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Graphical approach to assess urban quality: Mapping walkability based on the TOD-standard

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ABSTRACT

Graphical expression through mapping can be an essential tool to conduct urban analysis, capable of expressing contextual spatial distribution and providing complementary information to numerical analysis. Although urban analytics are central for most issues in cities, mobility and transportation have traditionally been disciplines very tightly related with quantitative analysis. Mobility in urban areas has become a central issue due to its high impact in environmental, social and economic concerns. Multiple studies consider that walking presents social, health, economic and environmental benefits as a short distance transportation mode. As pedestrian displacements are characterized by presenting great adherence, the features of the environment where they are performed is key to guarantee their success and promote their use. To be able to design appropriate walking city conditions, it is necessary to undergo extensive analysis of existing urban areas and their walkability impact. In order to illustrate this, this study takes as a basis the Transit Orientated Development Standard (TOD Standard), a scoring instrument defined by the Institute for Transportation and Development Policy (ITDP), to evaluate the area of Saint-Lazare multimodal station in Paris. The aim of this work is to compare its quantitative and graphical results through georeferenced mapping and TOD Standard score based numerical data, in order to identify the complementary information provided by the mapping. The conclusions display the importance of using graphical analysis to be able to spot singular spatial distributions and influencing relations within the urban environment, often imperceptible in numerical values.

1. Introduction

1.1. Graphical expression as an analysis method

Drawing is one of the most natural ways the human being has to express itself, to communicate and to record data. From Paleolithic parietal cave paintings or different types of ideograms, such as Egyptian hieroglyphs or Sumerian cuneiform, to the computationally enhanced Geographic Information Systems that our digital age offers, the human being has shown to rely on graphical expression.

Graphical representation has been used as an analytical system to unfold relationships or achieve general overviews of dispersed data. For instance, the work of the English physician John Snow (1813–1858) (Snow, 1855) shows the importance of locating data and relying on ground plans to display situations in order to be able to convey information. Snow traced the source of a cholera outbreak, in London, through the graphical representation of the deceased geolocation. In a similar line, the civil engineer Charles Joseph Minard maps of Napoleon Russian campaign of 1812–1814 (Friendly, 2002; Robinson, 1967) show the possibility of combining graphs and mapping to gain a clearer panorama of relations and possible causation. Representation tools condition the way we see the world (Santamaria & Martínez, 2016) and, therefore, the decisions we take involving this reality and its future.

Although maps and graphical data are not new in the toolset of our societies, current technologies seem to have allowed a new leap forward in this field by providing more available information and more powerful managing software. In the domain of mobility in general and walkability or TOD developments in particular, these technologies have often been claimed to be the opening of new possibilities in terms of analyzing current and future developments and confronting them with TOD objectives (Leslie et al., 2007; Ackerson, 2005). In a great range of TOD focused studies, current Geographical Information Systems (GIS) software are used as a tool to organize data regarding their geolocation, intersect different information through spatial relations and, from there, extract quantitative results. The graphical data provided in the process is often disregarded as an inevitable step in the way of

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collecting the real core results.

1.2. Walkability and the TOD

Walking is also the most natural way of moving for the human being. Our body, our sensorial perception and our mind have evolved for millions of years based on this displacement system (Pozueta, Lamíquiz, & Porto, 2009). The first cities were designed to ensure its proper development, as European centers still show nowadays by providing appropriate environments for moving by foot and reachable destinations at strolling pace (Southworth, 2005). Walking is also the most *adherent* of our current transportation systems (Mezoued, 2016), ensuring a close and rich relation with the environment. The introduction of transit systems, with different kinds of propulsion methods, enabled these walkable environments to create connections with further contexts (Parcerisa & Rubert de Ventós, 2001). However, the rise of the automobile age in the 20th century, with its consequent suburban based planning tendencies (Ewing, 1994), brought a decay period for both walking and transit systems (Montgomery, 2013). Walking faded away to offer open access to motor propelled systems and transit infrastructures were dismantled to give way to individual freedom formally translated into cars.

The 1973 oil crisis and 1979 energy crisis set under new considerations this energy-consuming moving system and sprawl based developments (Ewing, 1994). However, the environmental concerns were only the firsts to arise regarding this model. Soon, social, health and economic issues were connected with these motor based environments (Jacobs, 1992). Currently, multiple benefits have been claimed to be connected with walking (Southworth, 2005): reduction of congestion, low environmental impact and conservation of energy without air and noise pollution (Newman & Kenworthy, 1999); it is a socially equitable transportation mode and tends to promote sociability (Leyden, 2003), as well as mental and physical health (Ewing, Schmid, Killingsworth, Zlot, & Raudenbush, 2003; Pucher & Dijkstra, 2003). Nevertheless, the close relation that walking establishes with the environment tends to work both ways; its adherence also brings as a consequence the need of a welcoming environment to ensure its performance (Kaufmann, 2011; Gehl, 2011). Consequently, the car focused settings tend to be perceived as unpleasant by pedestrians (Ventura, 2016). Therefore, reversing the mobility habits and bringing back walking can be difficult in certain environments (Gehl, 2011).

The spreading of the suburban model and the sprawl based development raised great concerns, especially in the United States, regarding the results of the late developments (Ewing, 2008; Jacobs, 1992) and the possible future of the American Metropolis (Calthorpe, 1993). Soon, social movements grew together with new urban concepts, such as New Urbanism, Traditional neighborhood Developments, Pedestrian Pockets, Urban Villages or Compact Communities, seeking to offer alternatives to current urban realities (Carlton, 2009). Although different strategies were used, their ideas were centered in fostering walkable environments, slow mobility systems (walking, bicycle) and transit use through the design of new urban developments and the rehabilitation of existing ones.

It is in this context when the first Transit Oriented Development (TOD) concept appeared, introduced by Calthorpe in the 1980s and becoming a planning referent in the United States through “The New American Metropolis” (Calthorpe, 1993). It has been defined as “a mixed-use community that encourages people to live near transit services and to decrease their dependence on driving” (Still, 2002).

The TOD Standard is a “tool to help shape and assess urban development. It focuses on maximizing the benefits of public transit and non-motorized mobility while placing the emphasis firmly back on the users: people” (ITDP, 2017). This Standard is developed by the Institute for Transportation & Development Policy (ITDP) and it is addressed to “policy makers, planners, city officials, developers, architects, urban designers, landscape designers, civil engineers, civil society organizations, and the interested public” (ITDP, 2017). In order to achieve its objectives, the TOD Standard presents eight main principles together with measurable indicators that allow to assess current and future developments regarding their affinity with transit and walkable environments. After the overall analysis, a final score is obtained for each of the metrics considered in the TOD. This score leads to a label that qualifies an urban area.

Although the Transit Oriented Development objectives have scarcely been called into question, the possibility to apply the TOD Standard principles to different locations around the world has often been challenged. Several studies (Sung & Oh, 2011; Cerin, Macfarlane, Ko, & Chan, 2007; Leslie et al., 2007) have sought to prove its robustness in environments physically and socially different from the American urban centers that originated the concept. In order to do so, complementary analyzing methods have been used, such as surveys (Kelly, Tight, Hodgson, & Page, 2011; Cerin et al., 2007; Sun, Zacharias, Ma, & Oreskovic, 2016), multiple regression models (Sung & Oh, 2011) or in site measurements (Sun et al., 2016).

1.3. Objective

This work attempts to address the issue of abstraction when assessing complex urban realities. Although abstraction is essential in order to deal with data management and analytics, it is important to be aware of its limitations. Decisions are taken at each level of abstraction and these choices highly determine the final results obtained. Consequently, when assessing urban realities, being aware of the dangers of falling in over-simplifications and the consequences of making decisions based on partial models, should be acknowledged throughout the process. In addition, attempts of grasping their whole complexity should be made through different approaches and perspectives of information. This article argues that graphical representation through mapping can be an effective tool to add a different layer to purely numerical average-based analysis. It is especially important to address this issue in a moment when the availability of data and computational power are pressing urban decisions into relying on averages and scores of different parameters.

A clear example of this can be appreciated in the TOD Standard, a tool to assess walkability and Transit Oriented Development based on scores and averages that might not fully convey the reality of the place. This tool aims at being able to assess urban realities worldwide and, therefore, it is interesting to use it as a case study. This article aims to review the TOD Standard principles through graphical expression means, translating data into information-based drawings and comparing the results with the TOD quantitative scores. In this way, the study intends to show the potential of data-based mapping to communicate information and complement quantitative statistical analysis. The objective is to reconsider the perceived consistency of mapping as a central analysis tool and put its validity at the same level than other methods, engaging in its inherent subjectivity of interpretation. The transportation field has traditionally been strongly connected with quantitative methods, such as Large Scale Urban Models. However, multiple voices claim that these approaches have not been successful in modeling urban real circumstances (Klosterman, 1994).

In order to perform this study, an area around a major transit node in Paris, Saint-Lazare Station, has been analyzed both purely numerically and graphically following the principles of the TOD Standard. Paris choice was motivated by the objective of studying a walkable city with a complete transit network. Saint-Lazare station area provided a region around a major multimodal transit station with a generally positive walking environment located in a central area of Paris. The comparison of these two analysis has provided the opportunity to outline the benefits of complementing a study with graphical display instead of relying only on summarizing numerical scores.