passing through the New Towns throughout their day. The lines that connect the cities contain the text of the tweets, and the color of the letters represents the time of the day when the tweet was posted.

link: http://urban-sensing.eu/?p=670

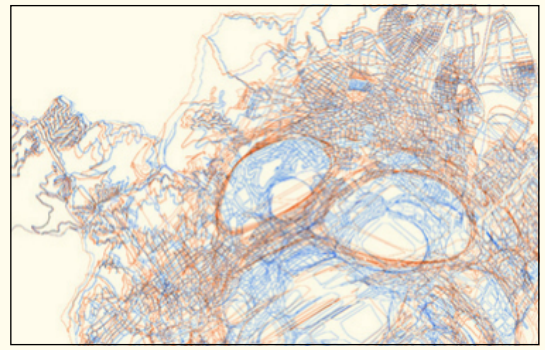


→ **atNight**
publication date Apr 9, 2013

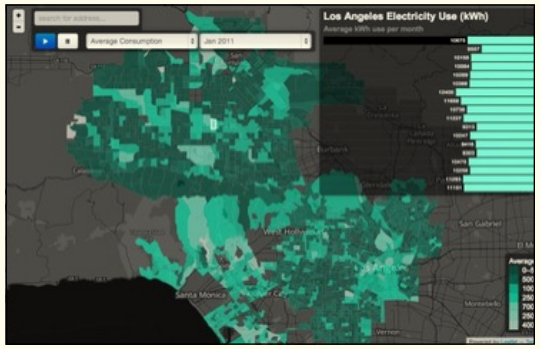
atNight project aims to be a first step towards building the image of the night: a first contribution to the (re)definition of the nigh-time identity. The website contains a large series of maps that each reveals a specific ‘hidden’ structure of the city. The map themselves are based on geolocated information retrieved from various data sources, such as Flickr, Twitter, Instagram, taxi locations and Google Places.

The main visual filter throughout all the maps is the contrasting of day time versus night time, as the ultimate goal of the project focuses on the creation of ‘nightscapes’, the visualization of the city organization by night.

link: http://atnight.ws/



→ **LA Electricity Consumption Map**
publication date Mar 29, 2013
LA Electricity Consumption Map is an interactive map of energy consuption in LA. Users can hover over block groups on the map to see electricity usage (kWh) over time, click on block groups on the map to zoom in and show land use, income, year built, and Block Group square meters; and switch between average use per month and percent change from one month to the next. Animating the usage over time is also possible by clicking on the play button.
link: http://sustainablecommunities.environment.ucla.edu/maproom/index.html



→ **Tweetping**
publication date Jan 29, 2013
Tweet ping displays the twitter activity in real-time with statistic data divided per continent and highlighting the top words mentioned within tweets, as well as the last hash tags and mentions in time.
link: http://tweetping.net/#

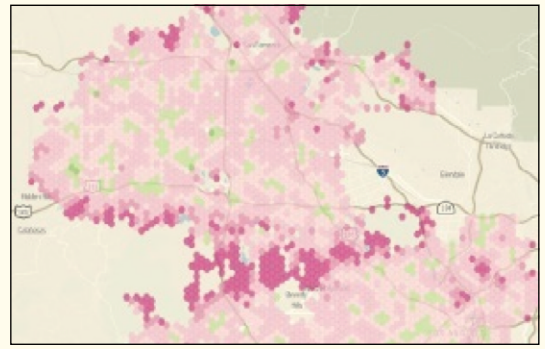
→ **Britain's Royal Navy in the First World War - animated**
publication date Nov 29, 2012
This visualization maps 1 million WWI Royal Navy locations transcribed by the citizen scientists of Old Weather and animated through time since 1913.
link: http://www.guardian.co.uk/news/datablog/interactive/2012/oct/01/first-world-war-royal-navy-ships-mapped

→ **Flooding and Flood Zones | WNYC**
publication date Nov 27, 2012
The project compares the areas in New York that have been flooded by Hurricane Sandy with the predicted surge zones through a switch menu. Users can browse for a specific address within New York City and New Jersey or navigate the map by panning and zooming.
link: http://project.wnyc.org/flooding-sandy-new/index.html#

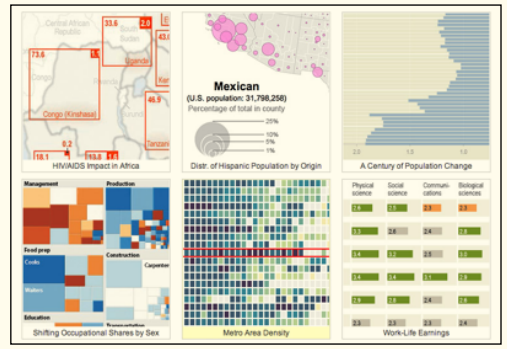
→ **Where Did Your Thanksgiving Dinner Come From?**
publication date Nov 22, 2012
This interactive interface allows people to explore the relationship between where Thanksgiving turkeys are originated and where they have been sold, thus consumed. Data are aggregated per County.
link: http://storymaps.esri.com/stories/2012/thanksgiving/#

→ **A Survey of the Flooding in N.Y.C. After the Hurricane - NYTimes.com**
publication date Nov 22, 2012
The map shows a survey of the damages provoked by Hurrican Sandy on the East Coast, according to the estimates by the Federal Emergency Management Agency. The interactive visualization displays the height reached by floodwaters as well as the state of the damage of buildings, indicates by building colors. Buildings are grouped by minor damage, major damage and destroyed.
link:http://www.nytimes.com/newsgraphics/2012/1120-sandy/survey-of-the-flooding-in-new-york-after-the-hurricane.html

→ **Map: How fast is LAFD where you live?**
publication date Nov 20, 2012
This is an interactive map disolaying a block-by-block analysis of how long it takes LAFD units to reach victims after the agency picks up a 911 call. The Times analyzed more than a million runs by the Fire Department over the last five years and produced a map that is color coded according to the time-span. Users can choose whether to divide areas in hexagonal bins and reach the precision of the block, or to aggregate data by neighborhoods.
link: http://graphics.latimes.com/how-fast-is-lafd/#11/34.1649/-118.5892



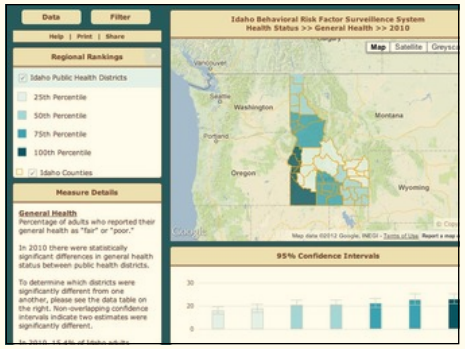
→ **Data Visualization Gallery**
publication date Nov 14, 2012
The Census Bureau is working to increase our the of visualization in making data available to the public, and this gallery is an early part of that effort. The first posted visualizations will pertain largely to historical population data, building on prior work done to portray historical changes in the growth and redistribution of the U.S. population. For later visualizations, the topics will expand beyond decennial census data to include the full breadth of Census Bureau data sets and subject areas, from household and family dynamics, to migration and geographic mobility, to economic indicators.
link: http://www.census.gov/dataviz/



→ **BRFSS Crude Data Report**
publication date Nov 8, 2012

BRFSS crude report is an interactive interface that reports data on the general health status of the Idaho population. Data on self-reported conditions through surveys are displayed through time from 1997 to 2012 and by Counties within the State.

link: http://healthandwelfare.idaho.gov/Portals/_Rainbow/InstantAtlas/CrudeDataReport/atlas.html



→ **rentonomy.com**
publication date Nov 4, 2012

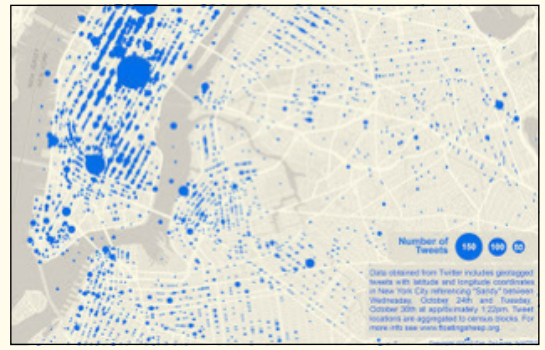
Rentonomy is a guide to renting in London. It uses a cartogram representation to display rental conditions (such as prices for different kind of apartments, time trends and comparisons with the closest neighborhood) for all of the neighborhoods in London.

link: http://www.rentonomy.com/maps/discover

→ **The Urban Geographies of Hurricane Sandy in New York City**
publication date Oct 31, 2012

The map includes a broader temporal range of tweets dating back to last week on October 24th, up to approximately 1:22pm on Tuesday, October 30th, as the storm was starting to subside and damage be more closely assessed. Tweets included in this dataset contain direct reference to "Sandy" and include more-or-less precise latitude/longitude coordinates (as opposed to being geocoded to less specific scales such as the city or neighborhood level), allowing a greater level of precision, despite sacrificing a significant number of tweets in order to do so, though still leaving us with nearly 16,000 individual observations to work with. In order to show density as opposed to individual points, tweets were then aggregated to the level of census blocks.

link: http://www.floatingsheep.org/2012/10/the-urban-geographies-of-hurricane.html

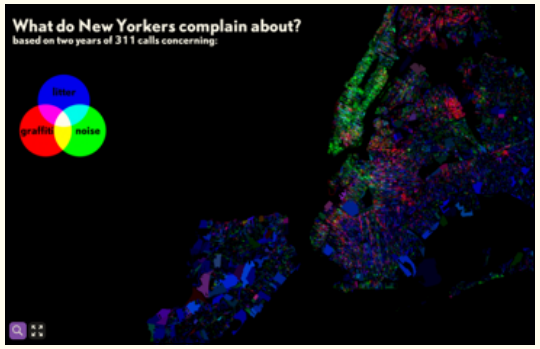


→ **The one million tweet map**
publication date Oct 25, 2012

This map displays the last geolocalized tweets delivered by the twitter stream API. Map data is updated in real-time and displays "only" the last one million tweets. Users can also browse for specific contents or apply a time filter.

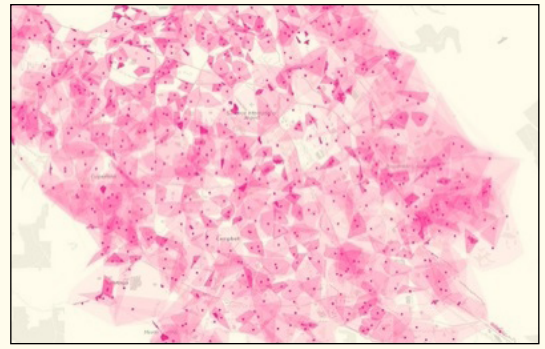
Tweet clusters are overlapped with singular tweets.link: http://onemilliontweetmap.com/

→ **What do New Yorkers complain about?**
publication date Oct 18, 2012
The map shows the relative number of complaints about noise, graffiti, and litter in different parts of NYC, using the RGB channels for a composite to compare the relative contributions of the different parameters.
link: http://www.visualizing.org/visualizations/nyc-311-composite



→ **CNN Home and Away**
publication date Oct 2, 2012
CNN Home and Away is an interactive map made for CNN to visualize the casualties in Iraq and Afghanistan. The left map shows the hometowns of the soldiers, and the right map shows the locations of the casualties. Time trends are displayed as well, singular casualties can be explored by clicking on the geographic points.
link: http://postarchitectural.com#CNN-Home-and-Away

→ **Cellphone Coverage Project**
publication date Oct 2, 2012
These set of visualizations studies the cellular network strength across four major carriers and displaying different kind of spatial aggregations according to the network cells and the intensities of the contributions. No further explanation on the data is provided.
link: http://postarchitectural.com#Cellphone-Coverage-Project

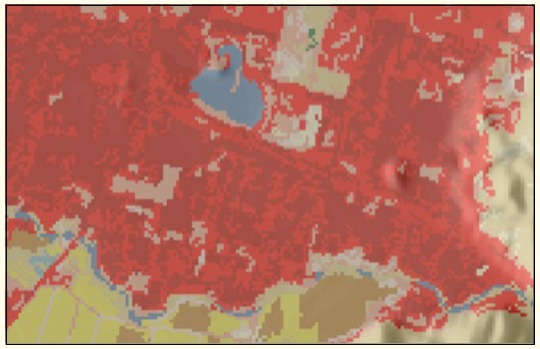


→ **foursquare Check-ins : NYC Parks**
publication date Oct 2, 2012
Foursquare Check-ins: NYC Parks displays foursquare check-ins within NYC Parks' properties in real time.
link: http://www.nycgovparks.org/web/foursquare/map.php

→ **LandEx | A Search Engine for Similar Landscapes**
publication date Sep 25, 2012

LandEx is a search engine for maps that can scan through and identify places in the U.S. that have a similar land coverage or ecological patterns. The program classifies satellite imagery of the earth's surface into 16 different land cover types – from scrub to pasture to deciduous forest to high intensity development. The map enables users to select a small area, about two miles wide, and then searches the rest of the country for places with similar conditions.

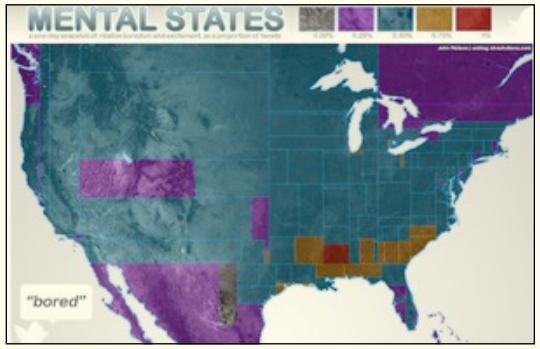
link: http://sil.uc.edu/landex/



→ **Mental States**
publication date Sep 23, 2012

Mental States is a bucket map of tweets by proportion of bored tweeters, or excited in the US. Data represents roughly 10,000 geo-located tweets over the course of one day (May 11, 2012) and zones are color coded according to the main sentiment.

link: http://uxblog.idvsolutions.com/2012/05/mental-states.html



→ **Constellations of Love and Hate**
publication date Sep 21, 2012

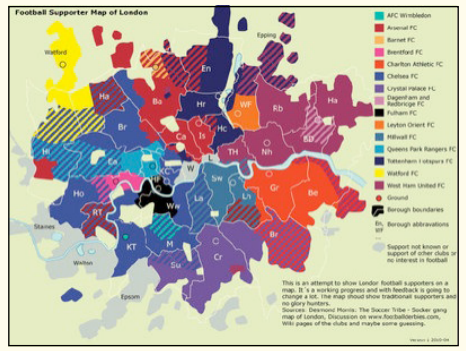
This image was made up of geo-tagged tweets that either contain the word "love" or "hate" sampled randomly over a few weeks, assembling themselves into a relative distribution of love and hate in New York City.

link: http://uxblog.idvsolutions.com/2012/06/constellations-of-love-and-hate.html

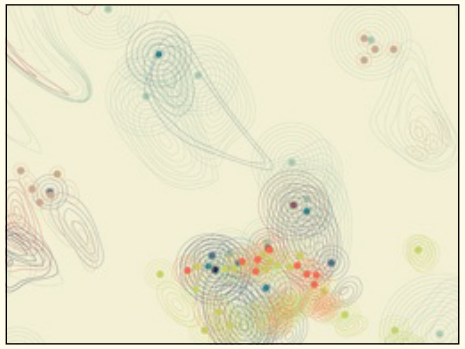
→ **Football Fandom**
publication date Sep 21, 2012

Football fandom is a complex compound of ancestral, social, and regional loyalties. There are no neat borders to be drawn around the 'fanlands' of each team, as indicated by the cross-hatched areas on this map, which reflect zones of mixed allegiance. Short of mapping the allegiance of every individual fan, attempts to make geographic sense of individual, subjective preferences – like this football supporter map of London – will remain rather imperfect

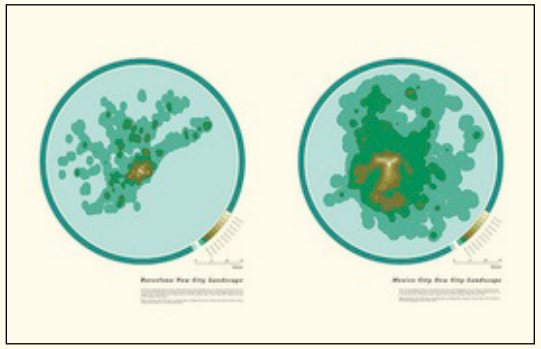
link: http://www.guardian.co.uk/commentisfree/interactive/2012/sep/07/weird-maps-to-rival-apple-in-pictures?CMP=twt_gu



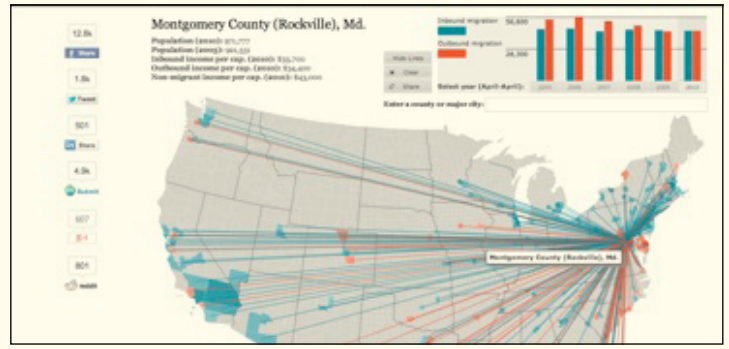
→ **Sensory Maps**
publication date Sep 18, 2012
The Sensory Map project represents several cities' peculiar areas smells according to a personal survey taken by the author. Coloured dots indicate the point of origin of the scents, the contour lines show where the smells blow to in the wind.
link: http://www.sensorymaps.com/maps_cities/newport_smell.html



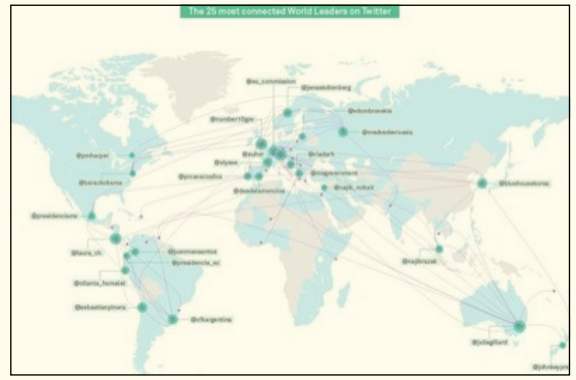
→ **Virtual Landscape**
publication date Sep 5, 2012
The maps are visualising location based tweet activity in urban areas. The range of maps produced show that unique conditions exist for different cities from around the world and this is reflected in the Twitter landscape maps. Three types have been identified showing similar characteristics. A type with one central core are, a type with several different islands of high activity and a type showing an area or shape of high activity.
link: http://urbantick.blogspot.co.uk/2012/09/virtual-landscape-and-peak-for-london.html?m=1



→ **American Migration [Interactive Map] - Forbes**
publication date Sep 4, 2012
Every year close to 40 million Americans move from one home to another. This interactive map visualizes those moves for every county in the country.
link: http://www.forbes.com/special-report/2011/migration.html

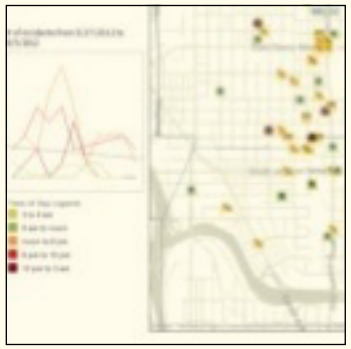


→ **Twiplomacy** |
publication date Aug 21, 2012
Twiplomacy is a global study of world leaders on Twitter. This study shows that while the social network invites direct interaction between users, few world leaders take advantage of this opportunity to develop connections. Almost half of world leader accounts analysed don't follow any of their peers
link: http://twiplomacy.com/



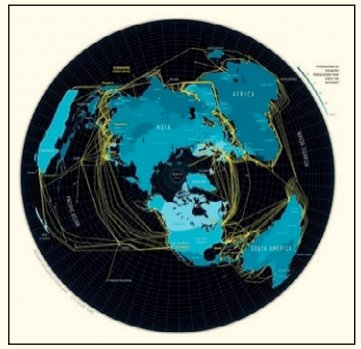
→ **Here, Data Visualization Lovers are!**
publication date Aug 20, 2012
This is a research project to share some references about Data Visualization featuring stories of data visualization from 100 recent tweets and 100 reference links that are displayed in the world map.
link: http://hyemisong.com/datavislovers/

→ **Seattle Police Incident**
publication date Aug 17, 2012
Seattle Police Incident is an interactive exploration of Seattle Police and Fire Responses to 911 Calls, geo-localized. Users can filter by type of incidents, by time and compare aggregated data on districts.
link: http://public.tableausoftware.com/views/SeattlePoliceIncidentData2011-2012_0/IncidentMap?:embed=y



→ **tornado tracks**
publication date Jul 27, 2012
Tornado Tracks visualizes more than sixty years of data about tornadoes in the US: each of the white trails on the tornado map represents an individual tornado path. A path's brightness denotes wind intensity, with brighter strokes representing more violent storms. This application uses data from the National Oceanographic and Atmospheric Administration (NOAA).
link: http://www.idvsolutions.com/Demos/interactive-tornado-map.aspx

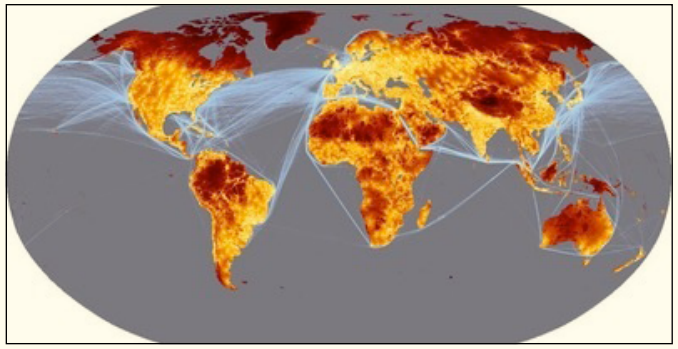
→ **Mapping the internet**
publication date Jul 27, 2012
The project maps and represents fiber-optic cables underneath the oceans. Territories are colored according to the number of internet users per area. Different maps at different zooms are provided on the website.
link: http://nicolasrapp.com/?p=1180



→ **Travel time to major cities: a global map of accessibility**
publication date Jul 19, 2012

Travel time to major cities captures the connectivity and the concentration of economic activity and also highlights that there is little wilderness left. The map shows how accessible some parts of the world have become whilst other regions have remained isolated.

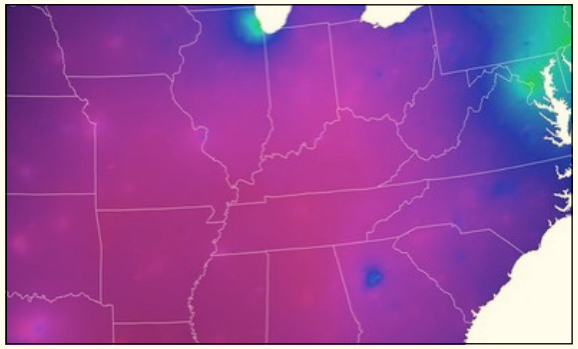
link: http://bioval.jrc.ec.europa.eu/products/gam/index.htm



→ **Isarithmic Maps of Public Opinion Data**
publication date Jul 19, 2012

This is an isarithmic map of county electoral data, produced from over 30,000 individual responses to the standard 7-point party identification question. A dense grid of points across the map have been generated, and the distance-weighted mean value for each point, as well as a distance-weighted response density for each point has been calculated.

link: http://dsparks.wordpress.com/2011/10/24/isarithmic-maps-of-public-opinion-data/



→ **Map Your Twitter Followers**
publication date Jul 19, 2012

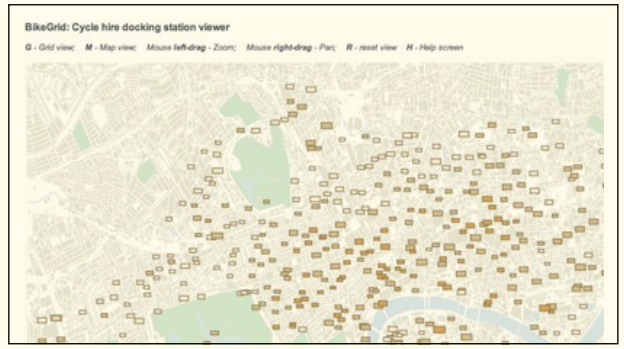
This simple interactive interface maps the Twitter followers of a personal account by State and County.

link: http://tweepsmap.com/

→ **BikeGrid: Cycle hire docking station viewer**
publication date Jul 19, 2012

BikeGrid uses live data from the Barclays Cycle Hire scheme to reveal patterns in docking station use across London. It uses spatial treemaps to show the last 24 hours use of all London docking stations in a grid.

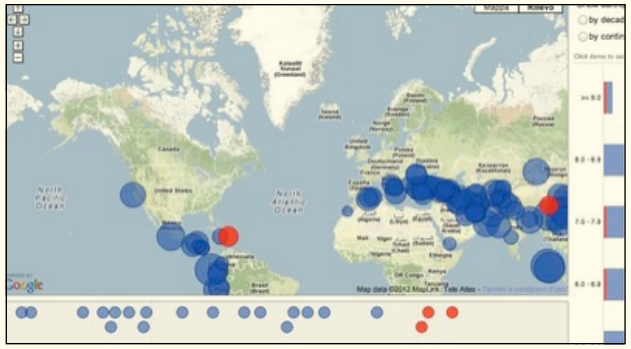
link: http://www.soi.city.ac.uk/~jwo/cyclehire/stationView/



→ **Deadly Earthquakes**
publication date Jul 4, 2012

Deadly Earthquakes is an interactive visualization showing earthquakes throughout the world, users can view earthquakes by filtering the decade, the causalities and the magnitude; and explore each singular earthquake information mousing over each item.

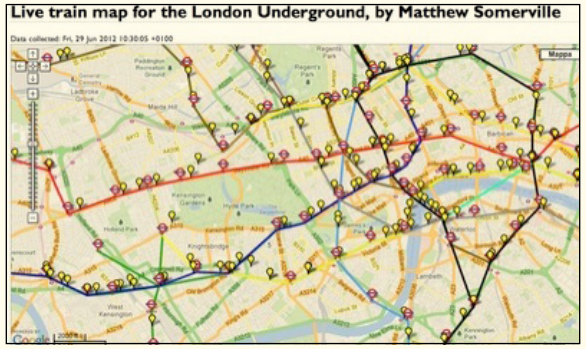
link: http://visual.ly/deadly-earthquakes?view=true



→ **Live map of London Underground trains**
publication date Jun 29, 2012

The map shows all trains (yellow pins) on the London Underground network in approximately real time.

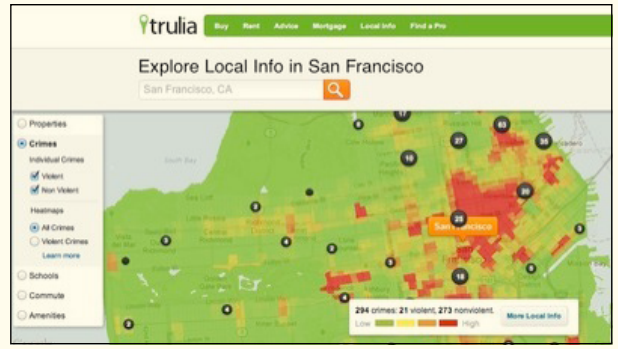
link: http://traintimes.org.uk/map/tube/



→ **Trulia Local**
publication date Jun 26, 2012

Trulia has developed a series of Commuter Maps that are totally unique in the space. Rather than telling you the time of one linear commute from point A to point B, they're area heat maps, conveying the time it will take to get anywhere from your designated homebase, in real time.

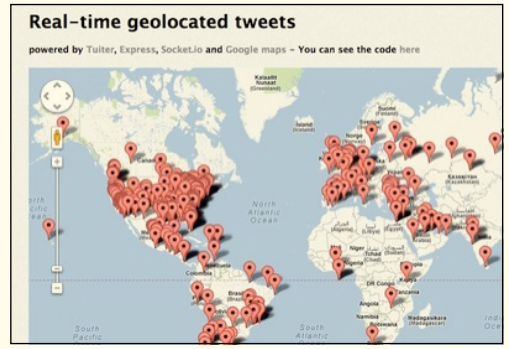
link: http://www.trulia.com/local/#crimes/san-francisco-ca



→ **Realtime geolocated tweets**
publication date Jun 17, 2012

The map displayes real-time geo-located tweets with an animation that make each pins falling from the sky.

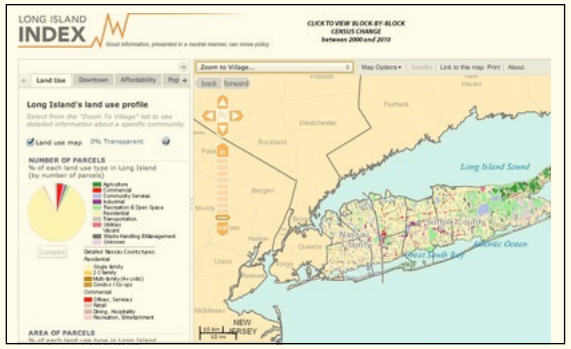
link: http://pure-waterfall-1016.herokuapp.com/



→ **Long Island Index: Interactive Map**
publication date Jun 15, 2012

The Long Island Index interactive map combines a rich amount of information coupled with easy-to-use tools so you can visualize relationships across several types of data at local and regional scales. It supplements and enhances the work of the Long Island Index to develop and monitor regional community indicators.

link: http://www.longislandindexmaps.org/



→ **Urban Mobs**
publication date Jun 12, 2012

Urban Mobs provides a tool to study crowd communication activities analyzing and visualizing citywide mobile phone activity. The maps on the website specifically show mobile phone activity on several France, Spain, Poland and Romania cities during days when special events happened.

link: http://www.urbanmobs.fr/en/

→ **The Living City | URBAGRAM**
publication date Jun 12, 2012

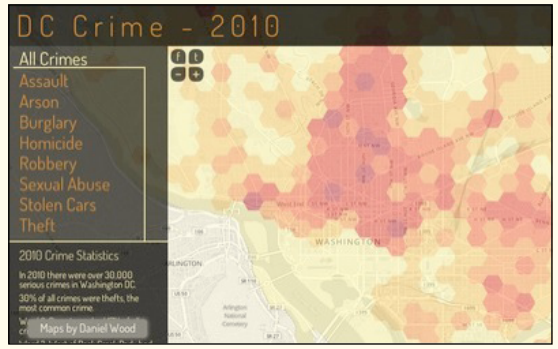
The living Cities is a project representing several cities in terms of social interaction density: it provides bottom-up images of cities by mapping millions of events on Foursquare. The maps on the website are always displayed by cutting the geographical layer. This research aim is to start quantifying qualitative terms such as 'sprawl' or 'segregation', in terms of human interactions.

link: http://www.urbagram.net/v1/show/Living

→ **DC Crime**
publication date Jun 9, 2012

Dc Crime is an interactive interface allowing users to visualize Crime statistics in Washington DC on the year 2010. Crimes are visualized on the map according to the aggregated values on a grid of hexagons, crimes can by filtered by type. General statistics are provided as well.

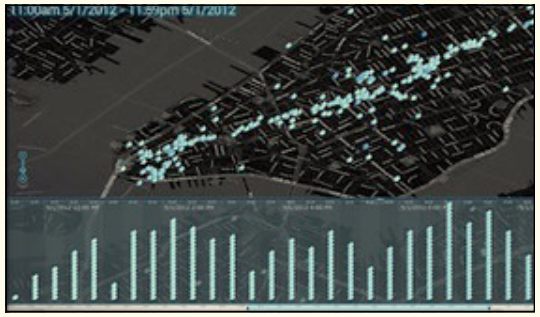
link: http://danieljwood.github.com/DC-crime/



→ **A Twitter Anatomy of a Protest**
publication date Jun 2, 2012

This project is a visualization of mid and lower Manhattan on MayDay, 2012, plotting the when and where of tweets containing the keywords, MayDay and Occupy. The visual coordination of three dimensions of data: location, time, and topic, provides an up-to-the-second profile of a social event as it forms, moves, and dissipates.

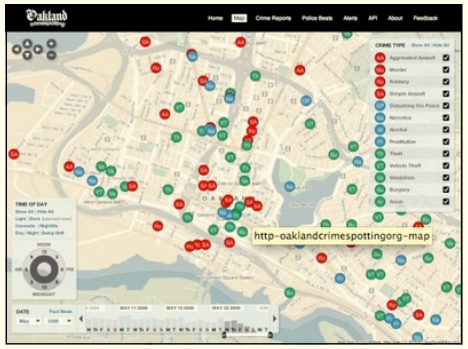
link: http://uxblog.idvsolutions.com/2012/05/twitter-anatomy-of-protest.html?goback=.gde_80552_member_112864887



→ **Oakland Crimespotting**
publication date May 18, 2012

Oakland Crimespotting is an interactive map of crimes in Oakland, CA. Crimes can by visualized and filters by type and time span. Crimes are represented here as singular entities and no aggregated data per area or neighborhood are available.

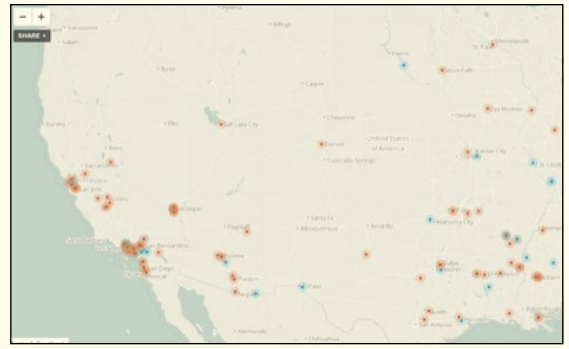
link: http://oakland.crimespotting.org/#hours=0-23&lon=-122.270&types=AA,Mu,Ro,SA,DP,Na,Al,Pr,Th,VT,Va,Bu,Ar&dtstart=2012-05-10T23:59:59-07:00&zoom=14&dtend=2012-05-17T23:59:59-07:00&lat=37.806



→ **Hate vs Love: a geo-located realtime listening on Twitter**
publication date May 18, 2012

Have vs Love follows two competing live Twitter feeds, one including tweets with the keyword ‘love’, and one with tweets that include the keyword ‘hate’ to find out which parts of the country are loving hardest and which ones are having the most hate.

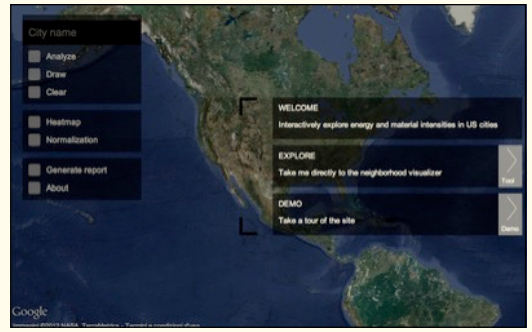
link: http://brunosan.github.com/Twitter-MapBox/



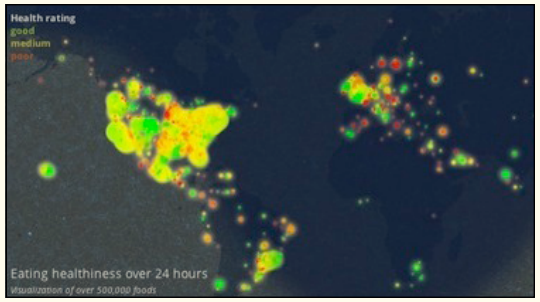
→ **Resource Intensity of Cities**
publication date May 14, 2012

Resource Intesity of Cities is a web-map that displays data on material and energy use in cities, allowing users to compare the two values and to normalize them as well to understand trends and percentages. The goal is to provide an intuitive way of understanding this complex problem using an interactive interface.

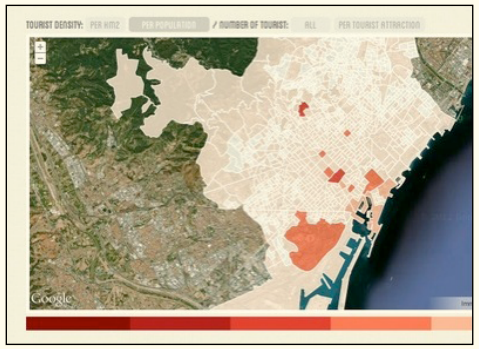
link: http://urbmet.org/



→ **Massive Health**
publication date May 9, 2012
Massive Health is a visualization that maps healthiness habits over 24 hours through monitoring and evaluating the posts coming from the popular social network “EATERY APP” .
link: http://data.massivehealth.com/

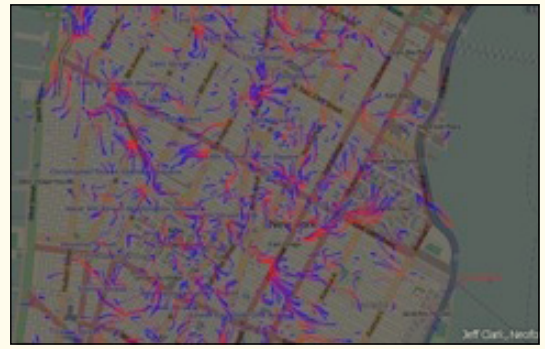


→ **Flickr Tourism Indicator 2011**
publication date May 7, 2012
The Flickr Tourism Indicator compares the touristic performance and success of different cities, different city’s areas or different tourist attractions, as well as to measure the impact of tourism over cities by retreiving and displaying Flickr activity. It is built on data extracted through the Flickr API, which allowed us to obtained more than 192,800 photos geotagged in Barcelona and 142,600 geotagged in Madrid, between January 1st 2011 and December 31st 2011.
link: http://flickrtourism.thedatarepublic.com/flickrtourism/en/barcelona/

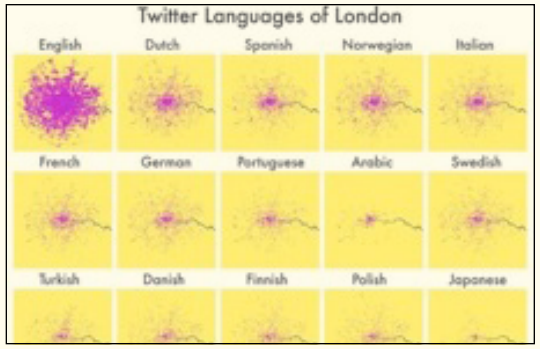


→ **MyBlockNYC**
publication date May 1, 2012
MyBlockNYC.com is an interactive mapping website that captures and presents personal video accounts of the life and culture of New York City in order to create an intimate, evolving, and complete portrait of the city. Each videos contain the information about his creator.
link: http://myblocknyc.com/#/about

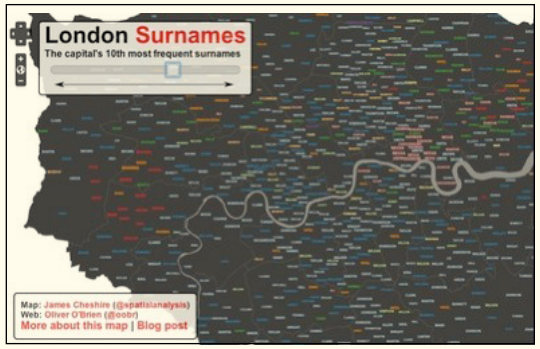
→ **Movement in Manhattan**
publication date Apr 28, 2012
Movement in Manhattan uses geolocated tweets to try to see how the movement of people is affected by the urban landscape. Tweets sent by the same person within a 4 hour time-window were used as samples of speed and direction. These samples were used to construct a vector field representing the average flow of people within the area. The vector field and total tweet density over the space were then used to simulate the movement of people. Particles, representing people, were released at locations where actual tweets were recorded and their subsequent movement was determined by the flow field. The particles start out blue and gradually change through purple to red over time so each trace shows the direction of movement. Locations where there is little movement will have blue dots or very short blue traces. Longer traces with more red show a greater speed at that point.
link: http://neoformix.com/2012/MovementInManhattan.html



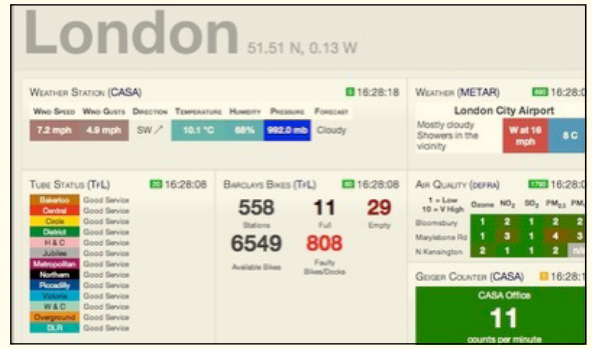
→ **The Twitter Languages of London**
publication date Apr 27, 2012
The twitter languages of London shows the spatial distribution of about 470,000 geo-located tweets grouped by the language stated in their user's profile information. It is a small multiple map allowing to compare intensity and spatial concentrations of English tweets and tweets in other languages.
link: http://spatialanalysis.co.uk/2012/04/twitter-languages-london/



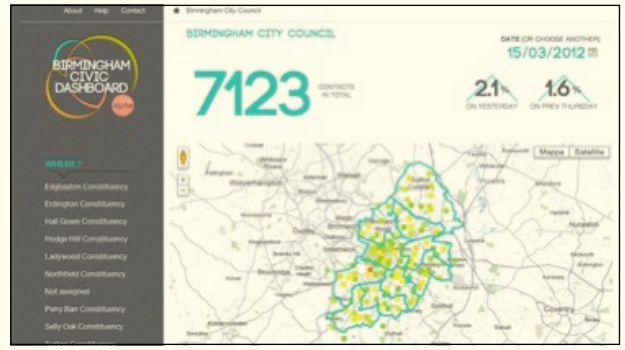
→ **Interactive map of London surnames**
publication date Apr 27, 2012
This interactive typographic maps to show the most popular surnames across London. There are 983 geographic units (Middle Super Output Areas) in each map and across all 15 there are 2379 individual surnames (15,000 surname labels in total). The font size for each surname label has been scaled to give an idea of the number of people who have that surname in each place. The surname frequencies come from the 2001 Electoral Roll and won't contain everyone living in London but it is one of the best datasets available.
link: http://names.mappinglondon.co.uk/



→ **CityDashboard: your city in realtime**
publication date Apr 20, 2012
This dashboard visualizes live information on social networking, transport and geographical trends for major UK cities, providing users with a special space dedicated to emerging events and the rhytms of urban life.
link: http://casa.oobrien.com/citydashboard/london/



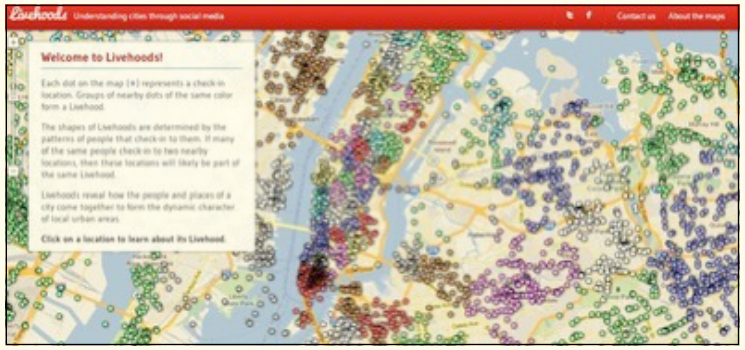
→ **Birmingham Civic Dashboard**
publication date Mar 18, 2012
The Birmingham Civic Dashboard receives a report of the requests that come in from members of the public for services from Birmingham City Council each day. It then produces a number of visualisations of that data, such as showing them on a map and allowing users to browse by geography, type of reports and time trends.
link: http://civicdashboard.org.uk/



→ **Livehoods: understanding cities through social media**
publication date Apr 17, 2012

The Livehoods Project presents a new methodology for studying the dynamics, structure, and character of a city on a large scale using social media and machine learning. Using data such as tweets and check-in to the interface allow users to draw novel boundaries of neighborhoods based on Social Media activities similarities and differences.

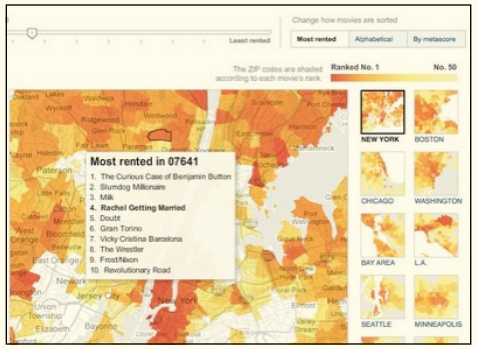
link: http://livehoods.org/maps/nyc



→ **A Peek Into Netflix Queues**
publication date Apr 10, 2012

This interactive Graphic examines maps of Netflix rental patterns, neighborhood by neighborhood, in a dozen cities across USA, and presenting a top 10 ranking per each neighborhood of the city.

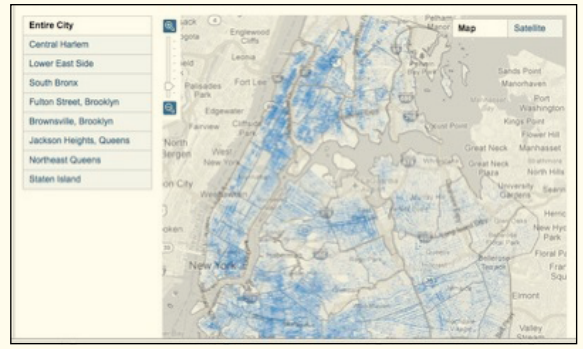
link: http://www.nytimes.com/interactive/2010/01/10/nyregion/20100110-netflix-map.html



→ **Stop, Question and Frisk in New York Neighborhoods**
publication date Apr 10, 2012

This interactive visualization lets users navigate the number of police stops for each neighborhood and block of New York updated in 2011, and filter them by time and type of event. Aggregated statistics are available per each one tof the districts.

link: http://www.nytimes.com/interactive/2010/07/11/nyregion/20100711-stop-and-frisk.html

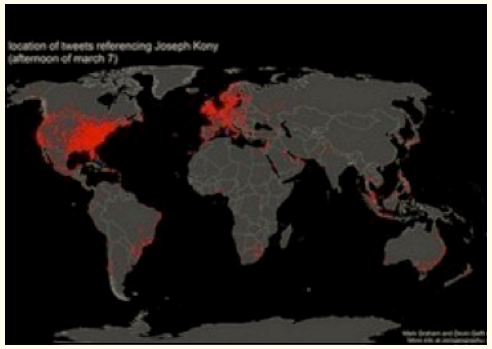


→ **Mapping Wikipedia**
publication date Apr 4, 2012

Mapping Wikipedia is a visualisation of the world mapped according to Wikipedia articles in 7 different languages. The map displays both the global patterns and the vast number of geo-located items. Languages are color coded and users can zoom towards the precise geo-localization of ip addresses.

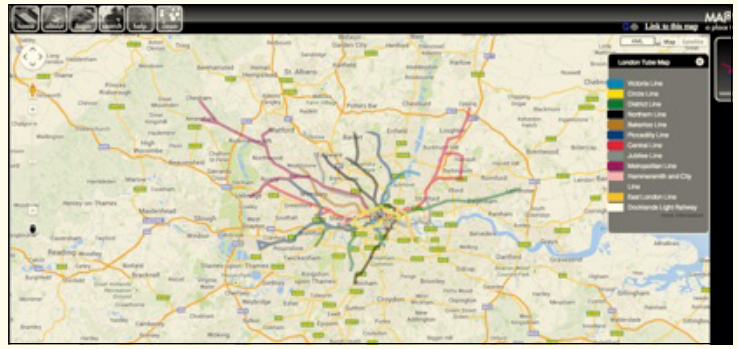
link: http://wikiproject.oii.ox.ac.uk/mapping_wikipedia/

→ **Mapping #kony2012 on Twitter**
publication date Apr 3, 2012
The map was made by collecting all georeferenced tweets containing the terms "#kony", "#kony2012", and "#stopkony" between February 28 and March 13 during the major timespan of the protest. Intensity of tweets per area is visualized.
link: http://www.zerogeography.net/2012/03/mapping-kony2012-on-twitter.html



→ **Financial Footprints: Transactions in Real Time.**
publication date Mar 31, 2012
The video covers purchasing movements in Spain over Easter Week of 2011. It shows the character of spending patterns of four categories of points of sale (fashion, bars and restaurants, food stores/supermarkets and gas stations) throughout the day across different Spanish regions and cities. Data will continue to be collected over the upcoming Easter Week 2012 with the aim of testing the predictive capacity of this kind of analysis.
link: http://www.youtube.com/watch?v=Zel6wych9p0&feature=player_embedded

→ **MapTube**
publication date Mar 28, 2012
MapTube is a free resource for viewing, sharing, mixing and mashing maps online. Users can mix and overlap transit maps, weather maps, and maps regarding public services distributions such as schools, and demographic geographical indicators such as death and birth rate.
link: http://www.maptube.org/home.aspx

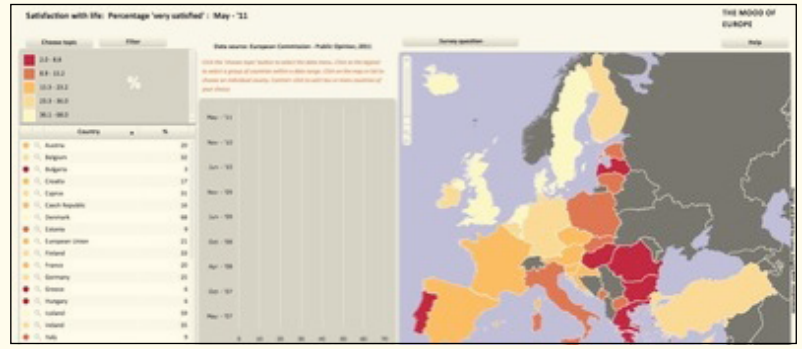


→ **Every public building mapped**
publication date Mar 26, 2012
Every Public Building mapped is an interactive guide to every French publicly-owned building providing information on the type of building, the owner, the precise address and the state of use.
link: http://www.guardian.co.uk/news/datablog/interactive/2012/mar/12/france-open-data?CMP=twt_gu

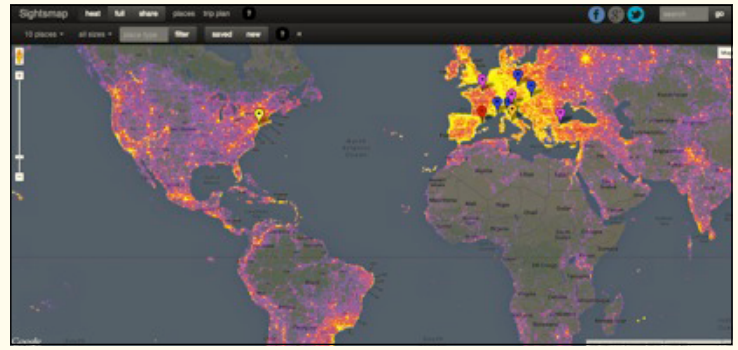
→ **TIMEMAPS**
publication date Nov 8, 2011
TIMEMAPS shows maps that are not based on distance, but on travel time with public transport, the map increases and decreases according to travel time from one location to another. Users can enter the two addresses and set up time-based queries.
link: http://bossingaround.com/post/12476536405

→ **Tweereal**
publication date Mar 19, 2012
Tweetreal is a map of twitter users activity in real-time. Animations on the map include only tweets containing geo-tags. There are two types of tweets on a map: with the exact coordinates and the coordinates determined with an accuracy of 1 degree (more transparent).
link: http://tweereal.com/

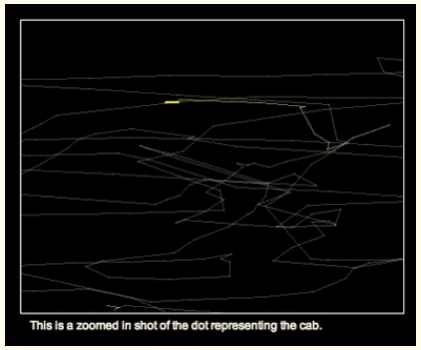
→ **The Mood of Europe**
publication date Mar 19, 2012
The Mood of Europe Monitor enables comparison between countries of the trends in European citizens' satisfaction with life, main concerns, trust in government and future view based on a set of surveys performed during 2011 by the Public Opinion department of the European Commission.
link: http://www.locusinsight.com/assets/files/demos/Report_moe_V8/atlas.html



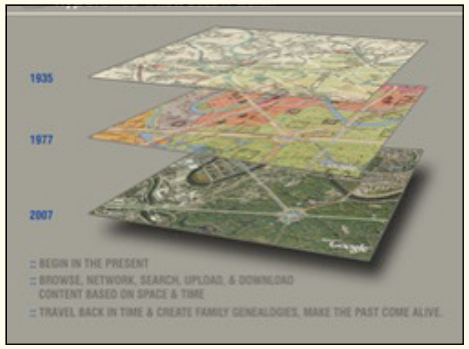
→ **Sightsmap**
publication date Mar 19, 2012
Sightsmap is a sightseeing popularity heatmap for the whole world, based on Panoramio photos, Wikipedia articles on places and FourSquare checkins.
link: http://www.sightsmap.com/



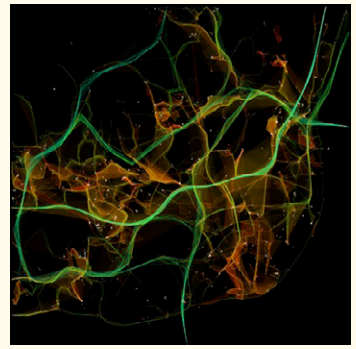
→ **Cabspotting - Cab Tracker**
publication date Mar 18, 2012
Cabspotting is designed as a living framework to use the activity of commercial cabs as a starting point to explore the economic, social, political and cultural issues that are revealed by the cab traces. It provides maps displaying the most frequent routes of cabs as well as the less frequent ones for several cities during different time-spans.
uplink: http://cabspotting.org/client.html



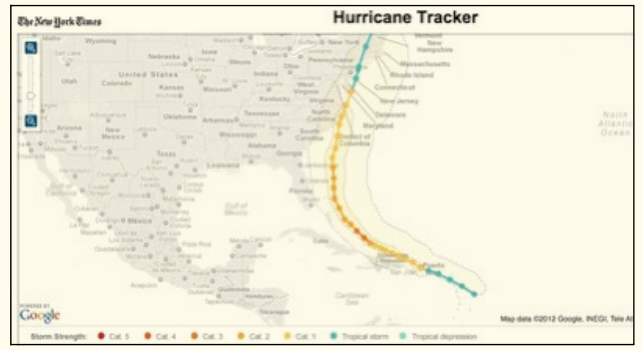
→ **Hypercities**
publication date Mar 17, 2012
HyperCities is a collaborative research and educational platform for traveling back in time to explore the historical layers of city spaces in an interactive, hypermedia environment. For several Cities worldwide, it displays the real city overlaid with a rich array of geo-temporal information, ranging from urban cartographies and media representations to family genealogies and the stories of the people and diverse communities who live and lived there. Using Google Maps and Google Earth, HyperCities essentially allows users to go back in time to create and explore the historical layers of city spaces in an interactive, hypermedia environment.
link: http://hypercities.com/



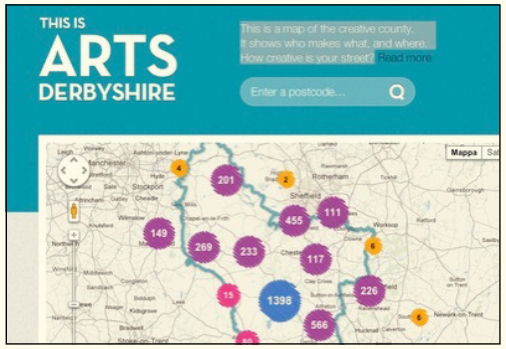
→ **Traffic in Lisbon condensed in one day**
publication date Mar 17, 2012
This post presents several experiments (picked between a total of more than 20 generated artifacts) that map 1534 vehicles, during October 2009 in Lisbon, leaving route trails and condensed in one single day.
link: http://pmcruz.com/information-visualization/traffic-in-lisbon-condensed-in-one-day



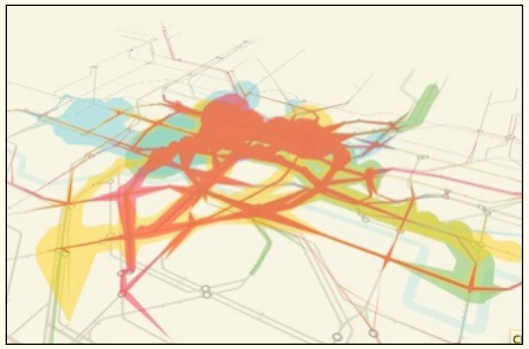
→ **Hurricane Tracker**
publication date Mar 17, 2012
Hurricane Tracker is a real time tracking systems for Atlantic hurricanes on an interactive map. Intensity of the wind and expected routes are displayed.
link: http://www.nytimes.com/projects/hurricanes/#!/2011/Irene?hp



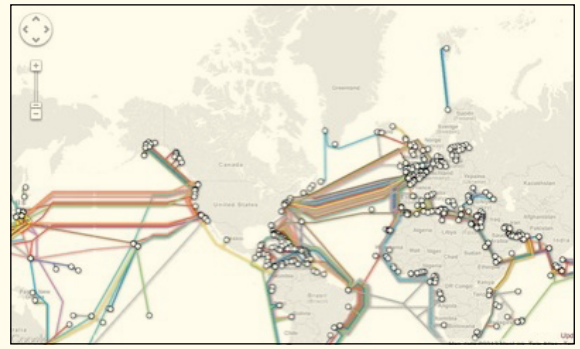
→ **This is Arts Derbyshire**
publication date Mar 18, 2012
This is a map that shows the distribution (or concentration, depending on which way you look at it) of artists and arts organisations in Derbyshire.It was created using the database of registered artists at artsderbyshire.org.uk, and is a visualisation of their Find An Artist database. Users can type their postcode in the search box to find what artists and arts organisations work in their area. Users can filter the results by selecting which type of art to view, and whether it is an individual or an organisation.The coloured circles with numbers inside represent clusters of creatives. This helps to view where the highest concentrations of artists reside in the county.
link: http://www.wearemudlark.com/derbyarts/



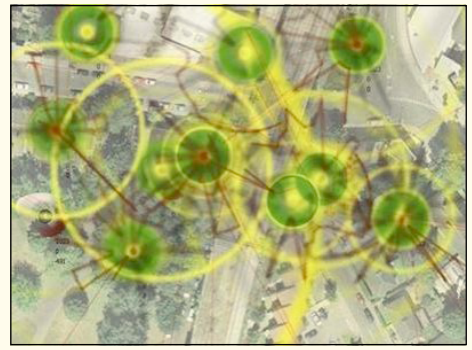
→ **Chromaroma**
publication date Mar 18, 2012
Chromaroma is a game that shows you your movements and location as you swipe your Oyster Card in and out of the Tube. It connects communities of people who cross paths and routes on a regular basis, and encourages people to make new journeys and use public transport in a different way by exploring new areas and potentially using different modes of public transport.
link: http://www.chromaroma.com/



→ **Submarine Cable Map**
publication date Mar 1, 2012
It is an interactive map of the world's undersea internet cables. TeleGeography's comprehensive and regularly updated interactive map of the world's major submarine cable systems and landing stations.
link:http://www.submarinecablemap.com/

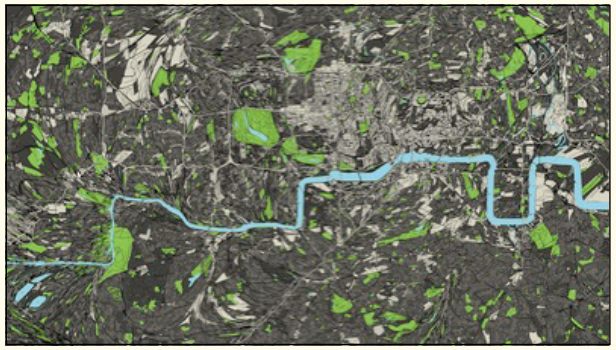


→ **Sensity. art from the invisble city.**
publication date Feb 25, 2012
Sensity Brixton London is an audio-visual artwork by Stanza that visualizes the dynamic data around the artist's environment. The city is made up of bits of data that change and Stanza's wireless sensor network captures and interprets this change, presenting it online in real-time. Sensity represents the movement of people, pollution in the air, the vibrations and sounds of buildings. They are in effect the emergent social sculptures that embody the emotional state of the city, representing the sense of accumulated incidents of love, abuse, death, and the fundamentally of change.
link: http://www.stanza.co.uk/sensity/motes/mote_sounds.html

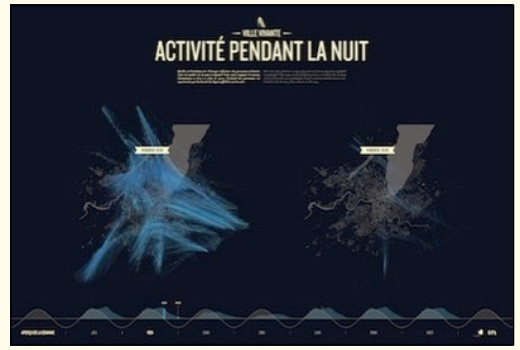


→ **Here Now**
publication date Feb 25, 2012
This project analyzes two weeks of checkin data collected from Foursquare and Facebook API to explore what these new ways of communicating can tell us about New York City. What are the most popular places in New York? When, Why and Where do people check-in? Which neighborhoods are the most check-in obsessed? How does Forusquare checkins compare to Facebook? Through statistical and geographical analysis the project explored all of these questions and compared them to the demographic and land use characteristics of the city.
link: http://www.spatialinformationdesignlab.org/projects.php?id=164

→ **Metrography**
publication date Feb 23, 2012
Metrography maps and scales London to the distorted reality of the Tube Map; it shows London through the same abstract lens as its own transportation system, trying to explore this mental glitch and manifest this intangible imaginary world to a new map.
link: http://www.fastcodesign.com/1669080/what-if-londons-geography-were-as-distorted-as-its-tube-map



→ **Ville Vivante**
publication date Feb 22, 2012
Ville Vivant is a project commissioned by the City of Geneva that decided to explore the city through the digital traces created by the mobile phones and creating maps of the city according to these paths activities through time, showing new landmarks as well as relationships between neighborhoods.
link: http://villevivante.ch/



→ **We Tell Stories - 'The 21 Steps' by Charles Cumming**
publication date Feb 15, 2012
We tell stories is an interactive narrative platform that displays 6 books of 6 famous authors the stories of which are told starting fom the places they mentions on a map.
link: http://wetellstories.co.uk/stories/week1/

→ **"Love Will Conquer"**
publication date Feb 15, 2012

It's a real-time, interactive, 3D stream of tweets that mention the words "love" or "hate". The application collects geo-tagged tweets and maps them onto a 3D Earth. Tweets are animated into a 3D structure whose properties are determined by variables such as the time the tweets were posted, how long the tweets are and whether the tweets mention love or hate. Users can browse the tweets by country to give them a snapshot of how much love (and hate) there is in that country. Locations are pre-selected according to the volume of tweets coming from that location.

link: http://www.chromeexperiments.com/detail/love-will-conquer/

→ **United Cities of America**
publication date Feb 14, 2012

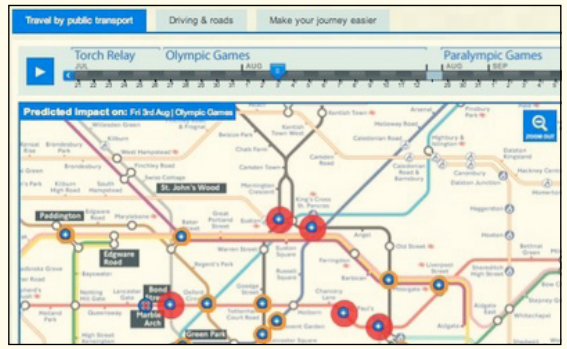
These maps, created using aggregated, anonymous data from the AT&T cell-phone network, depict commuting patterns in eight major US urban areas.

link: http://senseable.mit.edu/unitedcities/

→ **How will London's public transport be affected?**
publication date Feb 13, 2012

It is an interactive map created before the Olpympic games in London, it shows users how travel on London Underground, London Overground and Dockland Light Railway would have been be affected during the Games. The maps show information by date and time to help users plan their travel accordingly.

link: http://www.getaheadofthegames.com/travelinaffectedareas/city/london-public-transport.html



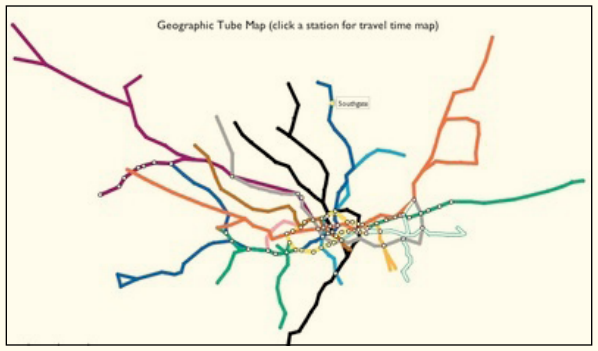
→ **NYC Subway Ridership**
publication date Feb 10, 2012

This is an interactive time based visualization of NYC MTA riders from 1905 to 2006. Users can browse data selecting a specific year of visualize the animation of the evolution of intensity of transportation for a specific line. The dimension of each underground line represents the number of passengers per years.

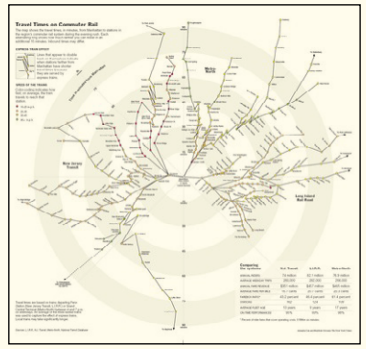
link: http://diametunim.com/shashi/nyc_subways/

→ **Travel-time Maps and their Uses**
publication date Feb 10, 2012
The heat map shows how long it takes to travel between one particular place and every other place in the area, using public transport. Using colours and contour lines they also show the areas from which no such journey is possible, because the services are not good enough.
link: http://www.mysociety.org/2006/travel-time-maps/

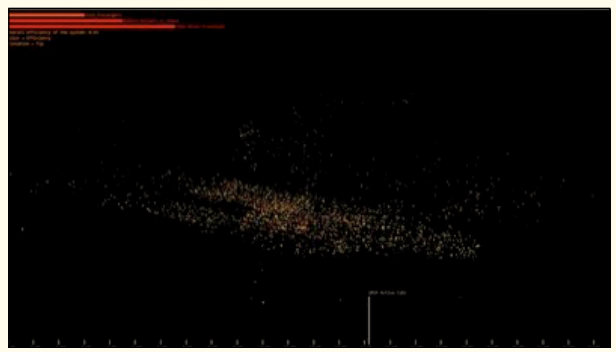
→ **Travel Time Tube Map**
publication date Feb 10, 2012
This interactive interface is a travel-time map of London underground. By clicking on (or selecting) a station it's possible to see the London Underground map reorganized around the times of travel from that station. Shortest paths are used to place the other stations - radius is proportional to time to travel, and angle should be correct for as-the-crow-flies direction on a map..
link: http://www.tom-carden.co.uk/p5/tube_map_travel_times/applet/



→ **Travel Times on Commuter Rail**
publication date Feb 10, 2012
The map shows the travel times, in minutes, from Manhattan to stations in the region's commuter rail system during evening rush.
link: http://www.nytimes.com/imagepages/2007/03/17/nyregion/nyregion-special2/20070318_TRAIN_GRAPHIC.html



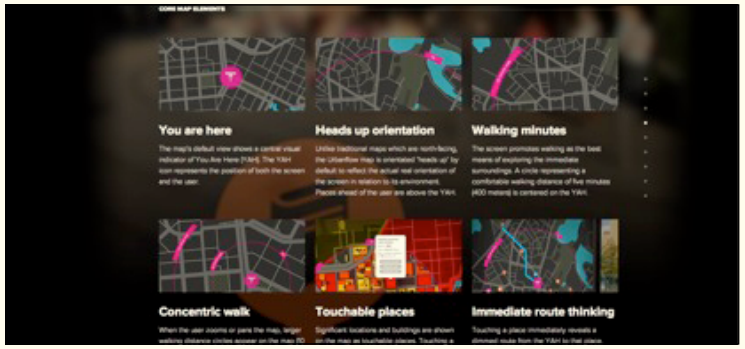
→ **Digital Urban: Taxi! Data Viz of 10,000 Taxi's in Manhattan**
publication date Feb 8, 2012
this is a data Visualization of 10,000 Taxi in Manhattan, it is an analytical model that maps the trip data for 10,000 taxi rides over the course of 24 hours. Geographic location data for the origin and destination of each ride is combined with waypoint data collected from the Google Maps API in order to generate a geographically accurate representation of the trip.
link: http://www.digitalurban.org/2012/02/taxi-data-viz-of-10000-taxis-in.html?m=1



→ **Urbanflow Helsinki**
publication date Jan 30, 2012

Urbanflow is a series of phisical screens that provide users with useful information on the city such as walkability, routes to places and public services availability in the area the screens are located. The situated nature of urban screens means that the 'one size fits all' approach to street cartography can be discarded and replaced with a living system that adapts to individual users' needs and requests In its simplest form, Urbanflow presents itself as a city map. As a street map, its role is multifaceted; it is a tool for orientation, identification and discovery, as well as a source of comfort for visitors.

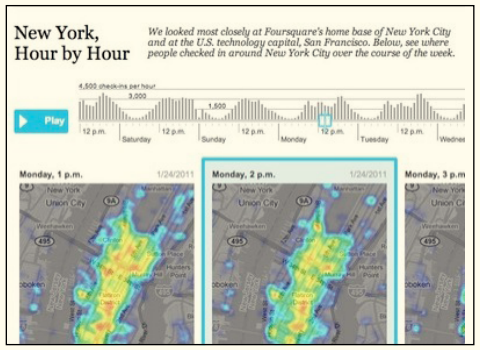
link: http://helsinki.urbanflow.io/



→ **A Week on Foursquare**
publication date Jan 19, 2012

This project analyses Foursquare check-in data for 2 weeks in major U.S. cities to compare time-trends, popular places and categories of check-in amongst different cities.

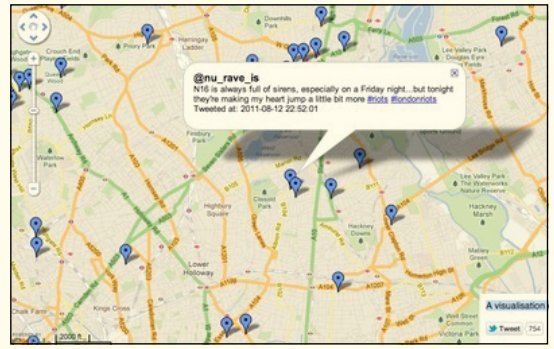
link: http://graphicsweb.wsj.com/documents/FOURSQUAREWEEK1104/



→ **London Riots Map**
publication date Jan 19, 2012

This is a visualisation of tweets mentioning a UK postcode and the #londonriots hashtag. LondonRiotsMap.appspot.com uses the hash tag #londonriot combined with mentions of London postal codes to parcel out the information across a map.

link: http://londonriots.ep.io/



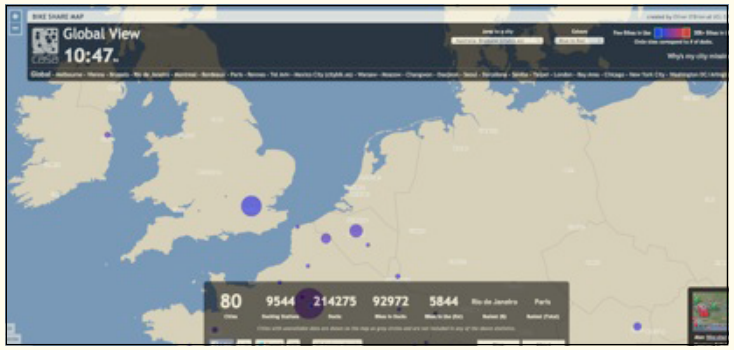
→ **REALTIME WAAG (Amsterdam)**
publication date Sep 17, 2011

During two months citizens of Amsterdam's were invited to be equipped with a tracer-unit. This was a portable device developed by Waag Society, equipped with GPS: Global Positioning System. Using satellite data the tracer calculated its geographical position. Tracers' data was sent in realtime to a central point. By visualizing the data against a black background traces, lines, appeared. From these lines a (partial) map of Amsterdam constructed itself. This map did not register streets or blocks of houses, but consisted of the sheer movements of real people.

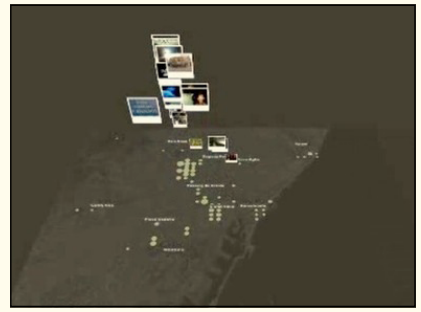
link: http://realtime.waag.org/

→ **Examining MetroCard Usage**
publication date Dec 18, 2011
This interactive visualization shows patterns of usages about where people are swiping different kinds of MetroCards, and how recent fare hikes affected their use aggregated per blocks and navigable through time.
link: http://graphicsweb.wsj.com/documents/MTAFARES1108/#v=showCommuters&s=77TH%2520STREET-LEXINGTON%2520AVE

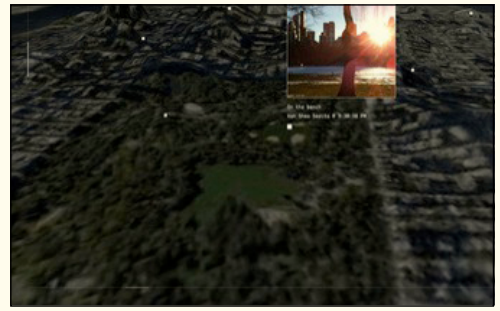
→ **Bike Share Map**
publication date Dec 18, 2011
Bike Share map is a visualisation of bike shares across the world. Data is updated automatically every 2-20 minutes from the provider's website. Bike usage is simultaneous usage and includes cycle redistribution. Actual total usage across the day may be much higher. Distribution imbalance - the number of cycles that would need to be moved to a different stand, in order for all stands to be the same % full. Higher numbers indicate a more unbalanced distribution, e.g. many bikes in the centre, few on the edge.
link: http://bikes.oobrien.com/



→ **The world's eyes**
publication date Dec 12, 2011
The world's eyes displays the photos people visiting Spain leave behind them as evidences of contemporary tourism in the country. The world's eyes provides insights to these question from the digital photos publically shared on the web by people visiting Spain. Through data mining and visualization techniques, it uncovers the evolutions of the presence and flows of tourists. As photos pill up to reflect the intensity of the tourist activity, they uncover where tourists are, where they come from and what they are interested in capturing and sharing from their visit. The analysis and mapping of this data allows understanding the attractiveness of leisure cities and their points of interest. In contrast it also reveals the unphotographed regions of Spain still free from the tourist buzz.
link: http://senseable.mit.edu/worldseyes/index.html



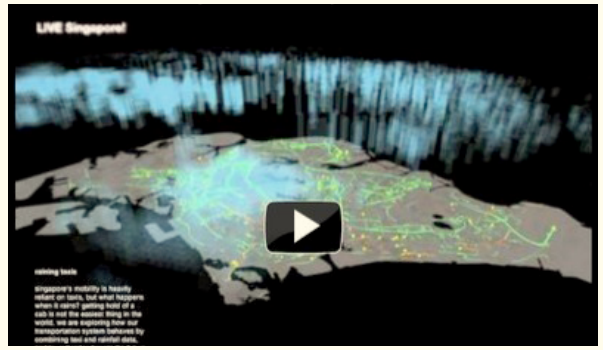
→ **Invisible Cities, a project by Christian Marc Schmidt & Liangjie Xia**
publication date Dec 2, 2011
By revealing the social networks present within the urban environment, Invisible Cities describes a new kind of city—a city of the mind. It displays geocoded activity from online services such as Twitter and Flickr, both in real-time and in aggregate. Real-time activity is represented as individual nodes that appear whenever a message or image is posted. Aggregate activity is reflected in the underlying terrain: over time, the landscape warps as data is accrued, creating hills and valleys representing areas with high and low densities of data. Invisible Cities maps information from one realm—online social networks—to another: an immersive, three-dimensional space.
link: http://www.christianmarcschmidt.com/invisiblecities/



→ **Ushahidi**
publication date Dec 2, 2011
"Ushahidi", which means "testimony" in Swahili, was a website that was initially developed to map reports of violence in Kenya after the post-election fallout at the beginning of 2008.
link: http://www.ushahidi.com/products/ushahidi-platform

→ **'The Geography of Buzz,' a Study on the Urban Influence of Culture - NYTimes.com**
publication date Dec 2, 2011
It is a study that measures what it calls "the geography of buzz" in New York and Los Angeles analysing a vast number of social media data parsed and filtered according to the topic they were referring to and producing images of the cities featuring the theater scene, the art scene, the fashion spots and nightlife events according to the descriptions of their citizens and users.
link: http://www.nytimes.com/2009/04/07/arts/design/07buzz.html?pagewanted=all

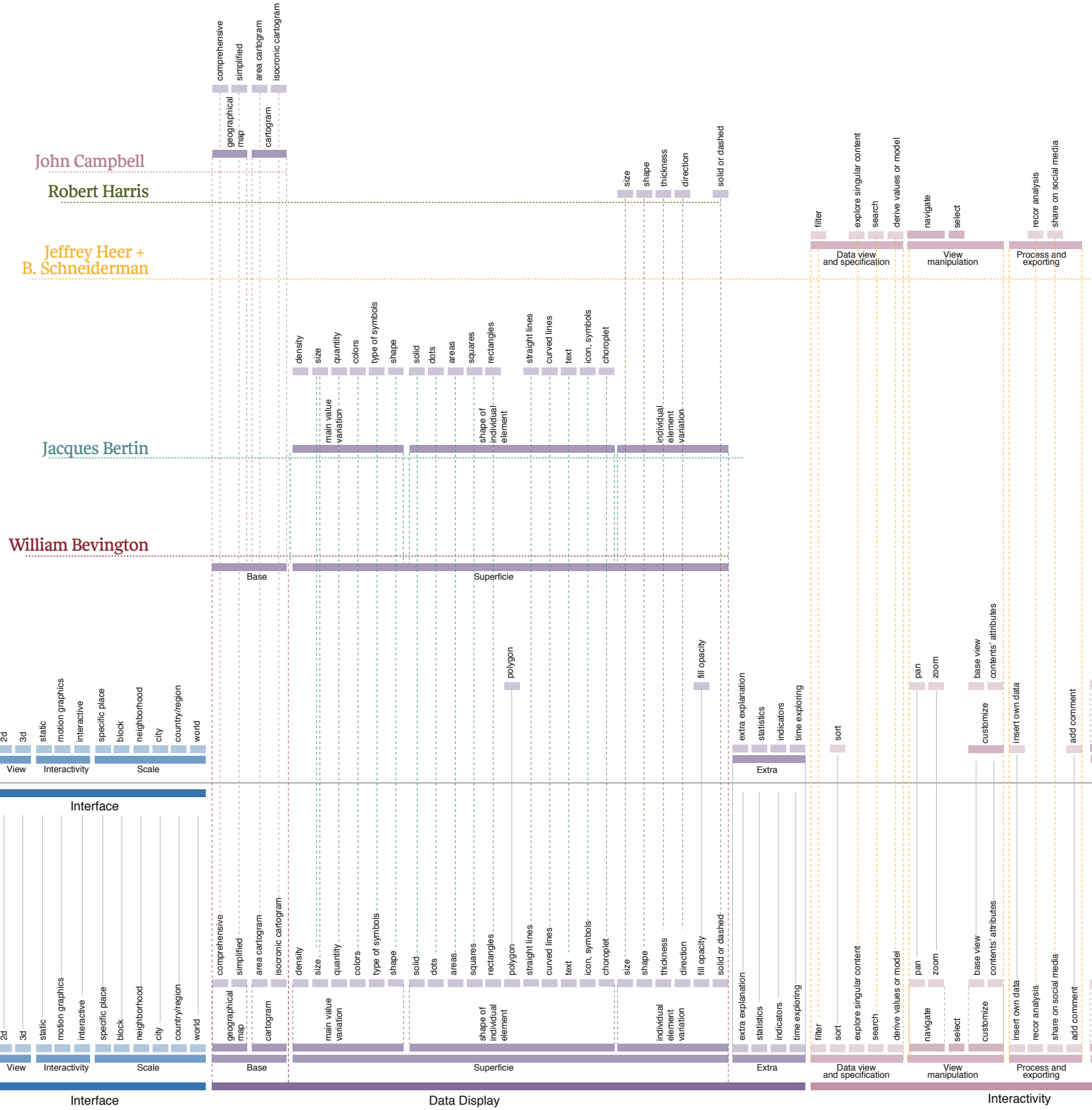
→ **LIVE Singapore! a feedback loop between people, their actions, and the city**
publication date Dec 2, 2011
LIVE Singapore! provides people with access to a range of useful real-time information about their city by developing an open platform for the collection, elaboration and distribution of real-time data that reflect urban activity such as the correlation between rain patterns and taxi routes, energy consumptions of the buildings and travel times.
link: http://senseable.mit.edu/livesingapore/index.html



→ **Trendsmap**
publication date Dec 2, 2011
Trendsmap s a real time explorations of city trends via social media most popular hashtags through time.
link: http://trendsmap.com/

[3]

Big version of the taxonomy presented in Chapter 3 (Fig. 43 - Categories definition: bibliographical validation of qualitative initial set of categories cording to: J.Campbell, R.Harris, J.Heer and B.Shneidermann, J.Bertin, W.Bevington


John Campbell
comprehensive
simplified
area cartogram
isocronic cartogram
geographical map
cartogram
Robert Harris
size
shape
thickness
direction
solid or dashed
Jeffrey Heer + B. Schneiderman
filter
explore singular content
search
derive values or model
navigate
select
recor analysis
share on social media
Data view and specification
View manipulation
Process and exporting
Jacques Bertin
density
size
quantity
colors
type of symbols
shape
solid
dots
areas
squares
rectangles
straight lines
curved lines
text
icon, symbols
choroplet
main value variation
shape of individual element
individual element variation
William Bevington
Base
Superficie
polygon
fill opacity
extra explanation
statistics
indicators
time exploring
sort
pan
zoom
base view
contents' attributes
customize
insert own data
add comment
brushing
clicking
buttons
check buttons
slide
view manupulation
menus
other windows
Interactive elements
Extra
originality
(addition from case studies)
real-time
not real time
UGC
not UGC
singular
aggregated
2d
3d
static
motion graphics
interactive
specific place
block
neighborhood
city
country/region
world
Harvesting
Source Aggregation
View
Interactivity
Scale
Data Handling
Interface
Data Display
Interactivity

[4]

Big version of the design space presented in Chapter 3 (Fig 44. - Design space analysis of geo-referenced data-visualizations)

case study	ISSUES	place	aim	real-time	no real-time	UGC	no UGC	singular	aggregated	2d	3d	static	motion graphics	interactive	specific place	block	neighborhood	city	country / region	world
				data handling – harvesting		source		aggregation		**interface** – view		interactivity			scale					
	ENVIRONMENT																			
Live Singapore / urban energy	energy	Singapore	narrative		1		1	1			1	1	1		1					
London Air Pollution	pollution	London	informative		1		1	1		1				1	1				1	
urbmet	energy	(world)	informative		1		1		1	1				1	1					1
NYC building energy	energy	New York	informative		1		1		1	1		1				1				
mapping urban tree density	green	Vien	informative		1		1		1	1		1						1		
windmap	wind	USA	narrative	1			1		1	1				1				1		
waste facilities	reclycling	USA	informative		1		1	1		1		1			1					
Groundwater in movement	water	(world)	informative		1		1		1	1			1							1
	POPOULATION																			
Maps of Babel	ethnicity	Milan	narrative		1	1		1		1			1					1		
Mapping America, every block	ethnicity	USA	informative		1		1		1	1				1		1				
Growing Switzerland	demographic	Switzerland	narrative		1		1		1	1				1					1	
Mapping wikipedia	ethnicity	world	informative		1	1				1				1	1					
The world popoulation by lat+long	demographic	world	informative		1		1		1	1		1								1
Interactive maps of London surnames	demographic	London	narrative		1		1	1		1				1			1			
Local and Tourists	city users	several cities	informative		1	1		1		1		1			1					
	MOBILITY																			
Metrography	travel time	London	decision making		1		1		1	1		1						1		
Timemaps	travel time	Amsterdam	decision making		1		1	1		1				1	1					
Live Singapore / raining taxi	taxi routes	Singapore	narrative		1			1	1		1	1	1				1			
Live singapore / isochronic	travel time	Singapore	narrative		1		1		1	1		1	1					1		
Sense of patterns	taxi routes	Vien	entertainment		1		1		1	1		1						1		
London Time travel maps	travel time	London	narrative		1		1	1		1		1			1					
Bikeshare map	bikeshare	several cities	decision making	1			1	1		1				1	1					
Map your moves	migration	New York	informative		1		1		1	1				1				1		
	SAFETY																			
Oakland Crime Spots	reported crime	severl cities	informative		1		1	1		1				1	1					
Stop and Frisk	police stops	New York	informative		1		1	1	1	1				1	1			1		
Seattle Police Incident	police stops	Seattle	informative		1		1	1		1				1	1			1		
trulia crime maps	crime	several cities	informative		1		1	1	1	1				1	1					
311 complaints in NYC	311 call	New york	informative		1		1		1	1		1				1				
Million dollar blocks	city prisons	New york	informative		1		1		1	1		1				1				
How fast is LAFD where you live?	rescue	Los Angeles	informative		1		1		1	1				1	1					
	PLACES PERCEPTION																			
The Mood of Europe	mood	EU countries	informative		1		1		1	1				1					1	
Hate VS Love	mood	USA	narrative	1		1		1		1				1	1					
The world's eyes	depicted places	Spain	narrative		1	1		1	1		1		1						1	
Ssighteeing heatmap	depicted places	world	narrative	1		1		1	1	1				1	1					
Invisible cities	tales from places	NewYork	narrative		1	1		1	1		1		1		1					
MyBlockNYC	tales from places	NewYork	informative	1	1			1		1				1	1					
	ACTIVITIES																			
Live singapore / realtime talk	phone activity	Singapore	narrative		1		1	1	1		1		1						1	
A week on foursquare	landmarks	New York	informative		1	1			1	1			1					1		
Urbanmobs	phone activity	EU cities	narrative		1		1		1	1			1					1		
New York talk exchange	phone activity	New York	narrative		1		1	1			1		1						1	
Livehoods	area clustering	USA cities	informative		1	1		1	1	1				1	1					
	ENTERTAINMENT																			
Netflix rental patterns	movie rent	USA cities	narrative		1		1		1	1				1			1			
Museum of the Phantom city	art	New York	narrative		1	1		1		1				1	1					
Design week tweets	special event	Milan	informative		1	1		1		1			1		1					
this is art	art	Derbyshire	narrative		1		1	1	1	1			1		1					
	EMERGENCY																			
Hurricane tracker	hurricane	USA	informative	1	1		1	1	1	1				1	1					
Flooding and Flood zones	flooding	New York	informative		1		1		1	1				1		1				
Northern Italy Shakes	hearthquake	Italy	informative		1		1		1	1				1	1					
	POLITICS																			
Public opinion Tool / PIM	elections	USA	decision making		1		1		1	1				1					1	
CNN home and away	conflict causalities	USA, Afg, Iraq	informative		1		1	1		1				1	1					
forecast of congress	elections	France	decision making		1		1		1	1				1				1		
presidential campaingn stops	elections	USA	informative		1		1	1	1	1				1				1		
	TREND TOPICS																			
Mapping kony	singular topic	world	informative		1	1		1		1		1							1	
Trendsmap	trends	world	informative	1		1		1	1	1				1	1					
Mapping the buzz	trends	NYC, LA	informative		1	1			1	1		1					1			
thanks-friday	topics	New York	informative		1	1		1		1				1	1					
anatomy of a protest	singular topic	New York	informative		1	1		1		1		1				1				
	EDUCATION																			
Dust	school choice	USA cities	decision making		1		1		1	1				1			1			
GreatSchools	school choice	New York	decision making		1		1		1	1				1			1			
Schooloscope	school choice	UK	decision making		1		1		1	1				1						
	HEALTH																			
Idao public health district	public health	Idaho, US	informative		1		1		1	1				1					1	
massive health	food health	world	informative		1	1			1	1				1						1
healthmap	public health	USA, Canada	informative	1		1		1		1				1	1					
	ECONOMY																			
Financial Footprint	financial transactic	Spain	narrative		1		1			1			1						1	
Live singapore / hub	import export	Singapore	narrative		1		1	1	1		1		1						1	
Us import and export	import export	USA, world	narrative		1		1		1	1				1						1
rentonomy	rent price	London	decision making	1			1		1	1				1			1			
TOTAL				9	60	18	47	34	44	60	7	16	15	39	28	6	7	13	11	5

case study	comprehensive	simplified	area cartogram	isochronic cartogram	density	size	quantity	colors	type of simbols	shape	solid	dots	areas	squares	rectangles	polygon	straight lines	curved lines	text	icon, symbols	choroplet	size	shape	thickness	direction	color palette	fill opacity	solid or dashed	extra explanations	statistics	indicators	time exploring
	data display – base: geographic map		cartogram map								shape of individual elements											individual element variation							extra			
ENVIRONMENT																																
Live Singapore / urban energy		1					1	1			1											1							1			1
London Air Pollution	1							1	1											1						1			1			
urbmet								1													1					1	1			1		
NYC building energy		1						1													1					1			1	1		
mapping urban tree density		1						1								1											1					
windmap		1			1													1							1				1			
waste facilities		1						1		1		1	1													1						
Groundwater in movement		1			1								1														1					1
POPOULATION																																
Maps of Babel		1					1	1				1														1						1
Mapping America, every block		1					1	1				1																				
Growing Switzerland			1			1		1								1						1				1						1
Mapping wikipedia		1						1				1														1						
The world popoulation by lat+long		1				1										1																
Interactive maps of London surnames		1						1											1							1						
Local and Tourists		1			1			1				1					1									1						
MOBILITY																																
Metrography				1		1												1				1	1		1				1			
Timemaps				1		1				1		1	1				1								1	1						1
Live Singapore / raining taxi		1				1	1				1	1										1				1	1					1
Live singapore / isochronic				1		1				1			1			1						1	1		1							1
Sense of patterns		1			1		1	1									1							1		1						1
London Time travel maps				1				1		1						1	1								1				1			
Bikeshare map	1					1		1					1									1				1				1		1
Map your moves				1		1		1				1						1				1			1	1			1	1	1	1
SAFETY																																
Oakland Crime Spots	1							1					1						1							1			1			1
Stop and Frisk		1				1							1									1					1		1	1		1
Seattle Police Incident		1						1	1											1						1			1	1		1
trulia crime maps		1						1				1									1	1				1	1		1	1		1
311 complaints in NYC		1						1													1					1						
Million dollar blocks		1						1													1					1						
How fast is LAFD where you live?	1							1							1	1										1			1	1		
PLACES PERCEPTION																																
The Mood of Europe		1						1													1					1			1	1		1
Hate VS Love		1						1				1														1			1			
The world's eyes		1																		1		1					1		1			1
Ssighteeing heatmap		1						1					1							1						1	1		1			
Invisible cities				1		1				1	1					1	1		1	1					1							
MyBlockNYC	1																1					1							1			1
ACTIVITIES																																
Live singapore / realtime talk		1			1			1				1						1				1		1		1						1
A week on foursquare		1				1		1					1													1			1			1
Urbanmobs		1				1							1									1					1					1
New York talk exchange		1						1										1							1	1						1
Livehoods	1							1				1				1										1			1	1		
ENTERTAINMENT																																
Netflix rental patterns		1						1													1					1	1		1	1		
Museum of the Phantom city	1											1																	1			
Design week tweets		1						1				1														1			1	1		1
this is art	1					1		1												1		1				1						
EMERGENCY																																
Hurricane tracker	1					1		1		1		1	1													1				1	1	1
Flooding and Flood zones		1						1													1					1			1			
Northern Italy Shakes	1					1		1					1									1				1			1	1	1	1
POLITICS																																
Public opinion Tool / PIM		1						1													1					1			1	1	1	1
CNN home and away		1				1							1									1							1			1
forecast of congress		1						1						1							1					1			1			
presidential campaingn stops		1				1		1					1									1				1			1			1
TREND TOPICS																																
Mapping kony		1										1													1				1			
Trendsmap	1					1													1			1							1	1		
Mapping the buzz		1			1			1					1									1				1			1			
thanks-friday	1				1			1				1														1			1	1		1
anatomy of a protest		1																		1									1			1
EDUCATION																																
Dust	1					1							1								1	1							1	1	1	
GreatSchools	1							1	1							1							1			1			1	1		1
Schooloscope	1							1	1											1						1			1			
HEALTH																																
Idao public health district		1						1													1					1			1	1	1	1
massive health		1			1			1					1													1	1		1	1		1
healthmap	1							1												1						1			1			
ECONOMY																																
Financial Footprint		1				1		1					1									1				1			1			1
Live singapore / hub		1			1			1				1						1				1		1		1						1
Us import and export	1					1		1									1							1		1						1
rentonomy			1					1							1												1		1	1	1	
TOTAL	17	41	2	6	9	21	5	49	4	6	3	18	18	1	2	9	7	6	4	9	12	22	3	4	9	46	12	0	41	22	7	35

case study	filter	sort	explore singular content	search	derive values or models	pan	zoom	select	base view	contents' attributes	insert own data	record analysis	share on social media	add comments	brushing	clicking	menus	buttons	check buttons	slide
	interactivity – data view and specification					view manipulation: navigate		select	customize		process and exporting options				interactive elements: main visualization		menus	other windows		
ENVIRONMENT																				
Live Singapore / urban energy																				
London Air Pollution	1				1	1	1									1	1			
urbmet	1		1			1	1					1						1	1	
NYC building energy			1			1	1						1		1	1				
mapping urban tree density																				
windmap			1			1	1								1	1				
waste facilities																				
Groundwater in movement																				
POPOULATION																				
Maps of Babel																				
Mapping America, every block			1	1		1	1						1		1			1		1
Growing Switzerland								1												1
Mapping wikipedia	1					1	1										1			
The world popoulation by lat+long																				
Interactive maps of London surnames	1					1	1						1							1
Local and Tourists																				
MOBILITY																				
Metrography																				
Timemaps			1	1				1								1	1			1
Live Singapore / raining taxi																				
Live singapore / isochronic																				
Sense of patterns																				
London Time travel maps																				
Bikeshare map	1			1	1	1	1	1								1	1			
Map your moves			1					1								1				
SAFETY																				
Oakland Crime Spots	1		1			1	1	1								1		1		
Stop and Frisk	1		1			1	1									1	1			1
Seattle Police Incident	1		1			1	1	1				1				1	1		1	1
trulia crime maps	1		1	1		1	1	1		1			1	1	1	1			1	
311 complaints in NYC																				
Million dollar blocks																				
How fast is LAFD where you live?	1		1			1	1	1		1					1	1	1		1	
PLACES PERCEPTION																				
The Mood of Europe	1		1			1	1	1								1	1			
Hate VS Love			1			1	1	1								1				
The world's eyes																				
Ssighteeing heatmap	1		1							1			1			1	1			
Invisible cities																				
MyBlockNYC	1		1	1		1	1	1			1		1			1	1	1		1
ACTIVITIES																				
Live singapore / realtime talk																				
A week on foursquare																				
Urbanmobs																				
New York talk exchange																				
Livehoods	1		1			1	1						1			1	1			
ENTERTAINMENT																				
Netflix rental patterns	1	1	1	1				1							1			1		1
Museum of the Phantom city			1			1	1		1		1					1	1			
Design week tweets																				
this is art	1		1	1											1	1	1		1	
EMERGENCY																				
Hurricane tracker	1					1	1		1				1		1		1		1	
Flooding and Flood zones	1			1		1	1						1					1		
Northern Italy Shakes	1		1			1	1	1					1			1			1	
POLITICS																				
Public opinion Tool / PIM	1							1									1	1		
CNN home and away			1	1		1	1	1								1	1	1		
forecast of congress			1										1		1					
presidential campaingn stops			1			1	1						1		1			1		
TREND TOPICS																				
Mapping kony																				
Trendsmap			1			1	1						1			1		1		
Mapping the buzz																				
thanks-friday	1		1			1	1									1		1		
anatomy of a protest																				
EDUCATION																				
Dust	1		1	1		1	1									1	1	1		1
GreatSchools	1			1		1	1									1	1	1		
Schooloscope				1		1	1									1				
HEALTH																				
Idao public health district	1		1			1	1		1							1		1	1	
massive health															1					
healthmap			1			1	1		1							1		1		
ECONOMY																				
Financial Footprint																				
Live singapore / hub																				
Us import and export			1			1	1								1					1
rentonomy	1		1	1		1		1							1	1	1		1	
TOTAL	25	1	30	13	2	32	31	16	4	3	2	2	13	1	13	28	19	15	9	10

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