The Walkable city and the importance of the proximity environments for Barcelona's everyday mobility

Abstract:

This paper analyzes proximity travel within Barcelona, in order to evaluate the importance of walkable environments and the vitality of neighbourhood in people's everyday lives. In this respect, we analyzed walking times of less than 10 minutes, a specific kind of trip that takes place on a neighbourhood scale, from one of the major mobility surveys in Spain. By analyzing people's mobility patterns, we obtain a more accurate approach to proximity and inner-neighbourhood dynamics. The analysis focuses on the frequency and purpose of these short walking trips, along with the urban settings that foster them. This study also evaluates how proximity trips are intimately related with personal travel purposes and how they are unequally distributed throughout the city. The data also show how, once a certain minimum level of density is achieved, income and sociodemographic factors ultimately determine the use of proximity.

Keywords: Proximity, Everyday mobility, Pedestrians, Neighbourhood, Walkability.

1 Introduction

Urban proximity has been a predominant theme in the contemporary urban discourses of recent years. Within the complexity of trying to define a more sustainable urban form and also, in the context of the "mobilities turn", the distance travelled to access urban amenities and services has been found to be a key factor. Proximity dynamics have a wide array of positive outcomes, from vehicle emissions to energetic consumption or the wellbeing of citizens (de Nazelle et al., 2010; OECD, 2012).

Despite this general positive assessment of compactness and small-scale dynamics (Kockelman, 1997; Ewing et al., 2002; Kaido & Kwon, 2008; Banister, 2011; Boyko & Cooper, 2011; OECD 2012), few academic studies have addressed proximity from the people's perspective and their daily uses of the city. To address this gap, this study explores how citizens of a compact Mediterranean city like Barcelona are using their most-near urban scale, and it does so through the analysis of their daily mobility, bringing a more accurate approach to the territorialisation of their daily habits within the city.

1.1 Compact City and urban mobility

In a traditional analysis of the compact city, the relationship between urban form and mobility has been expressed through variables such as density, land use and design. High densities, public transport supply and mixed-use developments are, usually, found to be key elements for improving access to local services and to promoting fairer transport models (Banister & Hickman, 2006; Banister, 2008; Dempsey & Jenks, 2010; Dempsey et al., 2012; OECD, 2012).

Environmental considerations have been at the centre of the debate for the compact city (Loo & Chow, 2006; IPCC, 2007; TRB, 2009; Muñiz & García Lopez, 2013) ever since Newman and Kenworthy (1989) noted that the built environment could effectively modify fuel and energy consumption for mobility purposes. Compact and proximate developments save fuel consumption and promote walking for transport, helping the recovery of the pedestrian as one of the main urban actors in the city's public spaces (Alshalalfah & Shalaby, 2007). Walking in the city is understood as a guarantee of almost universal accessibility and as people's capacity to reach a certain place with an affordable effort (Ureta, 2008), as everyone can be a pedestrian, regardless of income, skill, gender or ethnicity (Hanson, 2010; Boer et al., 2007; Delbosc & Currie, 2011). In addition, walking also is a major source of physical activity which has put the walkability of our cities at the centre of public health policies (TRB 2005; Koohsari et al., 2013; Sung et al., 2013; Næss 2013). Furthermore, small distances between urban functions such as residence, working or shopping also have an impact on travel times and personal schedules (Robert, 1992; Mückenberger, 2008; Miralles-Guasch, 2008; 2011; Miralles-Guasch et al., 2014)). Within a limited time budget of 24 hours, increasing some travel times requires a reduction in others. The paradox is that, as the functional city expands in size there has been a parallel emergence (or resurgence) of small-scale dynamics (Méndez et al., 2009). For example, as individuals travel farther to a place of employment, they are likely to seek shorter travel times, in order to complete other activities (everyday shopping, leisure) (Gimenez-Nadal & Sevillana-Sanz, 2011), which result in an intensified use of neighbourhoods (Timmermans et al, 2002).

Thus, different disciplines point to the fact that the near location of the diverse urban functions, such as residence, work, leisure, commerce, services and equipments,

intensifies the use of the neighbourhood. According to Banister (2008), this increases people's accessibility and improves their living environment, as the aim of mobility is not just travelling from one place to another, but also arriving to the right place at the right time, with affordable costs for anyone (Peters et al., 2012). Urban studies and public policies are also rediscovering the small urban scale and with it, the pioneering work of Jane Jacobs (1961) (Jensen, 2009).

1.2 Proximity and the compact urban form

But, how do we study proximity? Most of the studies have approached it at the territorial level, using different methodologies to measure densities and selected features of the built environment (Brownstone & Golob, 2009; Boyko & Cooper, 2011). They have tried to determine how dense the city must be to have a beneficial impact on mobility patterns, or how mixed the land uses must be in order to achieve the diversity needed to generate proximity travel (Cera, 2003; Geurs & Van Wee, 2004; Ewing et al., 2011). In most cases, they have analysed existing urban settlements and attempted to estimate the effects that a particular change in those urban spaces would have on people's mobility.

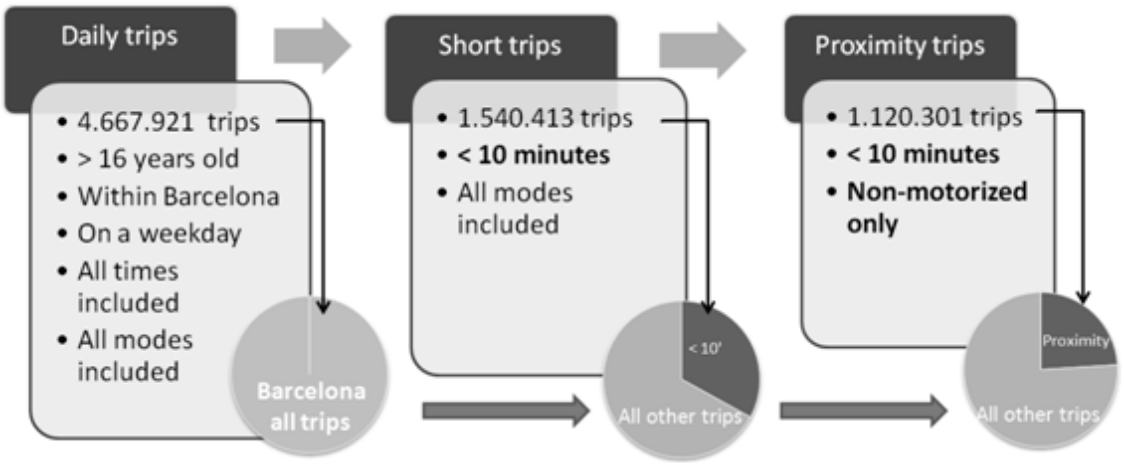
While the territorial dimension of the proximity is undeniable, it is necessary to go beyond the topological distance to incorporate more contextual aspects, such as travel time, the built environment where these mobilities are taking place, or the social characteristics of the population (Brennan & Martin, 2012).

From a mobility point of view, journeys and accessibility can be treated as a temporal attribute defined by travel times, because time is as inherent to proximity as is space (Banister, 2011). In other words, proximity dynamics only appear in those places that gather both nearness between origins and destinations with affordable forms of accessibility for the local population. Because of that, proximity must be understood as a combination of specific spatial and temporal attributes, a double condition that can be observed through mobility analysis.

1.3 Time and space, the defining elements of proximity

One of the difficulties of analysing proximity from the mobility point of view lies in the lack of a linear relationship between space and travel time, due to the different speed of each type of transport (Rodrigue et al, 2006). Therefore, modal choice must also be considered, in addition to travel time. To do so, it is necessary to establish a definition of what a short trip is, in terms of time. Ryley (2008) identified it as a travel that takes 10 minutes or less to be completed. However, to also estimate the covered distance on that same short trip, modal choice must also be taken into account. In this regard, the transport means that are more related to proximity are those that are non-motorised, especially walking, due to its regular speed, which is usually not faster than 4.5 kph (Rietveld, 2000). The combination of short-time trips with slow speeds results in a proximity journey that is certainly located within the neighbourhood scale of the city (Figure 1).

Figure 1: Theoretical framework, from all trips to proximity trips. Source: Own production



2. Methodology

Proximity analysis, based on mobility patterns, requires several sequential stages. We first studied how short-time trips (taking no more than periods of 10 minutes) are used in the city, setting out a general view of activities for which people tend to use very little travel time. Next, we focused on short trips involving not only little time, but also being made by walking, which entails covering short distances. These are the trips that have been defined as proximity trips and, once they are isolated, it is possible to

examine their frequency, the purposes they serve, and how they are distributed across the city. Finally, this study changes its scale to the neighbourhood level, comparing the spatial distribution of proximity trips and using Chi-square tests to search correlations between the use of proximity and the levels of population density and income.

2.1 Description of Barcelona

The area studied was the city of Barcelona, capital of the Autonomous Community of Catalonia (northeast Spain) and center of the Barcelona Metropolitan Region. In 2006, 1.6 million inhabitants were distributed across 10 administrative districts and 73 "*barris*", or small neighbourhoods. Nearly 90% of the city's 102.2 sq km had been urbanised by 2005 and its population density has not significantly changed over the recent years (Martori Cañas, 2010). Busquets (2004) described the city's morphological characteristics as dominated by a continuous, compact urban area with buildings, generally, not exceeding 8 or 9 floors and mixed land uses, including a commercial structure marked by small retail businesses. Average annual family income was about 17,900 Euros in 2006 with some significant differences on its distribution. Another characteristic of the Compact City, a parameter that is met in Barcelona, is a wide-ranging system of public transport: metro, train, tram, and bus routes.

Finally, the optimal design of street patterns, which is also a significant aspect for active transport and sustainable development, is clearly fulfilled by Eixample, an urban planning development in the centre of Barcelona with a worldwide reputation, created by the Spanish urban planner, Ildefons Cerda (1815-1876) (Dura-Guimera 2003; Pallares-Barbera et al. 2011).

2.2 Main data sources

The main data source in this study was the Everyday Mobility Inquiry, a wide-ranging mobility survey taken in 2006 (hereafter, EMQ06) as a joint initiative of the Department of Territorial Policy and Public Works of the Autonomous Community of Catalonia and the Metropolitan Transport Authority of Barcelona (Autoritat de Transport Metropolità & Generalitat de Catalunya, 2006). The aim of this survey was to describe the mobility of the resident population of Catalonia and, as in most international surveys, this study identifies "one trip" as one motivation to move.

The EMQ06 set the entire Autonomous Community of Catalonia as its territorial scope and performed 106,091 computer-assisted telephone interviews (CATI). The

EMQ data are segmented into 856 transport zones for the whole of the Catalan territory. Although there is, usually, one zone per municipality, Barcelona contains 63 transport zones, because of its size. Similarly, 24,000 (22.6%) of the interviews were undertaken in Barcelona, permitting in-depth analysis and avoiding the treatment of Barcelona as a monolithic entity.

The EMQ06 provides information on the journeys, their territorial distribution and some socioeconomic characteristics of the people undertake them. Mobility information includes modal choice, time spent on journeys, and degree of access to the different transport modes. Territorial characteristics include transport zone and total population. Furthermore, socioeconomic questions include gender, age, and professional situation.

EMQ06 also provides information about the motivations for each trip. This makes it possible to differentiate occupational mobility (travel to work or study) from personal mobility related to shopping, medical appointments, visiting or accompanying someone, personal business, leisure activities, or just taking a walk. We do not exclude any trip based on its motivation, as neither do we discriminate the specific origin or destination of the trip.

Data analysis was limited to travel by people older than 16 years of age with an origin or destination inside Barcelona, occurring from Monday to Friday (excluding holidays). The confidence level was set at 95.5% with a relative error of +/- 0.67%.

To effectively relate mobility analysis to urban and socioeconomic characteristics, we incorporated some of the vast information gathered by the official statistical service of the City of Barcelona. The two main variables drawn from this data source were population density of each neighbourhood and average family income for year 2006.

2.3 Analytical scales

Two scales of analysis were used: municipal and a sub local scale, similar to the neighbourhood level. The first scale is useful to obtain an overview of near-scale dynamics in Barcelona. The second scale offers the most suitable dimension to study proximity and to explore explanative aspects of neighbourhood dynamics.

At the municipal scale, we measured how many close-scale trips Barcelona residents reported taking, analyzing the time-length of short trips as a precursor to

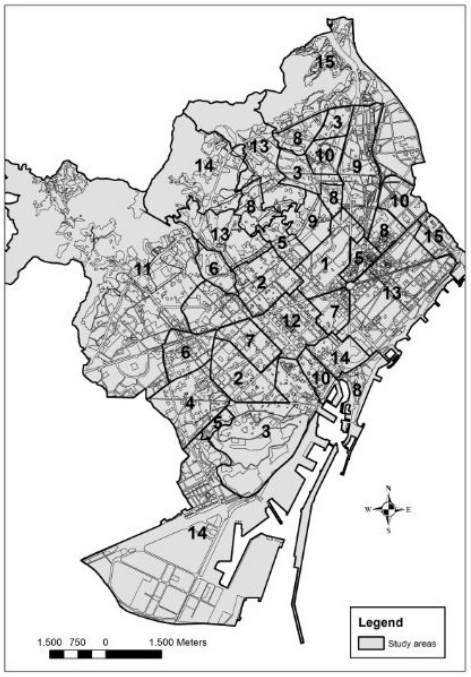
deeper analysis of proximity trips. At the city level, we analyzed the number of trips that took less than 10 minutes (short trips) and the number of trips that took less than 10 minutes and were taken on foot (proximity trips). We also examined the time of day at which those trips were taken and the purposes that triggered them. At the neighbourhood level, we delved more into these mobility patterns to see how they were related to specific urban characteristics, specifically populations density and income distribution.

The EMQ06 divides the city into 63 transport zones and organizes its data according to them (for a complete methodological explanation see IERMB, 2006). In order to have enough sample we had, however, to group transport zones into 15 study areas so that they had enough data to sustain a double disaggregation, such as searching those trips that were made on foot and also that were taking less than 10 minutes. Thus, to downscale the municipal analysis to the neighbourhood level, we designed 15 study areas (Figure 2). The overall criterion for the grouping of transport zones into the study areas was to put together the most similar urban areas, with respect to population density and income levels, making it possible to assess more accurately the weight of each explanatory factor in the intensity of neighbourhood dynamics. We ensured that each study area was clearly defined, provided an appropriate sample size, had similar population density and income levels, and was large enough to produce statistically significant results using the EMQ06 data and municipal statistics. In order to have enough sample size in the analysis, each and every study area had to group a minimum of 950 residents interviewed by the EMQ06. That provided us with a pool of 72,500 trips divided into 15 study areas. As a result, once the mobility data was disaggregated, each study area was comprised of an average of 1,176 proximity trips, there being no area with a minimum of less than 700 proximity trips.

Figure 2: Sample sizes and map of study areas. Source: Own production

Study Area	Sample size			Proximity Trips	
	Interviews	Number of trips	Number of proximity trips	Proximity trips out of total (%)	Statistical Significance
1	1567	5173	1178	22.8%	-2.3*
2	2597	8809	2160	24.5%	0.35
3	1990	6317	1733	27.4%	4.99**
4	1330	4508	1106	24.5%	0.27
5	1031	3233	699	21.6%	-3.13*
6	1080	3883	1023	26.3%	2.53
7	976	3347	758	22.6%	-1.98*
8	1990	6485	1579	24.3%	0.02
9	1623	5348	1373	25.7%	1.98**
10	1008	3395	1031	30.4%	7.13**
11	1301	4376	849	19.4%	-6.62*
12	1152	4013	1019	25.4%	1.36
13	1898	6388	1366	21.4%	-4.79*
14	1237	4115	1039	25.2%	1.18
15	1025	3109	731	23.5%	-0.93
Total	21803	72499	17644	24.3%	-

Source: own elaboration from EMQ06
Test Chi^2 sig=000 all categories; Adjusted residual test corrected.
** Significantly higher values
*Significantly lower values



3. Results

3.1 Quantifying short trips in Barcelona: who, how, where, why.

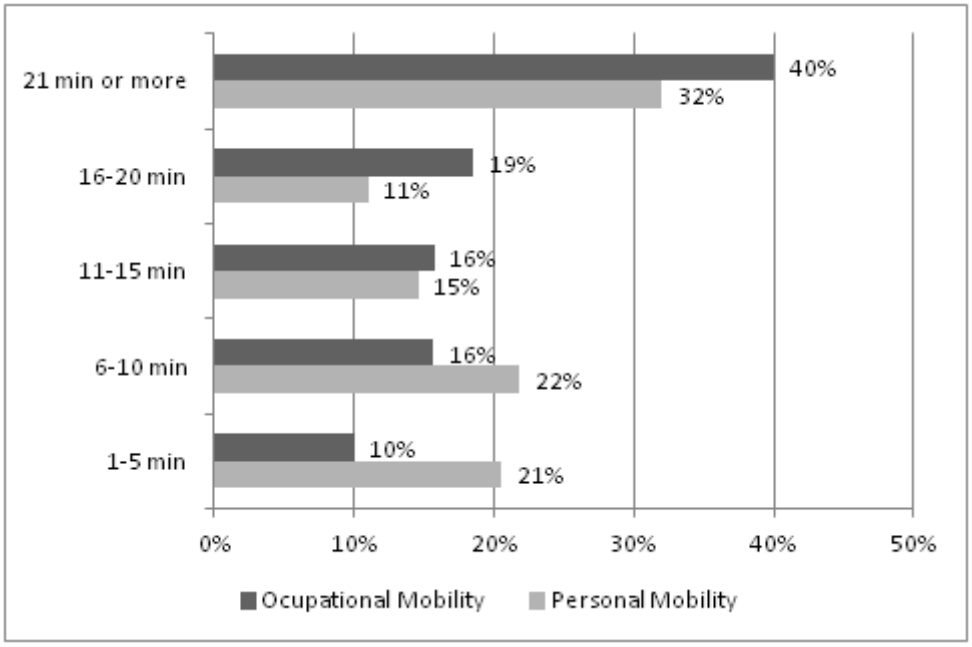
Mobility data for Barcelona showed that residents older than 16 years make an aggregate of 4,667,921 trips per day, which represents 90% of the total trips made in the city on a weekday. On average, each resident took 3.3 trips per day, investing 79 minutes in mobility. Trips were, usually, taken either by non-motorized means (45%, mainly walking) or by public transport (32%). Privately owned vehicles were used for 23% of trips. If the purpose of the trip is considered, personal mobility was the purpose of 60% of these trips; the rest were related to occupational mobility.

In terms of time travelled, slightly more than a third of all trips (1.5 million journeys) took less than 10 minutes, making the short trip, in terms of time, the most frequent kind of travel. The modal split of these short time trips differed from the city as a whole: non-motorized means (76%) is followed by use of a private vehicle (17%) and public transport (7%).

As a matter of where do those short, close-scale trips take Barcelona residents, and what purposes do they serve, data show that 43% of the personal mobility is completed with these short-time trips, compared to just 26% of all the occupational

mobility. Figure 3 shows how people allocate their travel times differently, depending on the purpose of the trip. Personal purposes are more frequent in short journeys (1-5 min and 5-10 min). In the case of trips taking in the range of 11-15 minutes, the distribution between occupational and professional purposes is nearly equal. Furthermore, trips of more than 15 minutes duration are clearly dominated by occupational mobility.

Figure 3: Breakdown of travel time allocation depending on mobility types. Source: Own production based on EMQ06 data



3.2 From time travelled to distance travelled.

Time is only one of the variables that define a trip, as the variables can also be explained using covered distance. Thus, travel speed always plays a major role and with it, the means of transport utilized, as each mean of transport provides us with different travel speeds inside the city. The distance travelled on trips that take the same amount of time will differ significantly, depending on what mode of transport was used. In a 10-minute trip, a pedestrian can walk 650 metres, the equivalent of 6 streets in the *Eixample* district of Barcelona. It is this covered distance that links short-time trips (up to ten minutes in duration) made by walking (with an associated speed of 4 km/h) with

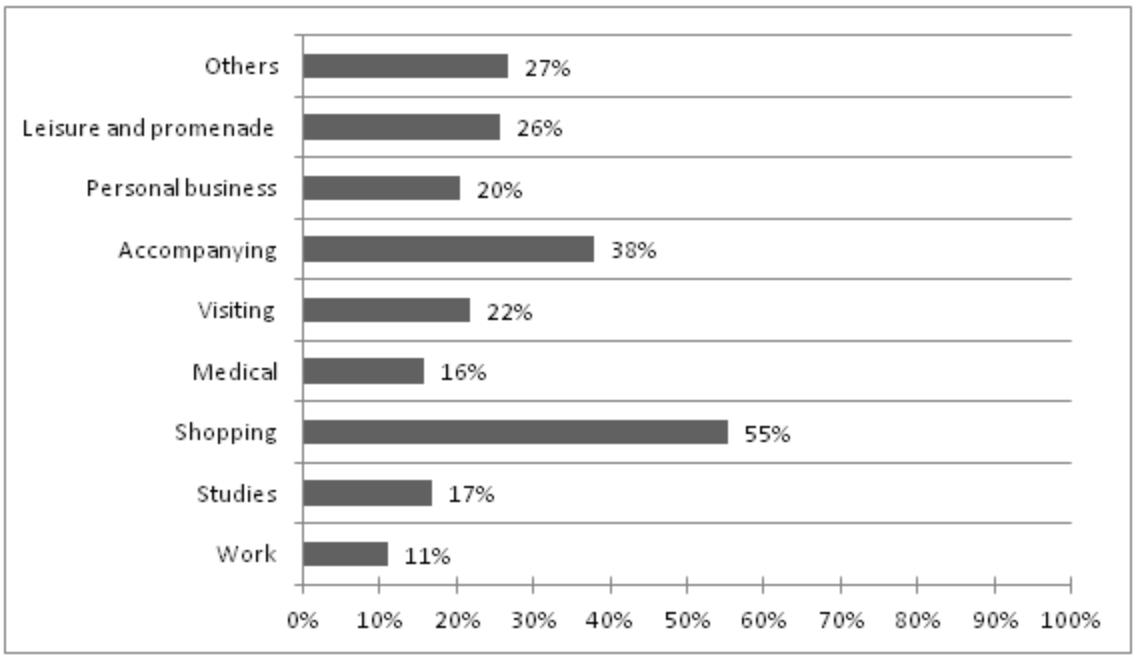
proximity dynamics. Other speeds would represent greater covered distances that could, certainly, not be included into these dynamics.

The data indicated that 1.1 million of these proximity trips in Barcelona were made in a single day, which represents 24% of all the daily mobility. These short walking trips represent nearly one quarter of all daily mobility; an evidence of the liveliness of the local dynamics that is indicative of how Barcelona has preserved a high degree of neighbourhood vitality.

An important aspect of this within-neighbourhood mobility is related to the motivations for these journeys. Figure 4 shows the frequency of proximity trips stratified by type of activity. At the local scale, the most frequent activity is shopping, followed by accompanying others: 55% and 38%, respectively, of all such trips in Barcelona, which are proximity trips. On the other end of the spectrum, only 11% of trips to work meet the conditions of being considered as proximity travel.

Data indicate that proximity is more related with personal than professional activities and strongly links neighbourhood utilization with the personal and domestic realm. The lower use of proximity travel for occupational purposes may also reflect some disconnection between the residential and employment spheres (Poli, 2009; Miralles-Guasch, 2011; Miralles-Guasch & Domene, 2010), however, it is also noteworthy that Barcelona has still managed to maintain a large proportion of its labour mobility inside this local scale.

Figure 4: Breakdown of proximity trips by travel purpose. Source: Own production from EMQ06 data



For a deeper analysis of proximity utilization, and given that local scale is comprised of very short distances, it is necessary to change the scale of analysis from the municipal to the neighbourhood level, in order to explain the localization of these dynamics and their relationship with their specific urban environment.

3.3. Proximity by area of study

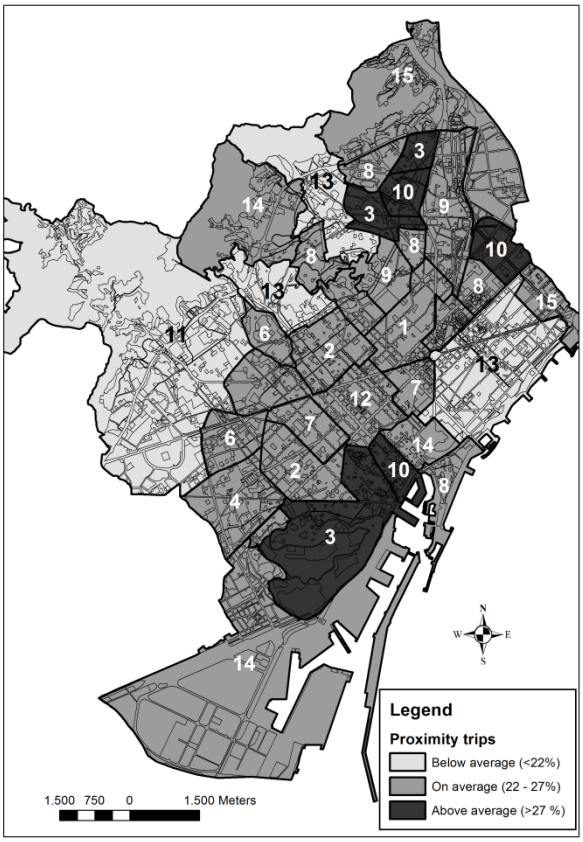
The scale provided by the 15 study areas (designed to accommodate trips completed by walking 20 minutes or less) made it possible to analyze the spatial distribution of local dynamics. By definition, it also permits the study of proximity trips in their most appropriate territory, as their field of action is equivalent to a 10-minute walk. At the same time, this change of scale enabled comparative analysis between study areas, making it possible to spot some key factors for the presence of close-scale urban dynamics.

Figure 5 shows the distribution of the proximity trips for each area. The most remarkable characteristic is the consistency of these kinds of mobility throughout the city: 11 of the 15 study areas were very close to the city-wide average of 24% of trips

made within the city by walking and taking less than 10 minutes, with proximity travel ranging from 22 and 27% of total trips.

This steady use of the local scale can be attributed to the general homogeneity of the city's morphological features. As reported in the municipal data analyzed, public and private services are well distributed throughout Barcelona, averaging 3 schools and 1 primary health care centre per square kilometre. The city's retail structure is characterized by medium- and small-sized businesses (SMEs), and 40 covered markets are distributed across the city. Overall, commercial use occupies 16% of the city's surface area. This distribution of services is combined with very high population density in most of Barcelona: 87% of the population lives in urban environments of more than 15,000 inhabitants per sq km.

Figure 5: Frequency of Proximity trips in Barcelona. Source: Own production from EMQ06 data.



Beyond the observed similarities, the analysis of areas with extreme values that are showing significantly different intensities of the use of the proximity travelling can also provide interesting insights. Of the four areas with remarkable differences in local-scale uses, two had values statistically significantly higher than the city average and two had lower values (Figure 3). In the two areas where proximity travel was most used (Nºs 10 and 13), these trips constituted 30.4% and 27.4% of total journeys, respectively. In contrast, proximity travel in areas 11 and 13 accounted for 19.3% and 21.4% of trips, respectively.

Areas 10 and 3 comprise the historical core of the city, along with a much more diverse building typology in areas of mixed development, that were mainly urbanized in period 1960-1970. They are neither peripheral nor exclusively centric areas, and are defined by high densities and with buildings which, almost, never surpass 8 or 9 floors. These areas concentrate a high proportion of the aging population, with 23% of the

population older than 65 years and more than 40% foreign-born, according to the 2006 municipal statistics.

In contrast, areas 11 and 13 are, indeed, located on the municipal periphery. These are the less dense areas of the city, with more recent urbanization (more than 15% of the urban tissue is post-1980). Finally, they are inhabited by adult (30-64 years old) and young (16-29) populations with higher average incomes.

It is also noteworthy how Ildefons Cerda's Eixample, which is Barcelona's most emblematic urban structure, shows consistent and regular local-scale uses. Its regular grid of vertical and horizontal streets occupies the geographical centre of the city. Its gross density is constantly above 30,000 inhabitants per sq km and, most importantly, its neighbourhood dynamics always generate a proximity travel ratio which is very close to the city's 24% average.

3.4 Explanatory factors

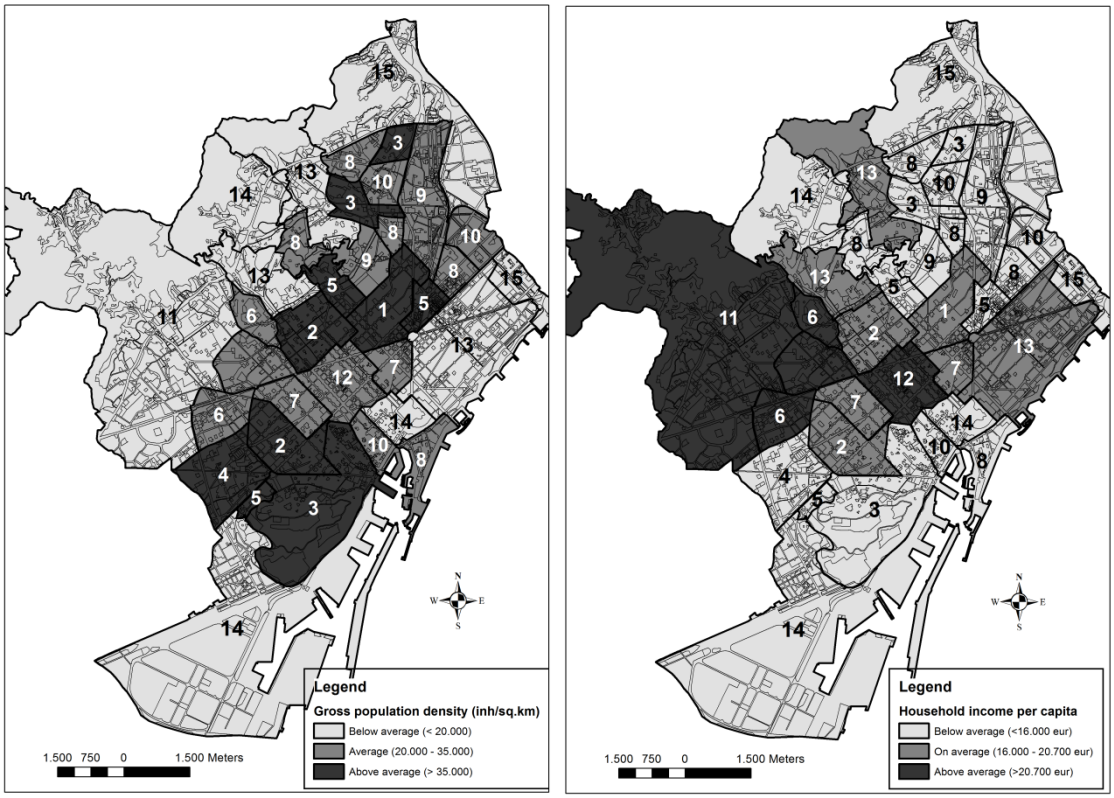
To explain differences in proximity uses, the literature has, generally, identified the built environment and sociological conditions of residents as the key determinants of urban mobility choices and behaviours. Among the many variables used to test this relationship, the most commonly analyzed include population density (Greenwald & Boarnett, 2001; Litman & Steele, 2009) and income per capita (Frank et al, 2005; García Palomares, 2010; Brownstone & Golob, 2009). Therefore, we chose to test how proximity trips were specifically related with the gross population density values (Figure 6, right side) and income levels (Figure 6, left side).

Population density has long been used as a proxy of the urban environment (Boyko & Cooper, 2011). Mediterranean cities like Barcelona have high population density which, typically, indicates a high concentration of population in a given area, which can lead to an assumption that there is also a high offering of services and retail shops. Furthermore, as a measure of concentration, density is also valuable in distinguishing between compact and disperse urban tissues. Thus, in diverse urban environments, such as Barcelona's, population density identifies areas with the potential to accommodate proximity dynamics.

As can be seen in Figure 6 (left side), a SW-NE swathe crosses the city with constant high densities. 11 out of 15 areas show density levels above 20,000 inhabitants

per sq km. Low density is observed only at the periphery. This homogeneous context of built environment grants almost every study area with the potential to develop strong proximity dynamics but, therefore, also decreases the value of density as an explanatory factor for the variation on the frequency of use of proximity trips.

Figure 6: Density and income distribution in Barcelona. Source: Own production from Barcelona Statistical Service data



Nonetheless, although its role may be small, density has some impact on neighbourhood utilization and proximity travelling in Barcelona, as can be seen in Figure 7. First, we can observe that denser areas are more prone to develop local dynamics. Areas with more than 35,000 inhabitants per sq km, tend to have more proximity trips (24.8%) than areas with fewer than 20,000 inhabitants per sq km (22,2%). As density increases from the more dispersed areas to the more dense ones, so the use of the neighbourhood increase. However, once a certain density threshold is surpassed, proximity utilization no longer varies significantly. For areas above the 35,000 inhabitants per sq km, density ceases to be significant for proximity use. In areas

with already enough critical mass of people and services, increasing density will no longer cause a major use at the local scale.

In conclusion, density acts both as a precondition and a facilitator of proximity uses; however, in highly homogeneous environments it cannot provide the sole explanation for the intensity of local-scale uses. There are other important factors, some of which may still be related to the built environment. One of them may be the number of services and facilities available to the residents of a certain area. In this sense, areas 11 and 13 have densities similar to areas 14 or 15, but while commerce represents 42% of the cadastral surface for the first pair of zones, for the second pair of zones this figure is 34%. A wider range of near destinations available contributes to areas 11 and 13 having more proximity trips.

The second main variable tested was family income per capita (Figure 6, right side). The spatial distribution of income levels is more differentiated than population density and it follows a very clear pattern. The average income in Barcelona is approximately 17,900 Euros per year. In urban areas on the west side of the city, incomes are much higher (29,000 Euros per year); in areas of the city's historic core and some areas to the north, they are well below the average (11,200 Euros per year). Below average income is found to be significant for proximity utilization, as 25.8% of low income trips are made through a short walking trip. In contrast, this figure is higher in Average and Above Average areas, which suggests a link between income and neighbourhood utilization that is statistically confirmed in Figure 8. Furthermore, income appears as the most relevant variable explaining variance in the use at the local scale in Barcelona ($\chi^2 = 74.774$ $p<0.001$), slightly ahead of density ($\chi^2 = 64.895$ $p<0.001$)

Figure 7: Use of proximity trips with respect to population density and income. Source: Own production from EMQ06 and Barcelona Statistical Service data

	Use of proximity trips (%)		
	Yes *(>10' walking trips)* (%)	**No** *(other types of trips)* (%)	*Total (%)*
Density (Pearson Chi-Square = 64895)			
Below Average (<20.000)	22.2*	77.8**	100
Average (20.001 – 35.000)	25.4**	74.6*	100
Above Average (>35.000)	24.8	75.2	100
Income (Pearson Chi-Square = 74774)			
Below Average (<16000)	25.8**	74.2*	100
Average (16.000 - 20.700)	22.9*	77.1**	100
Above Average (>27.000)	23.4*	76.6	100
Total	24.3	75.7	*100*

Source: own elaboration from EMQ06
Test: Chi^2 sig=000 all categories; Adjusted residuals test, corrected.
** significantly higher values
* significantly lower values

More intense proximity uses in poorer areas appear to be related to access to privately owned vehicles. The close relationship between motorization and income (Scheiner, 2010) is reflected in 25% higher rates of car ownership in wealthier areas than poorer ones. In the poorer areas, having no car makes it impossible to undertake long trips in an acceptable time range which increases usage of the local scale. Additionally, fewer cars per capita increases general utilization of non-motorized travel, which constitutes part of the definition of proximity travel.

4. Summary and conclusions

Most of the new urban discourses understand that proximity between different functions of the city creates mobility models that are more sustainable and democratic. However, proximity is not only defined as a Euclidian or topological distance, but is also based upon people's capacity to travel from one point to another in an affordable time and means of transport (Brennan and Martin, 2012). Proximity, therefore, encompasses both time invested in travel and distance covered on the trip. While the definition of short-time trips allows examination of the temporal aspect, proximity trips provide the complete temporal and spatial picture. In turn, as proximity trips relate to

very short distances, they are useful to examine the everyday functioning of the neighbourhood as a part of the compact city.

Analyzing proximity trips requires a two-scale analysis, combining the study of aggregated data at the municipal level and a detailed scope at the neighbourhood level. This dual analysis of mobility data extracted from the EMQ06 enabled both a global perspective on the use of the local scale and the study of proximity at its most appropriate level: the neighbourhood.

At the speed of the pedestrian, we can impute a distance travelled to every walking trip and, therefore, define proximity trips as those made by non-motorized trips and taking periods of 10 minutes or less. Such trips are very frequent in Barcelona's daily mobility, representing one quarter of all the trips taken in the city on a weekday (2006 data). The most remarkable aspect of the way people use these trips is that they are intimately related with personal mobility. Although citizens tend to report longer travel times for work-related trips, personal needs are being met within the neighbourhood scale. Despite this finding, it is also true that Barcelona's compactness has helped to retain a remarkable number of jobs inside the proximity sphere.

Such intense proximity dynamics are only possible thanks to the morphological characteristics of the built environment, defined by mixed land uses, homogeneous high-density developments, and a planning tradition focused on well-distributed services and facilities (Busquets, 2004). However, when we examined the distribution of proximity trips across the smaller study areas, we still observed some variations in the patterns and intensity of proximity uses. These variations are explained by a combination of density and income factors. In this specific analysis, income was the major factor, as the relevance of density is diminished by the constants that characterize the built environment. Our results suggest that density is a necessary element for the existence of proximity dynamics, but beyond a certain level of density (20,000 inhabitants per sq km) we observed that income and sociological factors gained importance in determining the intensity of local-scale uses. The income level affects every day mobility by determining access to private and public transport means. Thus, lower motorization of the poorer areas drives toward localizing a greater amount of trips inside the neighbourhood that is always reachable within a 10 minute walking trip.

Finding that once the built environment grants the possibility of short walking trips, it is the sociodemographic and economic factors that determine whether people

use proximity trips or not, which opens important fields of future research. From an urban planning perspective, the presence or absence of intense proximity dynamics can depend not only on the density or land mix distribution of the neighbourhood, but also on how this built environment is adapted to the specific needs of its population. Examining everyday mobility habits and the use of proximity trips can serve as a proxy of whether the built environment is well adapted, turning the direction of the analysis and making it pertinent from a user perspective.

Overall, studying proximity utilization, from the mobility point of view, responds to a disaggregated approach that allows better insights on daily life mechanisms (Røe, 2000) and contributes to increasing knowledge about short-scale dynamics that take place in every city and that may have passed underrated on traditional transport analysis. These inner neighbourhood dynamics involve a large variety of short journeys, used for a wide array of different motivations. They constitute a myriad of mobility of proximity applications that ultimately form the heartbeat of the city and that have still to be studied, accordingly (Bissell, 2013).

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