

# Living Maps

## New data, new uses, new problems

Christophe Aguiton, Dominique Cardon, & Zbigniew Smoreda

Sociology and Economics of Networks and Services department

Orange Labs

Paris, France

**Abstract**—In this paper, we address some sociological and political issues linked to the emerging of distributed, real-time “living maps”. A “living map” is a merger between a territory map and a dynamic localized flows representation creating visual information where places, people, activities, and time are mixed together. Starting with the hypothesis of transformation in urban meeting manners, we propose a typology of living maps and we discuss the social and privacy issues linked to each type of use.

**Keywords:** *geolocation data; dynamic cartography; privacy; social acceptability; perverse effects*

### I. INTRODUCTION

The development and use of digital networks produce an increasing affluence of new data and transform the actual use of classical information tools. One of these domains is the cartographic representation of space well known to geographers. The possibility to access large localization databases seems to resume the time-geography project [1] to examine the spatial and temporal coordinates of individual human activity, but at the present time on a mass level. Real-time geolocation offers new opportunities to build maps augmented with human presence and activity information. On the scientific side, it offers an extraordinary opportunity for complex system researchers; on the user side, it transforms a map into a kind of new search engine. Location data are becoming increasingly available not only to organizations operating large digital networks but also to smaller actors using localization tags (GPS, WiFi-spots, cellular antennas, Bluetooth, RFID...), and finally to everyone equipped with a location enabled device. These generate incredibly rich and fuzzy datasets. The mobile device data appear immediately as a rich source of information for urban analysis [2]. The presence and movements of people engaged in their everyday occupations can be followed en masse, proposing new, cheap and automatically collected information for urban planners or travel analysts [3]. On the other hand, location based services offer new business opportunities associated with the utility of information about one’s surroundings (close cinemas, restaurants, taxi stations, emergency shelters, and so on) and the support of one’s mobility (navigation, car traffic, itinerary, etc.) that they can propose. Numerous social web services have adopted localization as important information as well. Paid or free, localized information is now continuously accessible via digital cartography on personal computers, mobile phones or GPS receivers supplying simultaneously a large number of people with a highly precise territory view. At the same time, the integration of the heterogeneous data into a digital map

transforms it. A synchronized representation of territory, flows and events displayed on the unique, highly malleable and easy to use interface creates a new dimension of the map. The dynamic map puts into the hands of the user not only a useful way to domesticate space but also a potentially real-time information engine to see where and what kind of activity is going on. The capacity to have all at once a bird’s eye view of the city dynamics and to change instantly map scale by zooming provides the user with a new spatial representation that was limited in the past to specialized supervision rooms. It needs to be stressed here, this opportunity is offered to a large number of space users at the same time, thus giving them a reciprocal action frame.

In this paper, we want to address some sociological and political issues linked to this emerging opportunity to build distributed, real-time “living maps”. What we mean by living map is a contemporary merger between a classical digital territory map and a dynamic localized flows representation producing a new kind of visual information where places, people, activities, and time are mixed together. First, we look at the transformation in urban rendezvous cultures. Second, we try to propose a typology of living maps. And finally, we list the social and privacy issues linked to each type of use.

#### A. From rendezvous scheduling to map of opportunities?

The rise of living maps suggests several significant changes in the articulation of time and space in our societies. One of the most important is the changing attitude observed in some segments of the population toward the idea of forward planning. New information and communication technologies have generally been considered as tools rationalizing personal life. They create a new set of obligations, formalize organizational processes and oblige us to pay continuous attention to information flows. However, living in a more rationalized world, people are also searching to avoid forward planning in order to preserve flexibility and last moment choices. This tendency can be observed in many different aspects of everyday life: last minute booking, speed dating, flash mobs, barcamp as a non-scheduled conference, etc. Paradoxically, the taste for unpredictability is linked to the technology-driven rationalization of time and space. People are looking for a gain of flexibility in the way they use their time and to expand their opportunities of mobility or travel. In fact, the mobile location-based services offer new artifacts to create opportunistic encounters: instead of planning strictly a future rendezvous which involves coordination costs and cognitive investment, people can indicate simply “I’m there.” Thus they

don't create an obligation upon other, but just publicize the fact of their availability to people passing nearby who can blow in and meet, creating "a kind of technologically augmented serendipity" [2]. Those new coordination practices have been observed by Humphrey in a study of the use of Dodgeball by young people: "The kind of communication that Dodgeball facilitates seems to lead to a social molecularization, whereby informants both experience and move about through the city in a collective manner" [4]. Rather than having to plan the time and place for meeting, Dodgeball allows users to communicate indirectly about public places. Instead of scheduling rendezvous in a café, people can indirectly alert friends that they have found a new place. The exchange of social and locational information is accelerated, because it can occur in real time and, thus, allows users to make decisions about their physical movements based on the social and spatial information available to them. The rise of those forms of coordination requests the distribution of living information (availability, taste, and different kinds of behavior in the city) together with others check-ins on a map. Instead, or besides, agenda, maps are becoming a new information tool essential to bring more flexibility into mobility practices. Furthermore, this shift in urban coordination tools should also be seen as a part of an individualization process where people are asked to monitor and supervise by themselves a lot of new information that was previously hidden and/or supervised by institutional actors such as telecommunication or city operators.

## II. LIVING MAPS: THREE TYPES, DIFFERENT ISSUES

The emergence of a new technological opportunity of geolocation has provoked a variety of social reactions ranging from enthusiasm to fear. Inside the scientific community, the optimists consider large databases of localized personal digital traces as a great opportunity to refine [5] or even to rewrite the analysis of human behavior. Indeed, we have a unique chance to access via digital footprints long-term, automatic, highly reliable mass observation, so different from classical self-reporting, small sample studies of the behavioral sciences! Subsequently some have even proposed to establish a new "Computational Social Science" to take advantage of these data [6]. On the other hand, the pessimists see in the location data use more risks than advantages, a kind of ultimate fulfillment of Orwell's 'Big Brother' nightmare which can lead us to a 'geo-slavery' [7]. Someday an evil-minded government may use this technology to impose a total surveillance state. Thus they are also implicitly persuaded of the value and the power of these data for the understanding of individual and social behavior, but for them the balance of the pros and the cons is evidently on the dark side. However, other researchers oppose that both are wrong in believing that the extensive data can give us an overall understanding of the society. In his analysis of Parisian supervision systems, Latour observes: "Megalomaniacs confuse the map and the territory and think they can dominate all of Paris just because they do, indeed, have all of Paris before their eyes. Paranoiacs confuse the territory and the map and think they are dominated, observed, watched, just because a blind person absent-mindedly looks at some obscure signs in a four-by-eight meter room in a secret place" [8]. And after all, maybe he is right?

From our point of view, the best way to analyze the social opportunities and dangers of "living maps" is to enter in the reality of those maps in terms of databases, social uses and the possibilities of surveillance or control they offer. Doing this, we realize that we are talking about at least three different kinds of maps: (1) Republic-like, similar to "one person, one vote" principle, made up of general data generated (unintentionally) by user presence in the space-time showing human flows; (2) Segmentation-like or Tribe-like based on tastes, characteristics or community affiliations, using data from geolocated social networks and showing those "tribes" inside cities and territories; (3) Buddies-like or Friends-like, where a person can locate her "friends" on a map.

We will first present some examples of those different kinds of maps, and, then, the main social, legal and political challenges of those new representations. Our simple schema below shows some main differences between those maps. The first *public disclosure axis* opposes anonymous and identity data, depending on the degree of disclosure of personal identity. The second *consent axis* separates automatic implementation and "opt-in" services, that is, where geolocation data are collected autonomously or only if the user decides to.

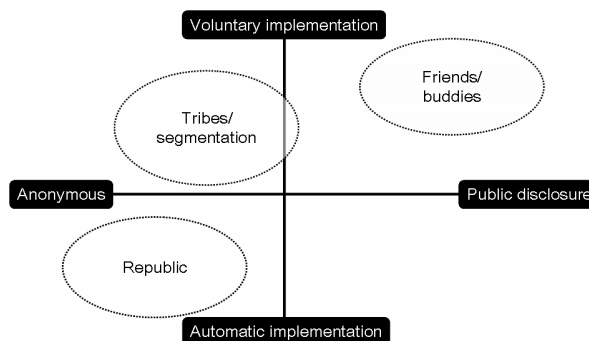


Figure 1. Schematic representation of living maps typology

### A. Republic and citizen

The Republic-like living map is similar to the dynamic chart well-known in the control rooms, set up to monitor a large range of spatial phenomena: cars, railway or subway traffic, flights supervision, water or electricity distribution, telephone or internet communication, etc. It is a kind of map where the observed flow is visualized to know what is going on; they are designed in particular to provide an alert of system malfunctioning. The particularity of this representation is the fact that each vehicle, voyager or kilowatt is one undifferentiated point on the map (see Figure 2a). Some recent projects fit well this schema, using an unprecedented amount of data. The 2006 MIT Real Time Rome project aggregated localization data from cell phones, buses and taxis in Rome to show city dynamics [9]. The traces of information and communication networks, and transportation systems were put on the map to show the "real-time city." In 2008, the New York Talk Exchange project was set up to illustrate the global exchange of information by visualizing volumes of long distance voice and data exchanges between New York and cities around the world [10]. The same year, the Urban Mobs

project used mobile phone data, communication and hand-over, to visualize the way popular events (World Music Day, European Football Cup) have been experienced in six large European cities [11]. The mobile phone communication and localization data have also been used, as in the “control room” model, to focus on the occurrence of anomalous events [12].

### B. Segmentation and tribes

In this case, the maps show hot-spots, clouds or flows which represent clusters of people according to their different characteristics - I can see where are people “like me” (see Figure 2b). Even if maps are created with data “given” by users in their profile and/or history of their activities, the result doesn't show individuals but only aggregated representations. Data used are usually generated through GPS devices. For example, the Sense Network's Citysense software [13] proposes to specify not only where people are gathering, but also where people with similar spatial/behavioral patterns (students, gays, tourists...) are congregating. Three types of data are used to segment a space user: GPS locations of users' movements around a city; publicly available data about the location of places (bars, schools, offices, residential areas...) and their in a city; and localized census data (age, income...). All provide information for datamining analysis looking for significant clusters of mobile users, called “tribes.” Those visible (i.e. connected) tribe members are then visualized on the map to show a real-time urban space occupation by different types of users. Stored data are then used to discover a cluster's mobility patterns which are openly centered on marketing applications (advertising, shopping, retailers...). Other interesting experimentation, from the MIT Senseable City Lab, has used photos on Flickr (Web 2.0 as “The World's Eyes” [14]) to show the top tourist spots of British sightseers.

### C. Buddies and friends

But the most popular services have tried to link the social network and the user and his/her friends' geolocation (see Figure 2c). For many years mobile-device access to social media sites has been considered one of the most profitable business opportunities. It will give continuous access to friend's conversations everywhere and anytime. More than that, many innovators consider that, with geolocation tools, spatial proximity could become an original search engine. The first services to develop such opportunities were Dodgeball (declarative self-positioning to signal location to friends where they hang out at night), and InstaMapper (providing contact list members location on user's mobile phone). Some experimentation (Spotme) has also been conducted in order to provide conference participants with an active badge that could help to discover people sharing the same interest around them [15]. Recent services like Aka-Aki, Brightkite or Latitude bring those ideas to a mature market. By generalizing tools allowing social network services, the spread of smartphones (iPhone or Android) helps users to establish a constant link to the spatial position of their friends. Even if those newest services are just at their beginnings, a first analysis attests that customers show a great interest in them, declaring at the same that they are frightened by the risk of commercial control of their private life. That is the reason why most of those news services carefully try to minimize automatic localization (and prefer an

opt-in feature instead) and offer an option to show personal location to a configurable circle of people, ranging from everyone to ‘trusted friends’ or, for some of them, indicate only the proximity between people without representing their precise geographic coordinates.

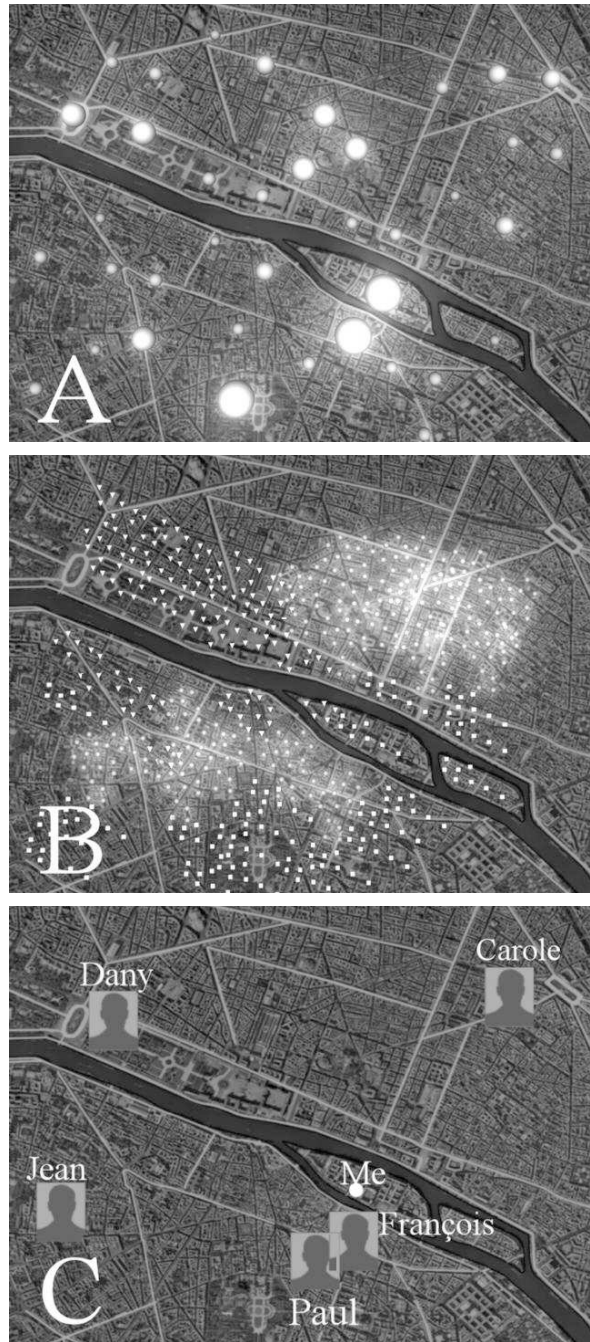


Figure 2. Examples of map types: (a) Republic-like, instant intensity of mobile phone traffic in Paris downtown (large spots mean high activity); (b) Segmentation-like, different nationalities visiting Paris (white triangles – Japanese, shadowed points – Americans...); (c) Buddies-like, GPS position of my network members.

### III. CULTURAL AND SOCIO-POLITICAL ISSUES

“James B. Rule, in *Privacy in Peril*, strongly makes one point that is either muted or absent in most other solid books about privacy and surveillance: Data collected by one institution are easily transferred, mined, used, and abused by another. So companies like ChoicePoint buy our supermarket and bookstore shopping records and sell them to direct-mail marketers, political parties, and even the federal government. They also collect state records like voter registrations, deeds, car titles, and liens to sell consumer profiles to direct-marketing firms. As a result of all that cross-referencing of so many data points, ChoicePoint knows me better than my parents do--which explains why the catalogs that arrive at my home better reflect my tastes than do the ties my father gives me each birthday” [16].

In this quote the issue of privacy and property of data are mixed up. We'll try to present separately those problems and to look at them through the typology of living maps, starting by the property of data. Then we will discuss privacy, space segregation that follows, and data reflexivity issues.

#### A. Property of data

At a first level, the issue of property of data could be seen in a classic way: when companies collect and organize files and data, they own it, as they always did with customer files, for example; on the other hand, public data could be considered as public and common goods. In reality, things were never as simple as that, but today, we are facing two important changes. The first one is the acceleration in the digitalization of everything, giving the possibility of new kinds of visualization. The second change is related to the Web 2.0 applications and services, where data are not collected by companies but given by the users and where Web 2.0 actors understood that it will be good for their applications to open those data to others, through their API (Application Protocol Interfaces).

If we look now at the three kinds of living maps:

- The Republic-like living map is made by automatic implementation of data such as mobile phone traffic; because the implementation is automatic, without asking the user if they agree with this use of their data, the only way to guarantee a social acceptability of this kind of map is to consider those data as a common and public good; the Republic-like living maps would then be a new layer of information for everyone, useful for the local authorities, the health and public transport services, the individuals as well as the companies which have provided the data;
- The Tribe or Segmentation-like living maps are different.; users opt-in to have their data stored, even if this feature is time-to-time 'on' by default or if people forget they opted-in some time ago; the point is more about the bootstrap, how to have enough people using the service to get a usable map? The answer is on the openness of data; looking at the Web 2.0 example, the interoperability of the services through open APIs is a condition to get a positive circle of innovation and a large amount of users; it would be even possible to

think of Wikipedia-like maps, where users could share points of interest as in the OpenStreetMap.org project;

- The Friends or Buddies-like living maps are simpler; the users are “visible” and need total control on the data.

#### B. Privacy

Privacy is one of the most sensitive issues of living maps. With the development of new services and behaviors on the Internet and mobile phones, new privacy problems are rising. Some thinkers [17, 18] suggest that we are facing an historical turn in the building of new protection laws, coming after the first set of rules that were created during the 70s to limit the interconnection of electronic files. Some preliminary reports on user expectations about living maps--mainly since the implementation of Google Latitude--have shown a strong apprehension expressed about people geolocation. Several large geolocated data visualizations, such as those quoted above by MIT Senseable City Lab or by Urban Mobs, have chosen to show their work to the public at art exhibitions. The Venice Biennale, the Paris Grand Palais, the New York Museum of Modern Art have all become the showrooms for these largely social sciences-inspired trials. Can we see behind this choice some doubts concerning the social acceptability of the enterprise? As suggested by Bradwell and Gallagher [19], in order to clarify this complex debate, we have to clearly distinguish “institutional” surveillance (by bureaucracies and large companies) from the new “interpersonal” surveillance (by parents, friends, lovers or neighbors). The distinction that we have proposed between three kinds of maps could be analyzed regarding those different forms of surveillance. In the Republic-like map case, the risk of institutional surveillance by telecommunication operators and state agencies is apparent. However, the actual legal protection can be reinforced to guarantee that manipulation and mining of large databases will be strictly anonymous and the disconnection between users identity and data will be total, and placed under control of government agencies and users' associations. As Latour noted: “water, electricity, telephony, traffic, meteorology, geography, town planning: all have their oligopticon, a huge control panel in a closed control room. From there, little can be seen at any one time, but everything appears with great precision owing to a dual network of signs, coming and going, rising and descending, watching over Parisian life night and day” [8]. Mapping a massive flow of population requires the recording of a narrow flow of information about each element of the whole. This could limit privacy risks if those services offer a clear guarantee that any nominative data would be collected.

Even though most of the privacy debate was associated with Republic-like maps, it seems to us that in fact privacy issues may be more sensitive in the two other map types. In the Segmentation-like map, disconnection between user identity and information should also be provided, but we have to pay careful attention to the possibility of discovering a person's hidden identity via a detailed analysis of certain specific behavior patterns. How can users be sure that they are providing anonymous information to living maps without being identified? If we can build a sharp and relatively clear distinction between Republic-like and the others types of living

maps, the boundary between Segmentation-like and Buddies-like maps is less obvious. Those services link general information that someone the user doesn't even know has published with the personal information of his/her friends. More broadly, this problem shows that even with an explicit opt-in consent from users, innovators can always build new representations of information or new links between multiple databases in order to reveal new information patterns that user's had not expected previously. The user agreement is always incomplete then. For example, researchers recently show that it is possible to make a good approximation of the location of wikipedians with a systematic examination of all their edits on the collaborative encyclopedia [20].

Research on living maps will bring new lateral control problems that we can hardly imagine today without experiencing them concretely. But to ensure user privacy, first of all, those services should offer a "right to lie" about one's geolocation. People not only need to monitor their actual presence shown by the service, they must also be able to position their point wherever they want to. Studies on privacy show that sometimes people have more secrets from closest ones than from strangers who they have little chance to meet face-to-face. Geolocation is precisely the kind of information that people could want to hide from people with whom they are in a close relationship. Second, those maps could create a new kind of privacy flaw that can be compared to the tagging of pictures on Facebook [21]. Space could create a breach of visibility between people who don't want to be mutually seen. Imagine that you don't want to add someone to your contact list because you don't want to let him know your location. He won't see you when you are in distant places, but if you are both in the same area, you could access his profile. The question here is: do you prefer to limit your visibility to your social network or to your actual location? Concerns about lateral surveillance is one of the consequence of a sociological shift in Web 2.0 practices where people create new space of visibility, where they publish personal information while trying to keep it private [22]. The "tagline culture" of Twitter and Facebook has created a new form of communication where private communications are also visible to the entire network of friends. Geolocation is perhaps the most sensitive and useful information that people could display on their tagline to create new opportunities to meet people or to participate to an event. We could be sure that a large potential for innovative uses and services will emerge from those personal data disclosure practices. But, in the same time, people are frightened by the risk of a new "geoslavery" [7] or a new "voluntary servitude" [23].

### C. Space segregation

The possibility to follow the urban movements of large user samples creates a new knowledge technology. Digital traces of presence and movement provide us more reliable information than personal accounts. Commercial recommendation systems' operators have understood it well; it is more important to know what we already bought to propose a new product than to analyze our reported tastes or personal characteristics. The behavior is a better indicator of customer needs than an individual declaration which inevitably contains a complex and abstract mix of self-presentation and self-knowledge. The map

visualization of crowds, tribes or buddies movements and positions will thus provide users trustworthy information about what is going on in the city and facilitate choices about where to go or how to navigate in the urban space. This knowledge will be distributed potentially to every person in the city and it could become a part of a collective decision making. It can become an important factor of the collective action but also an element reinforcing the existing spatial structures of the city. The urban space is socially segregated, in part due to the homophily mechanism [24], the tendency of individuals to associate and bond with similar others. The spatial distribution of people--not only residential one but also that of leisure places--is obviously shaped by this mechanism [25]. A real-time display of social occupancy of the city can reinforce the classic spatial segregation if this display attracts similar people to specific places. Far more than Republic-like or Buddies-like maps, a Segmentation map seems closely associated with this risk. Showing a typology of user in the city is of course useful to a person searching for a place to go, especially if one visits an unknown city. Nevertheless, if the majority of individuals look for the places crowded with people similar on age, education, taste, sexual preferences, etc., providing this information can intensify the segregation tendency and, in the long run, contribute to a kind of "ghettoization" of the urban space. Moreover, the real proximity of this way of analyzing space to the commercial interest in market segmenting can also reinforce these dynamics. In fact, disseminating reliable information about a space, user could provoke an adaptive reaction of commercial, leisure or cultural offer operators to adhere as much as possible to the local majority demand. The possible result would be a further within-places local homogenization and concomitant between-places social differentiation. However, the real precision of those space segmentation systems is to be evaluated carefully. The more and more heterogeneous tastes expressed by the person and multiple-identities adopted on the multiple social web platforms can blur the usefulness of living maps as a tool of space stratification monitoring.

### D. Reflexivity of the map and its perverse effects

Nowadays, the map has become much more than a space representation. The digital map offers a highly interactive user interface providing insights into spatial phenomena to a large audience of lay users, "and is at the same time a representation of information that in its own right directly aids the thinking process" [26]. The map enriched with flows and presence information, gives us a new opportunity to see, real-time or historical, dynamic "augmented" space and its social reality. In a sense, it provides the users a feedback of their own activities in the city and thus takes part in the increasing reflexivity of human action, typical to postmodern societies [27]. This capacity of self- and others-monitoring in space brings a new ability of calculated and rational behavior, but also a new requirement to be constantly aware of spatial information. We were already able to prepare our city tours or nights-out thanks to geolocated databases, but the living map offers an original possibility: to use others as guides of our choice. Now we can discover the city looking at "interesting people" and their preferred movements and places, exactly like a stranger who can follow the local team colors worn by people on the street to

find the stadium or like an experienced tourist who first checks how many locals sit in the restaurant before entering. We see others but also we are seen by them, we have all become the observed observers, this mutual visibility of our spatial behavior poses evidently complex privacy issues as discussed above, but it also can provoke new unintended consequences of our “well-informed actions.” A real-time car traffic map is a good example. It is a Republic-type map of course, each point is an anonymous vehicle and all vehicles in the area are represented. Before the advent of real-time public traffic visualization, this role was (and still is) essentially played by the radio traffic information broadcasted to drivers in order to warn them about traffic jams and provide them with actual traffic situation. Today, GPS navigation systems and living maps fulfill this function more and more. This traffic information helps to optimize the use of the road network and, on the driver’s side, to adapt to the actual traffic situation. However, rational reasons of path choice on the basis of information provided by living maps can result in creation of a new traffic jam in a different place, if every driver takes, at the same time, a similar reasonable decision to switch to the same roundabout way. Some authors called it the perverse effect, the composition effect when a rational individual behavior aggregation produces negative collective outcomes [28]. Living maps can contribute to the development of those perverse effects. Even if, in the case of traffic regulation, we can imagine that ingenious engineers will plug into navigation algorithms some clever filters to avoid sheep-like car movements, but we can hardly cheat with a real-time living map as a reliable information tool. Another example of real-time information risk is a possibility of unwanted reactions amongst too-well informed individuals. The live automatically generated information is almost uncontrollable and can induce potentially dangerous, panic-like movements in the urban space.

#### IV. CONCLUSION

Living maps don't leave people indifferent. They arouse reactions and debates. The first one is on the potentialities of those maps and the future society they could prepare. Some researchers [15] believe that this kind of map will weaken fate and the unexpected because automatic tools will frame everyone’s day-to-day life. With the use of GPS, for example, people will go from A to B without having a “chance” to be lost and to discover new territories... The opposite thesis is also there: we increase our freedom because the information system helps us to resolve technical issues; because I have a GPS device, I can take the risk to explore unknown parts of cities or regions... This way we increase our freedom, but this freedom is not exactly the same when one has a GPS security net: can we imagine Walter Benjamin's *flâneur* [29] being equipped with a GPS and living maps?

At a more sociological level, living maps and Web 2.0 social networks give us the possibility to revisit an old issue. Mobile location-based services offer new artifacts for opportunistic encounters, as in a village where you don't have to plan an appointment to meet someone: in the pub or in the café you can see everyone and talk with the people you want. In the same way, living maps will allow us to “see” where our

friends or the people like us are. But if we have the nostalgia of the village life and if we love to pass holidays in Mexican or Mediterranean villages, we also have to remember that our forebears ran away from the villages as fast as they could for the freedom of anonymity offered by large cities!

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