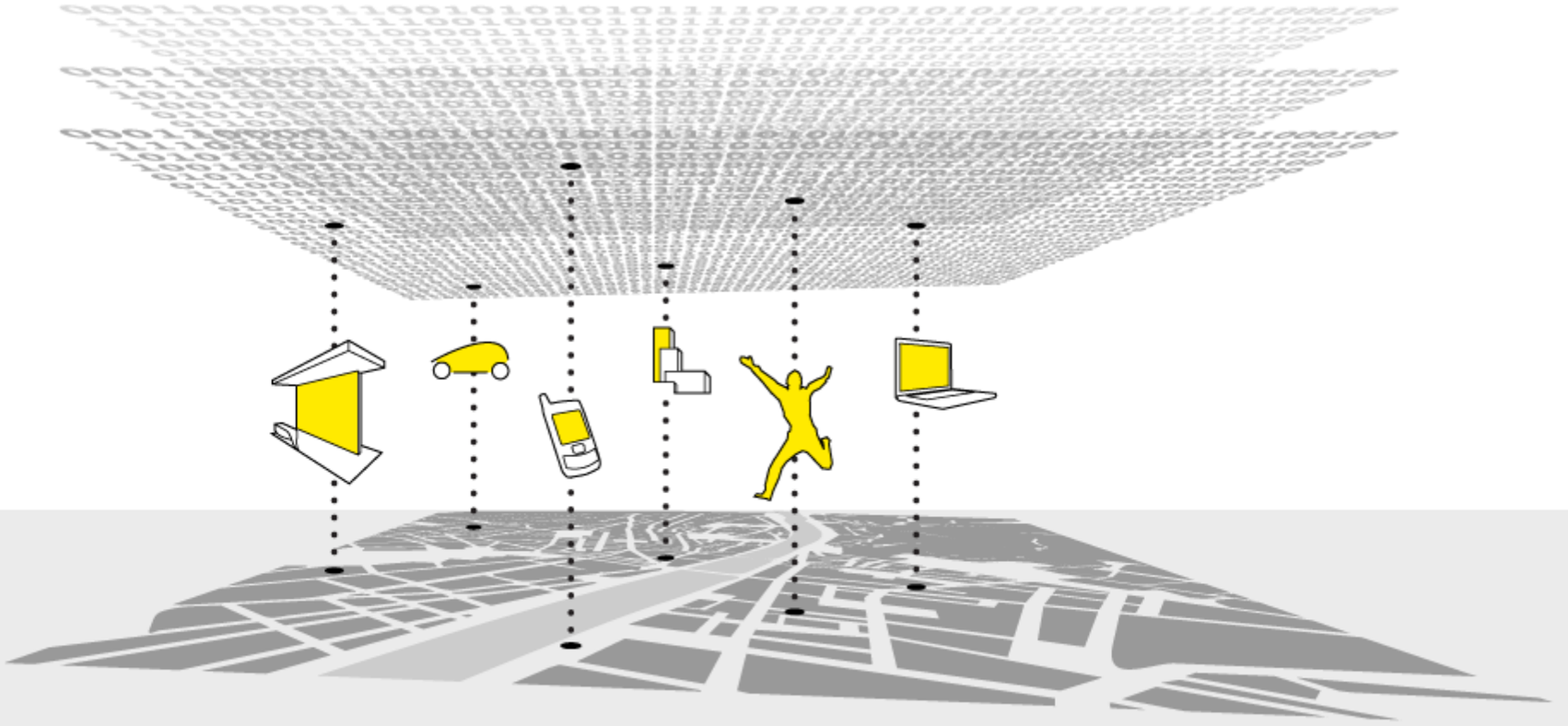
Mapping of city dynamics

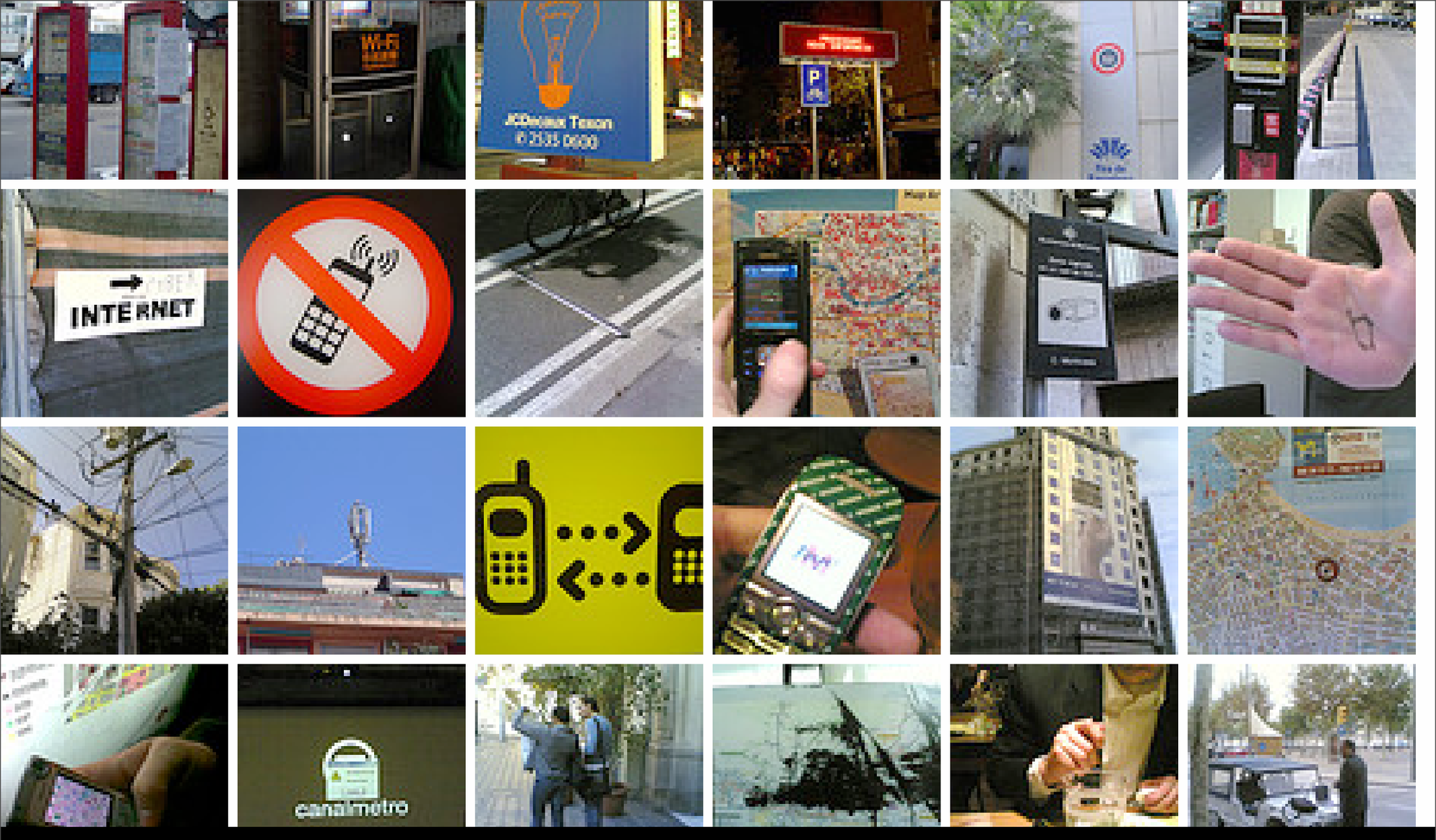


Fabien Girardin
Mobile Monday Barcelona, December 3, 2007

senseable city lab:.::

GTI GRUP DE TECNOLOGIES INTERACTIVES

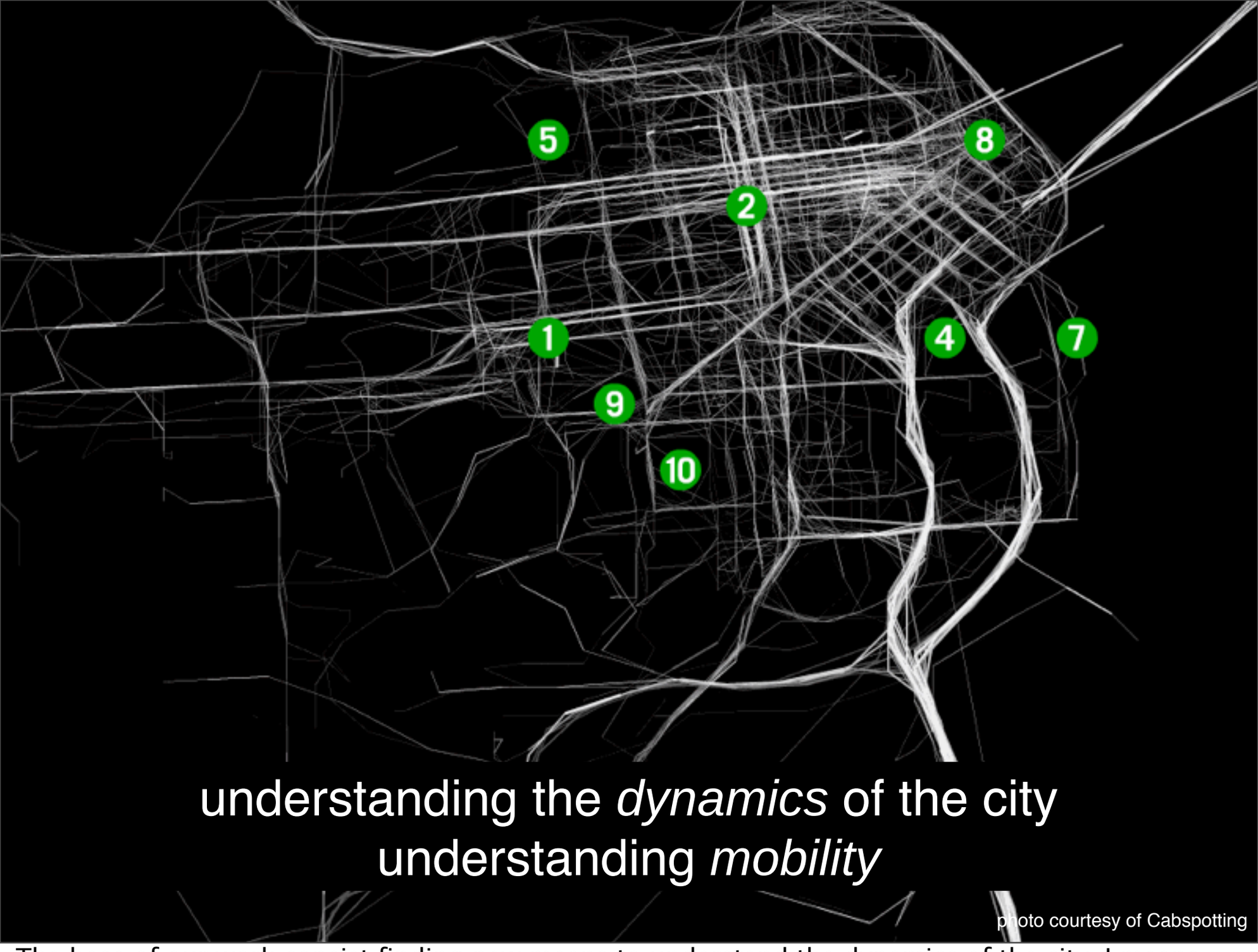
Good evening. My name is Fabien Girardin, I am a PhD student at the Universitat Pompeu Fabra in Barcelona. I perform part of my research work in affiliation with the MIT SENSEable City Lab in Boston. Today, I will present innovative ways to use mobile and wireless technologies to sense the city and reveal its pulse (i.e. its activity in space and time). Then, I will briefly discuss the implications and opportunities for the designers of location-based services that raise from these works. As an example, I will introduce an ongoing project lead at the SENSEable City lab, named WikiCity, that aims at offering an instrument for city inhabitants to base their actions and decisions upon in a better informed manner.



urban computing

mobile, wireless, sensors, people, urban infrastructures

The scope of our research lays in the domain of urban computing. That is that we try to understand how mobile, wireless and sensor technologies (pervasive technologies) can integrate the urban environment and infrastructure to improve people's lives. More precisely, it translates into three main themes: 1. How people appropriate technologies in the city 2. How to design these technologies and the systems they support to integrate people's life in the city. 3. How to take advantage of these technologies to better define people's mobility and activities in the city. Even though I will mainly discuss the latter these themes are highly connected.

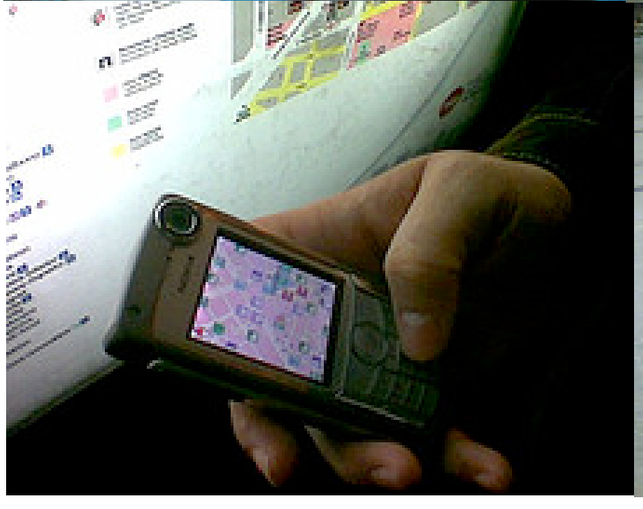


The base of our work consist finding new means to understand the dynamics of the city. I means collecting new types of data and visualizing them to reveal how people use the city, what is its activity, how different neighborhoods live along the course of a day, week or year.

“digital footprints”

increase of the interaction between the physical and digital



In the past, these types of mobility and activity data were hard to collect and grasp. It is done through surveys and observations.
Nowadays, in our every day activities we leave behind footprints from our interaction with the urban environment and its digital infrastructures (e.g. taking and sharing digital photos, communicating through wireless networks, withdrawing money, using an RFID card to rent a bike, accessing Google maps or now Google My Location).

real-time

real-time rome. implicit use of infrastructures

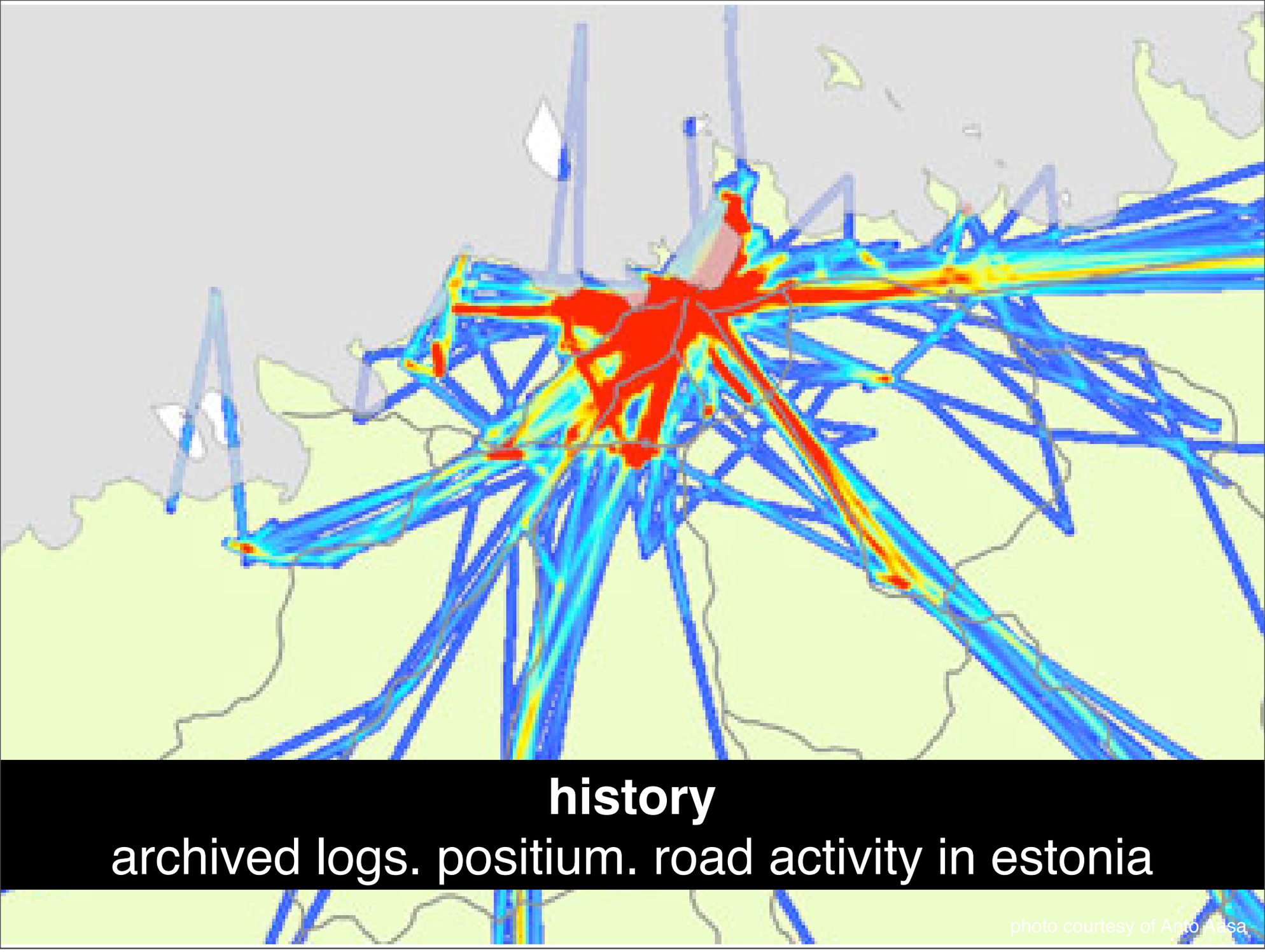
A major added-value in collecting these digital footprints is that it reveals the real-time status of the city. This is the example of the Real-Time Rome project that maps people activity in downtown Rome. The data come from people's implicit use of wireless network infrastructure when using their mobile phones. Every 5 minutes, we collect the number of calls and SMS made in each cell of the GSM network. Based on that we are able to map the hotspots of downtown Rome along the day.

This video show the pulse of Rome during last year's World Cup final. It shows how people occupy and move through certain areas of the city during this special events.

feedback loop

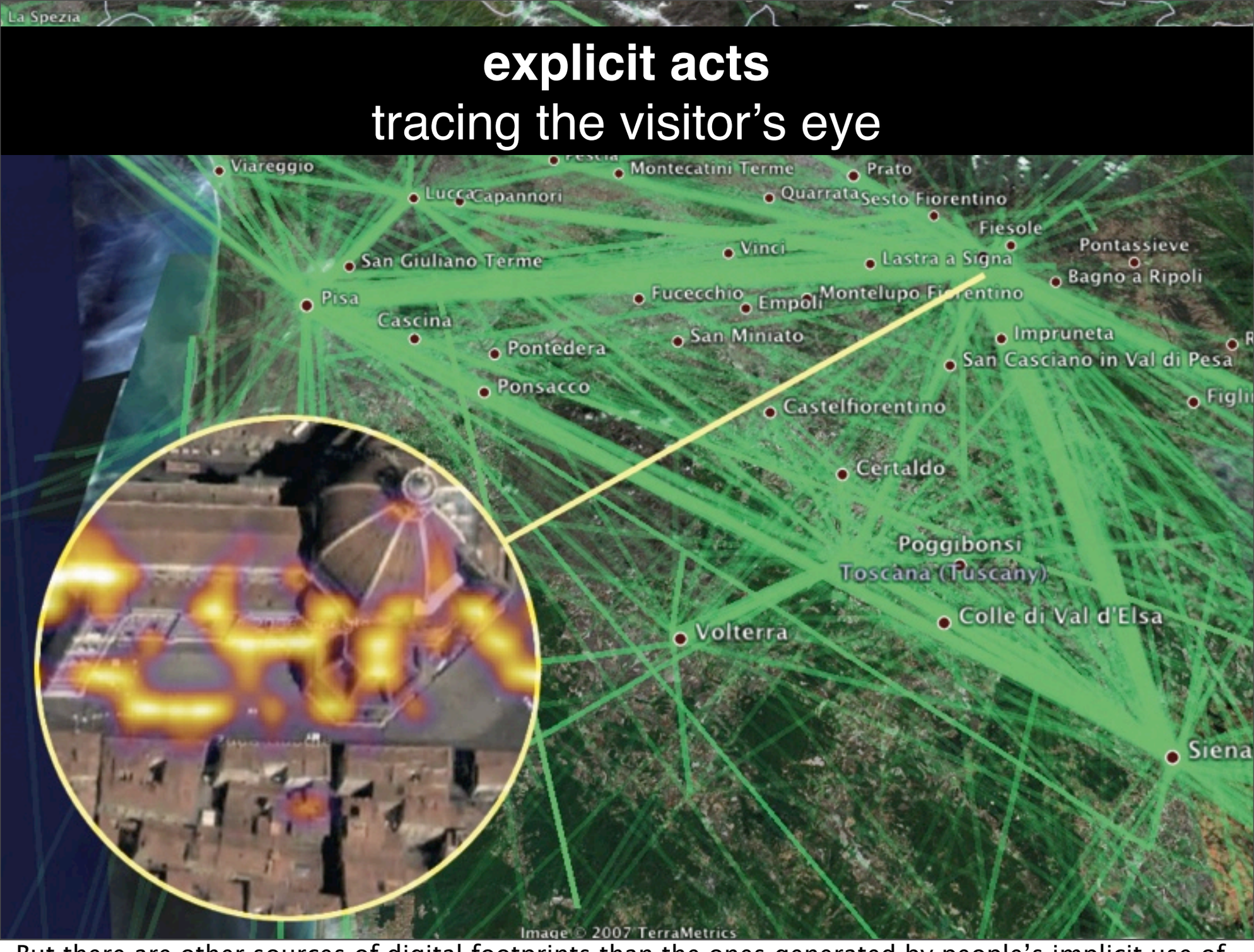
traffic jam alert, inform, adjust behaviors

Using similar type of wireless network data, the company IntelliOne is about to detect traffic jams and return the information to people in their car. The motion of the traffic is detected by the speed mobile phone roam from one area to another. The interesting concept in this use of the digital footprints is that it creates a feedback loop. That is the people generating the data can profit from the analysis to be informed and adjust their behaviors.



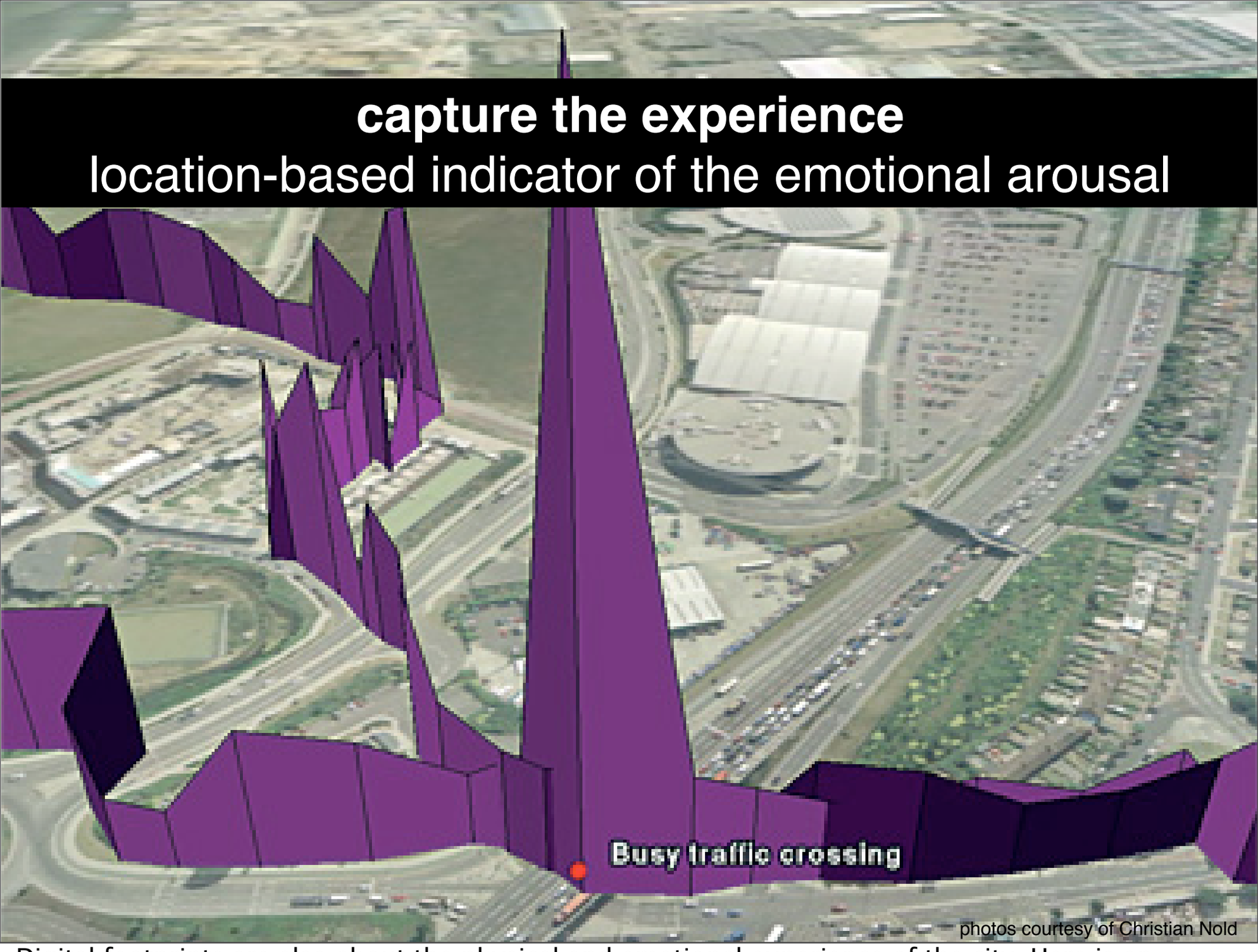
Digital footprints are stored, logged, archived. This history is important to reveal the patterns of movements and activities. This is the example of the Positium application that collected the archives of wireless network usage and map them over time to reveal people's use of transport infrastructures in Estonia. They also use these data for other purposes, such as revealing where do tourist spend time when they visit Estonia.

explicit acts
tracing the visitor's eye



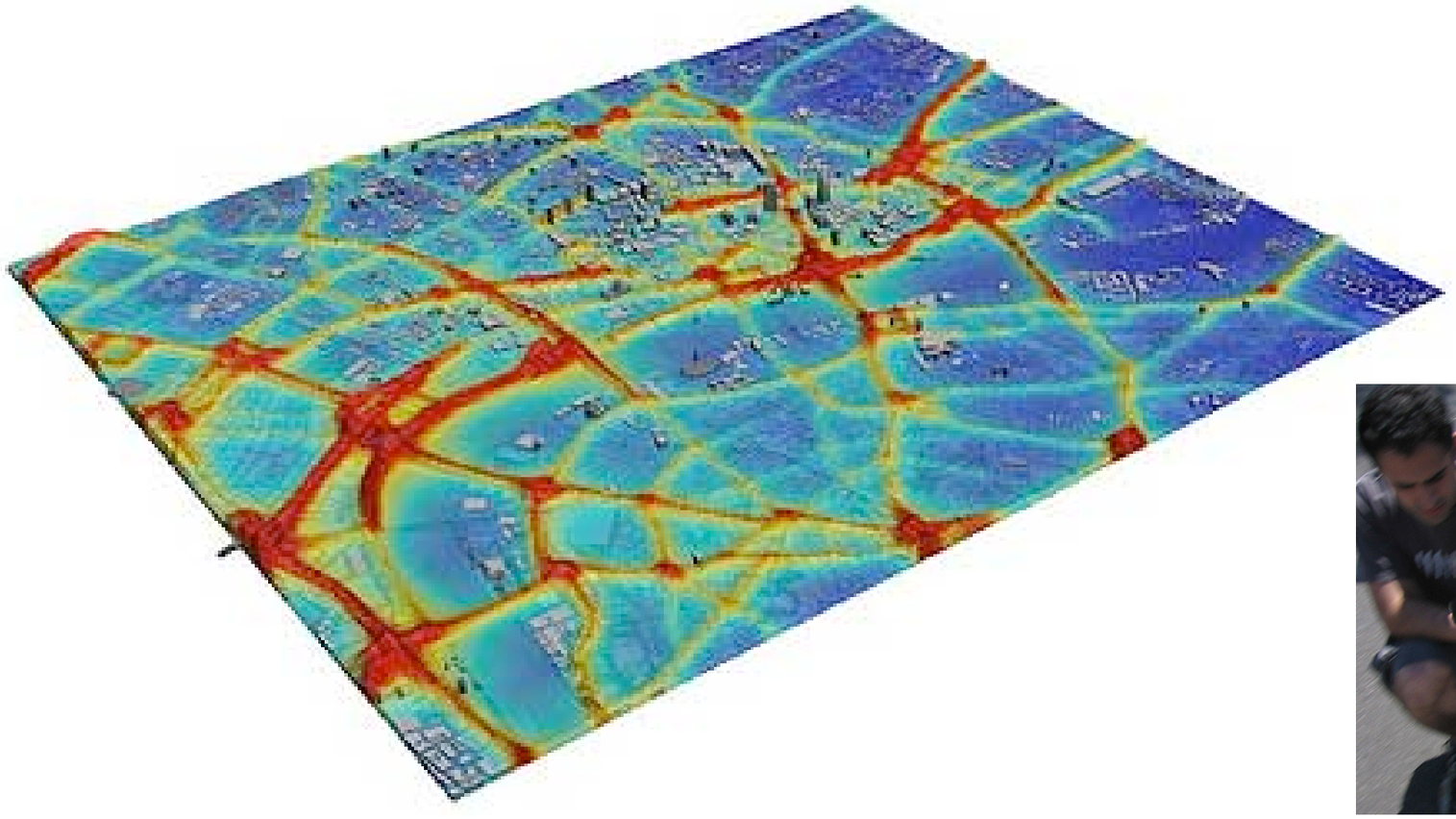
But there are other sources of digital footprints than the ones generated by people's implicit use of wireless networks. In this project "Tracing the visitor's eye", I analyze the photos that people publicly share in Flickr. For a city like Barcelona there are more than 150.000 photos with geographic and time references attached. The aggregation of these data allows me to reveal the main points of interests of the city and how tourists visit it (e.g. where do they come from, where do they go, how long do they stay). Compare week-ends with weekdays.

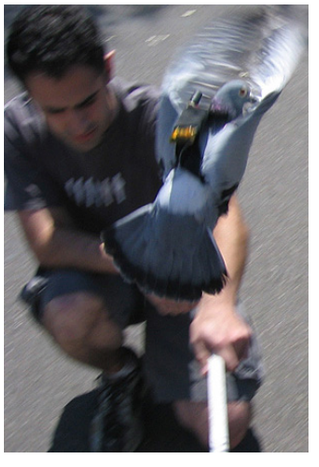
capture the experience
location-based indicator of the emotional arousal



photos courtesy of Christian Nold

Digital footprints are also about the physical and emotional experience of the city. Here is an example of the BioMapping project setup by Christian Nold. Participants of this project wear mobile devices that collect their emotional arousal in relation to their location. When the data are analyzed and mapped it reveals for example the fear to cross a very busy road.





not only the activities, but also the consequences

pollution mapping, multiple actors and actuators

Finally, these data are not necessarily about understanding our activities and experience, but also about analyzing the consequences. There are several project that use mobile devices wear by normal citizens to collect pollution data. In that sense everybody becomes an actor and actuator of the city. A rather extreme example being the pigeon blogs of the artist Beatriz da Costa. She equipped pigeon with gps devices and pollution sensors for them to report on the quality of the air.

so who does that concern?

Ok, so all this is nice, but who does that really concern?

audiences

1. provide **urban planners and local authorities** with useful information on how a city gets used by different groups of people.

   but also...

First, urban planners and local authorities thrive on getting on how their city gets used by different groups of people. That is how tourist visit the city (e.g. where do they spend their time). The Real-Time Rome project could compare the availability of the public transport in comparison with the density of people in certain areas of the cities and therefore detect the shortcomings of the infrastructure. But most importantly for tonight, these data also concern...

2. designers of location-based services

Now

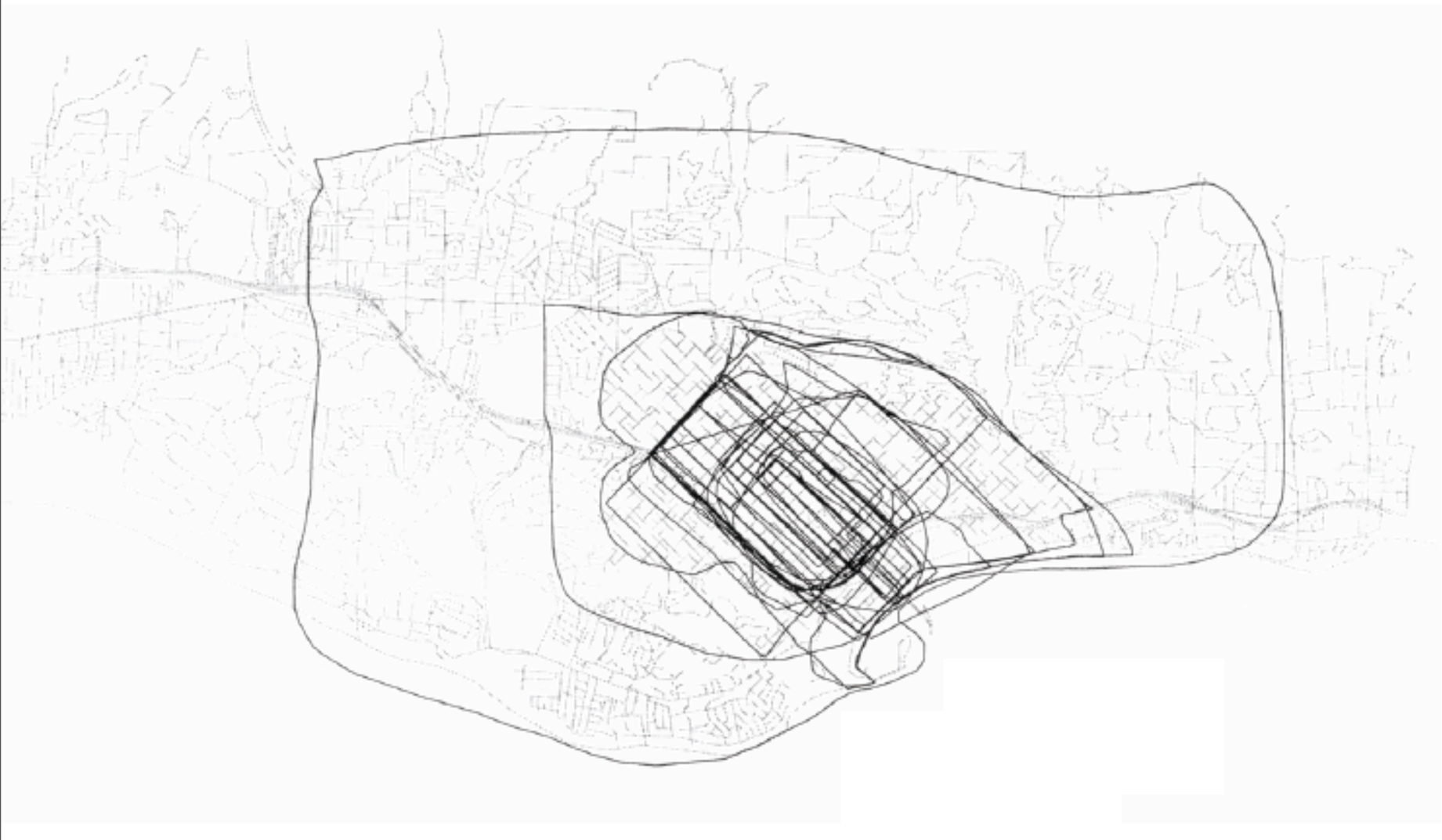
- Little understanding of geographical and temporal relevance. Hard to grasp a context.

Digital footprints

- Use position history to tailor results from requests for information further
- Define area of attention and influence as well as granularity
- Help define a human-based geographical concepts (e.g. define a neighborhood such as “downtown”)

... the designers of location-based services. For the moment location-based services that address the masses lack of geographical and temporal relevance. For instance, the activities at 22@ are not the same at daytime and nighttime. In addition, it is extremely hard to grasp any kind of context from a mobile phone. The use of digital footprints can help tailor results based on the history or past movements in space (people where were there at that time then went to do this activity). The way to people interact with the system can help defining the area of attention and influence of points of interest (how important is the museo picasso on a Monday afternoon?). Finally, it also helps having a human-based approach to geographic concepts.

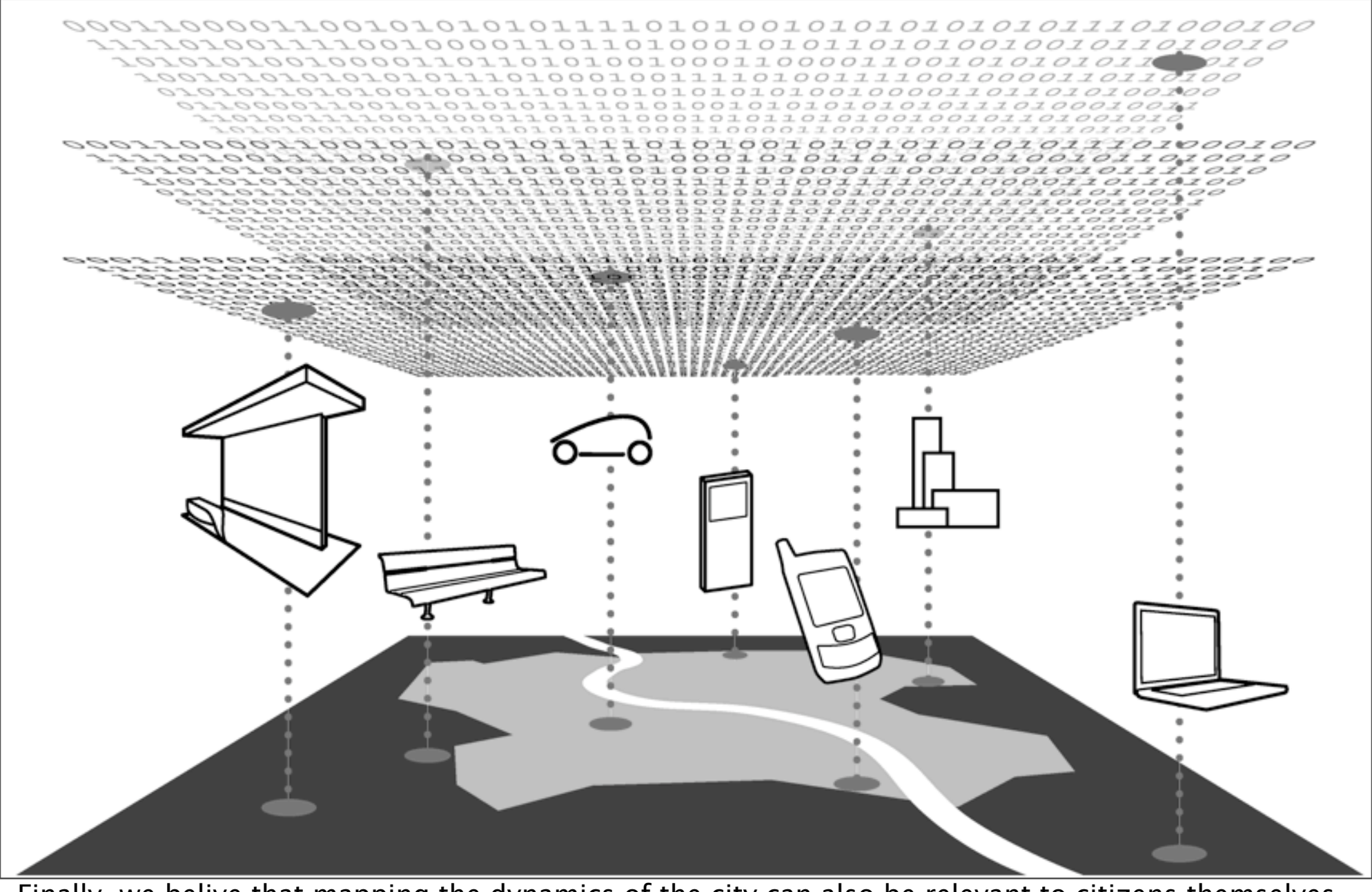
What is downtown?



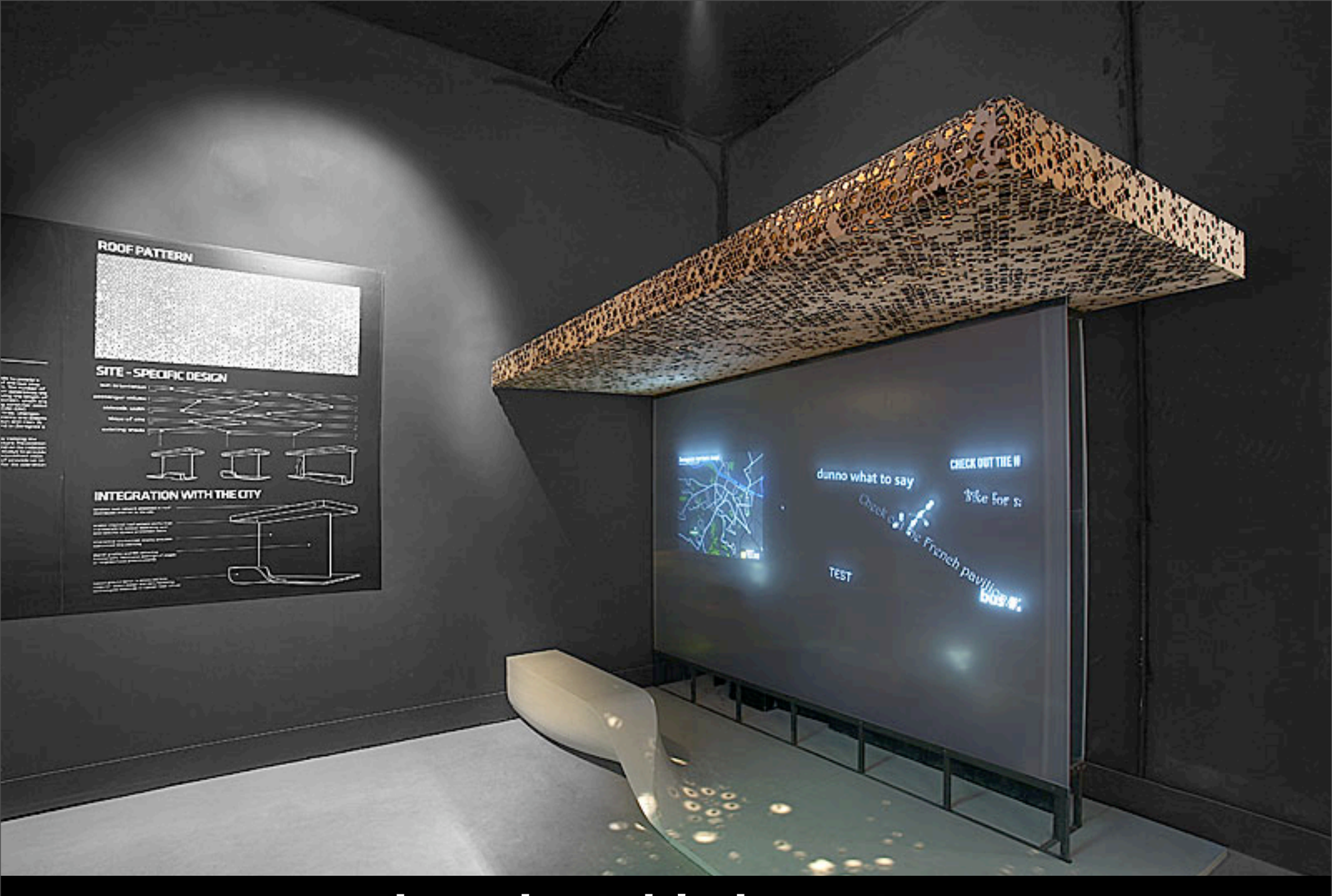
Thas it instead of using administrative boundaries to define the urban space, we can create the vague boundaries created about how people use the space. This is an example of people's perception of downtown Santa Barbara when you let them draw the are. Of course, everybody has its own vague definition of downtown, that also changes along time.

3. city residents and visitors

WikiCity. instrument for city inhabitants to base their actions and decisions



Finally, we belive that mapping the dynamics of the city can also be relevant to citizens themselves. In that perspective, we are developing WikiCity. In this project we aim at providing the inhabitants with a better idea of their own city based on the feedback loop. The system aggregates various types data and visually mapped the density and movement of people, buses, taxis. The visualizations can be helpful to raise awareness among city residents and visitors: others were here, this was popular, where I can find something, or where shouldn't I go.



the adaptable bus stop

zaragoza 2008 world expo

An example of this multi-modality is the adaptable bus stop that we will deploy in Zaragoza for the World Expo. Among many other features it aims at providing real-time data about the city.

WikiCity Rome

Aggreate various types of data. mapped movement of people, buses, taxis, events in real time

A first instance of WikiCity was deployed in Rome for the Notte Bianca festival. During Notte Bianca many of the cultural attractions of the city are open to the public. WikiCity was available on the web and in giant screans in the city. The system aggregated various types of data and visually mapped the density and movement of people, buses, taxis, events in real time throughout the whole of the Eternal City. People can then see where others where, the events, the availability of the transports (buses, taxis, train). Other instances of WikiCity will take place in other cities these upcoming months.

photo courtesy of Nicolas Nova

vital

the protection of contributors' privacy

Such a presentation can not close on a clear statement about privacy. Privacy was a main concern of the projects I presented. The data were either aggragate (crowd not individuals) and from coming from public data or the explicit consent of people. It is absolutely crucial with this kind of project reveal to people with real transparence what is done with the data, where do they come from and where do they go.

thank you

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