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SLOW MOBILITY AS AN INDICATOR OF SOCIAL URBAN SPACES - AN APPLICATION ON GPS DATA IN THE MILANO-BICOCCA AREA

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1. INTRODUCTION

The urban mobility is not only shaping the roads and the transportation system, but moreover it is shaping the social map of the European Metropolises, it is redefining the collective places and even creating a new map of the urban society. Traditional data sources and statistical figures can give a poor support for updating sociological map of the cities, nor they offer materials for constructing spatial indicators of the urban space consuming and of places of social interaction.

The scope of this paper is therefore to investigate the potential of methodologies based on new technologies, like GPS, for collecting relevant data, combined with the use of spatial analysis techniques in order to make feasible the monitoring of such urban processes.

2. THE NEW CITY AND THE SYSTEM OF MOBILITY

At the beginning of the new century the majority of the European population lived in the '*periurbain*' area, the place which lays between the borders of the historical cities and the low density land which most people continue to label countryside [1]; these changes are spreading all over Europe, with minor differences among the member States of the European Union [2]. This area has been differently named *metropolitan area, hinterland, banlieu, periferia, metropolitan fringe*, terms which are all indicative of a marginal space, or worst, an illegitimate part of the official city. From the point of view of the physical morphology the *periurbain* society is populated by airports, shopping malls, residential areas, infrastructure for the leisure time and a variety of services and activities all around the roads, the highways, the railroads, the bus and train stations; the factory is missing in the list, not because it disappeared, but because it lost its original function of main governing rule for the urban space.

The *periurbain* is therefore the place where the new factories grow, the large commercial malls spread, the new collective spaces take place; all around them, the new types of residential districts are developing, largely self-sufficient, but strongly dependent from the physical and logical communication network with the larger urban area.

The urban society which is emerging cannot be critically understood without catching the strategies of use of time and space from the part of the populations inhabitant, working and consuming in the new cities. The 'immaterial society' is not substituting the material city, on the contrary several suspect that logical communication is reinforcing the physical mobility and the demand for transportation [3]; the urban mobility is *built in* the metropolitan way of life and might be considered as being the major force shaping the new urban space [4].

According to Castells [5], the most relevant feature of the changes from the traditional city to the new one consists in the passage from 'the space of places to the space of flows';

the urban mobility therefore is not only shaping the roads and the transportation system, but moreover is shaping the social map of the city, is redefining the collective places and even creating a new map of the urban society.

2.1 How to map the new city?

The *periurbain* space and in general the new shape of the city cannot be described using the statistical data traditionally gathered. The most traditional data collected by statistical institution are based on two assumptions:

- the social morphology of the city is described in an accurate way by the spatial location of the population at night, that is to say that the sleeping city is fairly reflecting the active and consuming city;
- the mobility is functional to the moving from home to work or school and is driven by a strategy of efficiency and effectiveness. In this perspective, the largest part of the mobility is not recorded, and, what is worse, the non systematic movements are discharged like *brownian* movement, i.e. fragmentary and scarcely predictable movements dues to a large number of activities scattered over the space requiring numerous and frequent short-range journeys [6].

Citing a very known case study [7], one must consider that between 1991 and 1998 individual mobility in the metropolitan area of Paris (Ile-de-France) increased from an average 3.48 to 3.72 journeys per day, to say an increase of 11%. Like in Paris, in all second-generation metropolises, we find more turbulence and less predictability of movement.

Who is moving in this *brownian* way? Where and at what extent this type of movement is spreading in the new and old urban spaces? Are they defining a new map of the urban space?

As several authors [8] [9] as pointed out, what is needed for understanding the complexity of urban mobility is first of all the ability of reconstructing the continuum of the trips focusing on small segments of the mobility system, getting a precise georeferencing and timing; secondly is necessary to pay attention to the neglected sector of the slow mobility, pedestrian or cycling, because the slow mobility is an essential part of the overall mobility, and in a way is the strategic scope of the speedy mobility, by car, bus, train, which is generally aimed to move efficiently from one place to another.

From an other hand, the slow mobility and the speedy mobility are the two main ways of consuming the urban space. They are functional to each other, particularly in the European cities, where parking and bus stop in the core city are usually far away from the final destination, and where pedestrian areas are common; nevertheless they are also conflicting for the use of urban resources and are indicators of social activities of totally different type.

3. THE CASE STUDY OF MILANO-BICOCCA

The Metropolitan Area of Milano, located in the northern part of Italy, with 9 million inhabitant of which 4 millions in the core, is the largest urban area in Italy and one of the largest in Europe. In the north-western side of the city is growing one of the major urban transformation of Europe; like in several other European cities, the profound changes of industrial structure in the 70s and 80s and the disappearing of the factories left large holes, which are signs of the contextual missing of the factories as rulers shaping the cities of the XIX and XX century.

In the north-easterner part of the core of Metropolitan Area was located since the beginning of the XX century the large industrial settlement of Pirelli-Bicocca [10] which was a leading company in the Italian economy for tires and rubber; in the late 80s large part of the activities were relocated and the industrial activities were dismissed; in the early 90s urban

renewal project was developed and in the area were located distinguished activities: an university campus, a national theatre, private residences, commercial and research structures, i.e. the National Research Council, Siemens Company, Deutsche Bank, as well as Pirelli Research.

The Bicocca is a melting pot of students, instructors and researchers at the university and the research centers, employees in the advanced tertiary sector, people working in logistic and personal services, a public made up of participants in scientific congress and people attending cultural activities and finally local inhabitants.

The area is populated by almost 20.000 people during the daytime and about 1.000 residential people; due to the scientific, cultural and research nature of the area, a daily flow of temporary population must be added to the count of the area users.

The Bicocca site represents by now the largest urban renewal project in Italy in the recent decades and it is a unique example of settlement on a metropolitan scale, both for the functions that it houses and for the population that use it.

Being a completely new settlement, we envisaged the opportunity of monitoring the process of 'colonization' of the area by the Bicocca users, i.e. the construction of social places, where people meet or consume, and in general the spaces where social networks are developing. For that purpose we set up a Geographic Information System Observatory in the Department of Sociology and Social Research of the University of Milano Bicocca for gathering and analyzing territorial data information on buildings, populations, services, and events at different calendar time.

3.1 Constructing spatial indicators of the urban space consuming

As a part of the monitoring system we defined a project aimed to the analysis of the impact of Bicocca mobility on the urban space, both locally and at regional level.

As a pre-test phase, we collected tracks of two selected groups, student, on one side, and technicians and clerical workers of the University, from the other, concerning the overall mobility during a daytime, having as a common point the presence in the Bicocca area.

We collected about 40 day-tracks (fig. 1), using an hand held GPS, recording geodata at 30' intervals; track point were managed in a GIS, where derived variable were calculated, i.e. speed, classification of speed, day-time class, together with attributes of the author of the travel, i.e. activity group, gender, age.

Fig. 1 Mobility tracks focused on the Bicocca area

One particular objective is to analyze and test the usability of GPS data in order to construct spatial indicators of the urban space consuming and of places of social interaction, based exclusively on GPS data itself. The access to the urban space resources, i.e. shopping along the road, cafeteria opened to public spaces, urban parks, and the possibility of social relation, i.e. meeting new people or friends and so on, depend at a large extent from the pedestrian mode of the travel [11]. The speedy mobility, with collective or individual mode, confines the use of urban space to the mobility functions and limits the use of other space resources.

More precisely, empirical translation of these opposite modes of use of the urban space, which we named slow mobility and speedy mobility is based on the instant speed; obviously, the information derived from speed by itself, not supported by the mode, adds errors which relevance must be evaluated, but lowers the costs of collecting valuable data. For this purpose we classified the track points collected by GPS in reference to the speed associated, assuming as critical range the speed of 3m/s, according to the statistical distribution.

The second step for the construction of the spatial indicator required the application of a traditional tool of density analysis in order to identify the Hot Spots of the slow mobility, extracting and analyzing the class of track point of slow mobility (Fig.2).

Fig. 2 Slow mobility track points

The density of points in the space can be interpreted as a measure of space consuming, if referred to a single subject; if referred to the sample population or a specific group, the total density of the track point measures in the same way the space consuming of the population. In other words the density indicator constructed in such a way is a multiplier indicator of the track point per persons present inside the areal unity of observation.

We built the indicator using the traditional method of the Kernel density estimation for obtaining a spatially smooth estimate of the local intensity of events over a studied area, which essentially amounts to a “risk surface” for the occurrence of those events.

The contour areas resulting from the application of the Kernel methods identify hot spots with different values which can be interpreted as places characterized by a potentially high level of urban consuming and social interaction (Fig. 3-4).

In particular this kind of approach can be useful for discovering non-traditional places of social interaction and urban consuming as an instrument for drawing a new social map of the city.

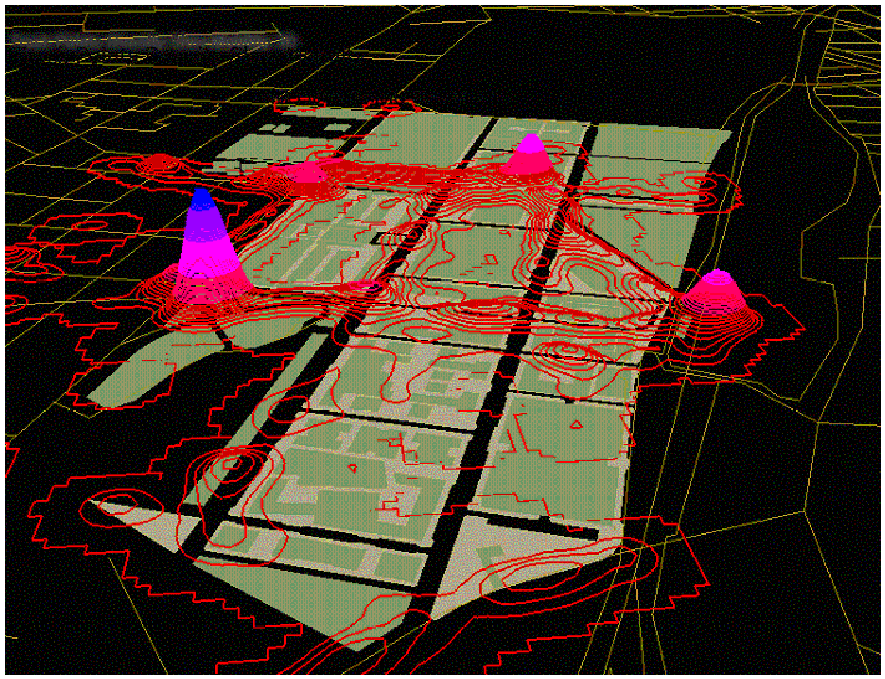

Fig. 3 Urban consuming and social interaction places

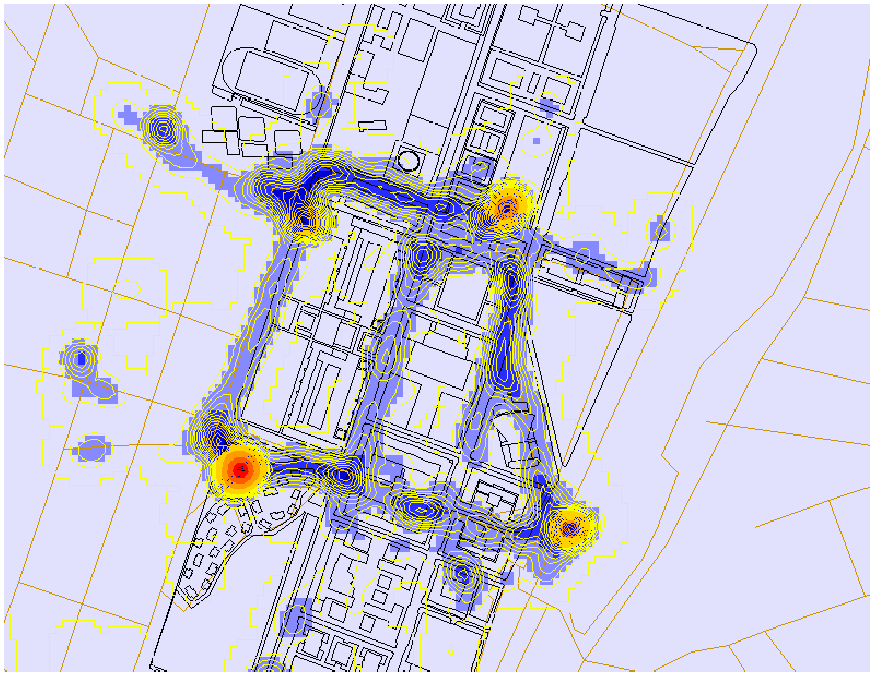

Fig. 4 Kernel density of track point slow mobility in the Bicocca area

4. CONCLUSIONS

We tried to evaluate the potential usefulness of GPS data regarding slow mobility of people in urban area in order to assess in a systematic way the hot spots of urban consumption and social interaction. The drawback of this method lays in the limited capability of the speed of discriminating among different modes of transportation; in fact the indicator built according to such a simple rule, based on the speed, lacks accuracy.

A second problem involved in this particular use of GPS data concerns the severe limitations of receiving the signal in urban areas crowded with buildings and moreover the absence of data inside covered spaces: this excludes from the analysis a relevant part of the urban movements in the core of the cities or inside malls, university campus, or stations.

On the positive side, the pre-test showed a good capability of GPS data for building space indicators which identify hot spots of urban space consuming at a very low cost and with a high rate of comparability.

Furthermore the application of the method of the Kernel Home Range instead of the general Kernel method seems bringing some advantages in mapping the results, in that it focuses on local areas covered by slow movements leaving uncovered the residual space.

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