Discovering Regularity Patterns of Mobility Practices through Mobile Phone Data

Paolo Tagliolato, Dipartimento di Architettura e Studi Urbani, Politecnico di Milano, Milano, Italy

Fabio Manfredini, Dipartimento di Architettura e Studi Urbani, Politecnico di Milano, Milano, Italy

Paola Pucci, Dipartimento di Architettura e Studi Urbani, Politecnico di Milano, Milano, Italy

ABSTRACT

This article addresses the issue of analyzing and mapping mobility practices by using different kinds of mobile phone network data, which provide geo-located information on mobile phone activity at a high spatial and temporal resolution. It will present and discuss major findings and drawbacks, based on an application carried out on the Milan urban region (Lombardy, Northern Italy) and suggest possible implications for policies.

Keywords: Density of Space Usage, Mapping Urban Domains, Milan Urban Region, Mobile Phone Data, Mobility

1. INTRODUCTION

Interpretative tools for the identification of mobility practices in the contemporary metropolis are needed, not only for the some known limitations of traditional data sources but also because new forms of mobility are emerging, describing new city dynamics and time-variations in the use of urban spaces by temporary populations. In Italy, the traditional data sources for urban and mobility investigations (i.e. surveys, census) have known limitations, including the high cost of surveys, the difficulty of data updating, the difficulty of describing city dynamics and time dependent variations in intensity of urban spaces usages by temporary populations at different scales.

New forms of mobility, close to daily mobility, are changing the way in which urban spaces are used. They are characterized both by being based on the use of transportation system, and by the efficient appropriation of information technologies (internet, mobile phone). They intensified the density of the moves with which we can read diversified uses of the city, that traditional sources of analysis are unable to

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return with continuity. In Lombardy region, the systematic mobility represents only the 29% of daily travels, which are attested on 2.65 travel/day in average, with a propensity to mobility that changes in relationship to the professional condition.

As underlined by some authors (Ascher, 2004; Bourdin, 2005; Ehrenberg, 1995; Kaufmann, 2000; Scheller & Urry, 2006; Urry, 2002), the changes in the management of mobility in contemporary cities are a useful key for understanding the transformations of times, places and modes of social life and work programs, structuring the metropolitan areas.

In this perspective, mobility may represent both a tool of knowledge and a project for urban planners, provided that a better understanding of different patterns of mobility in the form of “active biographies”, which increase the range of “post-fordist living and labor styles” (Nuvolati, 2003), is available.

Considering the role of mobility practices in social and spatial differentiation, it becomes important to formulate pertinent analytical approaches, aimed at describing the different densities of use of the city as a new challenge and a prerequisite for understanding the city and its dynamics.

Hence, from an analytical point of view, it becomes important to accompany the traditional quantitative approaches referred to a geographic displacement that tends to focus on movement in space and time, in an aggregate way and for limited periods, with data sources able to describe fine grain over-time variation in urban movements.

In this direction, an interesting contribution may come from mobile phone network data as a potential tool for the development of real-time monitoring, useful to describe urban dynamics, as it has been tested in several experimental studies (Ahas & Mark, 2005; Gonzalez, Hidalgo, & Barabasi, 2008; Ratti, Pulselli, Williams, & Frenchman, 2006).

The application researches were focused on two different products. Some studies dealt with aspects of representation of the data, emphasizing the most directly evocative aspects, to highlight how these data may represent the “Mobile landscapes” (Ratti et al., 2006). Other studies focused both on data-mining analysis and on the construction of instruments capable of deriving summary information and relevant data about the urban dynamics from cell-phone (Ahas & Mark, 2005).

As opposed to the more traditional methods of urban surveys, the use of aggregated and anonymous mobile phone network data has shown promise for large-scale surveys with notably smaller efforts and costs (Reades, Calabrese, Sevtsuk, & Ratti, 2007).

If we consider the observed and aggregated telephone traffic as the result of individual behaviors and habits, we can treat mobile phone data as a functional source on the real use of the cities, capturing, for example, traces of temporary populations, which are difficult to intercept by traditional data source, but which, at the same time, increasingly affect urban practices both quantitatively and qualitatively.

In this direction an increasing number of studies concerns the exploitation of mobile phone data in urban analysis and planning (Becker et al., 2011). In particular an interesting issue regards the classification of urban spaces according to their users’ practices and behaviors (Reades et al., 2007; V Soto & Frias-Martinez, 2011). In (Víctor Soto & Frías-Martinez, 2011) the authors outline the fact that city areas are generally not characterized by just one specific use, and for this reason they introduce the use of c-means, a fuzzy unsupervised clustering technique for land use classification, which returns for each area a certain grade of membership to each class.

In this general context, we used mobile phone data provided by Telecom Italia, the main Italian operator, in order to test the potentialities of this information in describing the density of use of urban spaces at different temporal and spatial scales as a precondition:

• To identify temporary populations and different forms of mobility that structure the relationships in the contemporary city;
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