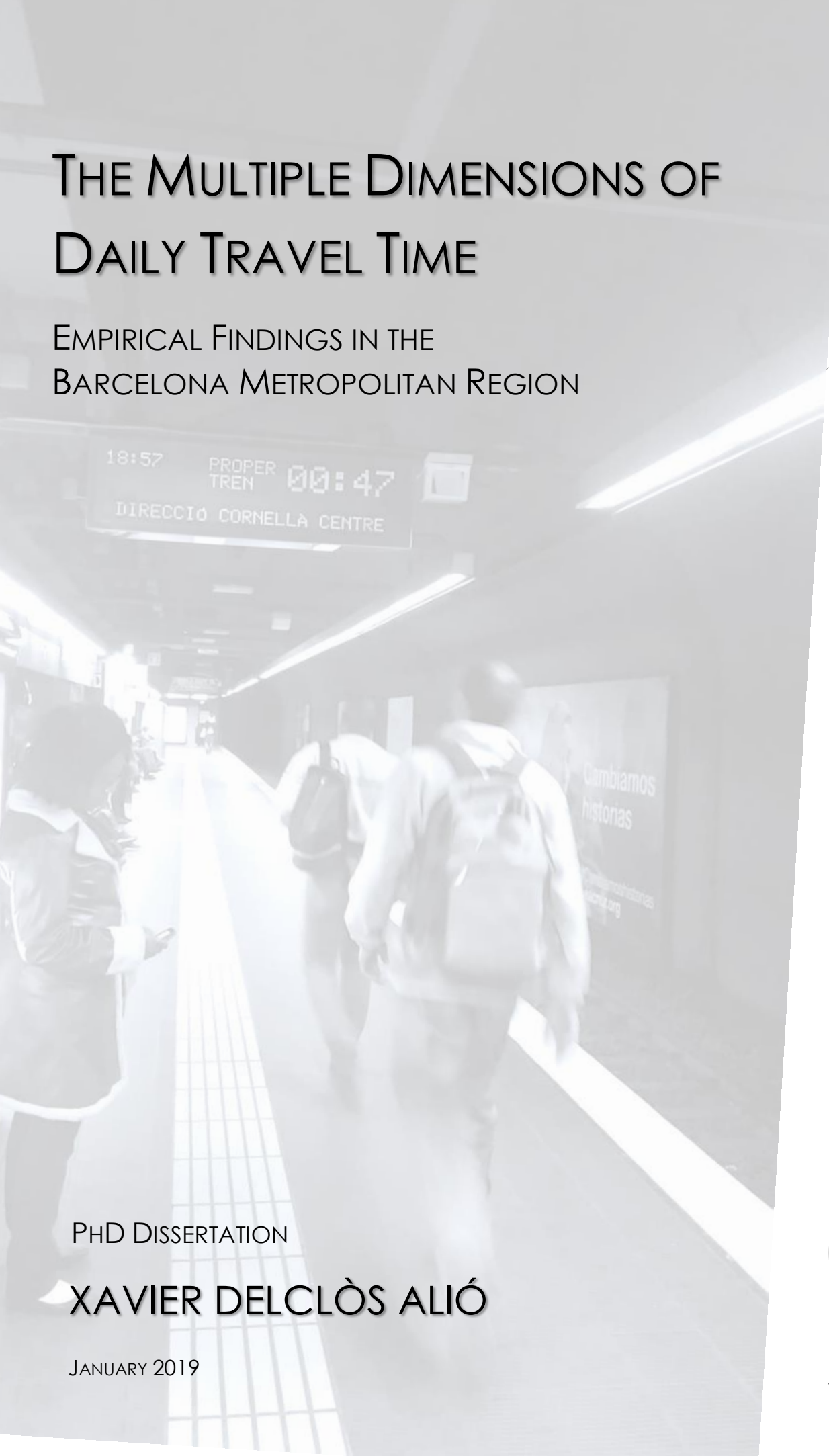
Universitat Autònoma de Barcelona

THE MULTIPLE DIMENSIONS OF DAILY TRAVEL TIME: EMPIRICAL FINDINGS IN THE BARCELONA METROPOLITAN REGION

Xavier Delclòs Alió

The Multiple Dimensions of Daily Travel Time

Empirical Findings in the Barcelona Metropolitan Region



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XAVIER DELCLÒS ALIÓ

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Departament de Geografia

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Universitat Autònoma de Barcelona

We each exist for but a short time,
and in that time explore but a small part of the whole universe.

Stephen Hawking

The Grand Design, 2010

PREFACE

The basis of this dissertation is a compendium of academic publications. Consequently, it is structured following the regulation approved by the Academic Committee of the Doctoral Program (CAP) of the Department of Geography of the Universitat Autònoma de Barcelona, regulated by RD 99/2011 and according to the transitory disposition approved by the CAP on April 10, 2015 for students enrolled prior to the 2015-2016 academic year.

Following the specific regulation RD 1393/2007, all article-based dissertations must be constituted by at least two scientific contributions authored by the candidate (published in academic journals or in the form of books or book chapters, among others). Contributions included in the dissertation should be published or at least accepted at the moment of deposit. Based on this regulation, this dissertation is structured as follows, and as presented in Figure 1:

- Part I consists of three chapters that describe the general research presentation, a broad theoretical framework and the research design and methodology.
- Part II corresponds to the main core of the thesis, based on four empirical studies published in academic journals.
- Part III presents the general discussion and conclusions.
- Part IV is left for the reference list and annexes.

This doctoral thesis is based on four academic papers published in international journals, as approved by the Academic Committee of the Doctoral Program (CAP) of the UAB Department of Geography on December 19th 2018. These papers are presented below:

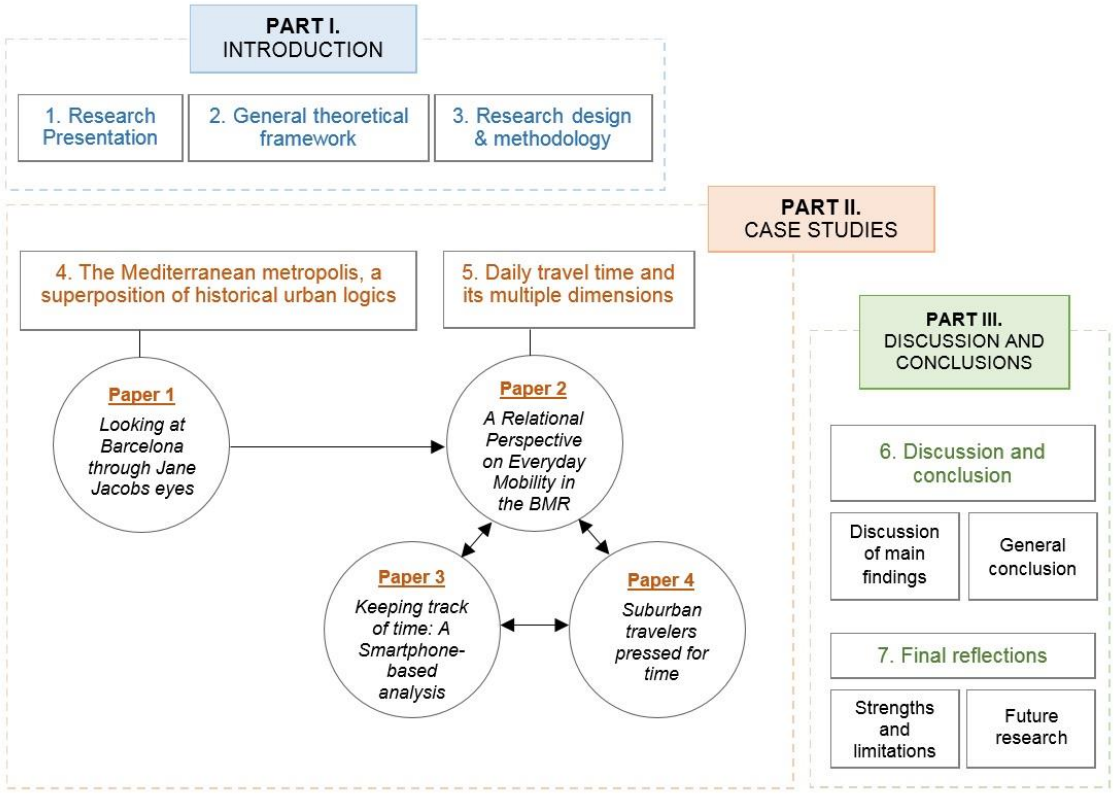
1) **Delclòs-Alió, X.**, & Miralles-Guasch, C. (2018). Looking at Barcelona through Jane Jacobs's eyes: Mapping the basic conditions for urban vitality in a Mediterranean conurbation. *Land Use Policy*, *75*(June), 505–517. https://doi.org/https://doi.org/10.1016/j.landusepol.2018.04.026. **JCR (2017):** Impact Factor = **3,194**, Journal Rank = **Q1** (Environmental Studies).

2) **Delclòs-Alió, X**., & Miralles-Guasch, C. (2018). A Relational Perspective on Everyday Mobility in the Barcelona Metropolitan Region: Individual and Household-Related Differences in Daily Travel Time. *Tijdschrift Voor Economische En Sociale Geografie*, *109*(4). https://doi.org/10.1111/tesg.12315. **JCR (2017):** Impact Factor = **0,653**, Journal Rank = **Q4** (Environmental Studies, Economy)

3) **Delclòs-Alió, X**., Marquet, O., & Miralles-Guasch, C. (2017). Keeping track of time: A Smartphone-based analysis of travel time perception in a suburban environment. *Travel Behaviour and Society*, *9*, 2214–367. https://doi.org/10.1016/j.tbs.2017.07.001. **SJR (2017):** Impact Factor = **1,382**, Journal Rank = **Q1** (Transportation).

4) **Delclòs-Alió, X.,** & Miralles-Guasch, C. (2017). Suburban travelers pressed for time: Exploring the temporal implications of metropolitan commuting in Barcelona. *Journal of Transport Geography*, *65*(July), 165–174. https://doi.org/10.1016/j.jtrangeo.2017.10.016. **JCR (2017):** Impact Factor = **2,699**, Journal Rank = **Q1** (Geography, Economy), **Q2** (Transportation).

Figure 1. Dissertation structure.



Own production.

The present work was supported by the Spanish Ministry of Education, Culture and Sport, through a **FPU grant (FPU14-02638)**. This grant has allowed for a total of 4 years

of full-time dedication to the research project, and has also provided complementary funding to conduct research visits to international academic centers.

This doctoral thesis has also had support from the following two research projects at the Research Group on Mobility, Transportation and Territory (GEMOTT), of the Universitat Autònoma de Barcelona, led by Dr. Carme Miralles-Guasch:

- M**ovilidad cotidiana activa y saludable en entornos urbanos de proximidad. Enfoques multimetodológicos: *tracking living labs*, encuestas de movilidad y estudios cualitativos –** CSO2016-74904-R – Ministerio de Economía y Competitividad (Gobierno de España). Period: 01/01/2017 – 31/12/2019.

- **La movilidad cotidiana y las dinámicas de proximidad. Un enfoque territorial, social y medioambiental** – CSO2013-42513-P – Ministerio de Economía y Competitividad (Gobierno de España). Period: 01/01/2014 – 31/12/2016.

AGRAÏMENTS

Aquesta tesi doctoral, com totes, no és només fruït de l'interès i esforç personal, sinó també d'aquelles estructures i persones que l'han feta possible.

En primer lloc voldria donar les gràcies a la meva directora, la Carme Miralles Guasch. Gràcies Carme per haver-me convidat a fer la tesi amb tu quan cursava el màster, per la teva constant dedicació i les tantíssimes hores de treball i de correccions, per la teva insistència en el *relat*, per la teva paciència amb els errors de *júnior,* per la teva capacitat de mantenir *els platerets rodant* i, per damunt de tot, per haver-me fet notar la teva confiança en tot moment.

En segon lloc, vull destacar la importància que ha tingut per a mi desenvolupar aquesta recerca en el marc del Grup d'Estudis en Mobilitat, Transport i Territori (GEMOTT). Formar part del GEMOTT des del 2015 no només m'ha brindat una gran diversitat de recursos materials per a treballar còmodament, sinó que, per damunt de tot, m'ha permès investigar amb el suport d'una estructura de grup que ha fet que qualsevol repte semblés més assequible, i que el camí fos menys incert i solitari. Un especial agraïment al Guillem Vich per haver estat company de fatigues des del primer dia, amb qui hem compartit dificultats, dubtes, i també les alegries dels primers articles; a l'Oriol Marquet per haver obert el camí i per ser un referent per a mi i per la resta de companys; a la Maribel Arcos, les Mòniques (Monika Maciejewska i Mónica Castañeda), al Dani Montané, a la Camila González, l'Oriol Roig, l'Eva Pulido, el Cesc Maneja i la Irene Gómez per haver compartit tantes estones agradables entre despatxos. Gràcies a tots vosaltres i també a tots els que han estat visitants esporàdics per les interessants converses de recerca a les #ReunionsDelsDimarts.

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ABSTRACT

Time is our most finite resource, and one that is a priori equally limited for all human beings. A considerable part of our life time, approximately one hour and a half every day, is spent on the move: going to and from work, running errands, visiting others, strolling, and so on. But, is this average value applicable to everyone, independently of who we are and where we live? Do we all perceive and manage time in the context of everyday life in the same manner? The present doctoral thesis aims to contribute in answering these questions by analyzing daily travel time in the context of the Mediterranean city, in this case by focusing on the Barcelona Metropolitan Region, in Catalonia.

The main hypothesis of this research is that travel time presents multiple dimensions that have not traditionally been sufficiently visible. This, in turn, requires a specific methodological design based on the combination of data sources and techniques that allow for these different dimensions of travel time to emerge. In this thesis daily travel time is analyzed in the context of its underlying spatial structure, in relation to individual and relational variables, taking into account the difference between perceived and objective travel time and, lastly, understanding what implications large temporal investments in mobility can have at the individual level.

For this purpose, the present research has been structured around four specific empirical studies published in international high-impact academic journals, which constitute the core of the dissertation. Besides specific results of each study, the dissertation concludes that while there is an evident relationship between territorial structure and socioeconomic variables with daily mobility, alternative understandings of time are in place both for future research and also planning practices.

RESUM

El temps és el nostre recurs més escàs i, a la vegada, un que a priori es troba igualment limitat per a tots els éssers humans. Una part considerable del nostre temps de vida, aproximadament una hora i mitja al dia, l'invertim en desplaçar-nos sobre el territori: anant i tornant de la feina, fent encàrrecs, visitant altres persones, passejant, etc. Però, és aquesta dada mitjana aplicable a tothom, independentment de qui som i d'on vivim? Percebem i gestionem els temps de desplaçament de la mateixa manera en el context de la nostra organització quotidiana? Aquesta tesi doctoral pretén contribuir a respondre aquestes preguntes analitzant el temps diari de desplaçament en el context de la ciutat mediterrània, en aquest cas centrant el focus en la Regió Metropolitana de Barcelona.

La hipòtesi principal d'aquesta investigació és que el temps de desplaçament presenta múltiples dimensions que tradicionalment no han estat suficientment visibles. Aquest objectiu, al seu torn, s'afronta mitjançant un disseny metodològic basat en la combinació de fonts d'informació i de tècniques que permeten que diferents dimensions del temps de la mobilitat puguin emergir. En aquesta tesi s'analitza el temps de la mobilitat en relació a una determinada estructura espacial subjacent, en relació a variables individuals i socials, tenint en compte la diferència entre el temps percebut i l'objectiu i, finalment, incorporant-hi la comprensió de quines implicacions a nivell individual resulten de considerables inversions temporals en mobilitat.

A aquest efecte, aquesta investigació s'ha estructurat a partir de quatre estudis empírics, publicats en revistes acadèmiques internacionals d'alt impacte, que constitueixen el nucli de la tesi. A més dels resultats específics de cada estudi, aquesta tesi conclou que, si bé hi ha una relació evident entre l'estructura territorial i les variables socioeconòmiques amb la mobilitat quotidiana, hi ha conceptualitzacions alternatives del temps de desplaçament que poden informar a futures recerques i als professionals de la planificació.

RESUMEN

El tiempo es nuestro recurso más escaso y, a la vez, uno que a priori se encuentra igualmente limitado para todos los seres humanos. Una parte considerable de nuestro tiempo de vida, aproximadamente una hora y media al día, la invertimos en desplazarnos sobre el territorio: yendo y viniendo del trabajo, realizando encargos, visitando a otras personas, paseando, etc. Pero, ¿es este dato promedio aplicable a todos nosotros, independientemente de quiénes somos y de dónde vivimos? ¿Percibimos y gestionamos los tiempos de desplazamiento de la misma manera en el contexto de nuestra organización cotidiana? Esta tesis doctoral pretende contribuir a responder estas preguntas analizando el tiempo de desplazamiento en el contexto de la ciudad mediterránea, en este caso centrando el foco en la Región Metropolitana de Barcelona.

La hipótesis principal de esta investigación es que el tiempo de desplazamiento presenta múltiples dimensiones que tradicionalmente no han sido suficientemente visibles. Este objetivo, a su vez, se afronta mediante un diseño metodológico basado en la combinación de fuentes de información y técnicas que permiten que diferentes dimensiones del tiempo de la movilidad puedan emerger. En esta tesis se analiza el tiempo de la movilidad en relación a una determinada estructura espacial subyacente, en relación con las variables individuales y relacionales, teniendo en cuenta la diferencia entre el tiempo de viaje percibido y objetivo y, finalmente, incorporando la comprensión de qué implicaciones a nivel individual resultan de considerables inversiones temporales en movilidad.

A tal efecto, esta investigación se ha estructurado a partir de cuatro estudios empíricos, publicados en revistas académicas internacionales de alto impacto, que constituyen el núcleo de la tesis. Además de resultados específicos de cada estudio, esta tesis concluye que, si bien existe una relación evidente entre la estructura territorial y las variables socioeconómicas con la movilidad cotidiana, hay conceptualizaciones alternativas del tiempo de desplazamiento que pueden informar a futuras investigaciones y a profesionales de la planificación.

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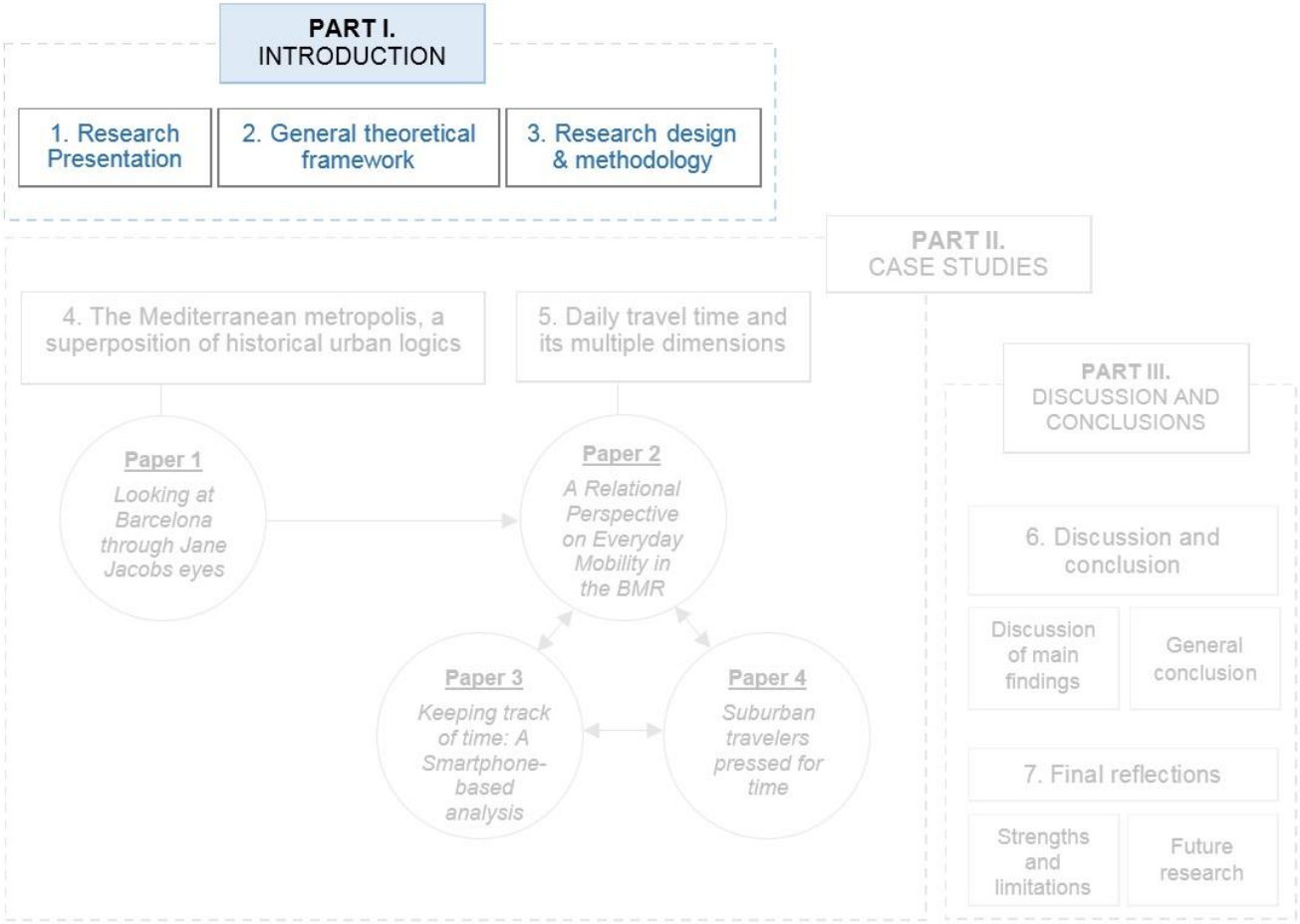
PART I. INTRODUCTION



1. Research presentation

1.1. Context

The urbanization process that has taken place during the 20th century, and in the Northern Mediterranean countries especially in the last decades, has been characterized by a logic of extension and also fragmentation of urban areas, both in terms of morphology but also regarding its functions (Neto, Pinto, & Burns, 2014; Roca, Arellano, & Moix, 2011; L. Salvati, Rontos, & Morelli, 2015). The implications of this extensive city model in opposition to the compact city are diverse, from the environmental impact of high land and resource consumption to greater social inequality resulting from increasingly residential and functional segregation (Camagni, Gibelli, Rigamonti, & Cristina, 2002). In turn, this territorial configuration, based on longer distances between activities, in broad terms translates into greater mobility levels. In many parts of the world, this generally results in a significantly higher dependency on the private vehicle in individual terms, which in turn implies that a design of an efficient collective public transportation system becomes a relevant societal challenge (Miralles-Guasch & Domene, 2010a).

Considering that individual mobility is conditioned by the morphological and functional structure of the city, the tension between space and society not only results in greater general mobility flows, but also in differences in accessibility levels derived from diverse mobility needs and capabilities, depending on personal characteristics such as residential location and sociodemographic variables. This implies that everyday mobility, as a function of the relationship between society and space, presents many different dimensions (Banister, 2011).

An adequate indicator of the relationship between a society and its underlying territorial structure is the time individuals spend on the move on a daily basis. In this sense, everyday mobility presents both spatial and temporal coordinates, considering time allocated to travel as a part of social time (Miralles-Guasch, 2011). Global values of time devoted to daily traveling have traditionally been considered to be relatively stable, with a daily average of approximately one hour and a half (Ahmed & Stopher, 2014; Mokhtarian & Chen, 2004; Peter Stopher & Zhang, 2010). However, there is some

evidence on how daily travel times might be on the rise in major metropolises and urban areas across Europe (van Wee, Rietveld, & Meurs, 2006; Vincent-Geslin & Ravalet, 2016), precisely due to the abovementioned dual urban nature of present-day metropolises, and specifically due to the relevance of longer commutes and what has been labelled as intensive traveling.

In this context, we must consider that our spatiotemporal behavior is not only a result of a given spatial structure, but that is also framed in the context of a series of constraints both at the individual and relational spheres which, in turn, are reflected in different strategies of everyday organization (Adams, 1995; Hägerstrand, 1970; Sui, 2012). Everyday mobility, and its temporal dimension in particular, hence should not be analyzed exclusively from a global perspective and based on average values, but also considering sociodemographic characteristics (Gallotti, Bazzani, & Rambaldi, 2015). Not only this, but considering that time can be also have different experiences and implications at the individual level, both in terms of density and compactness as well as referring to its role in the context of everyday organization (Wajcman, 2015).

1.2. General aim, research questions and hypothesis

The general aim of the research proposed here is to explore travel time in the context of the Barcelona Metropolitan Region. The **baseline hypothesis of this thesis is that travel time hides multiple dimensions at the territorial, social and individual scales, which can be identified and analyzed by employing multiple data sources and methodologies (H0).** This research therefore aims to contribute to the understanding of the spatiotemporal relationships that are drawn between a specific territory and its population, by focusing on Barcelona as an example of a Mediterranean conurbation.

This general approach is further developed upon a set of research questions and their corresponding specific hypothesis (H1-H4), which are conceived as guidelines for the analysis:

- **RQ1**: What are the main territorial characteristics of a present-day Mediterranean metropolis such as Barcelona?

  - **H1: The urban layout of the present-day metropolis of Barcelona is characterized by the combination of the traditional attributes of the Mediterranean city with those of more recent urban developments, which have been based on lower densities and higher segregation of urban functions.**

- **RQ2**: What is the relationship between territorial and socio-demographic variables, both at an individual and relational level, and different travel time investments?
  - **H2**: **Daily travel time is not the same for everyone considering individual variables such as age, gender or social status, relational variables related to the household, or the location of everyday activities such as residence or work.**

- **RQ3**: How is travel time perceived, considering both the individual and the mobility context?
  - **H3: There is a significant difference between how travel time is perceived and self-reported in travel surveys with actual travel time, and that this can vary across individuals and specific mobility contexts.**

- **RQ4:** How is travel time managed at the context of the daily organization, especially for those individuals with considerable temporal investments in mobility?
  - **H4**: **Investing an above-the-average amount of time on daily mobility can result in challenges in the context of daily organization and lower levels of general wellbeing.**

These issues are further developed in the form of more specific research questions in each of the presented studies.

1.3. Overview of the thesis

The present dissertation is structured around a set of empirical studies that constitute the main core of the research project. Considering the aims presented previously and the structure presented in the preface of this document, the outline of this dissertation is as follows:

After Chapter 1 has started Part I by presenting the research project, Chapter 2 consists of a brief review of general theoretical concepts that are required to understand the applied case studies, mainly relating to everyday mobility, its relationship with the built environment and a specific focus on daily travel time. Following this, the general methodology and research design are presented in Chapter 3. This chapter starts by describing the transition from traditional to new data sources in the study of everyday mobility, in order to then go on and presenting the research design, based on a mixed-method approach, and the specificities of each data source used.

The four empirical studies on which this research relies are presented in Part II. Chapter 4 describes the characteristics of the core of the study area based on the ideas of Jane Jacobs, which are used as theoretical basis to understand the territorial contrasts that are consequence of multiple layers of historical patterns of the urbanization process. Chapter 5 presents three case studies that delve into the different dimensions of daily travel time, which constitute the core of the empirical results of the dissertation. The first of the articles in this chapter gives a quantitative overview of the relationship between contextual data, both at the individual and household dimensions, and daily travel times of those residing in the Barcelona Metropolitan Region. The second and third articles related to travel time focus on a specific collective: those considered as intensive travelers due to their long commute. In the first case, the difference between objective and perceived travel time is analyzed, considering a set of individual and trip-related factors. In the second case, served by a specific three-step mixed-method design, the individual implications of intensive traveling are explored and discussed.

Finally, Chapter 6 presents a discussion of the thesis main findings, together with a final general conclusion. Strengths, limitations and future research lines are presented in Chapter 7.

2. General theoretical framework

In order to properly understand the case studies presented as the core of this thesis, a set of general concepts are briefly reviewed in the present section. First, a general definition of everyday mobility is provided, also referring to its main basic dimensions. Second, a specific focus is given to daily travel time, its relevance and research tradition, and the multiple driving forces of which are also defined.

2.1. Everyday mobility and its basic dimensions

Human society is characterized by being constantly on the move, from global flows of people, goods, capital or information, to the "micromobilities" that are drawn inside our residence (Cresswell, 2006; Urry, 2007). In this research, however, the focus is set at the mesoscale of human movement, which refers to what is known as everyday mobility. The fact that our daily activities are generally located apart from each other in space requires a minimum movement on our part. Everyday mobility, therefore, refers to the trips we conduct on a daily basis in order to access different locations and, by doing this, to fulfill our daily needs and desires (Miralles-Guasch & Cebollada, 2009).

Everyday mobility presents four basic dimensions that need to be considered. The first of the dimensions is *purpose*. Why do we need to move? Traditionally, daily mobility has been regarded as a derived demand, meaning that it does not present a purpose per se, but rather that its utility is derived from other domains such as work, performing errands or accessing recreational activities. Nevertheless and as it will be explained further in the text, this notion might have been, for some years now, under a significant amount of debate (Mokhtarian & Salomon, 2001).

The second of the dimensions of everyday mobility is *space*. We move as a result of a specific distribution of activities across space and, in turn, we use a specific portion of space to access them. This explains why the analysis of everyday mobility has been of interest in different fields of human geography to the point that, as Peter Gould explains, we might consider that "*human geography is about human beings moving (among other things) in geographic space"* (Gould, 1985, p. 116). At the same time, one of the main issues dealt with in this regard has been the exploration of the link between built environment

and how people move on a daily basis (Cervero & Kockelman, 1997; Næss, 2015), constituting the third of the dimensions of everyday mobility, *transportation mode*. This means that the manner in which activities are distributed across space, i.e. territorial configuration, on the one hand, and how these are particularly inserted in the built environment, on the other, will largely condition individual mobility options and strategies.

Lastly, every trip implies a *cost,* which can be regarded as the fourth dimension of everyday mobility. There are multiple costs related to everyday mobility such as those economic or environmental (Camagni et al., 2002), but the one that every human being share in principle is *time.* This dimension has also been traditionally incorporated in the analysis of everyday movement across space from very different perspectives. On the one hand, traditional transportation studies, based on the previously mentioned notion that mobility is a derived activity, have aimed to analyze how to reduce travel times to their minimum expression (Metz, 2008). On the other hand, time has also been the focus on behavioral analysis, with Time Geography being its main theoretical expression. Following the Swedish geographer Törsten Hägerstrand's theoretical model (Hägerstrand, 1970), people's daily itineraries are to be understood as paths in a spatiotemporal frame defined not only be the individual needs, but also by a series of constraints that project a particular prism of potential activity, both considering the social and personal relationship domains (Hägerstrand, 1982; Sui, 2012). This results in a temporal use of specific spaces, which can vary at the daily, weekly and even monthly scales (Mendizàbal, 1996).

Individual everyday mobility patterns, therefore, can be largely interpreted using these four different vectors, which are evidently related to one another.

2.2. Daily travel time: relevance and multiple perspectives

This research will focus on the temporal dimension of everyday mobility. The interest in the analysis of daily travel time is three-fold:

First, time is a resource which, a priori, is equally limited for every human being (Harvey, 1989). In this sense, the analysis of differences in the amount, composition and

management of a particular portion of this time, in this case allocated to daily mobility, may allow different sorts of inequalities to emerge (Strazdins et al., 2011).

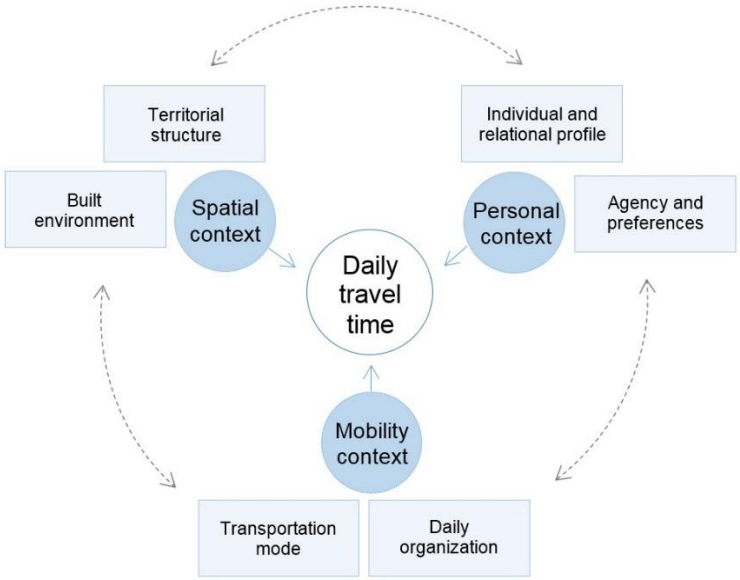
Secondly, the relationship between humans and space is mainly to be understood in temporal terms, rather than in distance units (MacEachren, 1980). This means that our daily mobility strategies are at the same time largely planned and experienced in temporal terms. We live and understand space through the experience of time: time spent in a given location, time spent on the move.

Thirdly, and related to the previous two points, the analysis of travel time can serve as evidence of the individual effect of a given underlying territorial structure. The elements that define the urban and metropolitan dynamics, (i.e. territorial and urban policies, real estate market, transportation infrastructure, the location of workplaces and economic activities as well as basic services and facilities, socio-demographic characteristics and migration patterns, among others) are decisive factors in the organization of individuals social times and, therefore, also of travel times. This implies that metropolitan dynamics have a direct impact in the organization of people's daily lives (Miralles-Guasch, 2011). That is why, increasingly, urban policies address the link between the functioning of cities and the use of time by their residents. So much so that the classical spatial vectors of spatial planning increasingly align with the social time vector, considering that temporal conciliation speaks in turn of territorial conciliation (Miralles-Guasch, 2006).

As explained in the presentation section, previous research has found evidence on the fact that human beings approximately invest between 1-1.5 hours every day to conduct their daily trips (Tanner, 1981; van Wee et al., 2006). This has prompted researchers to present the hypothesis of the existence of a travel time budget (TTB), which would imply that individuals conceive a maximum amount of time that are willing to allocate for daily trips (Ahmed & Stopher, 2014). However, it has to be taken into account that travel time must be placed in the context of daily organization, considering daily mobility as a part of social time (Jon May & Thrift, 2001), and therefore competing with other daily domains (Crang, 2001).

This being considered, these average estimates of daily travel time expenditures are figures that describe the behavior of a given population as a whole. However, individual travel time might considerably differ when a certain array of variables are considered. In order to analyze daily travel time in its multiple dimensions, it must be placed between three different scopes: the spatial context, the personal context and the mobility context, as schematized in Figure 2.

Figure 2. Theoretical schema of contexts shaping daily travel time.



Own production.

First of all, a population daily travel time is majorly influenced by its *spatial context*. This is explained on two different levels. On the one hand, the location of human activities and their specific spatial relationship, i.e. territorial structure, determines the distances that are needed to be covered by individual mobility. In this sense, while metropolitan areas based on functional segregation will enhance long-distance mobility logics and higher dependency on motorized transportation means (Badoe & Miller, 2000), mixed-used developments, where urban functions are close to one another, will make proximity dynamics to be present, exemplified by short walking trips (Marquet & Miralles-Guasch, 2015; Miralles-Guasch & Marquet, 2013). Conversely, the detailed characteristics of the built environment will reinforce this, considering that elements such as the quality of the infrastructure and elements of design are also to be considered in promoting the use of non-motorized means of transportation (Frank, Giles-Corti, & Ewing, 2016).

Secondly, travel times are not only a function of a given spatial configuration, but also they are a result of the individual or *personal context*. In this sense, two different frameworks can be used. On the one hand, structuration theory (Giddens, 1984) serves as basis to understand that human action in space is also dialogued through agency, which is defined as an individual capacity of deciding and organizing daily mobility habits. Nevertheless, individual spatiotemporal behavior is not only a function of space and personal agency, but also has to be put into relational and social contexts. This is line with a social conceptualization of time (Adam, 1995), considering in this case that time is understood, used and controlled at a social level while shaping individual lives. In the field of geography this was mainly developed by Hägerstrand's theory on spatiotemporal 'constraints', which implied that individuals are largely conditioned by their personal capabilities and socioeconomic characteristics, familiar and social relationships, and a set of societal or authority rules. In this same line, Adams (1995) and Crang (2001) have also critiqued the linear idea of time by introducing the existence of "multiple times" or the concept of "experiential time-space", implying a multidimensional understanding of time in space, considering individuals' daily life is not to be understood as linear but instead as a branching structure in space time.

Lastly, regarding the *mobility context*, we must take into account that daily travel time largely depends on what transportation mode is used, based on their speed capabilities: private vehicles are generally faster means compared to public transportation, and evidently faster than cycling or walking. However, Banister (2011) among others such as Lyons et al. (2007) and Jain & Lyons (2008) point out that a deeper understanding of travel time is needed, as it has mainly been regarded from the perspective of speed and time savings, leaving out of focus aspects such as quality of time or the benefits of slower movement, implying that a qualitative vector ought also to be included in the analysis. On one hand, aspects related to the actual utility of that trip, or *density*, should be regarded. As pointed out by Lyons and Urry (2005), "*the boundaries between travel time and activity time are increasingly blurred. Specifically, many people are using travel time itself to undertake activities. The cost to the individual of travel time is reduced as travel time is converted into activity time. In turn, less of the individual's travel time budget is used, enabling*

more travel or encouraging greater use of modes that may enable en-route activities to be undertaken."

On the other, it is interesting to pay attention to how time is perceived and experienced based on the specific context of that trip, considering that while the easiest measure of time is that provided by clocks, our daily decisions and plans are largely based on our own recollection and perception of reality (Li, 2003). Lastly, our daily mobility strategies are also contextualized in a larger frame, which is that referred to daily organization. This will not only have an effect on the amount and utility of travel time, its *fragmentation* and its relationship with other domains of daily life.

All of these theoretical notions are further described and discussed in the background section of each of the case studies included in this dissertation.

3. Research design and methodology

Even though each case study that will be presented in this dissertation contains its own methodology section, it might be useful to have, first, a general perspective on the research design and the methodological framework of the project as a whole. With this in mind, the chapter is divided into three different sections. First, an overview of the traditional methodologies and data sources used in the analysis of everyday mobility is provided, and the specific role that recently developed location-based tools may provide in this area is noted. Second, it is also timely to consider that this array of data sources should not be thought of in an independent manner, but instead, considered from an integral perspective that understands that a combination of sources must be properly implemented in order to analyze a phenomenon that is multi-dimensional. It is therefore interesting to understand why mixed-methods approaches are presented as the most adequate research designs to explore such complex phenomena. Third, the specific research design of this dissertation is presented, by describing in detail the characteristics of each data source used and also a brief introduction to the study area.

3.1. How do we analyze everyday mobility? From traditional to new data sources

As many other disciplines inside the reign of social sciences and the analysis of human behavior, studies focusing on everyday mobility or travel behavior have been recurrently framed by the traditional quantitative-qualitative methodological divide (Goetz, Vowles, & Tierney, 2009).

On the one hand, an 'outside in' perspective has largely prevailed in such studies, this being characterized by approaching the phenomenon in question from a generalist point of view aiming at identifying general behavioral and spatial patterns. This is usually achieved by means of large, official and representative data sources (Miralles-Guasch, 2012). These sources are such as population census, time use surveys, mobility surveys, origin-destination matrices and other activity measurements such as daily average traffic intensities or pedestrian volume accounting. This approach falls within the epistemological reign of what is known as the 'quantitative', broadly dominated by scholars in the fields of transportation planning and spatial analysis starting in the 1960's

in the United States (Røe, 2000). This has been particularly the case for research specifically focused on the study of travel time, considering the rather specific and measurable nature of it: hours, minutes, and seconds.

On the other hand, and in occasions being seen as an opposition to the quantitative dominance, a second group of analytical body interested in everyday mobility has been more interested in an 'inside out' take. This consists, put simply, of research design that focuses in the exploration of individuals' experiences, motivations and rationales behind their behavior (Clifton & Handy, 2003), often with a more critical perspective on the matter under study. In such approach, the individual dimension becomes a central part of the analysis, and therefore qualitative sources and methods are their main methodological corpus. This has been particularly fueled by the so-called *mobilities turn* that studies focusing on human movement at very diverse scales has experienced in the turn of the 21st century (Sheller & Urry, 2006). In the qualitative field, travel diaries, focus groups and especially in-depth interviews are the most commonly used techniques. Again in regard to the specific case of time, this is regarded in the qualitative arena as something that is much more influenced or biased by the individual experience and perception, and also on the specific context in which the trip is undertaken. This reflects upon a much more 'multidimensional' understanding of travel time, beyond the positivist approach defined by the clock, which assumes that time is universal and experienced by everyone in the same manner.

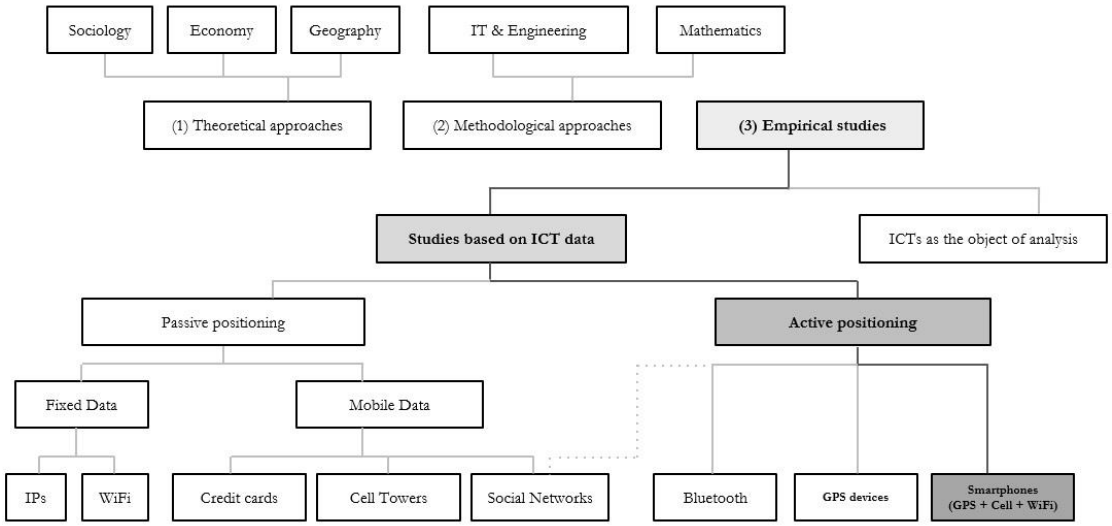
Beyond this traditional quantitative-qualitative divide, and approximately in the past 15 years there has been, in the academic field, a need to seek for new sources of information in order to analyze the relationships established between urban form, individual mobility and accessibility (Cottrill et al., 2013; Kwan & Weber, 2003). In the case of daily mobility studies and specially in Catalonia, this need derives, in the first place, from the progressive reduction in the quantity and quality of the available official databases, both in general (see the last Spanish Population and Housing Census, as an example) but also specifically in terms of daily travel surveys. The latest available exhaustive Daily Mobility Survey dates back to the year 2006 (the *Enquesta de Mobilitat Quotidiana* or *EMQ*). From then on, yearly editions of the Weekly Mobility Survey (*Enquesta de Mobilitat en Dies Feiners* or *EMEF*) are also available, even though these present less detail

and territorial coverage. Lastly, this also applies to secondary sources such as Survey on Living Conditions and Habits of the Population (*Enquesta d'Hàbits i Condicions de Vida de la Població* 2006, 2011). This source, however, does not present information on the trips themselves, but rather on the location of the daily activities of the population. On the other hand, in a context where daily mobility patterns have become much more complex and have distanced considerably from exclusively commuting dynamics, traditional data sources present limitations especially regarding the spatial dimension of mobility.

In this sense, the development of Information and Communication Technologies (ICTs) has progressively become a new source of valuable data for researchers, not only in engineering or technology-based disciplines, but also in social sciences (Graham & Shelton, 2013; Miller, 2010). As shown in Figure 3, the appearance of ICTs in research that focuses in daily human movement is very diverse, ranging from theoretical to methodological approaches and, increasingly, empirical studies based on this type of data. In this context, the advance of Location-Based Technologies (LBT) has brought into light new possibilities for research in human mobility (Chen, Ma, Susilo, Liu, & Wang, 2016).

This highly accurate technology has also helped in improving data quality and addressing some of the methodological weaknesses derived, for example, from self-reporting (Bricka, Sen, Paleti, & Bhat, 2012; Peter Stopher, FitzGerald, & Zhang, 2008). These approaches can be categorized into two different groups, namely passive and active positioning. Passive positioning refers to data that the individual might not necessarily be aware of its collection, such as WI-FI hotspots, cell towers or credit card transactions, usually included under the umbrella of 'big data'. On the other hand, active positioning refers to data gathering techniques in which the participant is aware of being part of an experiment, which are usually based on technologies such as Bluetooth, GPS devices, and increasingly, location-enabled smartphone apps. Data from social networks such as *Twitter* © or *Facebook* ©, which have also started to be used in academic research (Salas-Olmedo & Rojas Quezada, 2017), could fall within these two tracking domains, considering that users might or not be aware of their data being collected .

Figure 3. ICTs in the analysis of daily human movement: from theoretical and methodological background to different options for ICT-based case studies.



Source: translated and adapted from Miralles-Guasch, Delclòs, & Vich (2015).

Of particular interest for this project is active positioning or individual tracking, which is being increasingly used in the study of human movement. The majority of the research conducted in the field of tracking still presents a methodological orientation. The most common topics are related to post-processing data (Hong, Heo, & Vonderohe, 2013; Liu, Zheng, Feng, Yuan, & Lu, 2013; Rasmussen, Ingvardson, Halldórsdóttir, & Nielsen, 2015), route identification (Bierlaire, Chen, & Newman, 2013; Casello & Usykov, 2014; Hanaoka, Nakaya, Yano, & Inoue, 2014; Quddus & Washington, 2015), transport mode detection (Ferrer & Ruiz, 2014; Gong, Chen, Bialostozky, & Lawson, 2012; Stenneth, Thompson, Stone, & Alowibdi, 2012; Xiao, Juan, & Zhang, 2015) and the comparison between mobility related variables reported in traditional sources and those derived from these location-based technologies (Bricka et al., 2012; Houston, Luong, & Boarnet, 2014; Kelly, Krenn, Titze, Stopher, & Foster, 2013).

From an applied perspective, the use of individual location-aware technologies has been above all implemented in the fields of health and physical activity sciences (Almanza, Jerrett, Dunton, Seto, & Ann Pentz, 2012; Carlson et al., 2015; Demant Klinker, Schipperijn, Toftager, Kerr, & Troelsen, 2015; Dessing, de Vries, Graham, & Pierik, 2014; among many others) and also environmental studies (Pooley et al., 2010; Whyatt et al., 2007). Nevertheless, until recently these methodological approaches had not yet

completely flourished in the reigns of daily mobility or geography (Shoval, Kwan, Reinau, & Harder, 2014). Only some recent works have studied, for instance, people's activity spaces applied to tourism (Pettersson & Zillinger, 2011), accessibility to services or opportunities (Tana, Kwan, & Chai, 2015), social segregation (Greenberg Raanan & Shoval, 2014; Palmer et al., 2013), and travel behavior and walking patterns (Beeco et al., 2013; Clark, Scott, & Yiannakoulias, 2013; Millward, Spinney, & Scott, 2013; Shen, Kwan, & Chai, 2013; Shoval et al., 2010).

From a technological perspective, the majority of such studies is still based on dedicated GPS devices, which allow researchers to track people's mobility with high accuracy. Given their battery autonomy, these devices can perform all day long and still provide high precision data at very short intervals. However, the main drawback of experiments on daily mobility using this sort of technology is related to their price and the logistics of the fieldwork design. This implies that it is still difficult to study large samples of population, therefore, only few studies have used representative samples so far. On the other hand, the technological development of smartphones as location-enabled devices and their extension everyday pocket items allow conducting highly accurate analysis in similar ways as GPS do, while aiming at larger samples (Cottrill et al., 2013; Palmer et al., 2013). Moreover, while there is still room for improvement regarding the technological capacity, for instance battery efficiency (Zhuang, Kim, & Singh, 2010) or accuracy especially in urban and indoor environments (Van der Spek, Van Schaick, De Bois, & De Haan, 2009) in the case of smartphone applications this can be compensated by the use of the mobile network or the Internet via Wi-Fi access (Palmer et al., 2013). Privacy concerns are also a remarkable consideration in this type of work, given the high spatial accuracy of the data, for both the process of data collection and data management and analysis.

However, the main challenge regarding tracking techniques regards the analysis and interpretation process. Beyond a sequence of georeferenced locations there is a need for a deeper interpretation of the data from the point of view of everyday mobility. While these tools present evident opportunities for research, especially given the ability to clearly depict the spatiotemporal dimension of daily life, they still need to be complemented by other sources of information. In this sense, these technologies are not

to be seen as substitutes but instead as complements of traditional sources, which ought to be combined in research designs that combine the attributes of each of them.

3.2. Mixed methods designs and their application to everyday mobility studies

In the past few decades there has been some interest in overcoming the previously mentioned quantitative-qualitative methodological divide, not only provided by new data sources but also by innovative research designs. More specifically, this has been the case of those studies that combine attributes from both research standpoints, which are generally known as mixed methods designs. While this has been a topic for debate since the 1980's, it has not been until the last decade and a half that the interest in such combined methodologies has grown exponentially, exemplified by the creation of the *Journal of Mixed Methods Research* in 2007 (Tashakkori & Creswell, 2007).

However, why are mixed methods necessary or even useful? In one of many handbooks on the topic, Creswell & Clark (2017) state that there are in fact multiple reasons to design a mixed methods research design and that these can be designed and implemented to respond to a wide variety of research needs. The need to corroborate or explain initial results, the need to conduct tests before deciding on the final method, the need to compare different types of cases or to involve participants in the research processes are some examples of methodological reasons that might justify the use of this type of research design. Nevertheless, there are often situations in which a mixed-method approach might prove useful for conceptual reasons. This is the case when the nature of the research intention is precisely the need to understand a phenomenon from different lenses and therefore to provide interpretations from different perspectives and levels, and therefore understanding mixed methods as "*multiple ways of seeing and hearing, multiple ways of making sense of the social world, and multiple standpoints on what is important and to be valued and cherished*" Greene (2007, p.20)

The research design is not only a function of the researchers' needs, but also of their own preferences and epistemological standpoints or worldviews. In this sense, while positivism and constructivism have dominated research in the social sciences, an alternative worldview known as pragmatism is associated with mixed methods research

(Creswell, 2013). In this sense, pragmatism is defined by research practicality, designing the collection of data based on 'what works', depending on the nature of the research question and therefore the need to base the analysis on data of different nature. This leads to the consideration that the "*forced-choice dichotomy between post positivism and constructivism should be abandoned*" (Tashakkori & Teddlie, 2003)

From a practical perspective and while there are many definitions for what mixed methods is, it basically can be summarized to a research design "*in which a researcher or a team of researchers combines elements of qualitative and quantitative research approaches (e.g. use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purposes of breadth and depth of understanding and corroboration"* (Johnson et al., 2007: p. 123). While this is commonly true for all mixed methods research projects, these can be designed and implemented in very different manners depending on the needs of the researchers. In turn, these different designs will also have an influence on the selection of data sources, the steps in which each data source comes to action and, lastly, the manner in which the information extracted is interpreted. This being considered, mixed methods designs can be generally classified under the following categories (adapted from Creswell & Clark (2017) and Hesse-Biber (2010)):

- Complementation: quantitative and qualitative data sources are used to obtain different types of information referring to different aspects of the analyzed phenomenon. The results of each data source are not compared among them, but they are instead used in different parts of the research process.
- Chaining: the results of either a qualitative or quantitative first step are used as basis to design and conduct a second step based on a different data source.
- Triangulation: quantitative and qualitative specific designs are used not to explore different aspects of a given phenomenon, but instead to provide different views on the same topics and, therefore, are designed to compare results between sources.

In this context, everyday mobility is especially apt to be researched using a mixed-method design, mainly for two different reasons. First and foremost, due to the multidimensional nature of such a phenomenon. Trips that humans need to conduct in order to access goods and services, and therefore to fulfill their daily needs, can be

analyzed and interpreted at least at two different levels: on the one hand, the individual, subjective, experience-based perspective and, on the other hand, their collective or societal dimension, the general behavioral patterns at the population level, and their relationship with the geographical context and the built environment, which are to be analyzed from an objective and aggregated lens. Secondly, from a methodological perspective. Traditional data sources are generally based on self-reported measures, which therefore can be complemented based on the abovementioned objective location-based data sources.

It is for this reason that recent studies can be seen as examples of each of the categories of mixed methods designs. For instance, two recent studies that exemplify classic chaining and triangulation are those by Bjørner (2015) and Næss et al. (2017), who implement a sequence of quantitative and qualitative sources in order to explore time use on trains from different dimensions and levels of interpretation in the first case, and to analyze travel behavior after residential relocation, in the second. As mentioned above, with the extension of location-based technologies and the realization that these cannot be used solely as substitutes of traditional sources, mixed methods have also been implemented in this area. In general, lots of different efforts have been directly aimed at comparing self-reported to objective measurements considering that this is regarded as one of the main capabilities of such technologies (Kelly et al., 2013). Nevertheless, these have also been used in more complex research designs. For instance, travel surveys can be complemented by tracking experiments in order to obtain the previously missing spatial dimension between destinations (Patterson & Fitzsimmons, 2016a) or, on the other hand, tracking itineraries have been as context in order to later inform qualitative in-depth interviews (Bell, Phoenix, Lovell, & Wheeler, 2015; Meijering & Weitkamp, 2016a).

3.3. Research design

The general methodological design of this dissertation is based on a mixed methods approach partially served by tracking-based data. This section presents the details of this design together with the description of the quantitative and qualitative data sources

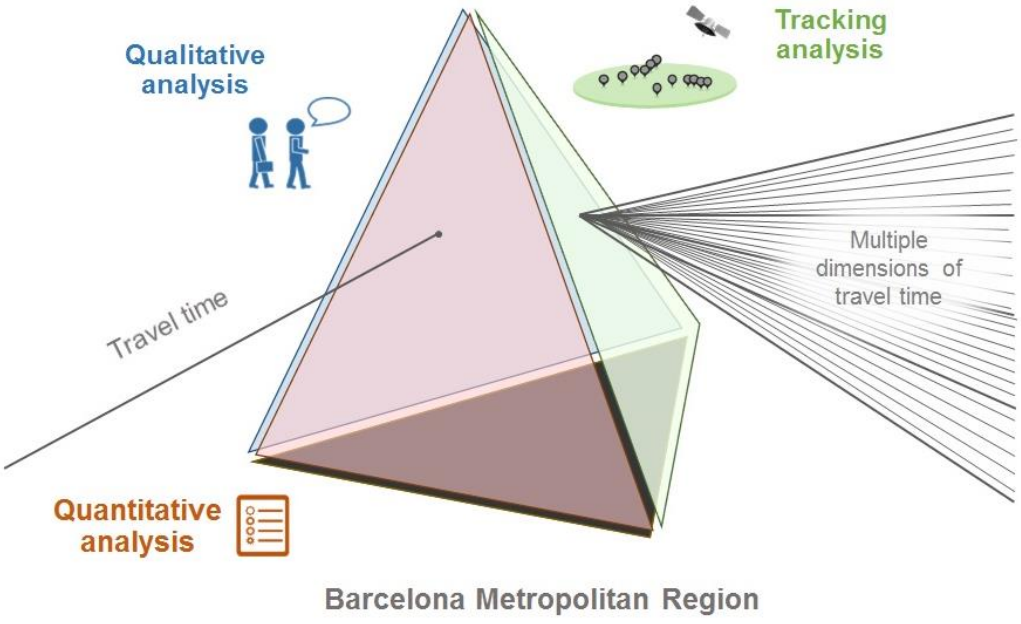
used in this study, the two experiments from which tracking data was extracted and, lastly, a brief introduction to the Barcelona Metropolitan Region as the study area.

3.3.1. A mixed methods design: the methodological pyramid

As it has been pointed out previously, a phenomenon as multidimensional as daily mobility, and specifically daily travel time, requires an equally multisided research design. In the specific case of this dissertation, this mixed methods research design translates to a combination of data sources and their respective analytical methods, which can be understood as an orchestration of approaches that use the Barcelona Metropolitan Region as scenario.

This idea can be illustrated by what could be understood as a methodological pyramid (Figure 4). This methodological prism consists of three different sides, each corresponding to an analytical approach, and a base, which corresponds to the study area. By combining different data sources, methodologies, and the territorial particularities of the study site, it is possible to uncover different understandings and interpretations of a phenomenon such as travel time, in the same way we can analyze the spectral signature of a beam of light.

Figure 4. Research design: the methodological pyramid.



Own production.

On the quantitative side, this research is based mainly on two different traditional mobility surveys. Secondly, the qualitative analysis consists of a set of in-depth interviews among a specific group of intensive travelers. Thirdly, the tracking data is provided by a smartphone-based tracking experiment. In all cases the Barcelona Metropolitan Region is used as the general territorial framework. Generally, the mixed methods nature of the thesis as a whole is difficult to be classified under only one of the three categories defined in the previous section. In general, it could be said that this methodological pyramid is the clearest reflection of a triangulation strategy, in which different lenses are applied to a very specific research item in order to facilitate a joint interpretation. Nevertheless, and it will be seen when each case study is defined, there are also some examples of both complementation and also chaining or sequential logics in other parts of the project.

The main methodological details used in each case study are summarized in Table 1.

Table 1. Methodological details for each case study.

CHAPTER	**4**	**5**		
Case study	***1. Looking at Barcelona through Jane Jacobs's Eyes***	***2. Daily travel time in the BMR***	***3. Objective and perceived travel time***	***4. Suburban travelers pressed for time***
Data sources	GIS layers and census data	Enquesta de Mobilitat en Dies Feiners	UAB Survey + Tracking (*Campus Mobility* app)	UAB Survey + Tracking (*Campus Mobility* app) + Interviews
Year of data	2011-2017	2014	2015	2015-2016
Population	-	BMR Residents	UAB community	UAB community
Study area	Barcelona conurbation	Barcelona Metropolitan Region	UAB & Barcelona Metropolitan Region	UAB & Barcelona Metropolitan Region
Analysis method	Mapping and descriptive statistics	Descriptive statistics & OLS regression	Descriptive statistics & Chi-square test & OLS regression	Descriptive statistics & Qualitative analysis

Own production.

3.3.2. Quantitative data

The quantitative part of this research project is based on data extracted from representative mobility-related surveys, which grant information on mobility patterns and preferences at a population level. The research presented here is specifically based on two different types of surveys: the first is a traditional everyday mobility survey covering the whole Barcelona Metropolitan Region, while the second is an accessibility survey focusing on a specific enclave in this metropolis, the main campus of the Autonomous University of Barcelona.

First of all and as presented in Table 1, two different study cases included in this dissertation are based on the *Enquesta de Mobilitat en Dia Feiner* (Survey on everyday mobility on workdays; EMEF), which started in 2003 and has an annual periodicity, now accounting for 15 editions. This survey is organized by the *Autoritat del Transport Metropolità* (Metropolitan Transportation Authority; ATM herafter), the Barcelona City Council, the *Area Metropolitana de Barcelona* (Barcelona Metropolitan Area; AMB) and, in the last editions, also by the *Agrupació de municipis amb transport urbà (*Group of municipalities with urban transportation; or AMTU) and the *Institut d'Estadística de Catalunya* (Catalan Institute of Statistics, or IDESCAT). This survey is focused on population over 16 years old residing in the Barcelona Metropolitan Region (BMR) (or the Barcelona Unified Tariff Area in the latest editions, consisting of 296 municipalities), querying about their everyday mobility patterns on workdays (Monday to Friday). The methodology consists of telephone-based interviews (CATI) among a representative sample of the BMR population, with approximately a ±1% margin of error with a confidence level of 95.5% across its different editions.

The survey is based on two different questionnaires, which translate into two different databases: one regarding the individual profile and the second describing the mobility patterns of the previous workday. The questionnaire regarding personal characteristics includes aspects such as age, gender, education level, professional status, among others, and also opinions on mobility-related questions such as the evaluation of different transportation options present in their municipality. An important question in this part of the survey is whether the respondent left the residence the day of the interview. This

allows this research to be focused on the so-called *mobile* part of the population, which consists of those individuals that conducted at least one trip the day of the survey. The second part of the questionnaire includes the most relevant information on daily travel patterns: number of trips conducted, trip purposes, transportation modes used, trip durations, among others. Most calculations presented in the two abovementioned case studies are based on this part. For instance, daily travel times or DTT are not presented per se in the survey, but are calculated as the aggregation of all trip durations.

In this research project the 2014 edition of the EMEF is used. In this edition the sample consisted of 9,461 individuals older than 16 years of age residing in a total of 226 municipalities.

Secondly, for two of the case studies a second survey is used. In this case, this is not a general everyday mobility survey but instead an accessibility survey focusing on the access patterns of the Autonomous University of Barcelona community to its main campus located in Cerdanyola del Vallès (Barcelona). The *Enquesta sobre els hàbits de mobilitat de la comunitat universitària UAB* (Survey on everyday mobility habits of the Autonomous University of Barcelona Community; UCMHS). This is a biennial survey that queries the UAB community regarding their Campus access patterns, this is: number of days they access the campus, hour of the day, transportation mode, reason behind modal choice, trip duration, among others. This survey also includes sociodemographic information such as age, gender, role at the UAB, car availability and home address.

In the two abovementioned case studies that are partially based on this data source, the 2015 edition of the UCMHS is used. The sample of the 2015 edition consisted of a 4,425 individuals, with a ±1.4% margin of error. This survey is useful in analyzing specific travel behaviors considering that the whole sample shares the same trip destination, while presenting different sociodemographic variables and different residential contexts. It has proven especially useful to analyze intensive commuting practices, provided by the suburban location of the Bellaterra Campus, outside the main urban areas of the Barcelona Metropolitan Region.

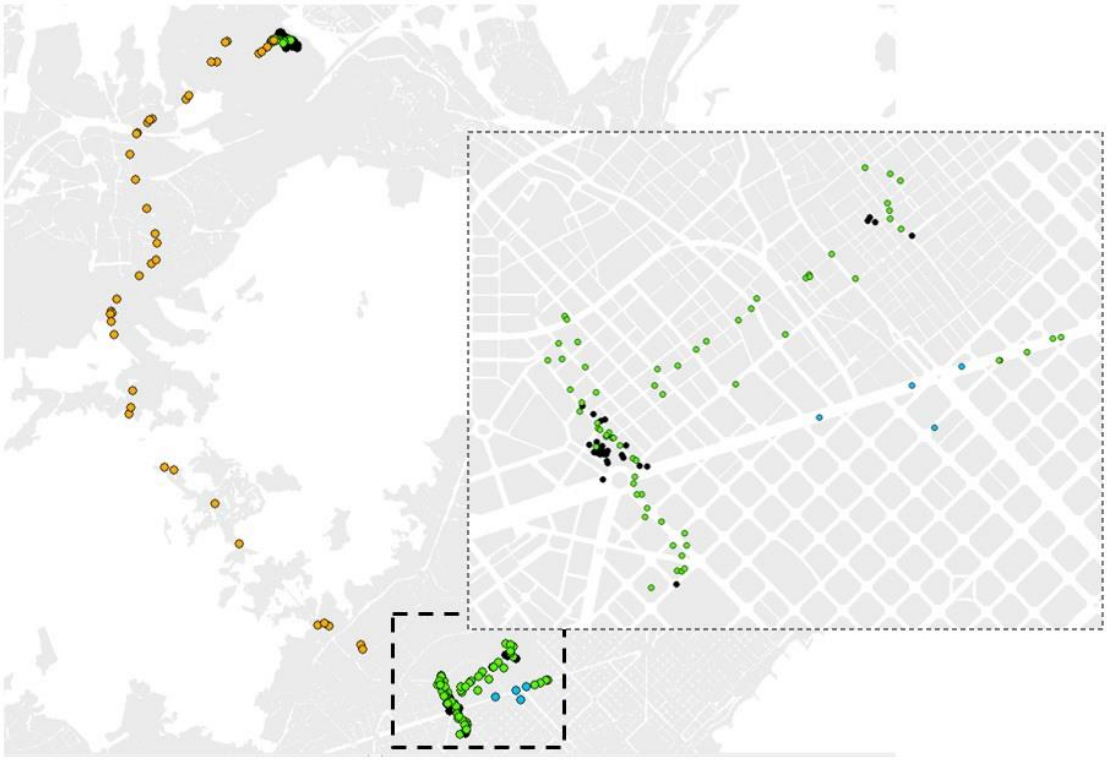
In terms of analytical method, the quantitative side of this research project relies on descriptive statistics and the use of bivariate tests such as the Chi-square or T-test and multivariate analysis based on a set of different Ordinary Least Square (OLS) linear regressions.

3.3.3. Tracking data

The second side of the pyramidal methodology of this project consists of tracking data. As described earlier in this chapter, tracking data is defined as high-resolution spatiotemporal data obtained from located-enabled devices such as GPS trackers or smartphones (Birenboim & Shoval, 2016; Shoval et al., 2014). Put simply, this means that for each individual taking part in an experiment, the researcher is provided with a dataset consisting of geolocation registered by the device in short intervals (which can move between seconds and minutes). This information contains both geographic coordinates and also time stamps, which therefore allow the identification of the precise location of the individual at every given moment and time-related values such as trip start and end times as well as the precise duration. In this sense and as it will be seen further in the dissertation, this will prove useful to detect differences between reported and objective values which, applied to the study of travel time, allow for the uncovering of different interpretations of the temporal dimensions of mobility. Also, this technology allows the collection of several days of activity.

The tracking data used in this research project was collected in an experiment based on smartphone tracking app. This means that each participant was requested to download and install an app that tracked their daily activities through space and time, using the GPS signal and cell tower triangulation or Wi-Fi when the first was not available. An example of part of one participant's raw database is presented Annex 9.2, and an example of one individual's complete spatial data is observed in Figure 5.

Figure 5. Example of an individual set of tracking data for one day.



Own production.

The experiment was called *Campus Mobility 2015* and it was organized by the *Grup d'Estudis en Mobilitat, Transport i Territori (*GEMOTT; Research group on Mobility, Transportation and Territory*)* together with the *Unitat de Planificació i Gestió de la Mobilitat* (UPGM; Unit for Mobility Planning and Management) at the Autonomous University of Barcelona, as part of the 2015 Edition of the UCHMS UAB mobility survey. Participants who took part in the online survey were invited to be included in a tracking experiment in order to provide further data on their daily mobility habits, both considering their daily commute to the UAB but also all other daily activity. Participants were asked to download the *Campus Mobility*[1] app from Google Play Store © (only Android OS © users were able to take part in the experiment), log in using a given user code and have the app running for approximately one week. The app recorded each participant's location approximately every 2 min in average. This data was stored in a server and later downloaded for the analysis. From an initial sample of 4,425 survey respondents, a total of 1,100 individuals inscribed their e-mail address to obtain further

[1] *This app was developed by John R. B. Palmer, at that time researcher at the ICREA MoveLab (CREAF), as a continuation of his work* (Palmer et al., 2013).

information regarding the tracking experiment. Among these, a total of 233 registered in the application. A final sample of 150 individuals presented valid information for at least one day of activity.

Considering that the Campus Mobility app was developed specifically for this purpose and the functionality was simpler than Moves, in this case the data processing was necessary. The two general decisions were the removal of tracking points with erroneous geometry due to satellite malfunction, together with the dismissal of those with speeds over 150 km/h. In the case of Moves © no further data processing was conducted.

3.3.4. Qualitative data

The third side of the methodological prism of this dissertation is one based on a qualitative approach. Specifically, one of the six case studies is based on a set of in-depth interviews to a group of suburban travelers. The aim of this qualitative work was to understand the individual experience of the everyday practice of commuting to a suburban location, how this was emotionally interpreted and how it was managed in the context of the day and the week.

Based on the results of the 2015 UCMHS and the abovementioned Campus Mobility 2015 tracking experiment, UAB community members that presented long commuting practices, which were defined by a threshold of 1h round-trip commute. Participants with these characteristics were contacted through e-mail. This is what is known as purposive sampling, this being a non-probability sample that is selected based on characteristics of a population and the aim of the study (Bryman, 2012). A final group of 25 individuals was interviewed using a semi-structured design.

The interviews were structured as follows: first, a general and introductory description of the daily routines of participants; second, a conversation regarding the role that their commute played in the context of their everyday organization, also considering the relationship with other daily activities; third, a specific section dedicated to nature and experience of the daily commute by itself: how they felt, what activities they conducted and so on. Each of these sections was developed based on a set of possible specific

questions that served as guidelines. Then, each interview evolved in different ways depending on the interviewees' responses.

Considering that the interviewees were all UAB members, either students or staff (both administrative and research personnel) all interviews took place inside the UAB campus premises. Twenty-four of the 25 interviews were conducted at the Geography Department, and in one case an interview took place in the interviewee's office. The interviews lasted an average of 25 to 30 min. and the audio was recorded with participants' permission. These interviews were later manually transcribed and analyzed using qualitative analysis software MAXQDA © Plus v10.9.

3.3.5. The base of the pyramid: The Barcelona Metropolitan Region

The methodological pyramid described in the previous paragraphs rests upon a base that corresponds to general study area, the Barcelona Metropolitan Region (BMR hereafter). Located in Catalonia, in the northeastern region of the Iberian Peninsula (see Fig. 13 in page 88) and with the city of Barcelona at its core, this is one of the main urbanized areas in Southern Europe (United Nations, Department of Economic and Social Affairs, 2014).

The BMR extends over an area of 20 km² divided in 7 *comarques* (counties) and 164 municipalities, hosting a population of approximately 4.8 inhabitants in 2017 (IDESCAT, 2017). The main fraction of the population resides in the core of the metropolis, which is known as the Barcelona Metropolitan Area (or AMB in its Catalan denomination: *Àrea Metropolitana de Barcelona)* and corresponds to the first metropolitan ring. The AMB consists of 36 municipalities where 3,329,337 people live (IDESCAT, 2017). Other than this central region there are also secondary urban nodes present in this metropolitan area, such as the urban system composed by Terrassa and Sabadell and intermediate cities such as Mataró, Granollers, Vilafranca del Penedès and Vilanova i la Geltrú.

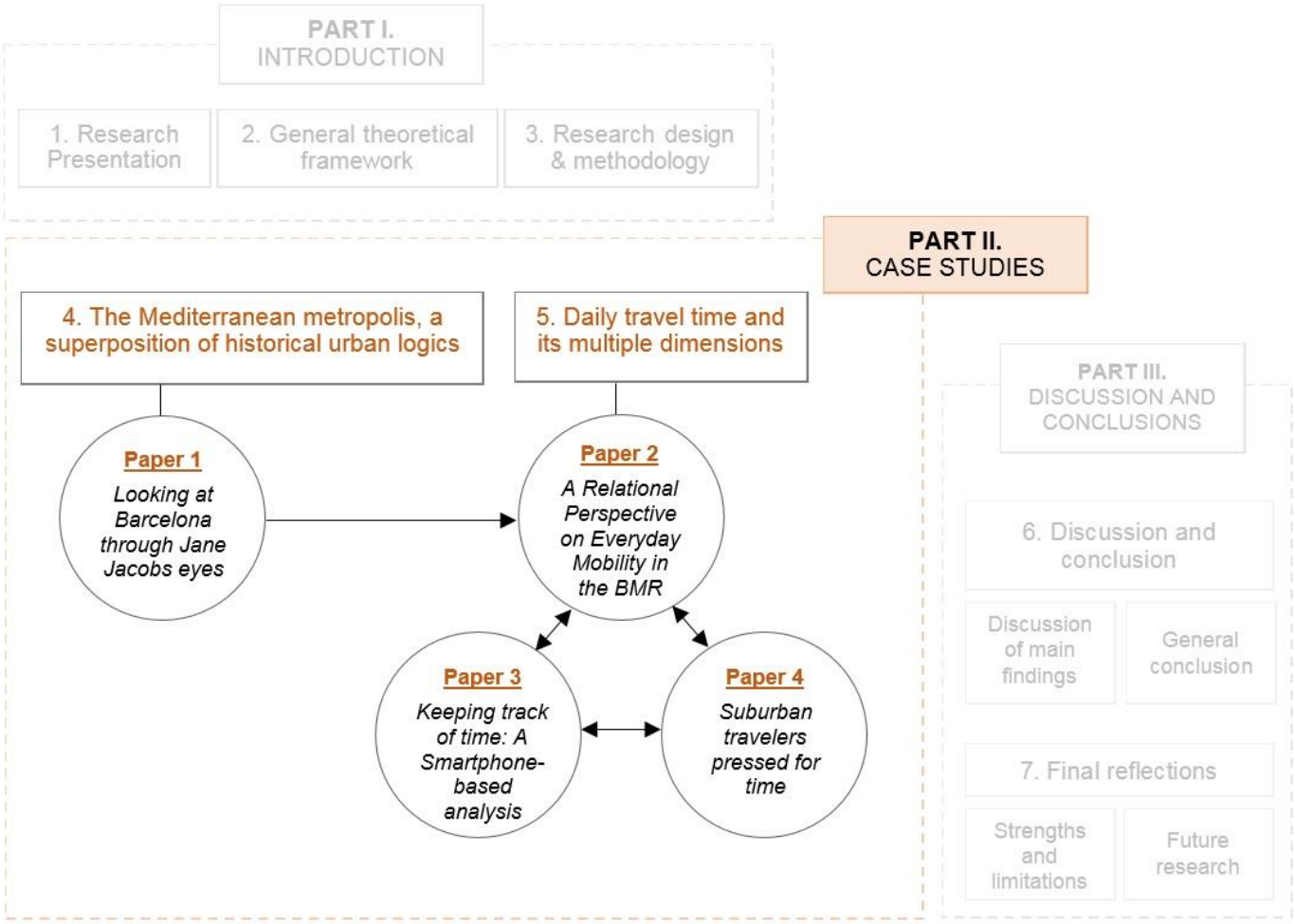
In terms of territorial structure and urban morphology, as it will be further detailed in the first of the case studies, the BMR presents what could be defined as a dual urban nature. On the one hand, traditional town and city centers are still visible, with their

compact, mixed-use and densely populated characteristics. These correspond both to historical settlements and also urban expansions developed mainly during the mid-19th century and first half of the 20th century. From the 1950's and 1960's on, low density urban areas, isolated residential and industrial settings and high-capacity transportation infrastructures became much more present in this metropolis.

In turn, this plays a key role in terms of the general mobility dynamics of the population residing in the BMR. According to the EMEF'17, the latest mobility survey available for this area, a total of 13.6 million trips are conducted every workday in the region, which corresponds to approximately 3.2 trips per person (Autoritat de Transport Metropolità and Generalitat de Catalunya, 2017). While a part of these correspond to work-related trips (22%), the main part of everyday mobility is conducted to carry out non-work activities (34%), excluding all trips made to return home (44%). In terms of modal split, active modes (such as walking or cycling) and the private vehicle (car, motorbike, etc.) are the two main mobility strategies in the BMR (39.8% and 38.9% respectively). Conversely, public transportation is used to a lesser extent (21.3%). Nevertheless, this picture is rather different when the focus is set upon the abovementioned compact urban areas. For instance, the modal split in Barcelona is led by active modes (45.1%), followed by public transportation (34.5%) and a significantly lower share of private vehicle use (20.4%).

These figures exemplify not only the polycentric nature of this metropolitan area, but also the fact that its dual urban nature weaves two different mobility logics: on the one hand, the motorized and long-distance dynamics that are to be understood at the context of the whole metropolis, and, in contrast, the short-distance trips that are still possible given the existence of proximity environments (Marquet & Miralles-Guasch, 2015). This is also reflected by the average duration of trips. While the trip to and from work lasts the average of 26.3 minutes, the average non-work trip is 7 minutes shorter (19 min). In fact, it is interesting to note that according to the Autoritat de Transport Metropolità and Generalitat de Catalunya (2017), while the average duration of the work-related trip has been progressively increasing since 2005 (from 22.8 to 26.3 min), the non-work trip has remained the same and has even slightly decreased (from 19.5 to 19.0).

PART II. CASE STUDIES



4. The Mediterranean metropolis, a superposition of historical urban logics

4.1. Looking at Barcelona through Jane Jacobs's eyes: Mapping the basic conditions for urban vitality in a Mediterranean conurbation

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Looking at Barcelona through Jane Jacobs's eyes: Mapping the basic conditions for urban vitality in a Mediterranean conurbation

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ABSTRACT

Jane Jacobs' quest for urban vitality has had an indisputable influence for urban researchers and planners especially in the Anglo-American context, yet her theories have reached smaller audiences in other parts of the world. This is especially the case in the Mediterranean context, in which her principles for urban vitality would very well correspond to the traditional attributes of these urban settlements, even though their inherent vital nature has been progressively challenged under the paradigm of modernity. In order to contribute with the efforts conducted in the past few years aimed at empirically testing Jacobs' ideas, we consider of special interest to question the nature of these new urban configurations by analyzing Barcelona (Spain) through Jacobs's eyes. An analysis of urban vitality throughout a systemized approach has allowed a detailed spatial interpretation of a conurbation that combines both the attributes of traditional Mediterranean cities and the conflicts that modernity brought with it. The approach that Jacobs provided has proven useful to highlight that this urban area is far from homogeneous, and therefore is also presented as a useful framework for other researchers and urban practitioners to study urban vitality in different geographic contexts, especially in those areas where the logics of modern city building may still persevere.

1. Introduction

One of the most influential yet controversial figures in the history of urban planning is neither an architect nor an urbanist, but instead a magazine journalist who, in the 1960's, was able to grasp the true nature of what cities consisted of. This is no other than Jane Jacobs, whose strife against New York's head of planning Robert Moses became known worldwide as her legacy transcended the activist sphere to become a central part of present-day urban theory (Klemek, 2007). The ideas she eloquently expressed in her seminal book *The Death and Life of Great American Cities* (1961) are now widely considered as benchmarks in urban and planning studies, and in consequence have been periodically re-discovered and re-visited (Daniere, 2000; Hirt and Zahm, 2012; Klemek, 2007; Page and Mennel, 2011; Schubert, 2014; van den Berg, 2016). City administrations worldwide are at the time explicitly or implicitly incorporating Jacobs' principles in their agendas, mainly by promoting higher densities, mixed-used and pedestrian oriented developments, street-level and local economies and bottom-up community action (Schubert, 2014). This can be viewed as a response to the social, environmental and morphological challenges that urbanization under the paradigm of twentieth-century modern planning brought up (Fainstein, 2005; Marans, 2015).

Consequently, Jane Jacobs' theses are also back on the table for researchers in urban studies, as seen in the past few years with several efforts being made to empirically test her ideas using present-day sources and methods. The most recent examples have aimed to link her conditions for vibrant streets to everyday walking patterns at different urban scales (Sung et al., 2013, 2015; Sung and Lee, 2015). Similarly, her theories have been more recently used as framework in innovative approaches, for instance by tracking human activity throughout cell-phone data (De Nadai et al., 2016). Her views on city life have also been regarded as appropriate basis in other disciplines, for example in the studies of criminal activity (Faria et al., 2013) or in the arena of public health (Putnam and Quinn, 2007).

Jane Jacobs' quest for urban vitality has had an indisputable influence worldwide, yet this has been especially acute in an Anglo-American context, considering that her own experience in the United States and Canada has served as basis to the interpretations of post-modern planning currents such as those advocating for smart-growth (Downs, 2005; Hirt and Zahm, 2012). On the contrary, we consider that

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Jane Jacobs' quest for urban vitality has had an indisputable influence worldwide, yet this has been especially acute in an Anglo-American context, considering that her own experience in the United States and Canada has served as basis to the interpretations of

post-modern planning currents such as those advocating for smart-growth (Downs, 2005; Hirt & Zahm, 2012). On the contrary, we consider that Jacobs' theories have reached smaller audiences in other parts of the world. This is especially the case in the Mediterranean context, even though her principles for urban vitality would very well correspond to the attributes of traditional urban settlements in this context (Schubert, 2014), where cities are well-known for their mixed-used and compact urban models (Martín-Ramos, 2012; Morelli & Salvati, 2010; Pallares-Barbera, Badia, & Duch, 2011; Luca Salvati, Sateriano, & Bajocco, 2013).

In the past few decades, Mediterranean cities and their traditionally inherent vital nature have been progressively overcome by urban areas developed under the paradigm of modernity, being characterized by lower densities, higher degrees of morphological and social fragmentation and now more than ever dependent on high-capacity transportation infrastructures (Cardozo, Gutiérrez Puebla, & García-Palomares, 2010; Delclòs-Alió & Miralles-Guasch, 2017; Méndez, 2009; Nel·lo, López, Martín, & Checa, 2017; Vich, Marquet, & Miralles-Guasch, 2017). In this context, we consider of special interest to question the nature of the urban configurations resulting from these processes by analyzing them through Jacobs's eyes. This paper is therefore set to explore how vital neighborhoods and districts of a Mediterranean metropolis are, considering that they present both historical urban fabrics, inherently provided with the morphological attributes that Jacobs valued and, secondly, that from a planning perspective it might be useful to confront more recent urban developments with the same optic in order to assess their potential success as vibrant environments. For this purpose, in this paper an integrated approach is developed in order to map and spatially analyze Jacobs' conditions for urban vitality in the specific case of the conurbation of Barcelona, and hence contributing to the growing interest aimed at studying her ideas from an applied perspective. This is conducted based on the systematization of Jacobs's separate conditions and also synthesized in a final indicator of urban vitality. Altogether, using a rather comprehensive approach yet simple in its conceptualization, we intend to provide a useful framework for other researchers and urban practitioners to study urban vitality in different territorial contexts.

The remainder of the paper is structured as follows: Section 4.1.2 provides a brief overview of Jacobs's basic and complementary conditions for urban vitality, Section 4.1.3 presents materials and methods for the analysis of these ideas in the conurbation of Barcelona, Section 4.1.4 presents results of both separate conditions and the synthesized score and Section 4.1.5 is left for the discussion and conclusion.

4.1.2. Jane Jacobs' conditions for urban vitality

Based on her own experience, Jane Jacobs aimed at describing "*how cities work in real life, because this is the only way to learn what principles of planning and what practices in rebuilding can promote social and economic vitality in cities, and what practices and principles will deaden these attributes*" (Jacobs, 1961, p.4). At that time, this was a declaration of war to city officials in major cities such as in Robert Moses' New York, who had started to rely on large housing and infrastructure projects, together with plans that sought for higher degrees of land use specialization (Hirt, 2016), as modern solutions to urban challenges such as crime, poverty or social alienation (Corbusier, 1933).

Under Jacobs' view, this was not how cities worked. Instead, she argued that round-the-clock life in its streets constituted the very core of what urbanity is about, and in order to ensure it, a certain set of requirements should be promoted. She proposed a set of four basic generators of diversity as conditions that would result in vibrant districts and neighborhoods. These, and following Sung et al. (2013) interpretation, are in turn complemented by two accessory conditions that appear throughout Jacobs' book. In this paper we will consider these six conditions as appropriate tools to measure to what degree an urban area can be regarded as vital.

The first of Jacobs' conditions for an urban area to be vital is what she called "*a sufficient mix of primary uses, and preferably more than two*" (Jacobs, 1961, p. 152): residences, offices, little shops and warehouses, among other functions, are equally necessary. This is in line with traditional research on built environment, which has proposed land-use diversity as one of the main drivers for street vibrancy, mainly through walking activity (Kang, 2016; Kockelman, 1997; Wey & Chiu, 2013).This is not only referred to the district scale, but also is to be applied to its internal parts: neighborhoods and streets. As a result,

people will be there for many different purposes and at different times throughout the day. This would lead not only to a more vibrant economic activity, but also to a higher degree of social interaction.

The second of the conditions argues that the urban fabric mostly has to consist of small blocks that can guarantee a certain degree of contact opportunity (Jacobs, 1961, p. 178). Put plainly, short blocks multiply the presence of streets. Frequent corners result, first, in a higher degree of possible turns, hence shorter distances and also a higher possibility of taking different paths to get to the same place. Also, short blocks and hence a higher number of intersections would create a greater supply of spots apt for local shops that would find pools of customers in more than one street. Jacobs always pointed out the need for streets to be constructed at a human scale in order to enhance a sense of place acquired through higher degrees of social interaction, and the communal sense of safety provided by what she named *"eyes on the street"*.

Jacobs stressed as her third condition the need for a certain degree of mixture between buildings of different characteristics and ages. In this sense, she argued "*cities need old buildings so badly it is probably impossible for vigorous streets and districts to grow without them"* (Ibid, p. 187). Beyond aesthetic arguments, she proposed that if a certain neighborhood only consists of brand new buildings, as for instance in a large-scale single-aged urban development project, this will imply that only those (dwellers, businesses) apt to meet higher rents will be allowed to occupy that space. Oppositely, if a certain mix of new and aged buildings is maintained, diversity both from a land-use and social perspective will be enhanced (King, 2013).

To our view, even though Jacobs addresses this as the fourth principle for urban diversity, concentration is probably the most basic of conditions for an urban area to be vital, since it is precisely the fact that people are present and to be close from one another that is the expression of urban vitality (Jacobs, 1961, p. 200). In this sense, Jacobs' stressed throughout her manuscript the importance of a sufficiently dense concentration of people, which will be a result not only of residents, but also of people that are there for other purposes. She argued that if this is to be achieved, not only a considerable density of residences is needed, but also a high net building density in general is to be aimed for.

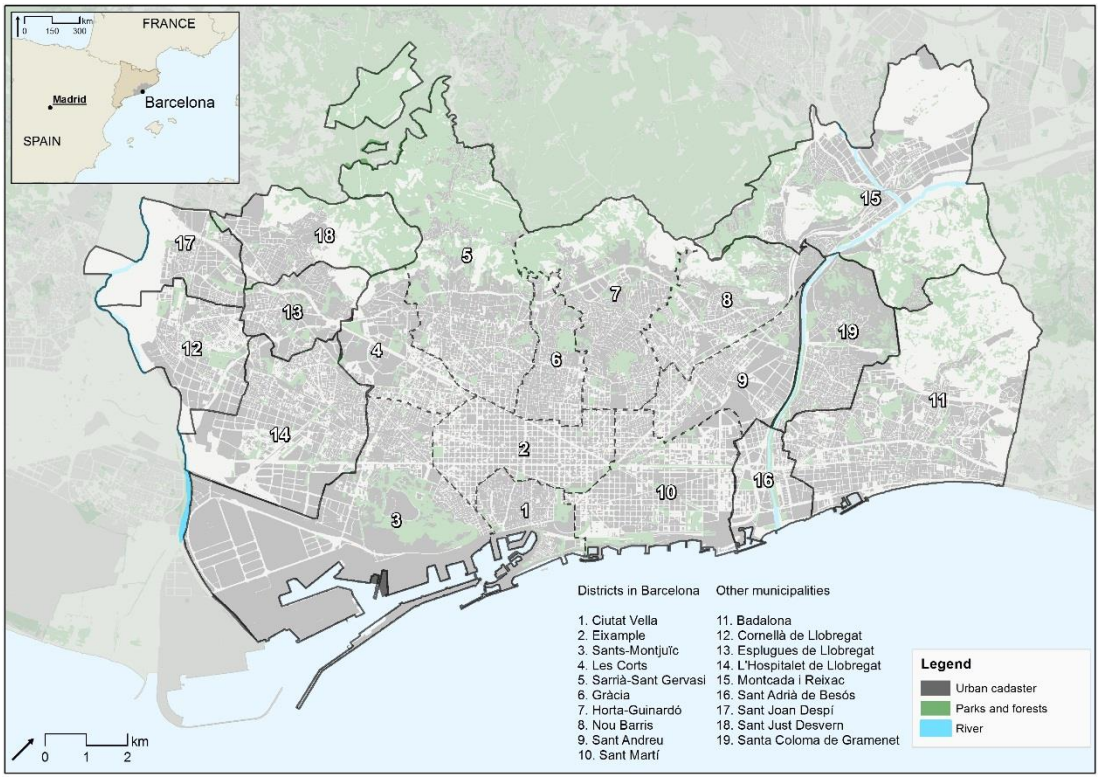
Lastly, two other elements are commented throughout the book in relation to urban vibrancy. Jacobs mentions that vital cities would require a high degree of accessibility both on foot and on a higher investment on public transportation, in opposition to the at the time car-dominated city planning. Secondly, Jacobs discussed the negative effects that large infrastructure and single-use buildings or public spaces could have on urban buoyancy. This type of urban element were seen by her as border vacuums, as these could suck out the life of the streets by creating artificial impermeable borders. In this sense, she also talked about on-the-ground railroad tracks, waterfronts, extensive parks that closed at certain hours or large single-use service, administrative or commercial buildings.

4.1.3. Methodology

4.1.3.1. Study area: the conurbation of Barcelona

In this study we apply Jane Jacobs' ideas on urban vitality to the conurbation of Barcelona. Populated by approximately 2.4 million inhabitants, this is the core of one of the major metropolitan regions in Southern Europe. Limited by the Mediterranean Sea in the south-east and the Collserola hill in the north-west, the urban continuum extends over a total of 10 municipalities, with the City of Barcelona at its center (Figure 6). Since there is no administrative delimitation available, the extent of the public transportation network (metro and light rail systems) has been used as criteria to delimitate the study area. As reference for the analysis, the conurbation has been divided into a total of 19 sub-areas with generally similar dimensions, some of which corresponds to the districts inside the municipality of Barcelona, while others correspond to neighboring municipalities.

Figure 6. Study area map: the Barcelona conurbation.

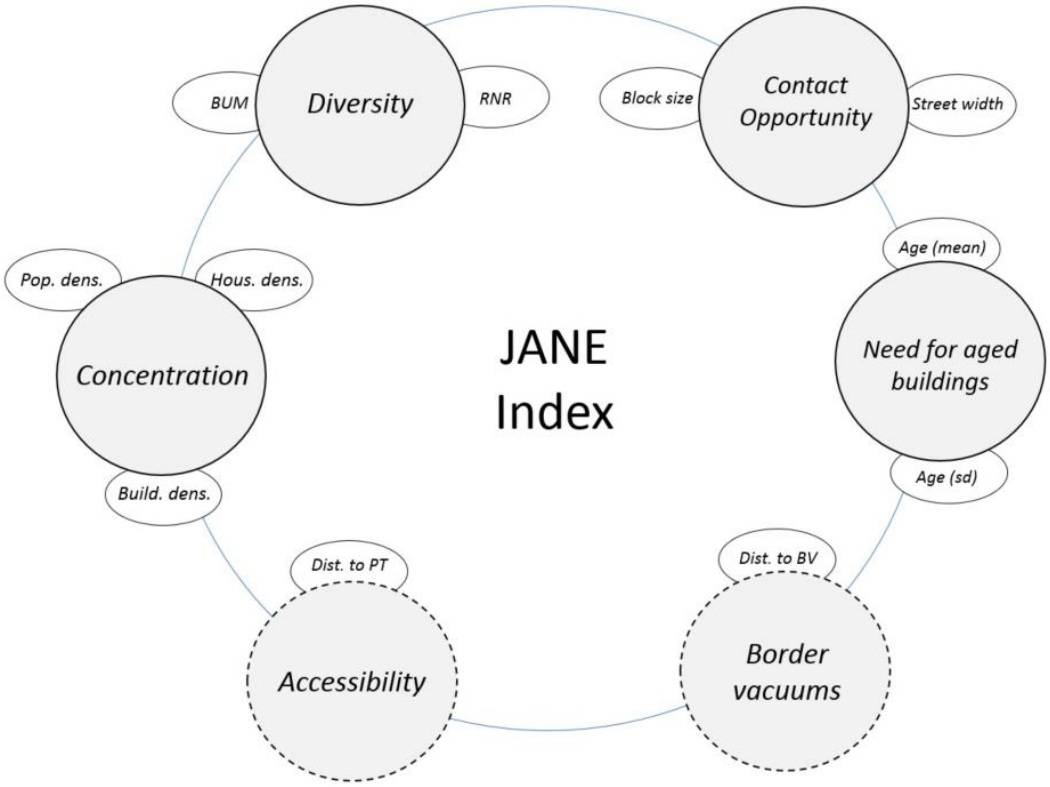


Own production.

4.1.3.2. Variables and data sources

In order to study Jane Jacobs' ideas on urban vitality from an applied perspective, we synthesize her views in the methodological schema presented in Figure 7. We consider a total of six conditions for urban vitality: concentration, diversity, contact opportunity, the need for aged buildings, accessibility and border vacuums. Following Jacobs' arguments, the first four conditions are regarded as basic requirements for urban buoyancy, while the latter two are considered here as accessory issues. These six conditions are constructed based on a total of 11 specific variables obtained from a diverse array of data sources summarized in Table 2, and that are after synthesized in what we have named the JANE Index.

Figure 7. Methodological schema in developing the JANE Index.



Own production.

Even though Jacobs presented ***Concentration*** as the fourth condition for urban vitality, we start off with it since we consider that this is the most basic of the ideas the she highlights throughout the book: the potential for people to be present. In order to study this condition, we have considered *population density (PD)*, *housing density (HD)* and *building density (BD)*. The first two variables were obtained at a census tract level, while building density is extracted from the municipal cadaster, which provides data at the property level.

Secondly, we analyze the Jacobs' need for a mix of primary uses, which we have shortened to ***Diversity***. This is based on two indexes: *Building-Use Mix* (BUM) and *Residential-Non-Residential* (RNR). BUM is an adaptation of traditional measures of land use mix (Frank et al., 2010), which in this case is based on data at the building level based on 6 uses that we have extracted from the cadaster (residential, commercial, work-related, recreational and others). This is constructed as follows:

$$BUM = -1\ (\frac{\sum_{i=1}^{n} pi * \ln(pi)}{\ln(n)})$$

where *pi* refers to the proportion of the use *i* in the building considering all uses, and *n* is the total number of uses. On the other hand, RNR is intended as a complement of BUM and measures how compensated is a given building in terms of residential and non-residential uses. It is constructed as follows:

$$RNR = 1 - \left| \frac{\mathrm{Res}_i - \mathrm{NonRes}_i}{\mathrm{Res}_i + \mathrm{NonRes}_i} \right|$$

where *Resi* refers to residential uses and *Non-Resi* refers to non-residential uses in a given building.

Thirdly, ***Contact opportunity*** is referred first to *block size (BS)* as an indicator of urban form and the possibility to engage with multiple routes. Following Jacobs' view on the need for streets to maintain a human scale, we have also decided to include *street width (SW)* as a proxy of visual contact between facades and people on the street.

Fourth, the ***Need for aged buildings*** has been addressed in this study by analyzing not only the *building mean year of construction (MA)* but also its *standard deviation (SDA)*, in order not only to point out the age of a given environment but also the diversity of urban fabrics.

Accessibility, the first of the accessory conditions, is analyzed as *distance to public transportation (DPT)* considering both large stations and street stops. Lastly, we incorporate in the analysis ***Distance from border vacuums*** *(DBV)*, taking into account large transportation infrastructures (such as urban highways or railroads at the ground level), single-use extensive service or administrative buildings and also large parks.

Table 2. Conditions, variables and data sources used in the analysis.

	Conditions	Short description	Variables	Resolution	Data source
Basic	Concentration	A dense concentration of people, residences and buildings is the main condition for a given urban space to be considered vital.	Population density	Census tract	Population Census (2011)
			Housing density	Census tract	Population Census (2011)
			Building density	Property	Municipal Cadaster
	Diversity	A sufficient mix of primary uses (residential, work-related, commercial, institutional) is required in order to promote not only residents to be present, but people for other purposes.	BUM index	Building	Spanish Municipal Cadaster
			RNR index	Building	Spanish Municipal Cadaster
	Contact Opportunity	The built environment must allow a certain degree of contact opportunity, achieved through a sufficient number of intersections resulting from short blocks. This is to be complemented with streets that are designed at the human scale.	Block size	Block	Topographic Map (ICGC)
			Street width	Street	Topographic Map (ICGC)
	Need for aged buildings	If a certain mix of new and aged buildings is ensured, both residents and businesses with different purchasing power will be present, and hence promoting both higher rates of building use and social mix.	Mean building age	Building	Municipal Cadaster
			St. deviation of building age	Building	Municipal Cadaster
Accessory	Accessibility	A city must provide a high degree of accessibility both on foot and also through a quality provision of public transportation.	Distance (meters) to public transportation	Street-level	Barcelona ATM & Open Street Map
	Distance to border vacuums	Certain urban elements such as large transportation infrastructure or single-use spaces or buildings are capable of discouraging street life.	Distance (meters) from BV	Land cover	CREAF Land-Cover Map (2009)

4.1.3.3. Data processing and calculations

Once all of these specific variables have been compiled for the analyzed territory and properly debugged erroneous data, variables have been re-structured in a 100x100 meter grid cells in order to homogenize the spatial resolution (Arranz-López, Soria-Lara, López-Escolano, & Pueyo Campos, 2017). While the majority of variables have been analyzed through the average of their original values present in each grid cell, BUM, RNR, the mean of the building age and its standard deviation have been calculated at this point for each cell based on the original values. Secondly, in order to have

comparable indicators for each of the conditions, each of the raw variables have been transformed to their corresponding z-scores (Frank et al., 2010).

In order to integrate the 11 original variables to their corresponding urban vitality conditions, we have created six scores by weighting the original z-values. Considering that while some of the variables have an expected positive effect on urban life (for instance housing density or building-use mix), others have to be considered as deterring street life and therefore presenting a negative effect (large blocks or proximity to border vacuums, among others). Taking this into consideration, each of the scores have been calculated as follows:

$$\boldsymbol{Concentration\ Score}\ (\boldsymbol{CS}) = zPD\left(\frac{1}{3}\right) + zHD\left(\frac{1}{3}\right) + zBD\left(\frac{1}{3}\right)$$

$$\boldsymbol{Diversity\ Score}\ (\boldsymbol{CS}) = zLUM\left(\frac{1}{2}\right) + zRNR\left(\frac{1}{2}\right)$$

$$\boldsymbol{Contact\ Opportunity\ Score}\ (\boldsymbol{COS}) = (-1)(zBS)\left(\frac{1}{2}\right) + (-1)(zSW)\left(\frac{1}{2}\right)$$

$$\boldsymbol{Need\ for\ Aged\ Buildings\ Score}\ (\boldsymbol{NABS}) = (-1)(zMA)\left(\frac{1}{2}\right) + (zSDA)\left(\frac{1}{2}\right)$$

$$\boldsymbol{Accessibility\ Score}\ (\boldsymbol{AS}) = (-1)(zDPT)$$

$$\boldsymbol{Distance\ to\ Border\ Vacuums\ Score}\ (\boldsymbol{DBVS}) = zDBV$$

Lastly, we have integrated all of this scores in what we have named the JANE Index, properly weighting each score based on the distinction made by Jacobs between basic and accessory conditions for urban vitality. This procedure is therefore a combination of an all equal weights for the construction of the conditions, and a weighting scheme derived from theoretical ideas, which can be found in similar studies constructing indexes (Frank et al., 2010; Frank, Schmid, Sallis, Chapman, & Saelens, 2005; Gullon et al., 2017; Peiravian, Derrible, & Ijaz, 2014). The JANE Index is hence constructed as follows:

$$\boldsymbol{JANE} = CS\left(\frac{1}{5}\right) + DS\left(\frac{1}{5}\right) + COS\left(\frac{1}{5}\right) + NABS\left(\frac{1}{5}\right) + AS\left(\frac{1}{10}\right) + BVS\left(\frac{1}{10}\right)$$

If any of the original variables was not available for a grid cell, this has been omitted from the calculation of both its corresponding condition score and also the final JANE.

Lastly, in order to facilitate the analysis and interpretation of the spatial distribution of JANE results, four categories have been identified based on the *Grouping Analysis* tool available in ESRI ArcGIS 10.5 ©. This technique has been previously used in research (T. W. Moore & Dixon, 2015; Snowden & Freiburger, 2015) and its aim is to classify entities based on one or more specified attributes. In this case, the entities are each grid cell, and the specified attribute has been the values obtained for the JANE vitality index. Since the aim of this process was not to obtain spatially contiguous clusters but only to yield four statistically different categories of urban vitality, *No spatial constraints* were specified for the calculation. When this parameter is selected, the tool runs based on a K-Means algorithm that aims to partition features into groups based on the input variable while minimizing differences inside the group (ESRI, 2017). The algorithm is based on a set of random seeds from which the clusters are constructed based on value similarity. For this purpose, the algorithm computes a mean data center for each group and re-assigns values, in up to a maximum of 100 iterations, until groups become stable. While this is an interesting tool to visualize and simplify data into categories, it has to be considered that results may vary in relation to how many groups are initially requested. In this case, it was specified to classify JANE results in four categories in order to identify *High vitality*, *Moderate vitality*, *Low vitality* areas and those which could be regarded as *Non-vital*.

4.1.4. Results

The result of mapping Jane Jacobs' urban vitality principles in Barcelona is presented in different maps in Figures 3 to 7. Comments on the side are made for each of the urban vitality conditions as well as for the final result in order to support their spatial interpretation.

4.1.4.1. Concentration and Diversity

Concentration and *Diversity* go hand-by-hand in Jane Jacobs' arguments on urban vitality. The spatial distribution of their corresponding scores in the conurbation of Barcelona is presented in Figure 8.

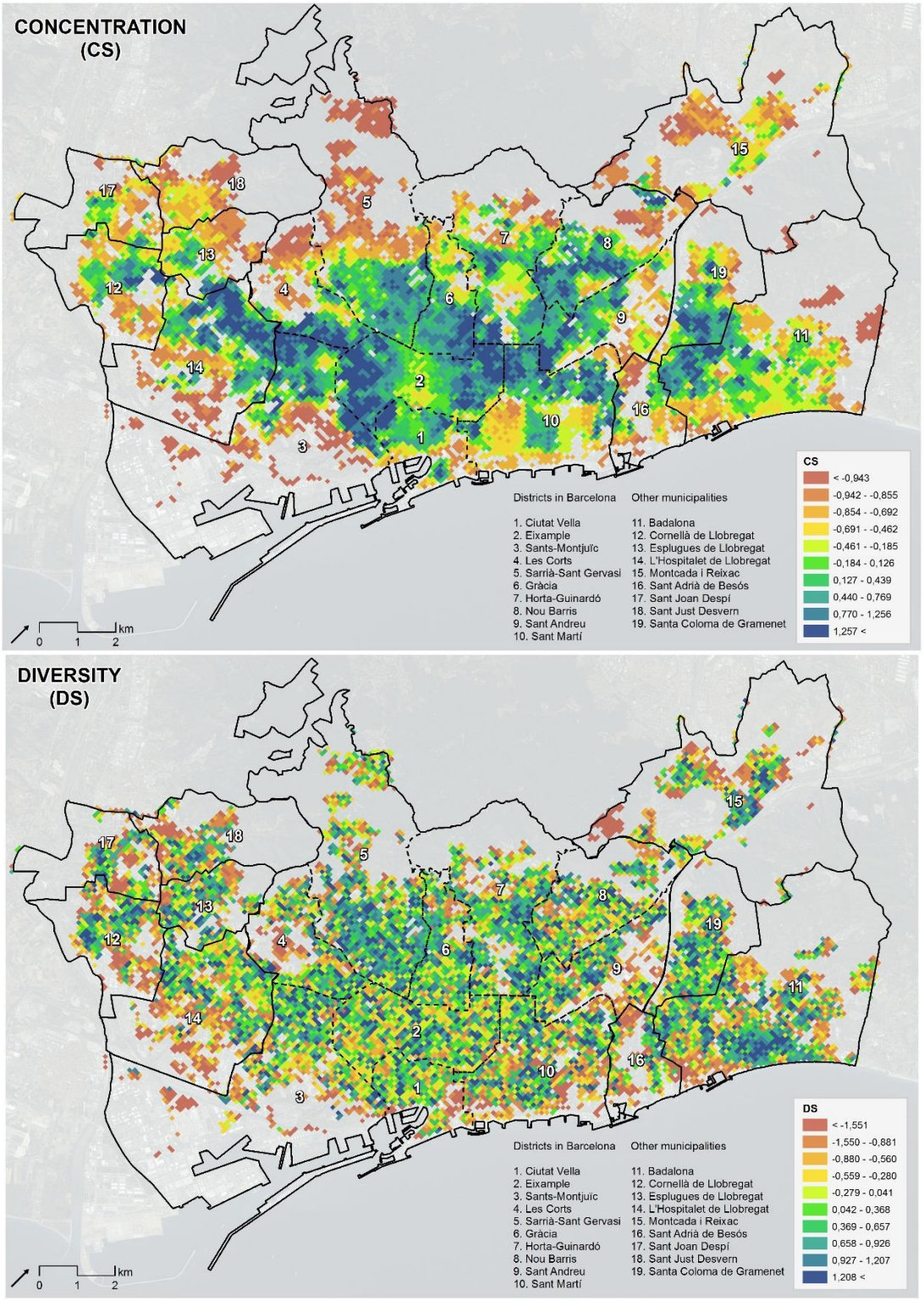
High concentration values are found in areas in which building, housing and population densities overlap. This is especially the case in two main central corridors that come together on the edges of the conurbation core (corresponding to the district of *Ciutat Vella – 1*): on one side, from the north-western part of one of the first of the municipalities that was absorbed by Barcelona's expansion (*l'Hospitalet de Llobregat* - 14); on the other side, from the north-eastern part of Barcelona (corresponding to the area that connects districts 2, 6, 9 and 10, even reaching the last of the central city districts, 8). Besides these two corridors, an isolated spot of concentration is to be highlighted on the other side of the Besós River, corresponding to an urban cluster constituted by *Santa Coloma de Gramenet* (19) and *Badalona* (11).

Central locations inside the conurbation, nevertheless, can also present surprisingly low values of concentration. This is the case of zones that either are retail or business oriented, such as the main street in the *Eixample (2)*, corresponding to the worldwide known promenade of Passeig de Gràcia, and the case of *Sant Martí (10),* in which we find a clearly identifiable area that corresponds to a large and contested urban renewal project designed to foster high-tech industries, known as the 22@ (Casellas, Dot-Jutgla, & Pallares-Barbera, 2012). Beyond this, the lowest concentration values are mainly identified in the edges of the conurbation, corresponding to industrial sites (for instance in areas 3 and 14) or in places which construction is not allowed for, either because of the terrain or due to the presence of large protected natural parks (such as Collserola in the north or around the Montjuïc hill, in District 3).

It is harder to depict clear patterns in terms of *Diversity* in the conurbation of Barcelona mainly due to two reasons: first, as in any Mediterranean city, this urban conglomerate is characterized by presenting drastic contrasts of land-use mix in relatively short distances, with buildings hosting a high number of uses next to others that dedicated to a single use. This contrast is further enhanced by the disaggregated nature of the original data, obtained at the building level. If a larger scale was used (e.g. at the census tract or neighborhood level) this micro-contrasts would very likely be softened. This being said, certain diversity patterns can still be identified. In opposition to what was observed in the previous condition, in this case diversity emerges in isolated spots scattered

throughout the conurbation. The main example is found in the isolated eastern core of *Badalona (11) or* in specific spots in peripheral areas 12, 17, 13, 15 or 18. Inside the core of the conurbation, we can identify a whole district as a rather homogeneously diverse area, *Sarrià-Sant Gervasi (5)*, and diverse small neighborhoods in the core of the eastern Barcelona districts. In contrast, the low diversity scores generally coincide with those areas with less concentration previously identified. It is interesting to note how, again, a large portion of *Sant Martí (10)* is classified in the low fork of the diversity score, especially in proximity to the coast and to the eastern and western edges. Similarly, some areas present drastic contrasts, for instance in *Sants-Montjuïc (3)* or inside District 4 (*Les Corts*).

Figure 8. The first and second urban vitality condition in the BMR: Concentration and Diversity.



Own production.

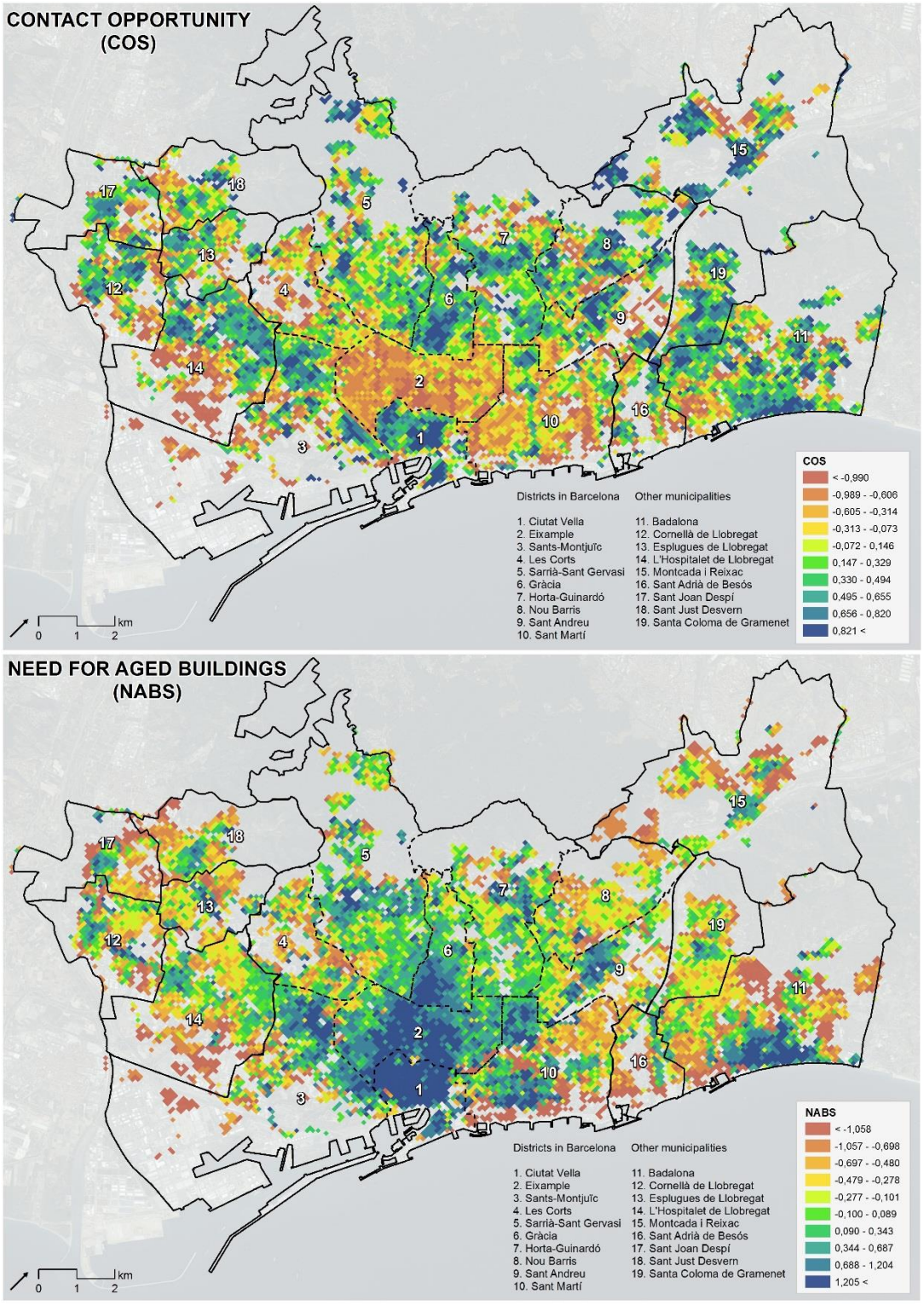
4.1.4.2. Contact opportunity and Need for aged buildings

The next two conditions, *Contact opportunity* and the *Need for aged buildings*, are mainly explained from an historical perspective and, in turn, are reflected in the urban morphology. The spatial distribution of their corresponding scores is shown in Figure 9.

From the perspective of *Contact opportunity*, we can clearly depict from the map the presence of the traditional cores of the old towns that were scattered over the plain before the urban expansion that took place in this site throughout the second half of the XIX century and all along the 1900s. These small towns were characterized by three or four-story and short buildings generally located in narrow streets, having as a result a dense and compact urban fabric. This is the case of *Ciutat Vella (1)*, with roman origins and still visible medieval heritage, or the urban cores of the villages of *Gràcia (6), Sants (3), Sant Andreu (9)*, and also those beyond the Besós River. In opposition, newer urban developments are presented as areas with lower potentiality for contact due to larger, more uniform blocks, together with wider streets. This is the clear case of Ildefons Cerdà's famous *Eixample*, with part in districts 2 and 10. Nevertheless, it has to be considered that this does not imply that urban fabrics such as the *Eixample* do not allow for interpersonal contact, but rather that they do to a lower degree when compared to more compact and irregular layouts.

The next condition for urban vitality, the *Need for aged buildings,* allows us to distinguish the areas in which a larger presence of older buildings coexist with newer ones, from those that are newer and more uniform in terms of age. While the aforementioned traditional town centers appear again as highlighted, in this case they are complemented by the older parts of the *Eixample* that connected medieval Barcelona with the villages in the plain.

Figure 9. The third and fourth urban vitality conditions in the BMR: Contact opportunity and Need for aged buildings.



Own production.

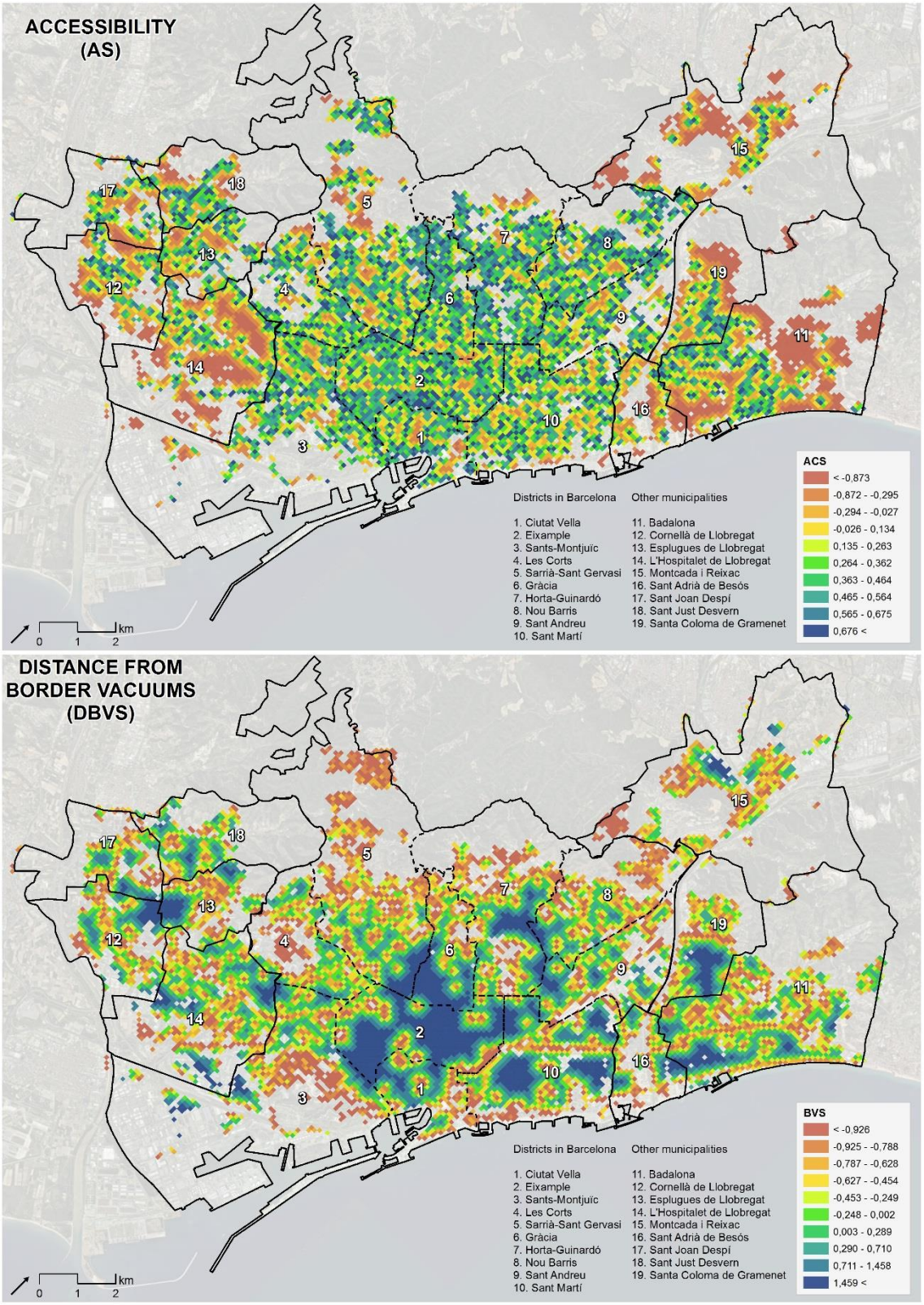
4.1.4.3. Complementary conditions: Accessibility and Distance from border vacuums

The spatial distribution of the two complementary conditions for urban vitality are presented in Figure 10: *Accessibility* and *Distance from border vacuums*.

Accessibility is mainly explained by a center-periphery logic, in which the *center* takes up most part of the conurbation, leaving only some residual spots relatively isolated. This is explained by the fact that, in terms of public transportation, Barcelona is generally well-connected. The locations with the highest values are found in its central district (2), especially in the areas in contact with *Ciutat Vella (*1). Even though it is not possible to depict it from the image, it is interesting to note that the highest accessibility value is found around *Plaça Catalunya*, the main public square of the Catalan capital. On the other hand, the contours of this large conurbation present significantly lower values of accessibility to public transit, for instance, in areas 14, 11 or 15.

In terms of *Distance from border vacuums*, areas with high values are those distant to large infrastructures or large, single-used buildings that can potentially discourage street life. Even though these heavy infrastructure are mainly found in-between municipalities and on its edges, it is interesting to note that inside the city of Barcelona there are also very central urban locations that present low scores in this indicator (and therefore are close to border vacuums). The clearest example of this is seen inside the *Eixample,* where isolated spots are observed. These correspond to large single-use buildings, such as shopping malls, hospitals or large cultural centers.

Figure 10. The two accessory urban vitality conditions in the BMR: Accessibility and Distance from border vacuums.



Own production.

4.1.4.4. Jane Jacobs' urban vitality in Barcelona

As the final part of the analysis, we have synthesized the six conditions of urban vitality in the JANE Index. Higher values of this index correspond to areas that are more likely to nest vibrant street life. The spatial distribution of this index in the conurbation of Barcelona is presented in Figure 11, while in Figure 12 the four categories resulting from GIS grouping analysis are shown.

A first glance at JANE results in Figure 6 reveals again a general center-periphery logic in terms of urban vitality: the closer you get to the center or any of the sub-centers of the conurbation, the more likely it is for you to be in a buoyant urban environment, while areas with less potential vitality or non-vital are relegated to the city contours. Yet, a closer look at JANE results shows that urban vitality is, as Jacobs' advanced, not to be picked up at the city scale, but is at the district and neighborhood levels that this is properly understood. In this sense, three main corridors of urban vibrancy are detected in Barcelona. Starting from the center, we can clearly depict a pattern to the north-eastern edge of *l'Hospitalet de Llobregat* (14), to the center of *Gràcia* (6), constituting the backbone of this conurbation, and a third corridor that bifurcates in the northern districts 7 and 9. Isolated from the previous we can clearly identify vital clusters beyond the Besós River that emerge as the two main vital satellites in this conurbation: *Santa Coloma de Gramenet* (19) and *Badalona* (11).

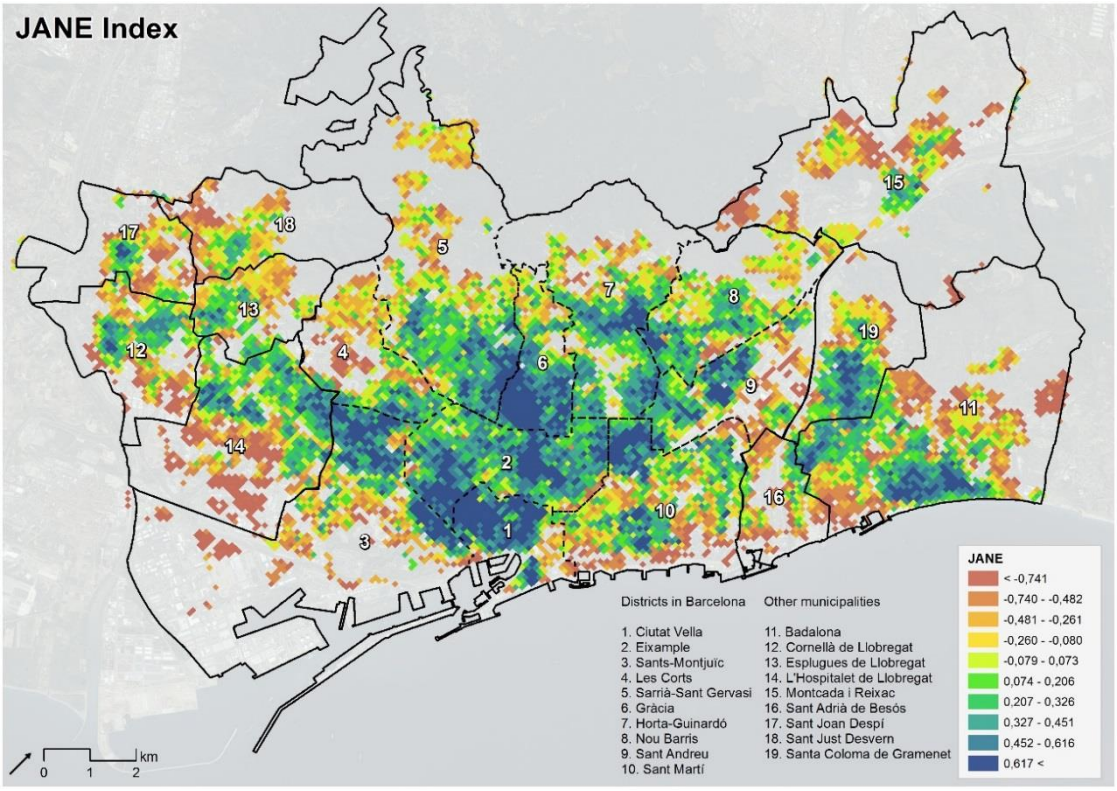
The four classes resulting from the grouping analysis in Figure 12 have been labelled as areas with *High vitality*, *Moderate vitality*, *Low vitality*, and *Non-vital* areas.

High vital areas cover approximately 23% of the analyzed territory. These areas mainly correspond to the traditional cores throughout the conurbation. Mediterranean town and city centers are characterized by dense and diverse urban environments, with buildings three or four stories high on average, combining both housing and retail and office space. In this type of neighborhood, quality public spaces such as boulevards and squares are also considerably common. But not only in these areas and in neighborhoods as a whole can *high vital* environments be identified, but also specific spots identified at a microscale. This is the case of areas that have experienced successful urban renewal projects mainly conducted in the 1980's under the socialist city council of Pasqual

Maragall previous to the 1992 Olympics. For instance, on the northeaster side of *District 10*, the urbanization project learning from historical local demands resulted in vital spots along *Rambla Prim*, or specific areas around the renewed avenue *Via Julia* in *Nou Barris* (8), which largely embrace the basic drivers for urban vitality classified even though they are rather far from the city center.

The contours of vital urban clusters correspond in our results with *Moderate vitality* belts that can be regarded as transition buffers between these and lower vitality areas. This second category takes up around 34% of the analyzed territory. Beyond this general consideration, it is interesting to note that areas that would apparently should be characterized by higher values of vitality fall instead in this second category. This is the case of some areas in the central and eastern parts of Cerdà's *Eixample* (2) or several spots between Districts 7, 8 and 9. While from an urban form perspective this district would be expected to present a uniform level of potential street life, the combination with other variables reflects that central areas of the district are classified as *Moderate* or even *Low vital* areas. It is also the case in less use-mixed neighborhoods, such as residential areas in *Sarrià-Sant Gervasi* (5) or central parts of districts or municipalities such as *Horta-Guinardó* (8) or *Badalona* (11).

Figure 11. Spatial distribution of the JANE Index in the BMR.



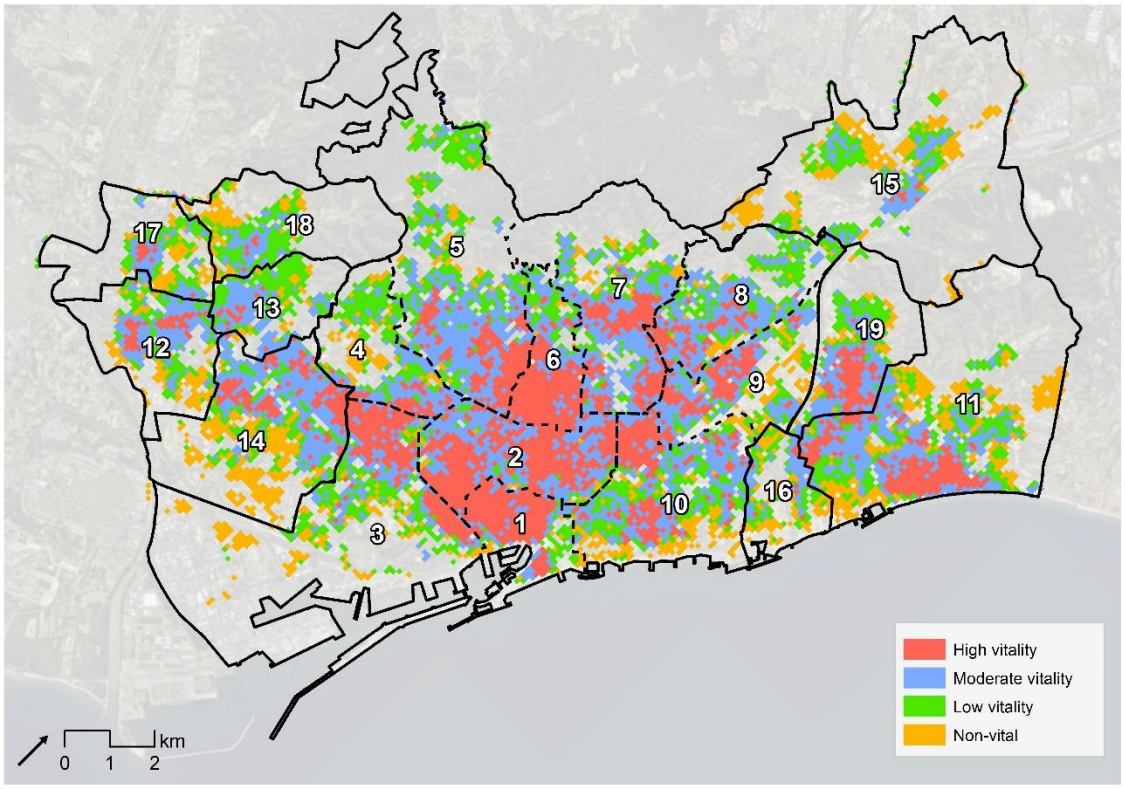
Own production.

This leads to *Low vitality* and *Non-vital* areas, the first corresponding to a 25% of the analyzed territory, while the latter takes up approximately a 17%. This kind of urban areas are found near to city limits due to different reasons. First, places in contact with agrarian, natural or industrial areas will present an evident low value of urban vitality, as it is exemplified by the south-western edges of *Sants-Montjuïc* (3) and *l'Hospitalet de Llobregat* (14). Other than this and rather surprisingly, almost all of Barcelona's water front between Districts 1 and 10 are classified as non-vital, followed by the coastal part of *Sant Adrià de Besós* (16). The same applies to other spots in the conurbation, such as the core of the business and college-oriented and high-rise neighborhood in *Zona Universitaria* inside *Les Corts* (4), also *Diagonal Mar,* in the south-eastern side of District of *Sant Martí* (10), which was a large urban renewal project developed after the Olympics as a strategy to re-design that part of the waterfront. Similar cases can be found at the Olympic Village created for the athletes, located in the south-western side of the same district, or the area immediately north from it, corresponding to the aforementioned 22@ project. All of these are in clear contrast to the *High vitality* area at the core of the district, corresponding to old part of the *Rambla del Poble Nou,* which has thrived a vital

environment surviving urban renewal projects happening at its immediate surroundings.

Other parts are classified as *Non-vital* mainly because of their proximity to heavy transportation infrastructures such as open air railways and highways, and also because of retail centers or large shopping malls, for instance on the eastern side of *Sant Andreu* (9) and also in District 4.

Figure 12. Four spatial urban vitality categories in the BMR resulting from JANE grouping analysis.



Group	n	Mean	Std. Dev.	Min	Max	Share
High vitality	2,384	0.622	0.171	0.408	1.496	23.3%
Moderate vitality	3,518	0.195	0.127	-0.040	0.408	34.3%
Low vitality	2,588	-0.276	0.146	-0.550	-0.041	25.2%
Non vital	1,763	-0.825	0.211	-1.667	-0.550	17.2%
Total	10,253	0.000	0.514	-1.667	1.496	100.0%

Own production.

4.1.5. Discussion and conclusion

This paper aimed to spatially analyze Jane Jacobs' conditions for urban vitality in the conurbation of Barcelona. Considering that the identification of specific features of urban design capable of promoting buoyant neighborhoods is one of the main goals of urban practitioners and planners, this paper is set to contribute to the recent research interest in the study her ideas from an applied perspective. The conditions Jacobs' proposed as the basic drivers that cities needed to ensure vibrant streets were mapped, throughout a systemized GIS-based process, yet simple in its conceptualization, in the context of the Barcelona conurbation.

The application of Jacobs' ideas to a metropolis such as Barcelona has allowed a detailed spatial interpretation of a conurbation that combines both the attributes of traditional Mediterranean cities and the conflicts that modernity brought with it. While the impacts of functional and sprawl-based growth have been traditionally explored throughout variables such as compactness and density (García, 2016; J. Lee, Kurisu, An, & Hanaki, 2015; L. Salvati et al., 2015), these have proven to have little effect in which the streets are effectively used in the city of Barcelona (Marquet & Miralles-Guasch, 2015). In this sense, the approach that Jacobs provided has proven useful to highlight that this urban area is far from homogeneous. Results have pointed out that in fact, a considerable part of the conurbation can be regarded as *Highly vital* (23%) and *Moderately vital (*34%), while, on the other hand, a still significant share of Barcelona territory has been classified in this study as presenting *Low vitality* (25%) and even being *Non-vital* (17%).

Amongst this general classification, a wide array of intra-city nuances can be found and explained. The distributional pattern of urban vitality is first explained by the presence of historical towns and centers, both at the core of the conurbation and also in adjacent municipalities, since these inherently meet the requirements posed by Jacobs by being dense, mixed, diverse and walking-oriented urban environments. But beyond these, it is interesting to note that vitality could also be found in peripheral neighborhoods that do not necessarily coincide with historical fabrics. As briefly introduced in the results section, this is mainly related to the efforts made during the 1980s', in the years leading to the 1992 Olympics, to improve the quality of the built environment all across the city

throughout specific urban renewal projects that, with time, have proven successful (Degen & García, 2012). This happened in a context in which both in the European and North American contexts, the traditional values of cities where again appreciated and promoted, in what some have called the "*Reconstruction of the European city*", which tried to react against the negation of such values by the schemes of modern urbanism (F.-J. Monclús, 2003; F. J. Monclús, 2000). An interesting idea underlies these results, which is that not only historical or traditional urban cores can foster urban vibrancy, but also what new developments, if these are properly designed, can also do so with a high success rate (S. E. Cho & Kim, 2017).

In the opposite direction, by looking at the example of the Barcelona through Jacobs' expert eyes, we can also learn to identify the harmful effects of urban designs that failed to meet the requirements that she proposed. In this sense, not only the contours of the city, areas surrounding heavy transportation infrastructures and isolated high-rise housing projects can be singled out as the legacy of the urban growth of the '60s and 70s, but also newer developments. Large-scale projects such as the Olympic village, the Barcelona waterfront and the *Forum of cultures*, the 22@ area or even large shopping malls, are examples of areas likely to fail in embracing urban vitality, as can be learned from the mapping results. To another scale, and while this was not an issue in Jacobs' New York in the 60's, the pressure that worldwide phenomena such as tourism is increasingly inflicting the day-to-day life of a city's inhabitants will also reflect on the potential for a neighborhood to be regarded as buoyant, as in this case has been exemplified among others by central locations in Barcelona which are being progressively emptied of its local population (Degen & García, 2012).

Besides the specificities of Barcelona, this is the first study to our knowledge that propose a spatially applied comprehensive view of Jane Jacobs, which we regard as useful to other researchers and urban practitioners by providing a methodological framework to study urban vitality features. In the last pages of her 1961 book, Jacobs specifically addressed the planning community by pointing out that professionals in this area "*have to diagnose which conditions for generating diversity are missing here* [in a specific project or neighborhood] - *whether there is a lack of mixed primary uses, whether the blocks are too large,*

whether there is insufficient mixture in ages and types of buildings, whether the concentration of people is great enough. Then, whatever among those conditions is missing has to be supplied-usually gradually and opportunistically, as best it can be" (Jacobs, 1961: p. 393).

To our view and in this line, the methodology presented in this study consists of four basic benefits. First, there is a matter of the application an appropriate scale for the analysis of the built environment. Jacobs' changed the way we would look at cities forever by moving on from the modern god-like aerial view on cities, to an experience-based and street-level perspective, which we have intended to embrace in this study. It is therefore useful not only to be able to characterize neighborhoods or districts as a whole, but also to be capable of analyzing specific locations at a lower scale. In practical terms, this implies that previous analyses conducted at the city or the district level (Sung et al., 2013, 2015; Sung & Lee, 2015) could be complemented with approaches that emerge from neighborhoods and streets such as the one presented here, in agreement with those advocating more in-depth detail analyses regarding the relationship between the built environment and human behavior (Clifton, 2017). A clear example is the manner in which very specific areas of the Barcelona conurbation resulting from urban renewal projects previous to the 1992 Olympics have been proven successful while others have apparently remained as dull environments. In this sense, it has been possible to identify, with high detail, those areas in a given city that present the basic requirements to be vital, or on the other hand, identifying those in which these conditions are lacking. To the authors' view, this can be regarded as the main contribution of this paper: an operationalization of Jacobs' theoretical framework in order to be useful to policy makers and practitioners to design and asses certain policies aimed at promoting not only livable but also lively environments, as it has been pointed out in studies with a similar scope (Arranz-López et al., 2017).

The second strength of this approach is one related to the comprehensiveness of Jacobs' take on the city, in this study materialized by using a wide array of variables of the built environment. While this is a common characteristic in studies aiming to construct a synthesized indicator of the built environment (Frank et al., 2010; Guan & Rowe, 2016; Millington et al., 2009), in this case, Jacobs includes alternative and less explored

attributes such as the mixture of building characteristics and elements such as border vacuums. The third benefit that this approach presents is a matter of replicability. All variables used in this analysis can be found in most major cities around the world in an open format, and both the separate construction of the six drivers of urban vitality and the synthesis in the final indicator are based on simple calculations, in order to contribute to research practices that may be transferable to cities both in developed and developing contexts (Kang, 2016). Last but not least, one of the main criticisms Jacobs received from those opposing her views was the fact that she was neither a planner nor an architect. To our view, this is not a weakness but partly explains how her thesis have made it to the present-day discussion. Her clear and strong views have created a great impact not only by their irrefutable underlying logic, but also due to the simplicity and eloquence she employed, in some sort of story-telling style, in explaining how cities worked (Rowan, 2011). This is not a minor issue, since the communication process involved in planning practices is often as important as the content of such a practice, especially with actors of different backgrounds and positions take part in it (Arranz-López et al., 2017; te Brömmelstroet & Bertolini, 2008).

The approach presented in this study is not exempt from limitations that can be described at different planes in order to properly inform future studies. First of all and from an applied plane, it has to be considered that the methodology presented in this paper is based on a set of specific variables that can be further widened in follow-up studies, for instance by incorporating relevant items that go beyond the built environment, such as retail performance or social and cultural characteristics of residents. Also, the index presented is the result of methodological decisions such as the specific weights applied in its calculation which, even though these have been either based on previous literature or directly drawing from Jacobs's guidelines, could very well vary depending on territorial context, and therefore there is still room for improvement. For instance, an in-depth qualitative study among a sample of resident population or based on a panel of experts could nurture this methodology by providing useful insight on what specific variables are more relevant in promoting urban vitality.

On the other hand, there are also constraints in relation to the conceptualization and interpretation of Jacobs' understanding of 'urban vitality', mainly considering that her views were based on her individual experience in mid-20th century New York. This implies that, on one hand, the reality of the city she lived in largely shaped the built environment features she valued, which in turn have to be properly reinterpreted when analyzing different territorial contexts such as the Mediterranean city. This is the case, for instance, of the relationship between the buildings' age and socioeconomic status: in cities such as Barcelona this relation might not be as straightforward as Jacobs proposed, since old neighborhoods might also become unaffordable for a large section of the population through high rents, derived both from their central location or by specific lifestyle attributes, while on the other hand newer developments might be suitable for low-income residents. But besides this and above all, the main point to make regarding this exercise's theoretical shortcomings is that Jacobs' approach may become limited if present-day phenomena are to be incorporated, especially in global cities such as Barcelona. For instance, areas that have thrived as 'vital' environments can also be scenarios for processes such gentrification or the overcrowding resulting from growing touristic interest (Casellas, 2009; Casellas et al., 2012). In Barcelona, this could very well be the case of specific sections of *Ciutat Vella* or *Gràcia,* and even more recently in *Poble Nou* resulting from the 22@ project. In this sense, we consider that while Jacobs' analytical framework may be regarded as quite useful to characterize the built environment resulting from modern planning logics, its application to contemporary, post-modern, urban realities could make use of new epistemological approaches capable of both embracing new meanings of 'vitality' and also its inherent nuances and conflicts. Even though Jacobs's conceptual body is still largely valid, it would, without a doubt, be strengthened by being re-contextualized to present-day urban landscapes.

All this being taken into account, we consider the main contribution of this study to be the provision of a tool capable of characterizing the built environment through its theoretical capacity of fostering vibrant urban life using Jacobs' theories. In this line, and in order to improve this initial schema, future research will take advantage of this high-resolution methodology by relating it with data from how these environments are used and specific urban phenomena occurring in the present, also with a specific focus on

those areas where the logics of modern city building may still persevere (Caprotti & Gong, 2017; S. E. Cho & Kim, 2017).

5. Daily travel time and its multiple dimensions

5.1. A Relational Perspective on Everyday Mobility in the Barcelona Metropolitan Region: Individual and Household-Related Differences in Daily Travel Time

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A RELATIONAL PERSPECTIVE ON EVERYDAY MOBILITY IN THE BARCELONA METROPOLITAN REGION: INDIVIDUAL AND HOUSEHOLD-RELATED DIFFERENCES IN DAILY TRAVEL TIME

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ABSTRACT

The collective dimension of everyday life plays a key role on how daily mobility patterns are drawn, especially considering relationships at the household level. However, previous literature regarding spatiotemporal behaviour has, above all, focused on individual characteristics detached from their immediate social contexts. By adopting a relational perspective this paper aims to explore how the combination of individual and household-related variables can exert different mobilities in a Mediterranean metropolis such as Barcelona. Based on travel times and trip purposes reported in a traditional travel survey, both gender and social status are first confirmed as significant factors shaping daily mobility. Second, the relationships in the household emerge as relevant as individual characteristics when understanding one's everyday mobility patterns. In particular, the presence of children is regarded as a clear spatiotemporal constrictor, which is especially acute for women.

Key words: everyday mobility, relational mobility, daily travel time, household structure, Barcelona metropolitan region

INTRODUCTION

The introduction of the factory clock in the nineteenth century gave start to the industrial organisation of everyday life, configuring time both as a structural and structuring element of human life (Thompson 1963). Since then, the 24-hour day is conceived as a temporal budget that is expected to be managed to the extent that our personal and social limitations allow. It is for this reason that the ability to get a hold on daily time is now recognised as one of the key indicators in assessing the quality of our lives (Nowotny 2005; Strazdins *et al.* 2011; Wajcman 2015).

The day is organised around time dedicated to work, to go on errands, to carry out family-related tasks, to enjoy leisure activities, but also to move from one place to another. Trips conducted on an everyday basis, known as daily mobility, hence constitute a crucial part of our day-to-day individual routines as

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5.1.1. Introduction

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The day is organized around time dedicated to work, to go on errands, to carry out family-related tasks, to enjoy leisure activities, but also to move from one place to another. Trips conducted on an everyday basis, known as daily mobility, hence constitute a crucial part of our day-to-day individual routines as these represent not only the mechanism through which we access basic and preferred services, but because these can also be regarded as an activity per se that has a central role in the relationship between society and space (Banister, 2008; Mokhtarian, Salomon, & Singer, 2015; Urry, 2007).

As it has been pointed out by previous research conducted in different urban settings and moments in history, people allocate approximately an hour and a half every day to their daily trips, (Ahmed & Stopher, 2014; Peter Stopher & Zhang, 2010). Nevertheless, daily travel time has significant differences at the disaggregate level, firstly, in terms of where people live, where their daily activities are located, and also, in relation to their specific travel behavior (Mokhtarian & Chen, 2004; Van Der Hoorn, 1979). But apart from this, daily travel times are also related to people's identity. As it was already suggested in the seventies by the Swedish geographer Torsten Hägerstrand (1970), our individual spatiotemporal behavior is framed by a series of constraints, which in turn, are reflected in different daily organizations. Under Sui's (Sui, 2012) interpretation, three types of constraints can be found in regard to one's daily mobility patterns: the ones that refer to the individual's characteristics or capabilities, those related to personal relationships, and those subjected to the social and the authority scale. It is for this reason that later reflections have pointed out that humans are to be better understood as branching rather

than linear entities in space-time, as the interaction with the daily needs and purposes of others results in intertwined temporal links (Adams, 1995, 2000). This implies that our daily life is explained by our individual realities (defined by routine tasks and sociodemographic characteristics), but also, by the needs and purposes of the social structures to which we belong, from the family environment to the administrative and productive scales. As Cipriani (2013; p. 25) explains, "*time is never homogeneous, it is multi-facetted and its aspects are distributed over its various contexts*". This is a social conceptualization of time (Adam, 1995; W. E. Moore, 1963), which therefore can be understood as the sum of multiple times that coexist and are in conflict (Crang, 2001).

In general, the effect of individual characteristics and preferences shaping daily mobility has been increasingly studied as a step forward from traditional focuses on objective trip-related characteristics (Jaramillo, Lizárraga, & Grindlay, 2012; Lu & Pas, 1999; Van Acker, Goodwin, & Witlox, 2016). The specific factors considered in the study of uneven allocations of travel time have been gender, age and status relations. From a gender perspective, studies have agreed on the fact that men tend to spend more time per day traveling than women (Hanson & Johnston, 1985; Kitamura et al., 1992; Kwan & Kotsev, 2015; David Levinson & Kumar, 1995; Robinson & Godbey, 1997; Ta, Kwan, Chai, & Liu, 2016). Nevertheless, it has been pointed out that while women present less overall travel times and less commuting times, other mediating factors play an important role for them such as the amount of working hours (McQuaid & Chen, 2012; Scholten, Friberg, & Sandén, 2012). A range of studies have found that age is also a significant factor in determining daily travel time (Schwanen, Dijst, & Dieleman, 2002). In this sense, people in their active years (between their twenties and their sixties) present larger daily travel times than the young and the elderly (Gunn, 1981; Kitamura et al., 1992; Prendergast & Williams, 1981). Social profile, basically defined by employment status and income, may be the most analyzed factor in travel time studies (Mokhtarian & Chen, 2004; Strazdins et al., 2011). Results have shown that, in general, higher employment rates and pays are tightly related to both longer commuting times and to larger daily travel time expenditures (Barnes & Davis, 2001; Frías-Martinez, Virseda, & Frías-Martinez, 2010; Lu & Pas, 1999; Prendergast & Williams, 1981).

As it has been pointed out previously, daily mobility is not solely explained by our individual realities. It is for this reason that the relational dimension of daily mobility has to be considered, starting with Hägerstrand's so-called authority and social constraints on individuals' spatiotemporal behavior. Examples of this would be the effect of working time (Schwanen & Dijst, 2002) or public facility open hours (Weber & Kwan, 2002), and even new concepts such as "geo-social radii" that are now able to be measured using innovative datasets (Phithakkitnukoon, Smoreda, & Olivier, 2012). Moreover, special attention has to be paid to the household level, as it is conceived as the first and possibly the most adequate arena in which these types of temporal relations can be analyzed. This mainly due to the fact that it is still the main location in which more time is spent and personal ties are stronger (Ellegård & Vilhelmson, 2004; Y. Lee, Hickman, & Washington, 2007; Susilo & Avineri, 2014). Some of the first studies focused on daily travel times stated that household size was playing a substantial role in the individual's daily allocation of travel time. In this sense, Zahavi & Ryan (1980), Yacov Zahavi & Antti (1980) and Purvis (1994) observed a negative correlation between daily travel time and the number of members in a household, which has been further confirmed with more recent studies, for instance by using GPS-based data to explore space-time constraints in relation to nuclear and extended families (Ta et al., 2016).

Besides the household dimension, its structure and composition also need to be explored as potential factors shaping individual mobility. One of the main aspects to be considered in this regard is the effect of children, as in other studies their presence in the household has been identified as a possible mediator in the spatiotemporal behavior of parents due to their care-giving responsibilities (Bernardo, Paleti, Hoklas, & Bhat, 2015; Susilo & Avineri, 2014; Tillberg Mattsson, 2002). This being said, some have recently found that having children results in less out-of-home available time (Ekert-Jaffé, 2011; Susilo & Avineri, 2014) and shorter commuting times (McQuaid & Chen, 2012), while others have pointed out that the number of minors in the household carry larger daily travel time expenditures (Y. Lee et al., 2007; Lu & Pas, 1999). These disparities could be a result of different urban settings, or rather this could point out that time among parents is destined to trips other than commuting. On the other hand, in the Spanish context, the presence of elders in the household could also be an important factor to be considered,

as these represent a highly dependent collective in terms of daily mobility (Camarero & Oliva, 2008), and their care can imply considerable mobility constraints (Hanrahan, 2016). All of these household or social relations mediating in spatiotemporal behavior can be highly gendered (Law, 2002; Schwanen, Kwan, & Ren, 2008), and consequently these must be specifically analyzed for men and women.

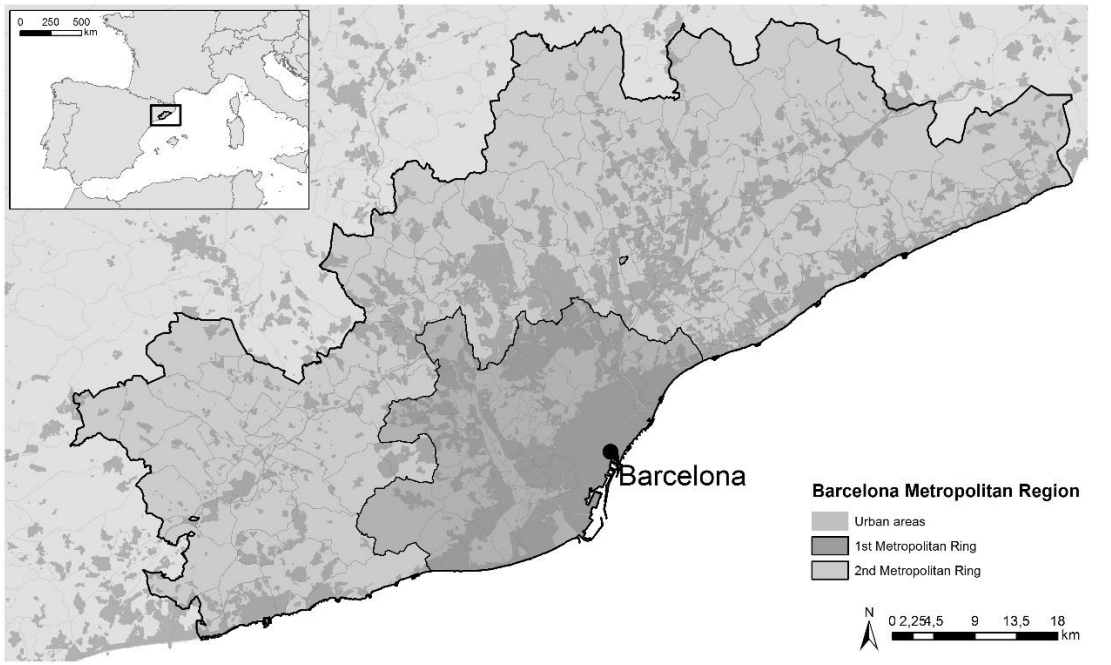
Lastly, daily travel time is also influenced by the purpose of everyday trips, such as having to go to work or to school, traveling to perform errands or heading out to conduct leisure-related activities, as these also reflect differences in terms of who we are and who we relate with (Schwanen et al., 2002). For this reason, if we are to understand differences in the temporal allocation that everyday mobility implies, not only the amount of time spent has to be put under the spotlight, but also its different composition in terms of trip purposes. In this sense, the aim of this paper is to explore the role of the individual and relational dimensions that explain both people's daily mobility temporal investment and its composition, in the specific context of a Mediterranean metropolis such as Barcelona.

5.1.2. Territorial context, materials and methods

The Barcelona Metropolitan Region (BMR hereafter) is one of the major metropolitan areas in Southern Europe, the urban core of the Catalan region and one of the most populous urban areas in Spain, composed of approximately five million inhabitants (Figure 13). This is a metropolitan area that while has experienced recent processes of urban fragmentation, traditional urban cores still play a significant role as everyday activity poles (Marmolejo & Stallbohm, 2008). According to the Barcelona Metropolitan Transportation Authority (Autoritat del Transport Metropolità, 2014), a total of 17.3 million trips are conducted every workday in the BMR, which implies a ratio of 3.7 trips per person. Of these, 46.8% are carried out either on bike or on foot, while 35.3% of the trips are conducted on private transportation modes and 17.9% on public transit, which mainly includes train, metro, light rail and bus. In terms of trip purposes, 17.9% of trips are conducted for occupational activities (both work and study related), 38.3% are related to personal mobility (considering aspects such as grocery shopping, personal

errands, accompanying others or recreational purposes, among others), and the remaining 44.3% is allocated to trips to return home.

Figure 13. The Barcelona Metropolitan Region (BMR).



Own production.

This article is based on data extracted from a traditional travel survey. The Workday Mobility Survey 2014 or EMEF'14 (Autoritat del Transport Metropolità, 2014) focuses on the mobility-related patterns on workdays (Monday to Friday) and opinions of those who reside in this metropolitan region. Based on Computer Assisted Telephone Interviews (CATI), a total of 9,461 individuals older than 16 years old residing in a total of 226 municipalities were inquired in 2014 to report on all trips conducted in the previous workday (trip purposes, transportation modes, and trip durations, among other items). A relative error of ±1.0% is assumed, estimated with a confidence level of 95.5%.

Daily travel times (DTT) are used as a reflection of the temporal implication of daily mobility, and were obtained by adding the durations of the trips performed by each respondent on that given day. Based on the purpose of the trip, a distinction can be made between time spent in commuting trips (considering paid work and study), and also according to a range of personal purposes, besides returning home: errands (such as

shopping, medical appointments or other general errands), accompanying other people and leisure-related trips. Lastly, it has to be noted here that a small share of respondents is excluded for the purpose of this work: those employed in the transportation sector (i.e. bus or truck drivers, which represent 1.0% of the sample) and those who did not travel that day (8.4%). This results in a final sample of 8,570 individuals, the main characteristics of which are presented in Table 3.

In order to explore the individual dimension of daily mobility, profile variables such as gender, age, education level and occupational status have been included, the latter two being interpreted as social status. Furthermore, as the focus is not only set on the individual but specifically on the relational dimension of mobility, variables at the household level have been included drawing from previous literature: household size, number of minors present (those under 18 years old) and number of elders present (those over 85 years old[2]). Also based on what was found in previous literature, an interaction effect between gender and household relations is included.

The analysis of the effects that each of the aforementioned variables has on both total travel time and its composition is based on a set of OLS regression models that have been adjusted. Thus, Model 1 presents the effects of the given variables on total daily travel time as a quantity in minutes. In Model 2, the dependent variable is the share (%) of DTT dedicated to commuting. Models 3, 4 and 5, respectively, present the effects of the variable in relation to the shares (%) of travel time allocated for errands, accompanying others and leisure-related trips. For each model, measures of goodness of fit are presented (R^2 and adjusted R^2), as well as ANOVA statistical significance of the models and independence of the error terms (Durbin-Watson measures ≈ 2.0). The presence of outliers has been checked for and corrected when necessary.

As daily mobility cannot be explained without its given territorial context or certain trip-related factors, a set of residential and travel characteristics have been included as control variables in the regression analyses. Instead of referring to place of residence in terms of location in the areas described in the first part of this section, population density

[2] *Despite 65 can be considered the average retirement age, in this study it is considered that especially those over 85 years old constitute a potentially high-dependency group.*

at the municipal level is used instead. In terms of travel-related features, the number of trips conducted is included, as well as the level of attachment on a given transportation mode. This variable has been obtained by creating an index in a 0-100 scale, which combines responses in several Likert-type questions regarding usage frequency of different types of transportation modes: non-motorized (walking and biking), private (car and motorbike) and public transit (bus, train, metro or light rail).

5.1.3. Results

The results are directed to understanding the effect of both the individual and household-related factors shaping daily travel time in the BMR. To do so, general trends of DTT are presented in relation to sociodemographic aspects of the analyzed sample in Sub-section 5.1.3.1, while the regression analyses explore the specific effects of these characteristics in both the total amount of DTT as well as in its composition (Sub-section 5.1.3.2).

5.1.3.1. General trends of daily travel times in the BMR

Time allocated for daily trips presents an average of one hour and 23 minutes, of which commuting is approximately half an hour, while trips with other purposes take up the remaining 50 minutes (Table 3).

The first glance at differences in daily travel times has to be conducted at the individual scale (Table 3), considering both the degree and also the overall purpose of everyday mobility. In general, data shows how the main differences are not to be found in the average daily travel times, which are rather stable, but in their composition regarding trip motivation. The analysis of the minimum and maximum values shows how young people (between 16 and 29 years old) constitute the group that spends more time traveling in a given day (with an average of 93.8 minutes), which is mainly explained by a higher temporal allocation to commuting trips (coinciding with student behavior). Conversely, the less mobile are those employed in house tasks (72.3 min.), who present almost no commuting times in average (0.7 min.). Putting this in another perspective, it is interesting to note that not having a paid job and hence almost no commuting time

(also the case of the elderly, retired, and those unemployed), does not result in a significant decrease in average daily travel times. This implies that there is a general need for daily mobility, whether people have to go to work or not.

In addition to the individual scope, household relations provide further descriptive differences. People that live in larger homes seem to allocate more time to travel in a given day, but the effect of the presence of minors and elders cannot be clearly depicted considering only these average values. Furthermore, the difference between commuting trips and those with other purposes shows how living in a household composed by three or more individuals results in an average daily commuting time of 43.2 min., three times larger than those in unipersonal households (14.4 min.)[3]. On the other hand, as the household grows and as the presence of children increases (especially with the first child), the average daily travel time allocated to trips other than commuting seems to be reduced to around 40 minutes. However, it has to be noted that this fraction of daily travel time hides specific purposes that cannot be analyzed as a homogeneous group. This will also be addressed in subsequent parts of the analysis.

The general trends observed to this point indicate that not everyone presents the same daily travel time and that this is not always the same in its composition. The specific association of the factors shaping travel times and therefore, the mobilities of everyday life, are presented in the following two sub-sections that regard individual and household characteristics. Even though these do not necessarily imply causation, the different regression analyses do allow for statistically significant associations to be observed.

[3] *Nevertheless, a look at the survey data shows that 61% of unipersonal households in this sample consist of retired individuals.*

Table 3. Average daily travel times (DTT) in relation to individual and household-related variables and trip purposes in the Barcelona Metropolitan Region (BMR).

			DTT (minutes)					
			All trips		Commuting[a]		Other trips[b]	
	n	%	Av.	SD	Av.	SD	Av.	SD
Total	8,570	100.0	83.5	61.6	32.2	48.1	51.4	58.5
Individual characteristics								
Gender								
Male	4,214	49.2	86.1	64.8	34.9	49.6	51.2	63.2
Female	4,356	50.8	81.1	58.2	29.5	46.4	51.6	53.6
Age								
16-29	1,558	18.2	93.8	66.8	59.9	60.5	33.9	45.5
30-64	5,327	62.2	80.5	57.6	33.7	45.6	46.8	55.1
More than 65	1,685	19.7	83.6	67.3	1.6	11.7	82.0	67.9
Education level [b]								
No education	309	3.6	76.9	63.2	3.8[d]	17.2	73.2	64.5
Elementary school	2,422	28.3	75.6	62.4	16.4	33.2	59.1	64.5
High School	2,845	33.2	86.8	62.9	38.6	52.2	48.2	56.4
Higher Education	2,939	34.3	87.8	58.8	42.1	52.1	45.6	53.2
Occupational status [c]								
Employed	4,266	49.8	82.3	56.1	50.5	50.3	31.8	42.5
Unemployed	1,283	15.0	82.9	65.7	13.2	38.2	69.7	62.8
Retired	2,138	24.9	84.8	68.2	1.0	8.6	83.7	68.4
House tasks	234	2.7	72.3	53.6	0.7	4.8	71.6	52.7
Student	643	7.5	93.1	66.0	63.7	58.0	29.4	43.3
Household characteristics								
Household size								
Unipersonal	1,052	12.3	78.6	58.6	14.4	32.1	64.2	59.7
2 individuals	2,768	32.3	83.0	63.1	19.9	38.8	63.2	65.8
3 or more	4,750	55.4	84.9	61.2	43.2	52.8	41.7	51.5
Minors in household								
None	5,622	65.6	83.5	63.2	26.8	45.9	56.7	62.4
1 minor	1,497	17.5	86.0	61.5	45.6	51.6	40.4	50.9
2 or more	1,451	16.9	81.1	54.8	39.1	49.1	41.9	46.2
Elders in household								
None	8,170	95.3	83.9	61.8	32.8	48.5	51.1	58.6
1 or more	400	4.7	75.6	56.9	18.3	37.2	57.0	57.3

Av. = Average. SD = Standard Deviation.
a. Commuting includes trips to work or study.
b. Other purposes include running errands, accompanying others and leisure-related trips. b. No Data = 0.6%. c. No Data = 0.1%. d. A share of 87% of people with "No education" in this sample corresponds with retired individuals, which explains low DTT allocated for commuting trips.

Own production based on EMEF'14 data.

5.1.3.2. Individual and household-related factors for differences in daily travel times

From the individual point of view, factors that present significant association with the total amount of daily travel time are gender and education level (Table 4). In this sense, being a man and having a higher education degree both are linked with significant

increases in DTTs (Beta values of 0.06 and 0.04 respectively). Household characteristics are also proven to have significant roles. Specifically, an increase in the household size carries greater daily travel times for a given individual (Beta=0.04). In contrast, an increase in the number of minors in the household is related to a larger decrease in total DTT, which is also the factor with the strongest association among the considered sociodemographic variables (Beta=-0.09). An interaction has been included between gender and number of minors and elders in the household, but no significant results have been observed in this first model.

Table 4. Model 1 results: explanatory factors for differences in DTT.

R^2	0.194					
Adjusted R^2	0.193					
Sig. F Change	0.000					
Durbin-Watson	2.001					
Sig. (ANOVA)	0.000					
Predictors	B	Inf. Lim.	Sup. Lim.	Beta	t	Sig.
(Constant)	18.64	10.00	27.28		4.23	.000**
Sociodemographic factors						
Individual characteristics						
Gender (Dum.; Male = 1)	7.08	4.41	9.75	0.06	5.20	.000**
Age	-0.03	-0.11	0.05	-0.01	-0.73	.463
Education level	2.49	1.31	3.68	0.04	4.13	.000**
Occupational status (Dum.; Active = 1)	2.37	-0.28	5.02	0.02	1.75	.079
Household characteristics						
Household size	2.01	0.60	3.42	0.04	2.79	.005**
Minors in household	-5.95	-8.16	-3.74	-0.09	-5.28	.000**
Elders in household	-5.81	-12.53	0.90	-0.03	-1.70	.090
*Int. females * minors in household*	-1.56	-4.14	1.02	-0.02	-1.18	.236
*Int. females * elders in household*	0.95	-8.01	9.92	0.00	0.21	.835
Residential and travel characteristics						
Municipal density (pop./km²)	-0.0003	-0.0004	-0.0001	-0.03	-2.91	.004**
Number of conducted trips	9.85	9.33	10.36	0.38	37.44	.000**
Time-related modal choice (Dum.; Yes = 1)	2.48	-0.26	5.23	0.02	1.77	.076
Attachment to transportation mode						
Non-motorized transportation	0.06	-0.04	0.16	0.01	1.22	.223
Private transportation	-0.08	-0.18	0.02	-0.02	-1.61	.106
Public transportation	0.83	0.75	0.91	0.26	20.77	.000**

** Significant p-value at 95.0% confidence level. **Significant p-value at a 99.0% confidence level.*

Own production.

The residential and travel-related variables selected as control factors present the following results: an increase in urban density is related to a decrease of daily travel times, while on the other hand, more trips and a higher attachment to public transportation shows the opposite tendency.

The effect of the considered variables in the share (%) of DTT employed for specific purposes is presented in Models 2 to 5 (Table 5). In this case, the binary distinction used in Table 3 between commuting and other trips is detailed by dividing up the latter into specific motivations: trips to perform errands, to accompany others and to conduct leisure activities[4].

From the individual perspective, gender relations seem to be reflected in different travel time distributions. While no significant differences are observed in the share of daily commuting time, being a man is associated with a smaller portion of DTT allocated to run errands and accompanying others (Beta values of -0.07 and -0.04 respectively). In contrast, men are more likely to spend a greater part of their travel time to leisure-related trips (Beta=0.09). Age, on the other hand, has a significant relation in both the percentage of commuting and errand-related DTTs: as the individual grows older, he/she dedicates a lower share of travel time to commute (Beta=0.10) and a greater percentage to go out on errands (Beta=0.10). A similar relation is observed regarding education level. Having a higher academic degree is related with a larger share of travel time employed for the daily commute (Beta=0.04), while, on the other hand, it also carries a significantly lower portion used for leisure-related mobility (Beta=-0.02). This is also the case in terms of occupational status, which is the factor that presents stronger associations in travel time composition, as evidenced by the Beta values. Being active (employed or student) is paired with a much higher share of commuting time, and significantly lower portions destined to other purposes: lower shares of DTT destined to perform errands, accompanying others and going out for recreation.

Besides the individual aspect of travel time composition, further details are obtained again when the relational sphere is considered throughout the analysis of the household structure. In this sense, an increase in the household size carries significantly larger commuting times (Beta=0.04), while the portion allocated to run errands shows the opposite tendency (Beta=-0.04). Moreover, the presence of children and elders in the

[4] *Even though the trip to return home is considered as a separate category in the survey and is accounted for in the total amount of DTT, its share is not analyzed in this part of the analysis, as it is considered that every individual has to return home in the same proportion and in relation to the other trip purposes.*

household play different roles. As the number of minors increases, the share of travel time used to accompany others significantly increases (Beta=0.25), while the portion used for leisure trips significantly reduces (Beta=-0.17). Having children seems to be specifically important for women in terms of how travel time is used, as suggested by the interaction variable (females * minors in the household). In this case, women see their percentage of commuting DTT reduced (Beta=-0.05), while the proportion of accompanying others particularly increases for them (Beta=0.08). On the other hand, the effect of having elders at home is not that evident. While the mere amount of elders in the household does not seem to have a major role on overall daily travel time, it presents a significant difference again for women: their share of daily travel time to run errands increases as the presence of elders becomes more important (Beta=0.04).

Lastly, even though it is not the aim of the paper to analyze the effect of the control variables, some interesting results are observed. Conducting more trips is associated with lower shares of commuting travel time, while the portion of those destined at accompanying others or going out for leisure-related activities both increase. Attachment to specific transportation modes also has significant associations but not entirely self-explanatory. Being more attached to non-motorized modes is related with significantly higher percentages of leisure-related travel times. On the other hand, relying on motorized means (both public and private) carries larger shares of commuting times and, in contrast, smaller percentages of DTT allocated to run errands and for leisure-related trips.

Table 5. Models 2-5: explanatory factors for differences in DTT composition.

Model	2: % Commuting DTT				3: % Errand DTT				4: % Accomp. others DTT				5: % Leisure DTT			
R^2	0.501				0.162				0.256				0.162			
Adjusted R^2	0.500				0.160				0.255				0.160			
Sig. F Change	0.000				0.000				0.000				0.000			
Durbin-Watson	1.976				1.989				1.982				2.009			
Sig. (ANOVA)	0.000				0.000				0.000				0.000			
Predictors	B	Beta	t	Sig.	B	Beta	t	Sig.	B	Beta	t	Sig.	B	Beta	t	Sig.
(Constant)	10.91		7.61	.000**	21.98		13.43	.000**	-2.84		-2.72	.006**	16.59		10.24	.000**
Sociodemographic factors																
Individual characteristics																
Gender (Dum.; Male = 1)	0.40	0.01	0.89	.371	-2.71	-0.07	-5.36	.000**	-1.13	-0.04	-3.51	.000**	3.47	0.09	6.93	.000**
Age	-0.13	-0.10	-9.82	.000**	0.11	0.10	6.89	.000**	0.02	0.02	1.73	.084	0.02	0.02	1.18	.238
Education level	1.00	0.04	5.10	.000**	-0.25	-0.01	-1.12	.263	-0.04	0.00	-0.29	.774	-0.46	-0.02	-2.05	.041*
Occup. status (Dum.; Active = 1)	26.49	0.58	60.24	.000**	-11.56	-0.29	-23.03	.000**	-3.87	-0.14	-12.14	.000**	-10.81	-0.27	-21.76	.000**
Household characteristics																
Household size	0.76	0.04	3.22	.001**	-0.77	-0.04	-2.86	.004**	-0.05	0.00	-0.28	.777	-0.18	-0.01	-0.68	.499
Minors in household	0.48	0.02	1.30	.194	0.12	0.00	0.29	.775	4.07	0.25	15.28	.000**	-4.03	-0.17	-9.72	.000**
Elders in household	-0.16	0.00	-0.15	.883	-0.82	-0.01	-0.64	.519	-0.68	-0.01	-0.84	.398	1.27	0.02	1.01	.314
*Int. females * minors in household*	-1.73	-0.05	-4.05	.000**	-0.67	-0.02	-1.36	.173	1.70	0.08	5.47	.000**	0.43	0.01	0.89	.372
*Int. females * elders in household*	-1.43	-0.01	-0.96	.337	4.42	0.04	2.60	.009**	1.18	0.02	1.09	.276	-1.30	-0.01	-0.77	.440
Residential and travel factors																
Municipal density (pop./km²)	-0.00	-0.01	-0.66	.507	-0.00	-0.01	-0.83	.407	-0.00	-0.01	-0.89	.372	0.00	0.03	2.66	.008**
Number of conducted trips	-1.69	-0.16	-19.69	.000**	0.00	0.00	-0.03	.977	1.95	0.31	31.43	.000**	1.08	0.12	11.17	.000**
Time-related modal choice (Dum.; Yes = 1)	0.63	0.01	1.39	.166	-0.54	-0.01	-1.03	.303	-0.42	-0.01	-1.26	.206	0.18	0.00	0.35	.724
Attachment to transport. modes																
Non-motorized transportation	0.00	0.00	0.04	.970	-0.06	-0.04	-3.01	.003**	-0.02	-0.01	-1.25	.211	0.04	0.02	1.99	.047*
Private transportation	0.09	0.05	5.09	.000**	-0.07	-0.05	-3.50	.000**	0.07	0.07	5.60	.000**	-0.07	-0.05	-3.46	.001**
Public transportation	0.10	0.08	8.06	.000**	-0.04	-0.04	-2.87	.004**	-0.01	-0.02	-1.53	.127	-0.04	-0.03	-2.74	.006**

** Significant p-value at 95.0% confidence level. **Significant p-value at a 99.9% confidence level. Own production.*

5.1.4. Discussion

In order to understand everyday mobility, travel time has to be explained in regard to one's relational context and as a function of different trip purposes. This involves understanding people's personal and household characteristics in relation to their travel time. These characteristics are formulated in two planes: first, the individual, far more studied by academic literature, and second, the household dimension as the basic relational arena. It is in regard to the latter where the article provides the most interesting results, by exemplifying more clearly the fact that time invested in daily trips is the result of complementarity and competition strategies that, among themselves, exert different everyday temporalities.

It is evident, once again, that men spend significantly more time than women traveling on a given day, which is thought to be a consequence of women having shorter commutes as a result of tighter temporal restrictions due to their dual role as workers and homemakers (Hanson & Johnston, 1985; McQuaid & Chen, 2012), and also considering a lower degree of car use among this group (Feng, Dijst, Wissink, & Prillwitz, 2014). This is confirmed by the distribution of trip purposes, as women present higher portions of travel times dedicated to running errands and accompanying others, while men's share of leisure-related travel time is significantly higher. This helps to exemplify the fact that women have more fixed constraints on a daily basis than men (Kwan, 2000; Miralles-Guasch, Melo, & Marquet, 2015; Schwanen et al., 2008), which results in uneven organizations of daily time.

Secondly, results also confirm that social status is tightly linked with larger temporal investments in daily trips, and especially in large metropolitan areas in which residences and workplaces are being progressively separated (Vich et al., 2017). In this sense, our results point out that education level goes hand in hand with greater travel time expenditures, and being employed is also seen as a factor linked with more mobility activity (Barnes & Davis, 2001), although the effect is not entirely statistically significant. But other than this, another interesting idea is that even though progress in social status carries longer travel times, it also leads to different time allocations in terms of trip

purposes, resulting in larger shares of commuting time and smaller percentages of that allocated to leisure-related trips. This can serve as an example, from a mobility point of view, of how progress in the social ladder is often related to higher daily temporal pressure (Delclòs-Alió & Miralles-Guasch, 2017; Wajcman, 2015), also related to a sense of being under a progressively accelerated pace of life (Rosa, 2003).

The addition of the relational sphere, less studied in terms of daily travel time, allows household relations to emerge as relevant as individual characteristics when understanding everyday mobility in this metropolitan region. Even though research conducted in the past and in rather different urban contexts had found that household size resulted in shorter daily travel times (Purvis, 1994; Zahavi & Ryan, 1980; Zahavi & Talvitie, 1980), the results of this paper point in the opposite direction. In this sense, some considerations regarding trip purposes are to be made. An increase in the household size indicates larger shares of commuting times and significantly less of that allocated to go out on errands. An hypothesis, adapted from the work of Susilo & Kitamura (2008) and Susilo & Dijst (2010), is that a household with more members results in an increase of responsibility sharing strategies which, in turn, liberates more time to spend individually in more out-of-home activities, in this case specifically in longer commutes. This kind of temporal compensation as a household strategy is an adequate example of the relational dimension of time.

The presence of minors in the household is much clearer in both the quantity of daily travel time and also in its different distribution. Having children can be conceived as an evident constrictor of daily travel time, since an increase in the number of minors results in a decrease of the duration of the trips. This is explained by the fact that having children is related with less out-of-home activity (Ekert-Jaffé, 2011; Susilo & Avineri, 2014), as having dependent members implies life-style decisions in terms of proximity to work or supplies (Susilo & Dijst, 2010). Moreover, the nature of travel time is also modified in this sense: when the presence of minors increases, higher shares of time are allocated to accompanying others, as children's mobility is tightly related to that of their parents (Mikkelsen & Christensen, 2009; Tillberg Mattsson, 2002), as well as lower percentages

of travel time related to leisure activities. This explains why, in some cases, parents can conceive traveling time as family quality time with their children (Waitt & Harada, 2016).

The interaction effect results help in confirming that these relations between personal travel times and the needs of children are clearly gendered, being especially acute for women (Michelson, 1990), as the presence of minors in the household also carries smaller shares of commuting times and again larger percentages of those allocated to accompanying others. In the same sense, the effect of the presence of elders in the household, another highly dependent group, seems to have also specific effects on women's everyday mobility, resulting in higher shares of travel times allocated to perform errands. In this sense, it can be said that women's daily organizations are much more related to the household responsibilities (Kwan, 2000), as exemplified in the case of this Mediterranean metropolis by the amount and nature of their daily travel times.

5.1.5. Conclusion

The aim of this paper was to explore both the individual and the relational dimensions of everyday mobility through the lens of travel time, as this has been presented as one of the components of social time. For this purpose, the study has been focused on one of the main urban areas in Southern Europe, the Barcelona Metropolitan Region, through the analysis of data extracted from a traditional travel survey conducted in 2014.

Results have shown that while it is true that people use an average of approximately one hour and a half per day for their daily trips, it has been confirmed that there are individual factors that shape daily travel time. Furthermore, the paper contributes to the increasing attention that is being paid to the relational dimension of daily mobility, by combining both individual and household characteristics with the amount and nature of daily travel time. As key points, the paper has found that gender and social status have a significant effect on daily travel time, and the more acute household-related feature that shapes daily travel time is the presence of children, especially for women. The exchange of daily time has also been detected throughout the compensation in daily travel times in relation to household size, which should be further explored in future research.

Lastly, other future lines for research can be also pointed out. As this study is based on a single workday travel survey, it has not been possible to analyze day-to-day variability throughout the week or even in terms of daily rhythms, which constitute two other interesting topics to analyze not only from the traditional individual perspective, but also considering a relational scope. Also, this article has analyzed travel time as a portion of the 24-hour day. This type of analysis focused on temporal relations should also be complimented with a qualitative perspective, not only considering the amount and purpose of time allocated for travel, but also its use and experience as a routine activity.

5.2. Keeping track of time: A Smartphone-based analysis of travel time perception in a suburban environment

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Keeping track of time: A Smartphone-based analysis of travel time perception in a suburban environment

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ABSTRACT

In line with a growing interest in complementing surveys with tracking technologies, this paper aims to explore what differences between perceived and real travel time can be found by using a smartphone-based tracking application. This is justified based on the fact that self-reported trip durations in traditional mobility data sources are based on travelers' memories and perceptions, which implies that these do not necessarily coincide with real or clock time. For this purpose, the daily commute to a suburban university campus in the Barcelona Metropolitan Region (Spain) is used as a case study. The app experiment points to a light under-perception of travel time, but further analyses show how misperceptions are especially related to the characteristics of this commute. Total trip duration has emerged as the main variable affecting the differences in reported and objective times, while different explanatory factors are suggested as accounting for the misperceptions of public transit riders and of those who drive.

1. Introduction

Time is one of the essential dimensions of travel behavior, as people are often concerned about time-related aspects such as speed, schedule planning or acceptable travel times (Milakis et al., 2015; Miralles-Guasch et al., 2014). Nevertheless, self-reported trip durations in traditional mobility data sources, such as surveys or travel diaries, are based on travelers' memories and perceptions, which implies that these do not necessarily coincide with real or clock time (Wan and Lo, 2005). In this sense, these two different measures of travel time, perceived and objective, should be considered in travel behavior research and modelling.

A diverse array of data sources and methods has been explored in recent years to obtain and analyze objective travel times as complements of traditional self-reported measures. In this line, with the advent of smartphones as tools for travel behavior research (Wang et al., 2017), a new opportunity emerges in order to study how travel time is perceived using smartphone-based data. This paper is an example of this intention, as it is set to explore what differences between reported and objective travel time can be found by using a tracking application designed as a complement of a traditional travel survey. For this purpose, the daily commute to a suburban university campus in the Barcelona Metropolitan Region is used as a case study.

The paper is structured as follows: Section 2 gives an overview of previous research regarding differences in reported and measured travel times; Section 3 presents the UAB suburban campus in its territorial context, and the methodological approach based on a smartphone tracking app is detailed; Section 4 contains the experiment's results, and Section 5 is left for discussion and conclusion.

2. Background

2.1. From self-reported travel times to trip durations based on tracking technologies

Self-reported trip durations in surveys or travel diaries are the most common sources to analyze time in travel behavior research and modelling. Yet, these are reported values that are subject to the individual's own perception (Kelly et al., 2013; Van Exel and Rietveld, 2009). As a response, in approximately the last decade

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5.2.1. Introduction

Time is one of the essential dimensions of travel behavior, as people are often concerned about time-related aspects such as speed, schedule planning or acceptable travel times (Milakis, Cervero, van Wee, & Maat, 2015; Miralles-Guasch, Martínez, & Marquet, 2014). Nevertheless, self-reported trip durations in traditional mobility data sources, such as surveys or travel diaries, are based on travelers' memories and perceptions, which implies that these do not necessarily coincide with real or clock time (Wan & Lo, 2005). In this sense, these two different measures of travel time, perceived and objective, should be considered in travel behavior research and modelling.

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The paper is structured as follows: Section 5.2.2 gives an overview of previous research regarding differences in reported and measured travel times; Section 5.2.3 presents the UAB suburban campus in its territorial context, and the methodological approach based on a smartphone tracking app is detailed; Section 5.2.4 contains the experiment's results, and Section 5.2.5 is left for discussion and conclusion. .

5.2.2. Background

5.2.2.1. From self-reported travel times to trip durations based on tracking technologies

Self-reported trip durations in surveys or travel diaries are the most common sources to analyze time in travel behavior research and modelling. Yet, these are reported values that are subject to the individual's own perception (Kelly et al., 2013; Van Exel &

Rietveld, 2009). As a response, in approximately the last decade and a half a variety of data sources have been used either to measure or to infer real travel time. Some examples are the calculations of trip duration based on information provided by public transit companies regarding official timetables (González, Martínez-Budría, Díaz-Hernández, & Esquivel, 2015), systems based on vehicle license plate detection (Peer, Knockaert, Koster, & Verhoef, 2014), calculations of shortest paths (Horning, El-Geneidy, & Krizek, 2008; Parthasarathi, Levinson, & Hochmair, 2013; Rietveld, Zwart, van Wee, & van den Hoorn, 1999) and, also, a growing number that analyze travel time relying on more precise measures, especially tracking data exclusively based on dedicated GPS devices (Bachu, Dudala, & Kothuri, 2001; Blanchard, Myers, & Porter, 2010; G. H. Cho, Rodríguez, & Evenson, 2011; P Stopher, Bullock, & Horst, 2002; Wolf, 2000). In this sense, GPS devices have become popular and useful as complements for travel surveys, yet they present considerable limitations due to their high cost, research design logistics and the burden that it implies for respondents (Patterson & Fitzsimmons, 2016b; Wolf, 2004).

This being considered, the technological advancement that has permitted the integration of geolocation systems in smartphones, together with their advent as almost universally basic everyday items, make them promising tools for research (Raento, Oulasvirta, & Eagle, 2009; Yue, Lan, Yeh, & Li, 2014). In the field of travel behavior and everyday mobility, a growing number of scholars and professionals have recently advocated for their use as new data sources with remarkable potential to both revisit traditional questions and also to imagine new research lines (Birenboim & Shoval, 2016; Nitsche, Widhalm, Breuss, Brändle, & Maurer, 2014; Patterson & Fitzsimmons, 2016b; D. Wang, Xiang, & Fesenmaier, 2014; Z. Wang et al., 2017). Among a wide variety of possibilities (Cottrill et al., 2013; Ferrer & Ruiz, 2014; Palmer et al., 2013), the analysis of itineraries and trajectories, both in terms of space and time, is one of the main capabilities that these devices are thought to offer (Nitsche et al., 2014; Yue et al., 2014).

5.2.2.2. How is travel time perceived? Evidence from previous research

By matching self-reported and objective measurements of travel time, previous studies have found that travel time is generally over-perceived (Kelly et al., 2013). Furthermore, a set of variables have been identified as potential confounders modifying or nuancing

this perception. These variables can be classified in two separate groups: personal characteristics and trip-related factors.

In terms of personal characteristics, previous studies point out that people with lower incomes have been found more likely to misreport trip characteristics in general (Houston et al., 2014), and specifically, to overestimate travel time in a higher degree than those with middle or high incomes (Burnett, 1978). Also, it has been detected that older travelers are less likely to correctly estimate the time they spent on their daily trips (Blanchard et al., 2010; Horning et al., 2008; Houston et al., 2014). Regarding gender, the effect is less clear: while it has been found that women tend to report higher travel times than men (Rietveld et al., 1999), in general, no significant differences can be affirmed in relation to perception nuances (Blanchard et al., 2010; Peer et al., 2014)

Trip characteristics, on the other hand, have been proved to be more strongly intertwined with the difference between reported and objective travel time. Total trip duration is accounted as one of the basic factors that modifies travelers' perceptions, specifically implying that shorter journeys carry greater miscalculations (González et al., 2015; Peer et al., 2014). Travel frequency has its own implications in terms of travel time perception, but its effects are less clear: while car drivers who commute less frequently have been identified with greater travel time over-perception (Peer et al., 2014), public transit riders have shown an opposite relation (González et al., 2015). The need to transfer between modes in a given trip (inter-modality) has also been proposed as a factor that could have an effect on how travel time is perceived, as a consequence of dividing the trip into different segments rather than considering it as a unique interval (Fraisse, 1984). On the other hand, the decision-making process that leads commuters to choose a specific transportation mode can also affect their perceptions: if modal choice is justified based upon time-saving motives, travelers seem to be more likely to experience trip duration as shorter than it really is, which is explained by their expectancies of that trip (M. R. Jones & Boltz, 1989; Li, 2003).

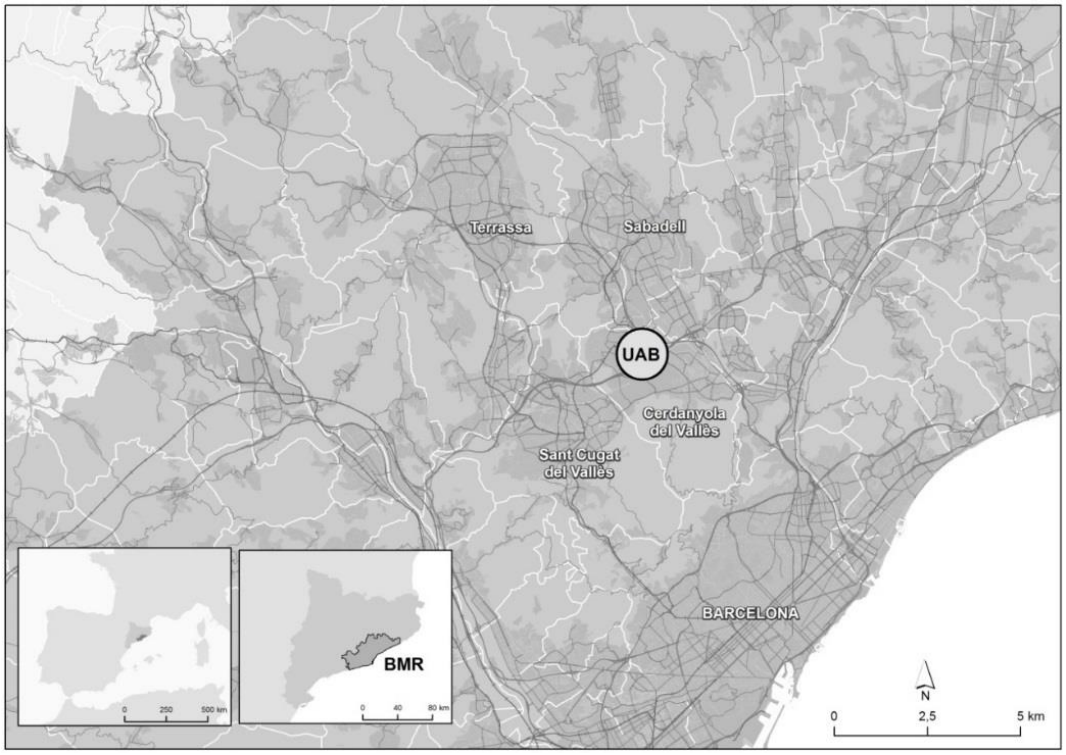
The aforementioned trip-related factors have also led to consider transportation modes as guidelines for the analysis. In this sense, the majority of authors have focused on a specific mode, of which the main attention has been paid to driving behavior (Blanchard

et al., 2010; Murakami & Wagner, 1999; Parthasarathi et al., 2013; Peer et al., 2014; Rietveld et al., 1999; Wolf, Oliveira, & Thompson, 2003). Those commuters who drive in the rush hour (Peer et al. 2014) and those who drive through denser street grids (Parthasarathi et al., 2013) tend to over-perceive their travel time to a greater amount. On the other hand, related studies on time perception among car drivers also found that waiting time, for instance in freeway access, is experienced as more onerous than the actual time driving (D Levinson, Harder, Bloomfield, & Winiarczyk, 2004; Zhang, Xie, & Levinson, 2005), which can reflect on how the overall trip duration is perceived. In contrast, perception of travel time in other transportation modes has been explored to a lesser extent. There are fewer evidences regarding trips conducted either in public transit options (González et al., 2015; Wu, Lu, & Ge, 2013) or on foot (G. H. Cho et al., 2011; Horning et al., 2008). In this sense, it has been found that more frequent transit commuters tend to over-perceive travel time in a heavier manner, and that, rather surprisingly, those who have to transfer between different transportation modes are more likely to be under-perceivers (González et al., 2015). Waiting time at the station can also have relevant effects on user's perceptions, since long waits can lead to dissatisfaction (Wu et al., 2013), which can turn into an overestimation of travel time (Li, 2003).

5.2.3. Data and methods

This study focuses on commuting trips to the Autonomous University of Barcelona (UAB hereafter). The UAB is located in a suburban campus outside the main urban area of the Barcelona Metropolitan Region (Figure 14). This campus holds a university community composed of approximately 40,000 members, considering students and staff. The university community can be targeted as a rather homogeneous group, as its members share similar objectives, needs and preferences (Wedel & Kamakura, 1998) which, in turn, can help identify the factors that shape their travel behavior (Miralles-Guasch et al., 2014).

Figure 14. The UAB campus in the Barcelona Metropolitan Region (Spain), 2015.



Own production.

5.2.3.1. Data sources

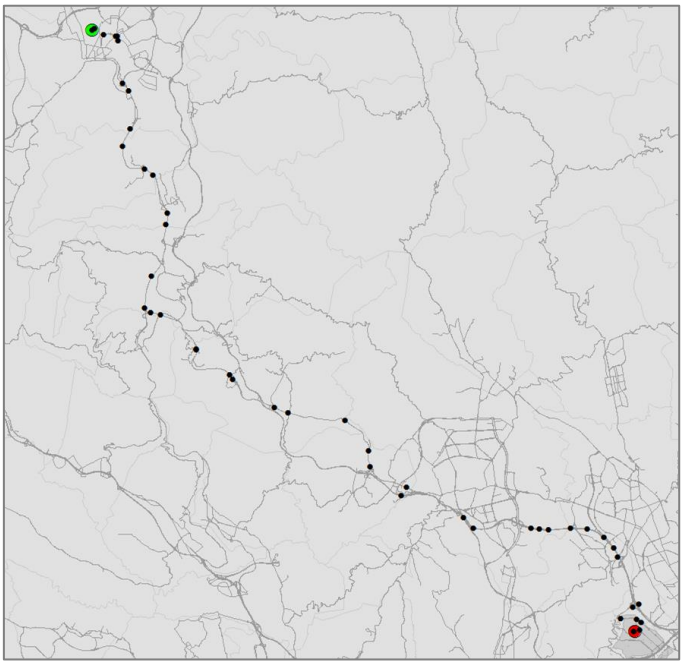
Drawing from previous research, this study is based upon two data sources. Perceived travel time is drawn from a large mobility survey taken within the university community, while a smartphone app provides an objective measurement of the duration of the trip.

The University Community Mobility Habits Survey (UCMHS) is a traditional travel survey based on UAB members' responses regarding travel patterns in their daily commute to the campus. This survey includes questions on personal profile, travel patterns (i.e. transportation mode used to access the UAB and declared travel times, among others), as well as opinions regarding travel satisfaction and motivations for modal choice. Between April and June 2015 the UAB held its 8th edition, providing a total of 4,425 valid questionnaires (±1.4% margin error). Earlier editions have already been used in previous research regarding travel behavior and daily mobility (Miralles-Guasch & Domene, 2010a; Miralles-Guasch et al., 2014; Soria-Lara, Marquet, & Miralles-Guasch, 2017).

In order to contribute to the growing research practice of using smartphone-based data, this experiment is based on the data extracted from an app named "*Campus Mobility*", developed specifically as a complement of the survey. Once the online survey was completed, respondents who declared an interest in the experiment were invited to download a free app from *Google Play Store* © and were asked to have it running on their phones for several days. The app tracked the users' itinerary using the satellite signal (specifically Global Positioning System) or either cellphone network or Wi-Fi connection when the previous were not available.

After carrying out filtering and processing of data extracted from the app, real trips to the UAB have been identified as exemplified in Figure 15. A real commuting trip is defined as the track constituted by the set of locations between the participants' residences and the specific building on campus in which they develop their activities (this information is also extracted from the survey). Real trip durations have been measured based on departure and arrival time. In order to relate real travel time with the user's perception of their commute, every real trip measured by the app has been related to the user's declared travel time in the survey. As a result, 309 trips conducted by a group of 129 UAB members have been analyzed.

Figure 15. An example of a random commuting trip by car extracted from the smartphone tracking app "*Campus Mobility*".



Own production.

Following what was found in previous research, variables regarding personal profile and trip characteristics have been considered as potential confounders of the difference between reported and real travel time. Regarding personal profile, the included features are members' gender, role at the UAB, age, and days per week of UAB attendance as a measure of commuting frequency. In terms of trip characteristics, those considered are transportation mode, inter-modality, modal choice based upon time-related aspects, the trip being conducted or not during rush hour (between 8:30 and 9:30 a.m.) and total duration of the trip. Basic description of the analyzed trips is presented in Table 6.

Table 6. Description of the analyzed commuting trips to the UAB, 2015.

		n	%
Total analyzed trips		309	100.0
Regarding personal profile			
Gender			
	Male	128	41.4
	Female	181	58.6
Role at the UAB			
	Students	153	49.5
	Staff	156	50.5
Age [a]			
	25 or less	105	34.2
	26 - 50	163	52.6
	More than 50	35	11.3
UAB access (days per week)			
	3 or less	31	10.0
	4 or more	278	90.0
Regarding trip characteristics			
Transportation mode			
	Non-motorized	23	7.4
	Public	159	51.5
	Private	127	41.1
Inter-modality			
	Unimodal	159	51.5
	Intermodal	150	48.5
Trip during rush hour			
	No	165	53.2
	Yes	144	46.5
Modal choice motive			
	Time related	121	39.2
	Others	188	60.8
Travel time to UAB			
	<= 30 min.	70	22.7
	31 - 60 min.	151	48.9
	61=< min.	88	28.5

[a] *No data = 1,9%*

Own production.

5.2.3.2. Methods

The analysis is based on two different measures of travel time: the one that is reported in the survey, which accounts for commuters perception of their travel time (Perceived Time, PT), and, on the other hand, the objective travel time that the app experiment has provided (Measured Time, MT).

The first part of the analysis intends to quantify the difference between these two data sources by comparing both measures of travel time (PT-MT). Furthermore, and beyond the first description of differences between perceived and measured durations, the second part of the analysis aims to explore to what extent several profile and trip-related variables have an effect on the direction and proportion of the difference between PT and MT. For this purpose, and in order to avoid magnitude biases, the approach used by González et al. (2015) is adopted in this study. Based on perceived travel times (PT) and measured travel times (MT), an "error" ratio has been calculated, as a 5 minute error in a 10 min. trip cannot be compared to 5 min. error in a 60 min. trip. The Perception Error Ratio (PER) is defined as follows:

$$PER = (pt - mt)/\, mt$$

Then, trips have been classified into 4 categories[5]: those in which heavy under-perception of travel time is found (HUP; PER<=-0.3), trips with light under-perception (LUP;-0.3<PER<0), trips with light over-perception (LOP; 0<PER<0.3) and trips with heavy over-perception of travel time HOP (HOP; 0.3=<PER). Chi-Square (χ^2) analysis in cross tables has been included in order to test statistical significance of the association by pairs between these categories and the specified variables.

Lastly, to confirm the different effects that the aforementioned variables have, when combined, on the difference between PT and MT, three multiple linear regression models have been estimated using the Ordinary Least Squares (OLS) technique. The models have been adjusted using the backward elimination method available in the statistical software IBM SPSS v.20. This method runs the regression several times, sequentially

[5] *Note that PER=0 is not included in this categorization, since no trip presented exact coincidence between reported and measured travel time.*

leaving out the variables with the least explanatory power, and only including the most relevant factors in the final model.

5.2.4. Results

5.2.4.1. General results: different measures of travel time in UAB commuting

The average commuting time reported in the survey (PT) is 45.1 minutes, while that measured by the smartphone app (MT) is 48.1 min (Table 7). This indicates that trips are generally perceived as shorter than their real duration, although this bias proves to be rather small, as the average difference between PT and MT is only of -3 min (in relative terms, PER=-0.06). Another interesting result is the fact that the app-based measurements present in every case very similar standard deviations compared to travel times found in the survey. This corroborates the reliability of this data source for the analysis, since both sources not only present similar mean values but also almost exact SDs. Moreover, the fact that both these SD and also that referred to the perception ratio are rather high suggest significant variability. This variability is further explored by considering personal and trip characteristics.

In terms of personal profile, men present longer trips to the UAB than women but they appear to report more precisely their travel times. The difference between students and staff is even wider: the first take on average 7 minutes more to get to the UAB, yet their account of travel time is much closer to that observed in the app experiment (PT-MT=-1.7), while staff members seem to under-perceive their commute times in a deeper manner, confirmed both by PT-MT (-4.3) and PER (-0.10). The same applies to the age factor: as people are older, their perception of travel times seems to differ from clock-time to a greater degree, resulting in a difference of around 5 minutes (and PER between -0.03 and -0.15) between the young and the old sections of the sample. This higher precision among youngsters is confirmed by the fact that, although their travel times are significantly more variable (given SD of both measured and perceived times), the variability of their error is smaller than that of older participants (SD =11.8). Besides this, people who commute to the UAB less frequently, present longer trip durations than those with higher attendance, and even though both average misperception measures

show under-perception of travel time, less frequent commuters seem to be slightly more mistaken (PT-MT=-5.4; PER=-0.10).

Table 7. General results: difference between perceived and measured travel times to the UAB.

		Perceived time[a]		Measured time[b]		PT-MT		PER[c]	
	Trips (n)	Mean	SD	Mean	SD	Mean	SD	Mean	SD
All trips	309	45.1	22.2	48.1	22.0	-3.0	12.7	-0.06	0.3
Regarding personal profile									
Gender									
Male	128	46.8	20.2	49.5	20.2	-2.8	12.2	-0.06	0.3
Female	181	43.9	23.5	47.1	23.1	-3.2	13.0	-0.07	0.3
Role at the UAB									
Students	153	50.3	24.4	52.1	24.5	-1.7	11.8	-0.03	0.3
Staff	156	40.0	18.5	44.2	18.4	-4.3	13.3	-0.10	0.3
Age									
25 or less	105	52.4	24.5	53.9	24.5	-1.5	12.7	-0.03	0.3
26 - 50	163	41.6	19.7	45.0	20.5	-3.3	12.1	-0.07	0.3
More than 50	35	37.3	20.6	43.7	17.4	-6.4	15.4	-0.15	0.4
UAB access (days per week)									
3 or less	31	48.2	18.1	53.7	21.8	-5.4	10.4	-0.10	0.2
4 or more	278	44.8	22.6	47.5	22.0	-2.7	12.9	-0.06	0.3
Regarding trip characteristics									
Transportation mode									
Non-motorized	23	32.4	15.2	29.2	14.3	3.2	9.3	0.11	0.3
Public	159	56.7	21.2	59.9	19.7	-3.2	12.9	-0.05	0.2
Private	127	32.9	15.7	36.8	17.0	-4.0	12.7	-0.11	0.3
Intermodality									
Unimodal	159	32.6	15.2	35.5	16.5	-2.9	12.4	-0.08	0.3
Intermodal	150	58.4	20.6	61.5	19.0	-3.1	12.9	-0.05	0.2
Trip during rush hour									
No	165	41.0	21.7	44.5	20.9	-3.5	12.2	-0.08	0.3
Yes	144	49.8	21.9	52.2	22.5	-2.4	13.1	-0.05	0.3
Modal choice motive									
Time related	121	37.9	22.0	41.7	22.8	-3.8	10.8	-0.09	0.3
Others	188	49.7	21.1	52.2	20.5	-2.5	13.7	-0.05	0.3
Travel time to UAB									
<= 30 min.	70	22.7	9.5	20.8	5.5	1.9	7.8	0.09	0.4
31 - 60 min.	151	41.8	13.3	45.6	9.3	-3.8	11.0	-0.08	0.3
61=< min	88	68.6	19.6	74.2	15.5	-5.5	16.8	-0.07	0.2

a. "Perceived time" (PT): trip duration self-reported in the survey. b. "Measured time" (MT): trip duration obtained from the app experiment. c. PER = (PT-MT)/ MT.

In terms of trip characteristics, transportation mode is the first variable considered. Trips made on public transit options clearly show longer durations than those on private or non-motorized means both in the survey and the app, and they show greater variability (both in reported and real travel time). It is interesting to note that travel time is averagely over-perceived in non-motorized trips (PT-MT=3.2 min.), while it is generally

under-perceived in their motorized counterparts, especially for drivers. Intermodality, the fact that commuting in the rush hour and the reasons behind modal choice do not present much differences other than those related to the duration of the trip. On the other hand, similarly to that observed with transportation mode, the overall duration of trip does provide interesting results. Trip duration in shorter trips is averagely over-reported in contrast to those trips over 30 minutes. Furthermore, as the trip gets longer (over 60 min.), the absolute error grows (PT-MT=-5.5 min.).

5.2.4.2. Bivariate analysis of travel time misperception categories

The observed average measures in Table 7 can hide relevant nuances that can be further explored according to the categories defined in Section 5.2.3.2. Firstly, it has to be noted that the larger proportion of trips are classified in Table 8 as presenting light misperceptions of travel times.

Secondly, in terms of personal profile, both gender and role present statistically significant differences regarding time misperception categorization (p-values < 0.05), even though that these cannot be considered as especially strong (Cramer's V = 0.168 and 0.163). As it has previously noted, travel times in trips made both by men and women are under-perceived on average, but results show how women tend to under-perceive them more heavily than men: 21% of trips made by women are classified in the heavy under-perceiving group, while men's share of HUP is significantly lower. The same relation appears in the case of role at the UAB, as staff members present a higher share of heavily under-perceived travel times (22.4%).

Trip characteristics present, in general, more relevant differences regarding Perception Error Ratios (PER). It is to be highlighted that non-motorized trips seem to present a higher share of heavily over-perceived travel times, in contrast to its motorized counterparts. Inter-modality presents the strongest paired association with travel time misperception categories (Cramer's V = 0.308). In this sense, unimodal trips present significantly higher shares of heavily under-perceived (HUP) and heavily over-perceived (HOP) times, implying that travel time misperception in unimodal trips is more present than in those that are intermodal. *Traveling during rush hour* and *time-related motivation in modal choice* do not present statistical significant differences regarding PER

categories. However, *total travel time* is the variable that presents the second strongest relation with travel time misperceptions (Eta = 0.297). Specifically, shorter trips present a rather larger share of heavily over-perceived travel times (32.9%), which hints that travel time is indeed an important factor affecting travel time perception.

Table 8. Travel time misperception categorization of trips made to the UAB in relation to personal and trip characteristics.

	Under-perception		Over-perception						
	Heavy	Light	Light	Heavy					
	HUP (%)	LUP (%)	LOP (%)	HOP (%)	Total (%)	χ^2	Sig. [a]	Cramer's V	Eta
All trips	16.5	45.8	25.2	12.6	100.0				
Regarding personal profile									
Gender						8.677	0.034	0.168	
Male	10.2*	53.9**	25.0	10.9	100.0				
Female	21.0**	40.3*	25.4	13.3	100.0				
Role at the UAB						8.229	0.042	0.163	
Students	10.5*	48.4	28.1	13.1	100.0				
Staff	22.4**	43.6	22.4	11.5	100.0				
Age						10.158	0.118		0.181
25 or less	9.5*	51.4	24.8	14.3	100.0				
26 - 50	18.4	44.2	25.2	12.3	100.0				
More than 50	31.4**	37.1	22.9	8.6	100.0				
UAB access (days per week)						1.825	0.610		0.077
3 or less	12.9	54.8	25.8	6.5	100.0				
4 or more	16.9	45.0	25.2	12.9	100.0				
Regarding trip charact.									
Transportation mode						37.828	0.000	0.247	
Non-motorized	8.7	21.7*	34.8	34.8**	100.0				
Public	9.4*	58.5**	23.3	8.8	100.0				
Private	26.8**	34.6*	26.0	12.6	100.0				
Intermodality						29.385	0.000	0.308	
Unimodal	23.9**	32.7*	26.4	17**	100.0				
Intermodal	8.7*	60.0**	24.0	7.3*	100.0				
Trip during rush hour						1.234	0.745	0.068	
No	17.6	47.9	23.6	10.9	100.0				
Yes	15.3	43.8	27.1	13.9	100.0				
Modal choice motive						2.567	0.463	0.091	
Time related	20.7	43.0	24.8	11.6	100.0				
Others	13.8	47.9	25.5	12.8	100.0				
Travel time to UAB						46.528	0.000		0.297
<= 30 min.	12.9	32.9*	21.4	32.9**	100.0				
31 - 60 min.	2.5	42.4	31.1**	6.0*	100.0				
61=< min	12.5	62.5**	18.2	6.8	100.0				

*a. p-value in Pearson Chi-square (bilateral asymptotic significance). *Significantly lower values (only if expected count is more than 5). **Significantly higher values (only if expected count is more than 5).*

5.2.4.3. Multiple linear regression analysis of travel time misperceptions

Bivariate associations have provided insight about the relation between each individual profile and trip characteristic and the travel time misperception categories. To this point, it is interesting to include not the individualized but the combined effect of these

variables in order to confirm their influence in the difference between reported and measured travel times.

Table 9 presents the results of the three different OLS regression models considering PER as the dependent variable and the aforementioned personal and trip characteristics as independent variables. Model 1 has been adjusted for all analyzed trips (n=309). Using the backward method, the variables included as significant predictors of PER have been member's age, driving to the UAB, travelling during the rush hour and total duration of the trip. Even though the model does not provide a high goodness of fit, it allows us to confirm that older participants and especially private transportation users are less likely to over-perceive travel times among the analyzed group. Commuting during the rush hour, on the other hand, is likely to have a positive effect on PER results; this is, traveling during the peak hour would lead to under-perceive travel time less. Lastly, the effect that the overall duration has on how travel time itself is perceived is confirmed in this regression: the longer one takes to commute to the UAB, the more likely one is to under-perceive travel time.

As it has been noted in Table 8, there are significant differences in PER results regarding transportation modes. Taking into consideration that this paper analyzes a suburban commuting trip, and that the share of non-motorized trips is rather low, these are not included in this step. In this sense, Model 2 and 3 present different results for public transit trips and those made on private options[6]. Model 2 provides less overall explanatory power (adjusted $R^2 = 0.05$) than Model 1; this low goodness of fit only allows to suggest that traveling during the rush hour and total duration of the trip have specific effects for public transit users. Commuting during the peak hour could result in being less likely to under-perceive travel time, while, on the other hand, total travel time is presented as a negative factor on PER results.

Model 3 presents a better fit than the previous models, according to the adjusted R^2 results (0.36). Also, a wider range of factors has been identified as for accounting for

[6] *While in Model 1 inter-modality was not included due to problems of multicollinearity with transportation modes (as this is a feature mainly related to public transit trips), in Model 2 and 3 this variable has been included, yet no significant results have been obtained.*

travel time misperceptions among private transportation users. The main features that seem to ward off under-perception when driving are basically the fact of being a male driver and being part of the staff. On the other hand, this model suggests that older drivers, those who justify their modal election due to time-related motives, those who attend the UAB more frequently and, accordingly to the previous models, those who conduct longer drives, are especially likely to under-perceive travel time.

Table 9. Results of OLS regression models in relation to PER results.

Model 1: All trips						
N	309					
R^2	0.14					
Adjusted R^2	0.13					
Sig. (ANOVA)	0.00					
Variables	Unst. Coef.	Beta	Inf. Lim.	Sup. Lim	t	Sig.
(Constant)	0.36		0.23	0.49	5.54	0.000
Age	-0.01	-0.19	-0.01	-0.002	-3.32	0.001
Transportation mode (Dummy; Private =1)	-0.10	-0.18	-0.18	-0.03	-2.75	0.006
Rush hour (Dummy; Yes = 1)	0.09	0.15	0.02	0.15	2.71	0.007
Total travel time	-0.01	-0.38	-0.01	-0.003	-6.16	0.000
Model 2: Public transit trips						
N	159					
R^2	0.06					
Adjusted R^2	0.05					
Sig. (ANOVA)	0.01					
Variables	Unst. Coef.	Beta	Inf. Lim.	Sup. Lim	t	Sig.
(Constant)	0.05		-0.06	0.17	0.92	0.358
Rush hour (Dummy; Yes = 1)	0.10	0.21	0.02	0.17	2.54	0.012
Total travel time	-0.002	-0.19	-0.004	0.00	-2.39	0.018
Mode 3: Private transportation trips						
N	127					
R^2	0.36					
Adjusted R^2	0.32					
Sig. (ANOVA)	0.00					
Variables	Unst. Coef.	Beta	Inf. Lim.	Sup. Lim	t	Sig.
(Constant)	1.41		0.94	1.87	5.96	0.000
Gender (Dummy; Man =1)	0.19	0.28	0.08	0.30	3.35	0.001
Age	-0.01	-0.50	-0.02	-0.01	-4.38	0.000
Role at the UAB (Dummy; Staff = 1)	0.16	0.22	-0.01	0.33	1.81	0.073
Modal choice motive (Dummy; Time-related =1)	-0.17	-0.26	-0.28	-0.06	-3.04	0.003
UAB access (days per week)	-0.13	-0.30	-0.20	-0.05	-3.26	0.001
Total travel time	-0.01	-0.57	-0.01	-0.01	-6.51	0.000

Own production.

5.2.5. Discussion and conclusion

This study used smartphone tracking to deepen in our understanding of travel time perceptions and recall bias. The use of the smartphone devices in travel behavior

research provides promising results, in this case, by comparing objective travel time with perceived travel time, reported in a traditional mobility survey. Specific advantages of smartphone based research are their low cost, especially when compared with the high cost of dedicated GPS devices, together with their progressive universalization as everyday pocket items. Also, and specifically related to the study of travel times, the fact that carrying a smartphone is not as intrusive as carrying other tracking devices, making travelers less aware of their trip being recorded. Considering this, it is interesting to reflect on the results obtained by this novel experiment in relation to travel times.

Firstly, the implementation of the app experiment has allowed to observe that these suburban commuters' average perception of travel time differs from real or clock-time, a phenomenon that has been pointed out in every study focused on this topic. Nevertheless, the magnitude of the average misperception is relatively low, which is also in accordance to most tracking-based perception analyses (Wolf et al., 2003; Stopher et al., 2007; Houston et al., 2014). However, this statement is based solely on mean values of time that can hide relevant nuances.

The obtained results show that, in this app-based study, under-perception of travel time is more relevant than over-perception. A part from the few cases that have also pointed in this direction (Department for Transport, 2011; Krygsman & Nel, 2009; Murakami & Wagner, 1999; Schuessler & Axhausen, 2009), the obtained results contradict the general trend observed in previous research, since it is opposed to what was found in the majority of studies reviewed by Kelly et al. (2013), and also in more recent works such as those by Houston et al. (2014) and González et al. (2015). The combined effect of being a repetitive and rather invariable suburban commute would serve as an explanation for the accurate perception of time, as mentioned above, but also for the sign of the observed misperception. This is explained by the concept of commuters' travel expectancies (M. R. Jones & Boltz, 1989), which implies that uncertainty leads to prediction biases and, specifically, over-estimation of travel duration. Furthermore, some evidence has also identified that trip length in suburban trips is more likely to be under-estimated than in denser and more complex urban areas (Horning et al., 2008), which would be a specific effect from the given mobility environment (Soria-Lara & Valenzuela, 2014).

As in other tracking-based perception studies, the use of the smartphone as a measure of real travel time has also yielded differences according to profile and trip characteristics. Regarding the effect of personal profile aspects on travel time misperception, the analysis has identified a statistical association between gender and PER categories, while Model 3 points out that this effect can be specifically related to private transport users. The combined interpretation of these results is not that men necessarily tend to over-perceive travel time more than women, but that female drivers are more likely to under-perceive the duration of the trip in a deeper manner. This is new insight considering previous research (Blanchard et al., 2010; Peer et al., 2014), which had not found significant differences regarding gender. A similar trend is observed in terms of role at the UAB, bivariate measures of which also identified statistical significant differences in PER categories, while the regression analysis provided some possible nuances. Even though the share of trips with heavily under-perceived travel times is especially relevant among staff members, in the specific case of those who drive, the relation seems to be the opposite. This implies that staff members who commute by private transportation modes are more likely than students to over-perceive travel time. Role at the UAB is somehow related to age, which has presented similar behavior in terms of PER categories, and has presented an interesting result related to the absolute error between PT and MT. In this sense, older commuters appear to be more likely to miscalculate their trip duration than younger travelers, which points to the same direction that previous studies (Blanchard et al., 2010; Houston et al., 2014). In contrast, other specific results differ from what has been previously found. Differently from the study by González et al. (2015), commuting frequency (analyzed as UAB attendance) has only proved to explain part of travel time misperceptions among private transport users. In this sense, in agreement with Peer et al. (2014), travel time is more likely to be more deeply under-perceived in trips conducted by those UAB members who drive more frequently to campus.

In this study, trip characteristics seem to be more relevant factors explaining the difference between travel time reported in the survey and that observed in the app. This has been proven both by stronger bivariate associations and later on confirmed by the individual coefficients in the regression analyses. The main trip feature that seems to be

affecting travel time perception is total travel duration, which is also related to the nature of this suburban commuting trip. First, results have shown that longer trips present greater misperceptions in absolute terms (PT-MT), yet smaller when PER values are used. Secondly, it has been observed that the longer the trip is, the more likely to present an under-perceived travel time. These results are in accordance with previous studies that also related travel duration with time misperception (González et al., 2015; Li, 2003; Parthasarathi et al., 2013; Peer et al., 2014). This is also consistent with that proposed by Brown (1995) regarding "Vierordt's Law", which explains that "*longer intervals tend to be underestimated while shorter intervals tend to be overestimated*". Nevertheless, it should also be considered that other studies have pointed out that low mental stimuli and boredom can lead to a higher over-perception of travel time (Peer et al., 2014; Wu et al., 2013). In this same line, Stopher, Bullock, and Horst (2002) found that negative content in time leads to overestimate time and distance. This would demand for future studies not only to consider the quantity of travel time in rather long commutes, but also the value of this time.

Considering that previous research had focused either on private or public transportation, it has been considered interesting to analyze the sample separately according to the modal split. Yet, the goodness of fit of these models do not allow for confident explanations of how perception works for public and private transportation users in general terms. While this suggests that there might be other important factors that could shape our perceptions of travel time, these still have yielded significant coefficients for some variables that can be interpreted. In this sense, traveling during rush hour appears to have a significant effect on public transit riders, implying that those who commute during the peak time slot of the day are more likely to over-perceive travel time. This is an interesting result, considering that this phenomenon is usually associated not with public transit users but with those who commute by car or motorbike, basically due to traffic congestion problems (D Levinson et al., 2004; Peer et al., 2014; Wardman & Nicolás Ibáñez, 2012). In this case, it seems that hopping on an intensely crowded train could have a specific effect on how commuters experience their travel time (Cheng, 2010), specifically by making time pass more onerously and therefore tending to its over-perception. On the other hand, the adjusted model for trips conducted on private

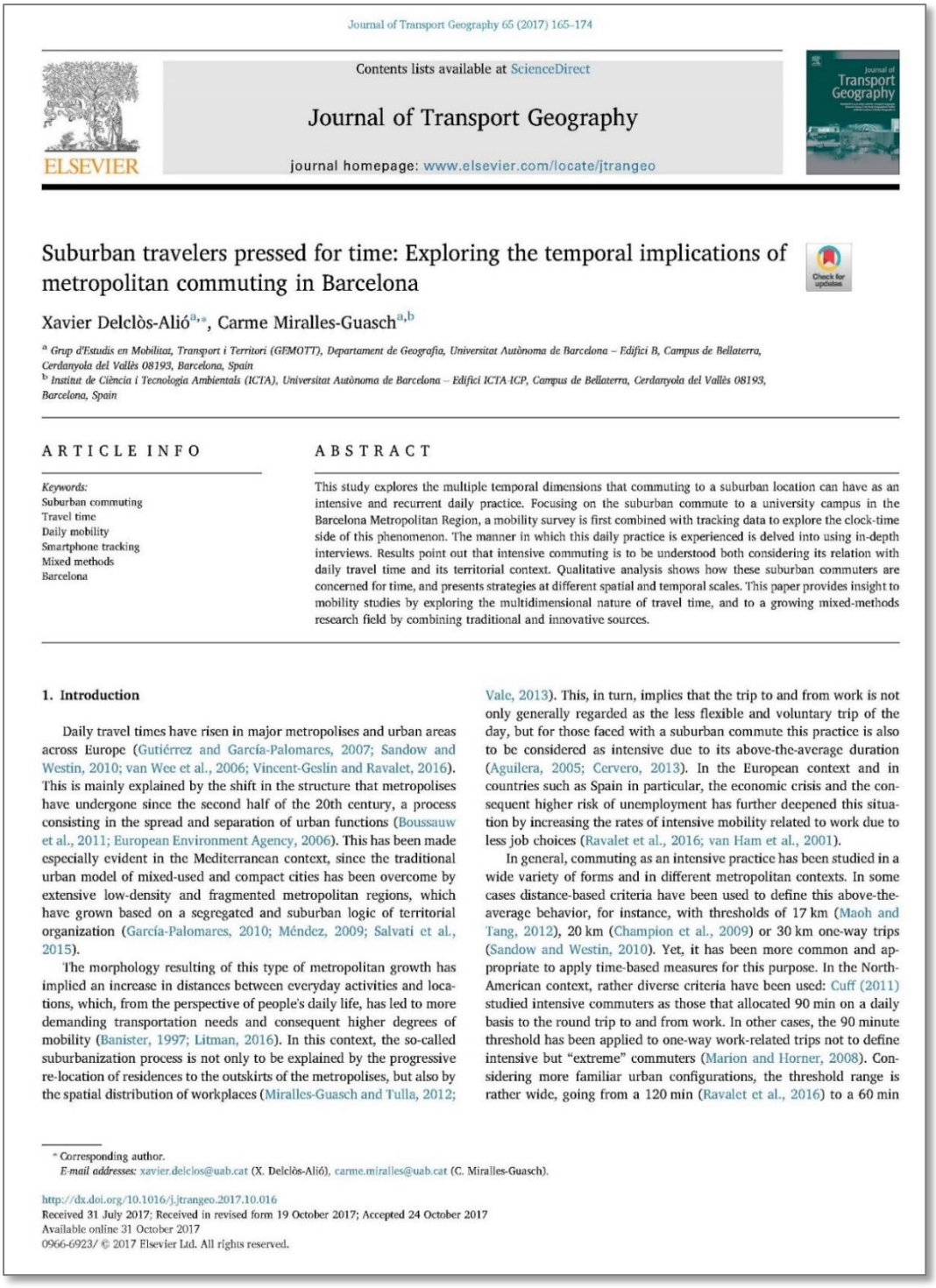
transportation options shows that the decision of taking the car to the UAB in order to save time seems to lead to under-perceive the real duration of the trip, which would again could be understood from the perspective of travelers' expectancies regarding that trip (M. R. Jones & Boltz, 1989).

On a methodological note, while the study has applied an innovative approach by comparing data from a traditional travel survey to a smartphone tracking app, as in any developing methodology, consideration must be taken that the differences in travel time perception could be slightly nuanced by the nature of the data source. Even though it is rather unlikely (Kelly et al., 2013; Murakami & Wagner, 1999), the disagreement between perceived and measured travel times could also be affected by the location system's own precision errors. Nevertheless, these margins of error should be considered in the same way as in those studies based upon rather approximate sources, such as those that consider public transport schedules or estimates of optimal routes.

To conclude, the interest of this study is justified by the fact that commuters' decisions are influenced by travel time, yet the duration of this trip is not necessarily experienced as real or clock-time. In this context, tracking based experiments that complement traditional mobility surveys can provide relevant insight for transportation planning and modelling by letting underlying aspects such as perceptions to emerge (Wan & Lo, 2005). In this sense, this smartphone-based study confirms the finding from previous studies that travel time perception differs in systematic ways from actual travel time. The direction and the magnitude of this difference matches, with only some exceptions and new results, what was found by previous research in regard to personal and especially trip characteristics. These, in turn, are proven to play a significantly higher role shaping our perception of travel time. On the other hand, the nature of the analyzed trip, a repetitive commute to a suburban setting, is thought to be the explanation for the observed average under-perception of its duration, which constitutes the main difference compared to previous studies. On a final note, as a way to contribute to the increasingly promising research field regarding the use of mobile phone data for travel behavior research (Z. Wang et al., 2017), the smartphone is proven here to be a useful

research tool for travel time analysis, since the results drawn from this experiment do not appear to be less accurate than the use of special-purpose devices.

5.3. Suburban travelers pressed for time: Exploring the temporal implications of metropolitan commuting in Barcelona



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Suburban travelers pressed for time: Exploring the temporal implications of metropolitan commuting in Barcelona

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ABSTRACT

This study explores the multiple temporal dimensions that commuting to a suburban location can have as an intensive and recurrent daily practice. Focusing on the suburban commute to a university campus in the Barcelona Metropolitan Region, a mobility survey is first combined with tracking data to explore the clock-time side of this phenomenon. The manner in which this daily practice is experienced is delved into using in-depth interviews. Results point out that intensive commuting is to be understood both considering its relation with daily travel time and its territorial context. Qualitative analysis shows how these suburban commuters are concerned for time, and presents strategies at different spatial and temporal scales. This paper provides insight to mobility studies by exploring the multidimensional nature of travel time, and to a growing mixed-methods research field by combining traditional and innovative sources.

1. Introduction

Daily travel times have risen in major metropolises and urban areas across Europe (Gutiérrez and García-Palomares, 2007; Sandow and Westin, 2010; van Wee et al., 2006; Vincent-Geslin and Ravalet, 2016). This is mainly explained by the shift in the structure that metropolises have undergone since the second half of the 20th century, a process consisting in the spread and separation of urban functions (Boussauw et al., 2011; European Environment Agency, 2006). This has been made especially evident in the Mediterranean context, since the traditional urban model of mixed-used and compact cities has been overcome by extensive low-density and fragmented metropolitan regions, which have grown based on a segregated and suburban logic of territorial organization (García-Palomares, 2010; Méndez, 2009; Salvati et al., 2015).

The morphology resulting of this type of metropolitan growth has implied an increase in distances between everyday activities and locations, which, from the perspective of people's daily life, has led to more demanding transportation needs and consequent higher degrees of mobility (Banister, 1997; Litman, 2016). In this context, the so-called suburbanization process is not only to be explained by the progressive re-location of residences to the outskirts of the metropolises, but also by the spatial distribution of workplaces (Miralles-Guasch and Tulla, 2012; Vale, 2013). This, in turn, implies that the trip to and from work is not only generally regarded as the less flexible and voluntary trip of the day, but for those faced with a suburban commute this practice is also to be considered as intensive due to its above-the-average duration (Aguilera, 2005; Cervero, 2013). In the European context and in countries such as Spain in particular, the economic crisis and the consequent higher risk of unemployment has further deepened this situation by increasing the rates of intensive mobility related to work due to less job choices (Ravalet et al., 2016; van Ham et al., 2001).

In general, commuting as an intensive practice has been studied in a wide variety of forms and in different metropolitan contexts. In some cases distance-based criteria have been used to define this above-the-average behavior, for instance, with thresholds of 17 km (Maoh and Tang, 2012), 20 km (Champion et al., 2009) or 30 km one-way trips (Sandow and Westin, 2010). Yet, it has been more common and appropriate to apply time-based measures for this purpose. In the North-American context, rather diverse criteria have been used: Cuff (2011) studied intensive commuters as those that allocated 90 min on a daily basis to the round trip to and from work. In other cases, the 90 minute threshold has been applied to one-way work-related trips not to define intensive but "extreme" commuters (Marion and Horner, 2008). Considering more familiar urban configurations, the threshold range is rather wide, going from a 120 min (Ravalet et al., 2016) to a 60 min

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5.3.1. Introduction

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The morphology resulting of this type of metropolitan growth has implied an increase in distances between everyday activities and locations, which, from the perspective of people's daily life, has led to more demanding transportation needs and consequent higher degrees of mobility (Banister, 1997; Litman, 2016). In this context, the so-called suburbanization process is not only to be explained by the progressive re-location of residences to the outskirts of the metropolises, but also by the spatial distribution of workplaces (Miralles-Guasch & Tulla, 2012; Vale, 2013). This, in turn, implies that the trip to and from work is not only generally regarded as the less flexible and voluntary trip of the day, but for those faced with a suburban commute this practice is also to be considered as intensive due to its above-the-average duration (Aguilera, 2005; Cervero, 2013). In the European context and in countries such as Spain in particular, the economic crisis and the consequent higher risk of unemployment has further deepened this situation by increasing the rates of intensive mobility related to work due to less job choices (Ravalet, Vincent-Geslin, & Dubois, 2016; van Ham, Mulder, & Hooimeijer, 2001).

In general, commuting as an intensive practice has been studied in a wide variety of forms and in different metropolitan contexts. In some cases distance-based criteria have been used to define this above-the-average behavior, for instance, with thresholds of 17 km (Maoh & Tang, 2012), 20 km (Champion, Coombes, & Brown, 2009) or 30 km one-

way trips (Sandow & Westin, 2010). Yet, it has been more common and appropriate to apply time-based measures for this purpose. In the North-American context, rather diverse criteria have been used: Cuff (2011) studied intensive commuters as those that allocated 90 minutes on a daily basis to the round trip to and from work. In other cases, the 90 minutes threshold has been applied to one-way work-related trips not to define intensive but "extreme" commuters (Marion & Horner, 2008). Considering more familiar urban configurations, the threshold range is rather wide, going from a 120 minute (Ravalet et al., 2016) to a 60 min. round-trip, using large metropolises such as Paris and London as evidence (P. Jones, Massot, Orfeuil, & Proulhac, 2008). This is in clear accordance with research that has aimed at understanding commuters' tolerance towards travel time, which has pointed out that the probability of searching for an alternative job increases sharply if commuting time exceeds 45 minutes (van Ommeren, 1998).

A growing number of studies have analyzed not only the causes and defining elements of intensive commuting, but also the implications that it has from different points of view. Considerable attention has been paid to its environmental impacts, especially due to its link with higher degrees of motorization (Marique, Dujardin, Teller, & Reiter, 2013; Soria-Lara, Miralles-Guasch, & Marquet, 2017), its economic costs both socially and individually (Burchell, Downs, McCann, & Mukherji, 2005), and its related feelings of anxiety and stress while travelling (Cheng, 2010; Morris & Guerra, 2015; Rissel, Petrunoff, Wen, & Crane, 2014). To this point it has to be considered that people's behavior in space and time is comprised in the frame of the 24-hour day, which is hence regarded as a temporal budget that is expected to be managed to the extent that our personal capabilities and social links and constraints allow for it (Hägerstrand, 1970; Sui, 2012). This implies that time dedicated to the commute is only a part of all daily time, and hence it can compete with other life domains such as leisure, family or community activities (Lyons & Chatterjee, 2008; Viry & Kaufmann, 2015). This has lead researchers to pay attention to the consequences of intensive commuting in terms of social interaction and satisfaction (Delmelle, Haslauer, & Prinz, 2013), and even its effects in overall people's happiness (Nie & Sousa-Poza, 2016; St-Louis, Manaugh, Van Lierop, & El-Geneidy, 2014).

In this context, provided that our ability to manage time is recognized as one of the key variables in assessing quality of life (Aaker, Rudd, & Mogilner, 2011; Nowotny, 2005), especially in a moment in which societal and individual time feels to be compressing and accelerating (Rosa, 2013; Wajcman, 2015) the purpose of this study is to delve into the different temporal implications that the intensive trip to and from work has among a group of suburban commuters. Most studies focused on commuting time, with only some recent exceptions (Bjørner, 2015), have been generally approached from a sole methodological perspective, this either being quantitative, qualitative, or increasingly using new data sources such as those offered by Information and Communication Technologies (ICTs) (Shen, Chai, & Kwan, 2015). This has provided interesting yet unilateral perspectives on commuting time, since, as Cipriani (2013) explains, time is not homogenous as it depends on individual and social contexts, and therefore presenting "*different facets*". This is especially relevant in terms of daily mobility time, one of the components of social time (Miralles-Guasch, 2011), as it involves complex mental processes both in regard to individuals' characteristics, relationships and also their own perceptions and expectations (Jain & Lyons, 2008; Li, 2003). Consequently, a study aimed at the different implications of suburban commuting duration cannot only be referred to the objective dimension of clock-time, but also to how this daily practice is experienced and managed (Joly & Vincent-Geslin, 2016). In this context, there is now a growing number of studies that combine methods in order to gain deeper understandings of social phenomena such as daily mobility, which is known as a mixed methods approach (Mertens, 2011). For instance, Christensen et al. (2011) and Babb, Olaru, Curtis, & Robertson (2017) discuss the potential benefits of using GPS tracking combined with ethnographic fieldwork to study children's mobility behavior, while Meijering & Wietkamp (2016) stated that combining traditional with innovative sources (specifically GPS with interviews) also help in understanding the complexities of older adults' everyday mobilities.

In this study a university community located in a suburban campus in the Barcelona Metropolitan Region (Spain) is used as evidence of intensive commuting. While, traditionally, the suburban commuter has been mainly studied from the perspective of the residential context, in this case our approach focuses on the location of the

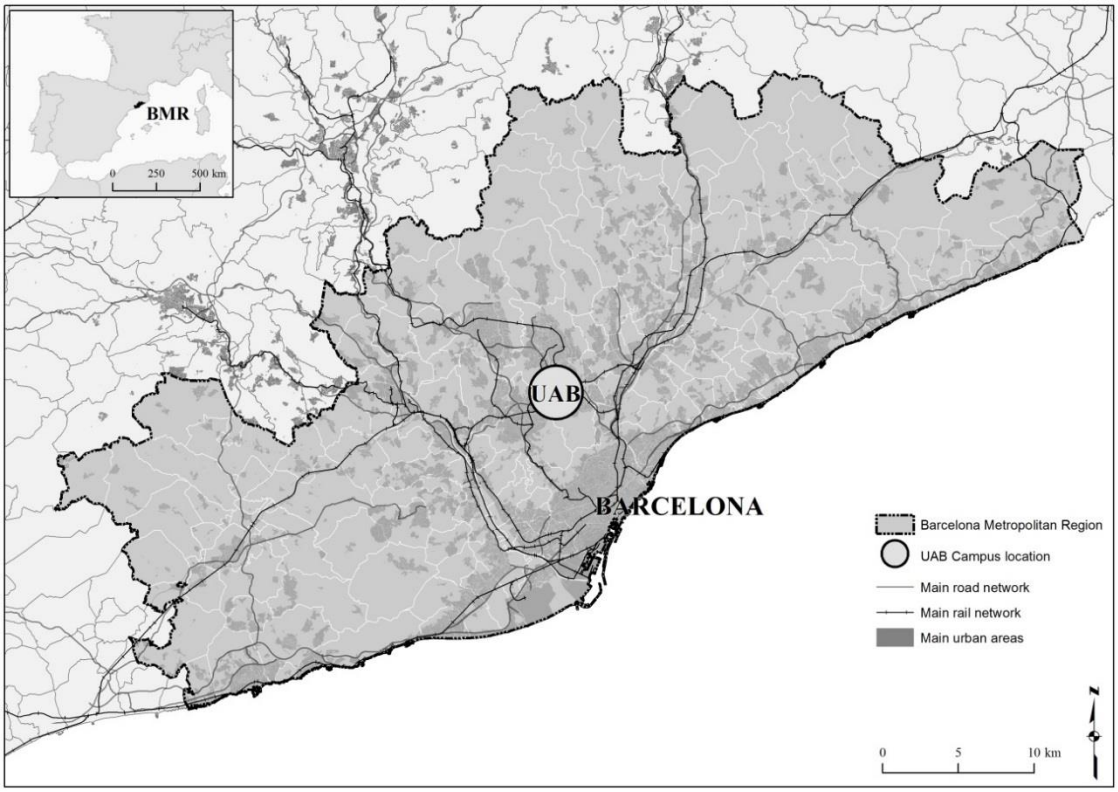
workplace. Therefore, we analyze commuters who reside in different parts of the metropolitan area but who commute to this isolated campus on a daily basis. In order to explore this suburban trip's temporal implications, a mixed-methodology is implemented to give answer to different and complementary research questions: What is the temporal investment of the commute in such an exemplificative case as that of a suburban university campus in the context of a Mediterranean metropolis? What is the role that this time-intensive trip plays in the everyday life of suburban commuters? How is commuting time regarded, experimented and managed among these intensive travelers? The remainder of the article is structured as follows: Section 5.3.2 presents the methodological approach as well as the territorial context; in Section 5.3.3 the results of the analyses are explained. These are then discussed and concluded in Section 5.3.4.

5.3.2. Methodology

5.3.2.1. The UAB community as a group of suburban commuters

The study focuses on the specific case of a suburban university community such as the Autonomous University of Barcelona (UAB). The UAB is located in a campus outside the main urban area of the Barcelona Metropolitan Region (Figure 16), and it holds a community of approximately 40,000 members, considering administrative personnel, research staff and students. This university is regarded as a strong territorial node in terms of knowledge spillovers and economic dynamism, but also in terms of mobility, since it attracts a large community on a daily basis. Furthermore, it can be conceived as a rather homogeneous group, as its members not only present a shared destination, but also, as a university community, they partake of similar objectives, needs and preferences (Wedel & Kamakura, 1998). This, in turn, presents such a community as especially interesting for travel behavior studies (Miralles-Guasch et al., 2014).

Figure 16. Location of the UAB Campus in the Barcelona Metropolitan Region.



Own production.

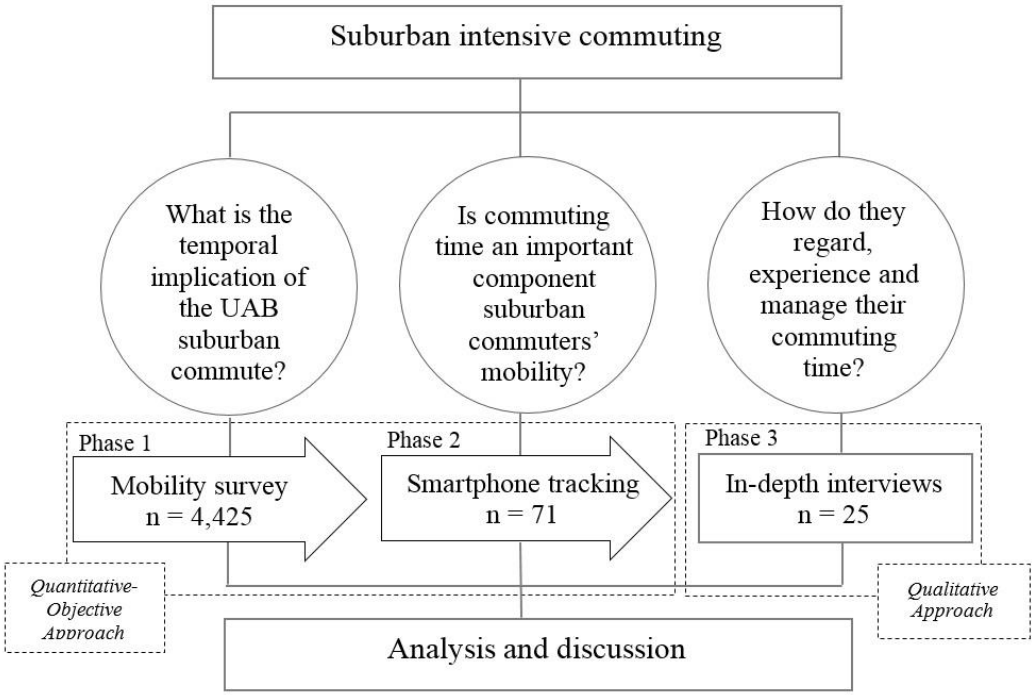
The suburban nature of this campus is explained by its isolated location, but also by the fact that, as a consequence, commuting to and from the UAB involves mainly motorized transportation modes, either by public transit options (60.1% of the cases), or by private vehicles (34.7%), while only a residual 5.2% of the UAB community accesses the campus in non-motorized transportation modes such as biking or walking (GEMOTT, 2015).

5.3.2.2. Research design: a three-step mixed methodology

In order to explore the multifaceted nature of travel time in the specific context of suburban intensive commuting, a mixed-methodology is presented in this study as the most adequate approach (schematized in Figure 17). The study is based on a three-step process, which is aimed both at providing results at each specific stage and also stablishing the groundwork for the following stages. This research plan was designed around the research questions used as guidelines for the analysis. The first part of the study is based on a combination of quantitative and objective data to measure the specific role and nature of commuting time in their daily life. To do so, a traditional

mobility survey is used (Phase 1), which is complemented by an innovative individual tracking experiment based on a smartphone app (Phase 2). Later on, the main core of the analysis (Phase 3) is based on qualitative work conducted among a group of participants selected from previous stages. This part of the analysis provides the necessary in-depth complement to the previous stages.

Figure 17. Schema of the three-step methodological design and implementation.



Own production.

Phase 1: The 2015 UAB Mobility Survey

The University Community Mobility Habits Survey (UCMHS) is a traditional mobility survey based on UAB members' responses regarding travel patterns in their daily commute to the campus. This survey includes questions on personal profile, travel patterns (i.e. transportation mode used to access the UAB or declared travel times), as well as opinions regarding travel satisfaction and motivations for modal choice (GEMOTT, 2015). This survey has been conducted once every two years since 2001, being an on-line survey since 2009. Between April and June 2015 the UAB held its 8th edition, providing a total of 4,425 valid questionnaires (±1.4% margin error).

This survey provides two main results in the specific context of this study. On one hand, it offers departure, arrival and total commuting times in campus access and egress, and how much time each community member spends on Campus. On the other hand, it provides opinions and perceptions on that commute, among which, in particular, it is of interest for this study their motive for modal choice.

Phase 2: "Campus Mobility", a smartphone-based tracking experiment

The study of human behavior in space and time has been improved in the last decade with the progress of tracking technologies and their implementation in analyzing individual and collective trajectories (Yue et al., 2014). These tools provide real spatiotemporal data that is not subjected to the usual skewness derived from user's perceptions and memory (Kelly et al., 2013), and also usually offering information on a multiday or even weekly basis (Delclòs-Alió, Marquet, & Miralles-Guasch, 2017). Traditionally, tracking experiments have been based on the use of dedicated GPS devices, which can provide high resolution spatiotemporal data, yet with a limited number of participants. The technological advancement that has permitted the integration of geolocation systems in smartphones, together with the advent of these devices as basic everyday items, present these as interesting tools for mobility research (Birenboim & Shoval, 2016; Ferrer & Ruiz, 2014; Palmer et al., 2013; Vich et al., 2017). When compared to GPS tracking devices, the smartphone can be seen as an interesting alternative based on the fact that it does not need to be given to the participant, and that is less likely to be left at home (Montini, Prost, Schrammel, Rieser-Schüssler, & Axhausen, 2015).

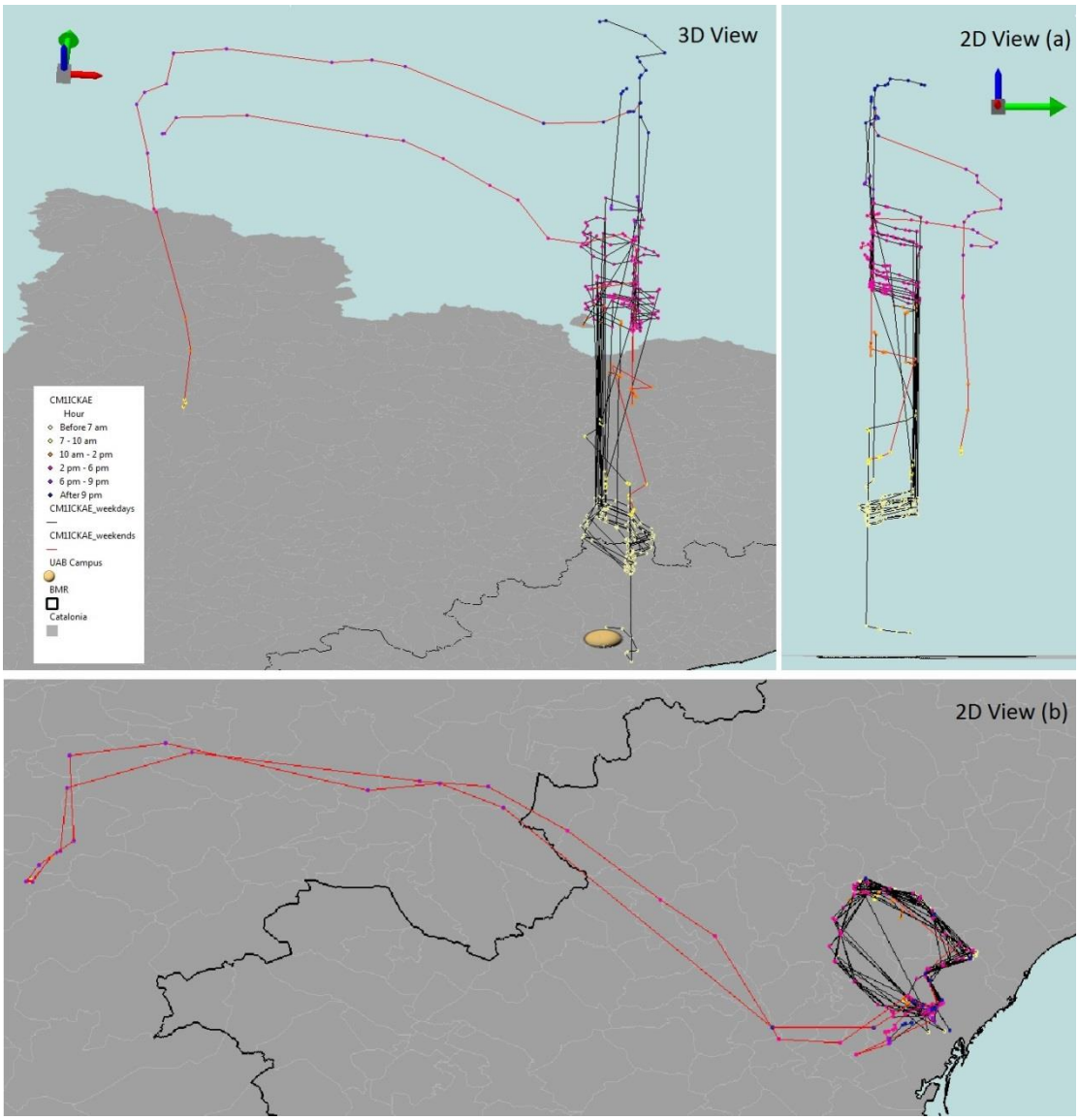
In line with this growing methodological field, Phase 2 of this experiment is based on data extracted from a smartphone app. The 2015 edition of the UHCMS was complemented with a voluntary tracking experiment based on an ad-hoc app called "*Campus Mobility*" (free for Android users at the Google Play Store ©). This app tracked the users' itinerary using satellite signal (specifically Global Positioning System) or either cellphone network or Wi-Fi connection when the previous were not available. A total of 233 survey respondents declared an interest in the experiment and downloaded and correctly installed the app. As in every tracking-based study, privacy and

anonymity was guaranteed in every step of the process, from their interest in the experiment to data management, processing and analysis.

From the total 233 survey respondents who had initially downloaded the app, only those with a minimum registered data of 12h per day and with at least 2 and up to 5 days of participation were initially selected. As the focus of this paper is on suburban commuting, only those individuals who commuted on motorized transportation modes (either in private or public transportation) were selected, resulting in a final sample of 71 individuals. Each participant recorded an average of 2.6 correct days of activity, which resulted in 189 user-days of valid data.

In order to depict daily travel times, two processes were conducted: first, a threshold of one meter per second was established to differentiate when participants moved from when they were stationary, and every location registered from the app was tagged accordingly. Second, all participants' daily tracks were manually analyzed based on 3D geovisualization in ArcGIS (ESRI ArcScene 10.3). This kind of technique has been used in previous research to identify specific mobility patterns, and especially in terms of commuting, that would prove to be more difficult using other methods (Kwan, 2004; Kwan & Kotsev, 2015; Shen et al., 2013). Moreover, the geovisualization of each of the participants' daily and weekly space-time paths were also used in order to select potential interviewee's for *Phase 3* of the analysis, specifically by identifying rather repetitive and intensive commuting practices both in space and time, which would not have been possible only using temporal data from the app. An example of a random participant's daily tracks in space and time is presented in Figure 18, in which X and Y coordinates represent space, while Z coordinate represents time. The black itineraries represent this participant's everyday behavior, while the red track represents an exceptional weekend trip.

Figure 18. Example of analyzed space-time tracks for one participant in 3D and 2D views.



Own production with ESRI ArcScene 10.3.

Phase 3: In-depth interviews among tracking participants

Results from Phase 1 and Phase 2 provided data to select a group of suburban intensive commuters among which conduct the qualitative part of this study. Therefore, interviewees for this part were selected using the technique of purposive sampling, considering that no statistical inferences are intended. This process resulted in a final group of 25 interviewees. The criteria to be selected for the interviews were: 1) to have taken part in the survey, 2) to have participated in the tracking experiment for more than two days and 3) to have declared in the survey an average round-trip commuting time of more than one hour. Also, it was also aimed to include different sociodemographic

profiles based on age, gender and role at the UAB, and also different commuting access characteristics, mainly transportation modes (sample description is presented later on in Table 12).

This qualitative part of the study was designed around semi-structured in-depth interviews[7]. These were a priori organized around three main sections: first, a general and introductory description of the participants' daily routines; second, a reflection on the role of their commute in the context of their everyday organization and its relationship with other activities; third, a specific assessment of the daily commute itself. Each of these blocks were addressed based on a set of possible specific questions that served as guidelines. With this general structure in mind, each interview evolved in different ways depending on the interviewees' responses and how the conversation evolved. These interviews lasted an average of 25 to 30 minutes (the shortest lasting 18 minutes and the longest 45 minutes). The audio was recorded with participants' permission. These interviews were later manually transcribed and analyzed using qualitative-oriented software MAXQDA © Plus v10.9.8.1.

5.3.3. Results

The results of the study are presented in relation to the three different steps defined in the methodological section: results from the survey first present the suburban commute signifies a considerable temporal investment both in terms of objective travel time and also in their regards towards modal choice; second, drawing from the data extracted from the tracking experiment, it is seen how daily commuting has plays an extensive part in overall daily mobility; third, the in-depth interviews provide deeper insight on how this commuting time is clearly regarded as a key element in their daily organization, which implies several temporal implications in the form of effective or desired tradeoffs. Lastly, rather different strategies have been identified among these suburban intensive commuters in order to cope with their feeling of temporal pressure.

[7] *Though not included in the published version of the manuscript, the guideline for the interview can be found in Annex 9.2 at the end of the dissertation.*

5.3.3.1. Background data: the time-intensive nature of the UAB suburban commute

The suburban nature of the UAB campus is translated into considerable temporal investments in the daily commute of its community. The results of the survey (Table 10) show how 70% of university members can be regarded as intensive commuters, considering that they invest more than 1h every weekday to their round-trip commute. Not only this, but it is also to be highlighted that a 24.1% of these could even be regarded as extreme commuters, with daily round-trip times of more than 2h.

Table 10. Round-trip commuting times to the UAB, 2015.

	n	**%**
Less than 1 hour	1,419	32.1
Between 1h - 1h 30m	835	18.9
Between 1h 30m - 2h	1,004	22.7
More than 2 hours	1,067	24.1
No data	100	2.3
Total	4,425	100.0

The intensive nature of this temporal investment is not only a function of its total duration, but is also confirmed by how these commuters express their mobility strategies and expectations in the survey. Drawing from these results we learn that despite the variety of reasons to choose a transportation mode, the most repeated motives are, in general, related to time (a 52.9% of the motives, specifically: "*Fastest option"*=22.2%, *"Shortest access time from home"*=15.1%, *"Better schedule combination"*=10.7%, *"More reliable or timely"*=4.9%). When each transportation mode is regarded separately, time concerns are especially acute for car and motorbike users, as the desire to minimize trip duration accounts for 61.4% of their motives. But not only this, but furthermore an important portion of public transit users that would like to switch to driving also express this desire either as a strategy to improve control over their daily time (36.4%) or simply to save it up (18.4%).

5.3.3.2. Daily travel time beyond commuting

Daily travel time is not only invested in the trip to and from work. Temporal data extracted from the app allows us to analyze how daily travel time is distributed considering all everyday trips, also including the daily commute (Table 11).

Time allocated for the commute represents approximately a 75% of daily travel time among this group of suburban travelers. This proportion is rather homogeneous across all profile segments, which is another evidence of the time-intensive nature of the suburban commute. Yet, some interesting differences can be underlined. Young members and those that use public transit in their commute seem to be investing a significantly larger share of daily travel time on commuting than their counterparts. This is not a coincidence, as in the case of the UAB, using public transit is a generalized strategy among young people (Miralles-Guasch & Domene, 2010b). On the other hand, it is also interesting to see how those that commute to and from the UAB every working day and those that have full-time dedications present shorter commuting times and also lower shares of this trip in relation to their daily travel time.

Table 11. Tracking results: daily travel times among user-days (n) considering main profile characteristics.

	n	Round-trip commuting time	Daily travel time	Commuting share of DTT
		Mean (hh:mm:ss)	Mean (hh:mm:ss)	Mean (%)
Total	189	1:04:53	1:30:04	74,7
Gender				
Males	82	1:13:48	1:39:44	75,4
Females	107	0:58:03	1:22:40	74,1
*Age in years**				
35 or less	77	1:17:08	1:40:01	79,2
More than 35	107	0:54:58	1:22:18	70,9
UAB role				
Students	73	1:12:17	1:39:54	75,1
Staff	116	1:00:14	1:23:54	74,4
UAB attendance frequency				
Not every working day	51	1:19:20	1:42:00	76,5
Every working day	137	0:59:05	1:25:19	73,9
UAB attendance duration				
Part-time (4h or less)	20	1:23:36	1:51:10	80,5
Full-time (More than 4h)	169	1:02:40	1:27:35	74,0
Commuting mode				
Public transit	66	1:20:13	1:44:12	79,0
Private vehicle	123	0:56:40	1:22:30	72,3

**Some participants did not declare their age, (n=5).*

For suburban commuters such as these, long commuting times are translated in smaller portions destined to trips other than commuting. This, in turn, implies that some kind of temporal budget exists and is organized between different activities, which in this case

seems to be translated into a reduction of personal-related travel time. This is further explored in the next sub-section.

5.3.3.3. A qualitative assessment of daily travel time among intensive suburban commuters

Time that allocated to commuting not only implies a significant quantitative portion of suburban commuters' everyday mobility, but is also conceived as a key part of their everyday life, implying tradeoffs and different response strategies. This is explored based on the 25 in-depth interviews presented in the following paragraphs.

Table 12. Profile characteristics of the 25 interviewees.

n	*Code (Initial_Gender_Age)**	*Status at the UAB*	*UAB attendance frequency*	*Commuting mode*
1	B_M_33	Student	Every working day	Train
2	G_M_39	Student	Every working day	Car
3	D_F_27	Administrative personnel	Every working day	Car
4	A_F_31	Student	Not every working day	Train
5	T_F_28	Student	Not every working day	Train
6	A_M_47	Research staff	Not every working day	Train
7	P_M_33	Research staff	Not every working day	Train
8	L_M_34	Research staff	Not every working day	Interurban bus
9	V_M_42	Research staff	Not every working day	Train
10	N_M_37	Research staff	Every working day	Train
11	X_F_28	Student	Not every working day	Car
12	U_M_22	Student	Not every working day	Train
13	P_M_63	Research staff	Not every working day	Car
14	E_F_39	Administrative personnel	Every working day	Car
15	F_M_36	Administrative personnel	Every working day	Car
16	F_F_21	Student	Every working day	Train
17	G_F_45	Administrative personnel	Every working day	Motorcycle
18	O_M_44	Research staff	Every working day	Train
19	S_F_50	Administrative personnel	Every working day	Car
20	T_M_23	Student	Every working day	Train
21	A_M_39	Student	Every working day	Train
22	C_M_48	Administrative personnel	Every working day	Car
23	D_F_42	Administrative personnel	Every working day	Car
24	E_M_24	Student	Not every working day	Car
25	B_F_31	Student	Not every working day	Car

**Original initials have been changed to preserve interviewees' anonymity.*

Time pressure and the suburban commute as a key element in daily organization

Interviews started by talking about the participants' daily routines and how these were regarded. The concept of *"time"* repeatedly appeared in the conversations in diverse ways and in different moments: interviewees expressed concerns regarding time optimization in their everyday life, they complained about having to spend too much time out of home, and made comments on how they had too many things to do or that

they had to cope with tight and rigid schedules. These feelings were found especially acute among female commuters.

> *D_F_27: "My job is, to say, my main concern. [...] Optimizing time is really important; time is money!"*[8]

> *D_F_42: "I have very tight schedules, and when I work in the evenings, I don't get out until six in the afternoon. But rather than time spent per se is the fact of having lots to do and having to balance the schedules."*

When explicitly asked about their daily commute, interviewees' responses did not address the origin of such a situation (the distant location of their residence and workplace), but rather they focused on the characteristics of the trip, almost exclusively referring to its long duration as the main defining element. In this regard, almost every interviewee talked about the temporal investment that this trip implied, and some of them explained how they had grown accustomed to this situation, which they could do anything to change. These perceptions resulted in a generalized shared feeling of resignation and a consideration of this travel time as a burden with which they had to cope. This, in turn, was exemplified by words of dissatisfaction, and comments on how they should try to spend less time or, at least, that they would not be willing to spend a minute more on their commute.

> *F_M_36: "I am not satisfied because those are 3 hours of productivity that I have lost. If I could do them from home I would not have to invest that time. I would win and also would the company."*

> *A_M_47: "I am very used to devoting and spending time on transportation. I have already embraced it."*

In this context, the daily trip to and from work was recurrently present among these suburban travelers' explanations regarding how their typical day was played out; this evidenced that commuting was being conceived as a part of their schedule and not an empty slot in the agenda. In this line, interviewees granted time spent commuting the same consideration as that allocated to other daily activities such as work, running errands or leisure activities. Even in some cases, commuting was presented as an element

[8] *Quotes are translated from their original form either in Catalan or Spanish.*

around of which the rest of the day was planned. This was evidenced by the fact that most of these suburban travelers used their daily commute to explain how their daily routines were organized:

> *P_M_33: "My routine is the following: every morning I get up, I take a subway from Joanic to Diagonal / Provença [metro stations] and from there take the train to the UAB. Then I am here almost all day until 6 or 7 pm, and then I take the train back again. This is what I do most of the times."*

Temporal implications of the suburban commute

The second idea that emerged from the interviews is that the temporal dimension of this suburban commute transcended its specific context and had effects at the extent their other temporal spheres. Commuting time was hence identified among the interviewees as a temporal constrictor that resulted in having tradeoffs of different kinds. In this sense, these suburban commuters explained how they had to give up activities that they would like to do because of the long-duration nature of their main trip of the day. The nature of these tradeoffs were diverse, but were more tightly related to personal activities rather than work-related tasks: participants explained how, if they could, they would rather use that travel time for activities such as going to the gym, reading, or spending time with their friends or family. This was especially relevant for staff members who were parents with children at their charge, as opposed to interviewed students.

This feeling was nevertheless nuanced later on when asked about what *in fact* they thought they would do if they could avoid the daily commute. Most participants answered they would try to use that time for productive purposes such as working or reading (work-related material), yet this was not universal, as some of them finally pointed out that they would most surely end up not taking full advantage of that time.

> *S_F_50: "I wish it as less [referring to commuting time]. It would be time that could be spent on other things; things for me, for instance, to join a gym, or just relax."*

> *A_F_31: "Looking at it objectively, I don't think I would work more during that hour. It is not related to that. [...] I would get up later. Or I would be on the internet, just like that, doing whatever."*

Strategies to cope with commute-driven temporal pressure: between the daily and the weekly scale

Thirdly, a set of strategies was identified as being conducted as a response to the temporal investment that long commutes imply. These strategies can be explained at two different planes. A first set of strategies was identified at the daily context in relation to the transportation mode used in the commute. Second, a shared tactic was observed across all suburban commuters, which is the switch of the organizational framework from the daily to the weekly scale.

The strategies identified at the daily sphere can be interpreted as aiming to "mold" time, in order to change the nature and composition of this travel time to make it more profitable in different ways. As it has been pointed out, these strategies depend on commuting mode. Private vehicle users' strategies were related to the fact that their travel mode allowed them to choose the *when* and the *how* they conducted their commute. In general, given the flexibility awarded by the individual nature of their vehicle, it was recurrent among this group to try and chain different activities on the way to campus or on the way back, such as picking up children or running errands such as buying groceries. Furthermore, even though car use is usually related to shorter commutes and it is thought as a mechanism of saving up time, a specific strategy for car drivers was to try avoiding peak hours by getting up earlier and/or leaving the campus earlier. On the other hand, one of the main tactics pursued among motorcycle commuters was to avoid traffic jams by circulating among cars in, as explained by the very same interviewees, a dangerous activity.

> *D_F_27: "[...] for other tasks such as shopping and all that, I always take advantage of the trip in order to save time. I never travel specifically for a purpose; only for work and that's it."*

> *E_F_39: "I organize so it becomes satisfactory. [...] If at 6:30 am there's nobody on the highway, let's go. I started working 9 to 5, and as transportation became tightened due to be trying to avoid jams, I began to start my schedules before."*

In the different case of public transit travelers, as the duration of their commute cannot be modified as it is conditioned by its timetable, their nearly exclusive strategy was to find ways of adding value to the time spent on the commute. This was achieved basically by employing it on a specific purpose or task. In this sense, a wide diversity of activities emerged in the interviews, among of which the main ones were reading, communicating

with others (either face-to-face or through ICTs), and sleeping. The extent to which travel time was incorporated into the agendas of these suburban commuters was evidenced by the fact that even in some cases, the tasks to be conducted in this portion of their days were planned beforehand, either prior to embarking or the night before. It is important to note here that the possibility or ability to conduct activities while travelling, hence of adding value to this travel time in public transit, resulted in higher satisfaction levels opposed to those who felt this was lost or empty time.

> *O_M_44: "I do other things during the trip. I'm sitting and I'm reading. I could be sitting on the couch at home reading but I don't do that. If I took the car it would be half an hour, stuck in the seat, while on the train it takes one hour, 35 min., which I can use to read."*

Other than the tactics found at the daily scale, a generalized strategy is identified across transportation modes and participants' profile, which is a switch in the organizational framework. It was detected among this group that they complemented the strategies at the daily scale with others at the weekly plane. The week, hence, was regarded as the budget to be managed rather than the day, which was translated into two specific approaches. On one hand, flexibility in UAB access days was a recurrent topic in these conversations. These suburban commuters valued the idea of commuting only some days of the week either as something they already did or something they would consider as an adequate response to their current situation (as most of the interviewees had a full-time entailment with the UAB). This was translated into considering partial tele-work as an appreciated possibility among administrative and research staff, and only having some days of face-to-face lectures among students. On the other hand, it was also common among this group to organize everyday tasks not only across the weekday, but also considering the weekend, for instance, to do groceries or to socialize, even though without the temporal inflexibility noted during the week. In this sense, the time of weekend was regarded in several occasions as an extension of the work-week budget.

> *L_M_34: "[referring to the UAB], if I had to do it every day, I would not be willing to sacrifice two hours and twenty or thirty minutes every day."*

> *B_F_31: "There are days when I get nervous in the car, especially in the morning. For this reason I didn't sign up for more courses, so I didn't have to come more days."*

D_F_42: "Usually the weekend is different. I would say that we spend less time, as usually we don't do that much, but for instance we will do the weekly shopping, because during the week we can't, so we take the whole family with the car."

5.3.4. Discussion and conclusion

In order to understand the multiple temporal dimensions of intensive commuting, a mixed-method analysis of the commute to a suburban setting in the Barcelona Metropolitan Region (BMR) has been conducted. This daily practice indeed involves a significant temporal investment, but its intensive nature is also related here to the fact that this one single trip represents an average of three quarters of individual daily travel time, as pointed out by tracking data. In addition, the qualitative part of the study has allowed deeper implications of intensive commuting to emerge, as well as response-oriented strategies conducted at different spatial and temporal scales.

The intensive nature of the suburban commute in Mediterranean metropolises such as Barcelona is to be interpreted not only by its lengthy duration, which has been traditionally used as a start point in related research, but also considering the characteristics of the environment in which it takes place, as this is the main element shaping daily travel behavior (Ewing & Cervero, 2010). In this sense, the fact that this one-hour commute represents 75% of these travelers' daily travel time explains how the suburbanization process has resulted in a change of patterns in comparison to the short-distance nature given by its mixed-used and compact urban tradition.

As a result of this situation, the analyzed group of suburban commuters appeared to be time-concerned in different ways, pointing out that how this daily practice is lived and perceived also shape how travel time is conceived, especially in long trips (Li, 2003). In the qualitative part of the survey time was especially present in relation to their modal choice, which agrees with related research (Palma & Rochat, 2000). Moreover, a sense of being pressed for time was picked up from the interviews, this being interpreted as a consequence of having to cope both with tight schedules and the long duration of the commute. As a result, the daily commute was conceived as a structuring part of the day,

with different kind of tradeoffs drawing from it. This led to feelings of resignation and dissatisfaction which are clearly expressed by the interviewees. This is in accordance with that found in related studies that have proved how long work-related trips imply lower levels of happiness, and even also an overall decrease in personal wellbeing (Delmelle et al., 2013; van Ommeren, 1998).

To this point, of special interest are the different strategies that participants simultaneously articulate both at explicit and implicit planes in order to address the intensive nature of their commute. Explicit response-oriented strategies, more familiar to travel behavior studies, are mainly aimed either at minimizing or molding travel time, and are highly dependent on the mode of transportation that is used in the commute. In this sense, transit riders sought to assign a specific use to time spent traveling by conducting activities on-the-go, especially helped by ICTs. This led them not to conceive the trip time as entirely empty or useless, and, reinforcing what has been pointed out by other researchers, in some cases even seeing it as a gift in the context of the day (Jain & Lyons, 2008). On the other hand, taking into consideration the flexible nature of private vehicle use, drivers aimed either at shortening travel time by any means possible, for instance by waking up earlier or leaving work later, or at taking advantage of it by chaining different trip purposes. An interesting contradiction can be found in this sense, since while in the survey drivers appeared to be more concerned for time, not always they seemed to acknowledge the temporal implications that result from changing their habits in order to spend less time on the road, which has also been found in related research (Sanz, 1996). In any case, the explicit expression of the strategies both for public transit users and drivers serve as evidence of how the commute to work is the most rigid of all daily trips. This is made clear by the fact that while interviewees expressed different kinds of time-related concerns and strategies, they did not seem to challenge the spatial separation between their residence and their workplace, and therefore conceive a change-oriented strategy, but instead they tended to focus on the aforementioned trip-related aspects as rather adaptive measures.

A deeper level of strategies is identified as taking part at an implicit plane. While the most restrictive and rigid activity of the day is forced to the outskirts of the metropolis,

and therefore involving a long trip, the remaining daily activities are re-arranged in a second plane and have to become more flexible both in space and time (Gimenez-Nadal & Sevilla-Sanz, 2011). This is evidenced by how 25% of daily travel time is enough to access these activities, for instance to shop, to run errands or to pick up someone, and hence necessarily involving short travel times. This can be clearly regarded as a subjacent territorial-driven strategy, as the characteristics of the urban environment in which these suburban commuters live is allowing them to compensate the long-nature of their commute by offering possibilities at another and complementary territorial scale. This is possible considering that the suburbanization process in large Mediterranean urban areas has overlapped, not substituted, its traditional compact and diverse centers, which highlights the relevance of dense, mixed-used and walkable urban environments (Marquet & Miralles-Guasch, 2015).

While the territorial context allows this daily temporal interplay, another kind of compensation is taking place at the weekly scale. In this sense, even though these suburban commuters conducted the aforementioned tactics on a daily basis, they still needed to make use of other days in the week in order to extend their travel time budget (Joly & Vincent-Geslin, 2016). This may very well be implying that temporal compensations are at play both at the daily and the weekly scale and, therefore, that in future studies the concept of "routine" among intensive commuters may not only be understood from the perspective of the day-to-day basis, but rather in a weekly or even monthly plane. This is made especially evident when the relational dimension of spatiotemporal behavior is considered, since this kind of temporal relation is especially relevant for those who have responsibilities linked with the needs and purposes of others (Lyons & Chatterjee, 2008), especially among women with children at their charge (Darcy, Stubbs, Perry, & Blunden, 2005).

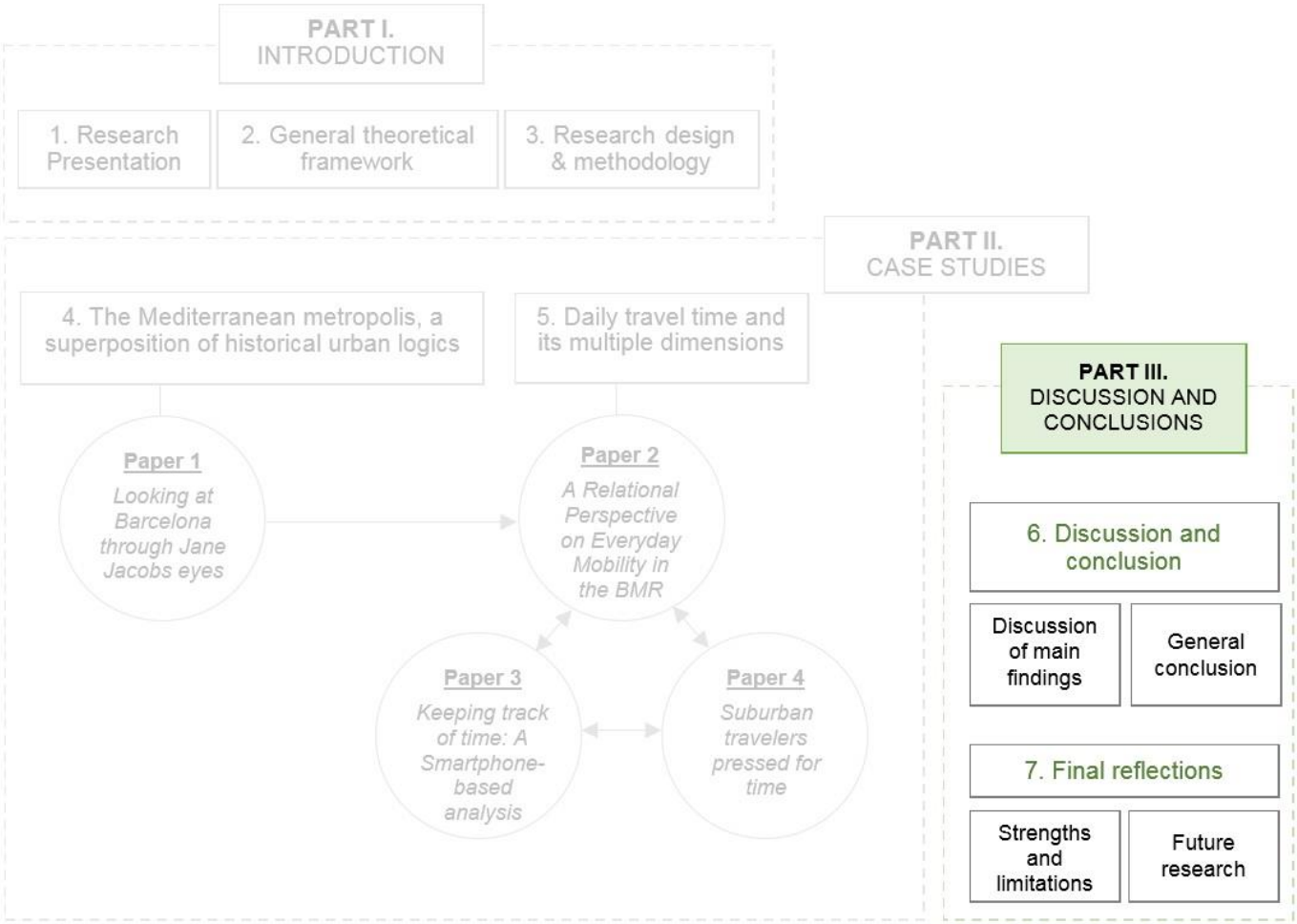
From a policy perspective, these type of results can provide insight for urban and transportation planners mainly by setting the basis for policies addressed at facing individual accessibility challenges. In this sense, if these are to be minimized by enforcing smart growth and proximity environments (Calonge Reillo, 2017; Litman, 2017), in the case of Mediterranean metropolis such as Barcelona this largely means

going back to traditional urban configurations (Busquets, 2005). Moreover, explorations of individual experiences and perceptions such as those presented in this paper can provide alternative policy-oriented knowledge by not only considering rational behavior patterns but also personal motives and reflections on key issues such as workplace or residence selection (Mondschein, Blumenberg, & Taylor, 2010). Also, one of the main challenges that emerges from the analysed commuters explanations is one aimed at improving the day-to-day travel experience, especially for those facing long-distance trips on transit, mainly through public transportation investments in that direction (Lyons & Chatterjee, 2008).

On a methodological note, the multiple-layered understanding of suburban commuting as an intensive practice presented in this paper serves as evidence on how mixed-method study designs can provide innovative and comprehensive scopes in a rather quantitative-oriented and unilateral research tradition. In this sense, the different facets and scales of such a phenomenon can only emerge if different data sources and methodologies are applied. In this case, a traditional travel survey was enhanced with in-depth interviews and smartphone tracking data, which is now increasingly recognized as a promising tool specifically for mobility studies (Birenboim & Shoval, 2016). Nevertheless, several limitations of the paper can be pointed out in order to be addressed in future studies. First, in regard to the tracking side of the experiment, it has to be considered that, as in other studies, while the data may provide detailed, high-resolution and multi-day information of the participant spatiotemporal behavior, the dimension of the sample and its representativeness power is still the main challenge to overcome (Palmer et al., 2013). Second, while representing such tracking experiments in 3D environments may become insightful for researchers, it is still difficult to empirically analyze these beyond their individual and visual exploration. Lastly, while university campuses may prove as interesting research scenarios for mobility studies such as the one presented in this case, it has also to be considered that these environments host communities that might not be entirely representative of the general population, mainly due to a large share of student commuters who present specific mobility patterns and preferences.

To conclude, this paper sought to achieve a better understanding of what implications specific territorial structures can have on an individual perspective, specifically through the analysis of an intensive daily practice such as the commute to a suburban location. In this sense, the combination of methods has brought to light a set of temporal tensions and interplays resulting from the spatial separation of basic activities such as workplaces and residences. In this sense, besides energy consumption, air pollution, higher investment in transport infrastructure, and loss of agricultural land and open space, the results found in this study can also be regarded as relevant transport-related externalities of segregated and low-density urban models, even though these are still largely understudied.

PART III. DISCUSSION & CONCLUSIONS



6. Discussion and conclusion

6.1. Discussion of main findings

The main results extracted from the four case studies included in the dissertation are hereby summarized and highlighted in order to ease a general joint interpretation. This summary is structured based on the general research questions and corresponding hypotheses described in Chapter 1.

In response to the general hypothesis regarding the multiple dimensions of daily travel time (H0)

The general aim of this thesis was to explore and understand the different dimensions of daily travel time from different perspectives and in relation to its different contexts. The construction of the methodological prism described in Chapter 3 has allowed the uncovering of different interpretations of travel time and therefore confirming the general hypothesis of this thesis. Travel time is not linear and objective, but instead presents many different sides both in terms of its daily amount and composition, and also in terms of how it is perceived and how it is managed on a daily basis. Not only this, but also an underlying relation between these different interpretations of time can be drawn with the characteristics of the base of the pyramid, corresponding in this case to the Mediterranean metropolis.

In order to evidence these ideas the following paragraphs aim to provide insight for each of the derived specific hypothesis, and then to present a joint conclusion in Section 6.2 in relation to these specific dimensions of travel time.

Regarding the territorial specificities of the Mediterranean metropolis (H1)

The theoretical approach that Jacobs provided has proven useful to highlight that this urban area is far from homogeneous. The results obtained in the paper 4.1 point out that a considerable part of the Barcelona conurbation, the core of the metropolitan region, can be regarded as vital while, conversely, a significant share of this territory is classified as having low vitality or no vitality at all.

These results are explained by the coexistence of two urban logics: on the one hand, a polycentric nature defined by the presence of historical towns and centers, both at the core of the conurbation and also in adjacent municipalities, representative of the traditional dense and diverse Mediterranean city, which has gained relevance in the past few years with newer developments in peripheral neighborhoods (Marmolejo & Stallbohm, 2008); on the other hand, the existence of low vitality and non-vital environments, corresponding to areas in the urban fringes and to areas urbanized during the last decades of the twentieth century, characterized by lower densities, less diversity and with a higher presence of heavy transportation infrastructures (Muñoz, 2010).

These results can be extrapolated to the whole of the BMR, taking into account that the "metropolitanization" process that Catalonia has experienced in the past decades has combined the re-enhancement of traditional urban areas with a parallel process of urban diffusion that had started already in the 70's (Nel·lo, 2006). This implies that while the city inherited by the 'modern' way of planning based on the separation of urban functions and the consequent increase in distance, proximity environments still remain in specific spots in the metropolitan area, dynamics that have aimed to be incorporated in metropolitan planning (Galland & Elinbaum, 2016).

This is a relevant point for this dissertation before understanding different interpretations of travel time, considering that the abovementioned territorial layout in fact largely shapes individuals' perceptions of the metropolitan reality (Vich, Marquet, & Miralles-Guasch, 2018) and hence their daily mobility strategies (Næss, 2005). This explains why papers 5.2 and 5.3 focus on different interpretations of daily time by focusing on suburban and intensive commuting, one of the main reflections of this urban model.

Regarding the individual and relational effects on daily travel time (H2)

In the Barcelona Metropolitan Region, this given territorial structure greatly conditions individuals' daily mobility, and particularly in terms of travel time. As we have seen in paper 5.1, even though only in terms of a control variable, that in general lower densities result in larger daily travel time investments (Table 4).

But when general daily travel times are analyzed, both individual and relational variables have seen to play even a more significant role, not only shaping the amount of time spent on the move, but also in terms of travel time composition.

At the individual level, it has been observed that daily travel time investments are greater for men and those with higher social status. These differences can be explained by the following reasons: both those with higher social status and men are associated with longer commuting trips. This is evidently related to the fact that women present shorter commutes, as a result of tighter temporal restrictions due to their dual role at the household level.

This leads to consider also the relational sphere: household relationships matter as much as individual factors in shaping individual mobility strategies, here analyzed through travel time investments and composition. In this sense, it is worthwhile to highlight that the presence of dependent groups such as minors and elders result in reductions of daily travel times, but higher mobility levels related to others' needs. This leads to a necessary interpretation from a gender lens. Daily mobility strategies are not genderless, but instead are significantly different when women and men are analyzed separately. Specifically, not only women present shorter overall daily travel times, but also lower shares of leisure-related travel time and higher shares of time devoted to trips undertaken to satisfy others' necessities. This allows to confirm the previously hypothesized different role in the household general mobility strategies among women and men: women cope with higher familiar responsibilities, exemplified by their higher attachment to the mobility needs of children and elders.

Lastly, the particular nature of the territorial structure presented in paper 4.1 and discussed above should also be incorporated in order to understand a number of results that are significantly different from other urban areas in the world. This is the case of how, rather surprisingly, higher education levels and larger household sizes present contradictory results from other territorial realities in the world, as pointed out in the paper. The particular nature of this kind of metropolis, with one scale defined at a proximity level, mostly corresponding to the residential environment, and another one defined at higher distances, mainly the one related to the workplace, helps in providing

some hints to understand this apparent contradictions. This will be further discussed regarding the last of the hypothesis.

Regarding how travel time is perceived (H3)

Traditional data sources have provided us with self-reported travel times which, even though they have been taken as real travel times, only account for individuals' perceptions of the duration of the trip. Travel time can differ not only in terms of where we live, who we are or whom we are related to. Travel time can also vary in how it is experienced, how it is perceived. By integrating location-based technologies, we are able to understand how different objective time can be from self-reported time. This is relevant considering that mobility-related choices, such as the selection of transportation mode are largely shaped by our recalling of time (as seen in paper 5.3), and therefore an analysis of how this is perceived is a point in place.

With data provided by an innovative tracking experiment based on smartphone app presented in paper 5.2, it has been identified that in fact there is a difference between objective and perceived travel time. Generally, and taking into account that the analyzed trip is a specific commute in the BMR, the results have pointed out that travel time is generally under-perceived, and that there are certain individual and trip characteristics that play an mediating effect on this difference. This general result also needs to be put into context in a territorial manner: the fact of this being a recurrent suburban trip characterized by its long duration, and generally different from other daily trips, can also serve as a plausible explanation of how this result is different from other territorial contexts in which this kind of analysis has been undertaken.

In general, it is interesting to highlight the fact that the mobility context, defined as the characteristics of the trip, in this case plays a significant role in shaping travelers perceptions. It has been identified that overall travel duration and transportation mode are the two main factors to be considered: time of longer trips tends to be more under-perceived, and different factors have an effect on travelers perception based on if they are public or private transportation users.

In this sense, it is quite interesting to see how the conditions in which public transport trips are conducted have an effect on individuals' perception of time and, on the other hand, how a wider set of individual characteristics shape perceptions among private car users.

Regarding how intensive traveling is managed in the context of the day (H4)

As pointed out previously, one of the main consequences of the sprawled and functionally segregated city presented in paper 4.1 is the higher relevance of intensive traveling and, specifically, in terms of daily commuting. This is particularly the case considering that one of the distances that has increased the most has been that between workplaces and residences, two of the main urban functions that has been progressively relocated to the outskirts of large metropolises.

It is for this reason that paper 5.3 aims to understand the implications of such a territorial structure at the individual level by analyzing intensive commuters from a qualitative side. First, we have learned that in the analyzed case of those traveling to the UAB campus, the long commute can be defined as intensive not only because it represents a commute that is significantly higher than the average in the metropolitan region (over 1 hour compared to 32 minutes observed in paper 5.1.), but because it implies a 75% of all daily travel time.

This situation leads to a set of implications at the individual level, among which a general sense of dissatisfaction was detected among the interviewees. This feeling was associated in general with the idea of having to renounce other daily activities as consequence of this large temporal investment and serves as proof of why travel time is not only to be analyzed as isolated, but instead as part of all daily time, with which it competes and is in constant conflict.

But the main implications of this study to highlight are those referred to both explicit and implicit strategies that arise as response to this situation. The generally shared relocation of the 'routine' to the weekly frame is to be highlighted in relation to the arena of explicit strategies. Specifically for private transportation users, this is the case of the strategies derived from the flexibility that their modal choices allow, while falling into

remarkable contradictions in terms of daily schedules. For public transportation travelers, the importance of the use of that time has also to be put forward, questioning the traditional transportation planning view on travel time being empty and useless.

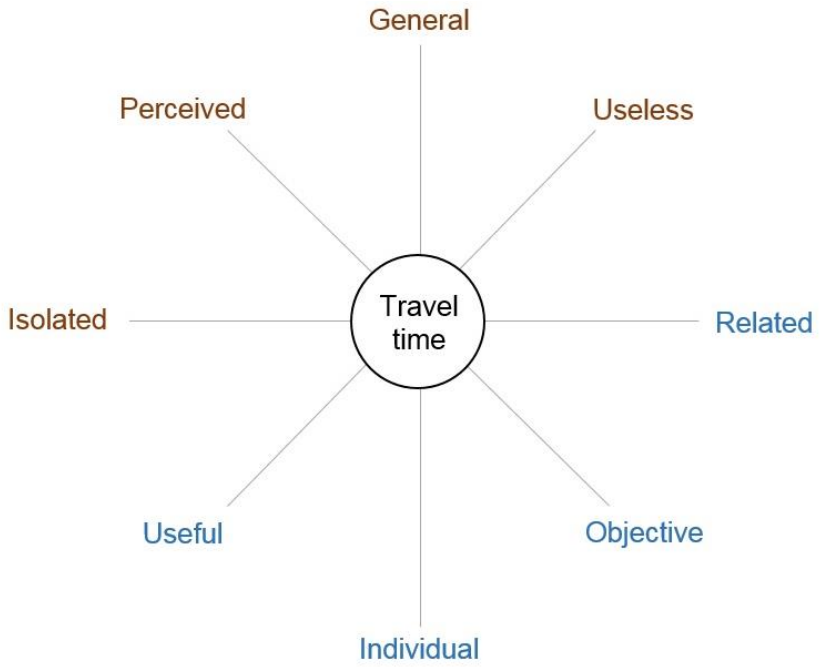
However, underlying these, an implicit strategy is detected regarding, again, the dual urban nature of the Mediterranean metropolis. While the 'modern' city at first implies an increase in distances and in time spent on the move on a daily basis, basically by means of longer commutes, the 'vital' side of many sub-centers of the metropolis still allow for some sort of temporal compensation. The existence of dense and mixed urban environments allow for the remaining mobility needs to be achieved by the remaining 25% of daily travel time, which is related to the what has been labeled as proximity dynamics (Marquet & Miralles-Guasch, 2015).

6.2. General conclusion

This thesis has proposed that the understanding of daily travel time is much richer than what has been traditional studies have presented. The general baseline is that not everyone presents the same travel time, and that not every travel time is the same, as evidenced both by the design and results of the presented case studies. As mentioned in the first paragraphs of this section, this means that the study of travel time can be structured around four different coordinates or vectors, as schematized in Figure 19: the scale of the analysis, the nature of data collected, the consideration of time in regard to other daily times and times of others, as well as the conceptualization of the use of that time.

The traditional approach to the study of travel time, both in terms of planning and research practices, has been based on: *general* analytical approaches, conducted mainly using aggregated data and quantitative methodology; self-reported measurements, and therefore not accounting for potential recall and *perception* biases; an analysis of time as *isolated* from the rest of daily time and from the time allocations of those around the individual; and, lastly, a conceptualization of time as something *useless*, and therefore implying that temporal cost has to be minimized to 0.

Figure 19. Interpretative coordinates depicting the multiple dimensions of daily travel time.



Own production.

Nevertheless, this thesis has aimed to defend that the analysis of daily travel time should be complemented, not substituted, by alternative perspectives along this four vectors. First, general quantitative analyses should engage in a dialogue with *individual*-specific and subjective experiences in order not only to understand general patterns, but also to understand both the reasoning behind a specific behavior and also the personal implications, for instance, of large territorial and urban policies. Second, the relevance of individual expectations and perceptions should be taken into account by complementing traditional data sources with *objective* measures of travel behavior, an arena in which location-based technologies offer promising capabilities. Third, travel time should not be analyzed as an isolated block of our daily schedule, but instead we must also consider the temporal tension and possible compensations taking place in regard with other daily activities, as well as the needs and strategies of those around us, and therefore forcing us to acquire a *relational* scope. Lastly, while it is still relevant to avoid excessive temporal investments in daily mobility due to its possible effects both at the societal and individual levels, the analysis of time should also take into account that, depending on the specific context of the trip, travel time might be even regarded as *useful*. This would have relevant implications not only in terms of modal choice, but also

in regard to abovementioned dimensions such as how travel time is perceived and managed in relation to other daily activities.

These considerations are not only in place for research purposes, but also from transportation and urban planning perspectives. The incorporation of the temporal dimension into the planning sphere has already started, as evidenced by examples in different parts of the world such as Portland (USA) or Melbourne (Australia), introducing the concept of the 20-minute city (Stanley & Stanley, 2014). While this evidences an interesting turn in planning practice from a static and fixed interpretation of human use of space to more dynamic views (von Schönfeld & Bertolini, 2017), there is still a long way ahead. In this sense, both the abovementioned interpersonal and intrapersonal differences and nuances should also be taken into account (Muxí Martínez, Casanovas, Ciocoletto, Fonseca, & Gutiérrez Valdivia, 2011; Queirós & Marques de Costa, 2012): are we going to design cities and transportation infrastructures and services based on the average travel time of a white, college-educated, middle-aged male resident of a European city? Are we going to interpret that time spent in a car or a bus is to be valued in the same manner? These are questions that this thesis contributes in formulating and giving some insight, but their practical operationalization is still a way down the road.

7. Final reflections

7.1. Strengths and limitations

The results summarized above are the result of a set of experiments that present both strengths and limitations that should be taken into consideration globally, before moving on the identification of future lines of research.

Strengths

Beside specific issues presented in each of the case studies, there also some general strengths of this dissertation. The main strength of the thesis is the multi-sided approach applied to a study object as specific as daily travel time. This has been possible due to a variety of analytical scopes that have produced a holistic perspective on what different interpretations of travel time can imply in different contexts. These different lenses are a result of the availability of different sources of data (surveys, tracking data, in-depth interviews), together with their respective analytical methods. Statistical models have been applied for specific purposes, which can be further complemented by descriptive values of tracking-based data and individual qualitative perspectives.

The comprehensive nature of this research project not only is defined by this horizontal multiplicity of optics, but also by the vertical integration of interpretative levels. In this sense, both the design and the results are based on an interplay between a general, population-based and territory-based perspective, to the micro-scale of the individual experience. While some analysis are designed in relation to the BMR as a whole, both in territorial and population terms, others narrow the analysis to specific case studies inside the study area. In this sense, the Autonomous University of Barcelona and its main campus has proven a useful sub-study area for the analysis of travel time perception and management among suburban travelers.

Lastly, the innovative component of this research, based on the use of location-based technologies for the exploration of travel time is also to be highlighted. Even though the main attribute of these technologies is precisely their inherent high spatial resolution, they also offer capabilities which can provide promising insight in the analysis of the temporal dimension of mobility.

Limitations

Despite the abovementioned strengths of this thesis, it is much more useful to discuss its limitations in order to inform future analyses.

There are two issues that were initially considered but have not been explored to a full extent for different reasons. First, while the relationship between individual variables and daily travel times have been generally tackled, a detailed exploration of the specific issue of the economic side of temporal inequality has not been entirely possible. Mainly this has been due to the lack of data regarding individual or family income in the different data sources used in the analyses. Second, while there has been an effort to explore the relationship between spatial context and daily travel time, this has only been possible from an interpretative and a general manner, linking results from different case studies. However and as it will be pointed out later on, it would have been interesting to dedicate a specific case study to this purpose.

Also in regard to the territorial dimension of this thesis, we must consider that while Jane Jacobs' theoretical framework is useful to describe the different characteristics of a Metropolis such as Barcelona, her ideas were developed in the '50s and '60s of 20th century, and based on her own experience in the specific case of Greenwich Village and the city of New York. This implies that, when translated to a different urban context and to a different moment in time, a set of interpretative limitations may arise, as it has been pointed out in paper 4.1.

On a methodological note there are different things to consider regarding the analyses undertaken. First of all, referring to the quantitative analyses and beyond the lack of certain crucial variables such as income levels, the models adjusted generally tend to present low goodness of fit. This is somewhat intrinsic to statistical modelling in social sciences, and it has to be noted that the intention of such techniques in these cases is not to provide an overall precise explanation of a phenomenon as a whole, but instead to test the magnitude and direction of certain variables in relation to a specific outcome (Goldberger, 1991).

In relation to the tracking experiment, the main shortcoming is associated with the recruitment process, basically in the form of two different limitations: sample size and different possible biases. Considering that participants take part in this sort of experiment in a voluntary manner and that it is based on an intensive fieldwork in term of days, it is quite challenging to achieve representative samples of a given population. On the other hand, the fact that these experiments are based on Smartphone app implies that individuals might present biases for instance in terms of age and socioeconomic status. Nevertheless, these devices are becoming more popular every year, to the point that in 2018 Spain 7 out of every 10 individuals are Smartphone users[9]. Lastly in this topic, while location-based technologies such as these provide researchers with high spatiotemporal resolution, they are not exempt of certain location errors, especially in dense urban areas, where the so-called *urban canyon effect* might be more relevant (Ellis et al., 2014). This might not be particularly relevant in this study considering that the focus is mainly placed on the temporal dimension of individuals' daily tracks.

There is one last issue to consider. The results regarding daily travel time and its multiple dimensions in this dissertation are based on the specific case of the Barcelona Metropolitan Region, a Southern European and Mediterranean metropolis. This implies that the interpretation of these results might not necessarily inform other geographical and sociocultural contexts to the same extent. This means, for instance, considering a long and intensive commute one that is over one hour round-trip might not be applicable to North American or Latin American contexts, where urban functions tend to be even more separated and traffic congestion might be much more relevant than in European cities. The same applies for a more general perspective on the relevance of time, and how time structures daily life, which can entirely vary from one country to another and even between cities in the same country (Levine, 1997).

[9] *Top Countries by Smartphone Penetration & Users - Newzoo. Retrieved 12 December 2018.* https://newzoo.com/insights/rankings/top-50-countries-by-smartphone-penetration-and-users/

7.2. Future research

Considering the general findings of the thesis, the overall conclusion and also its main strengths and limitations presented in the previous sub-section, a set of possibilities for future studies are hereby outlined.

1. From a quantitative perspective, it would be interesting to expand the analysis presented in this dissertation with larger samples, especially in relation to the tracking experiment.
2. To further develop the aggregated analysis on individual and relational perspectives by including specific income-based variables in the analysis in order to directly depict socioeconomic inequalities in the use of time.
3. To apply these models to other metropolitan regions in the world, with a particular interest in Latin American and Asian cities, where not only the urban layout is considerably different and the temporal implications of daily mobility might be posed as even more significant challenges, but also considering that the culture of time in these contexts might also be significantly different.
4. To develop not only interpersonal differences in terms of travel time, but to aim to develop further detailed analysis of intrapersonal daily and weekly rhythms, an issue in which the multi-day data provided by tracking technologies can also contribute to.
5. To conduct specific analyses on the relationship between specific urban configurations and both the amount and composition of daily travel times, using Jane Jacobs's theoretical framework as reference. In other words, to relate the concept of urban vitality with daily travel temporal expenditures.
6. In this very same line, to develop analyses of not only daily travel times, but also other temporal allocations at the extent of daily organization with the characteristics of the urban form.
7. Lastly, and derived from one of the main interests resulting from the development of this research thesis, to explore and analyze planning practices that have incorporated time as a guiding principle as a complement to the current space-centered tradition.

PART IV. REFERENCES & ANNEXES

8. References

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9. Annexes

9.1. Letters of coauthors

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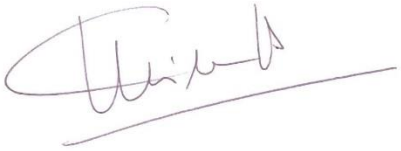
- Delclòs-Alió, X., & Miralles-Guasch, C. (2018). **A Relational Perspective on Everyday Mobility in the Barcelona Metropolitan Region: Individual and Household-Related Differences in Daily Travel Time**. *Tijdschrift Voor Economische En Sociale Geografie*, *109*(4). https://doi.org/10.1111/tesg.12315
- Delclòs-Alió, X., Marquet, O., & Miralles-Guasch, C. (2017**). Keeping track of time: A Smartphone-based analysis of travel time perception in a suburban environment**. *Travel Behaviour and Society*, *9*, 2214–367. https://doi.org/10.1016/j.tbs.2017.07.001
- Delclòs-Alió, X., & Miralles-Guasch, C. (2017). **Suburban travelers pressed for time: Exploring the temporal implications of metropolitan commuting in Barcelona.** *Journal of Transport Geography*, *65*(July), 165–174. https://doi.org/10.1016/j.jtrangeo.2017.10.016

no han format part anteriorment de cap altra tesi doctoral, i RENUNCIA a presentar-los com a tal en el futur.



Bellaterra, 5 de desembre de 2018

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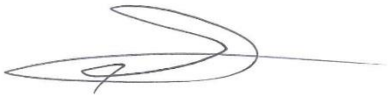
- Delclòs-Alió, X., Marquet, O., & Miralles-Guasch, C. (2017). **Keeping track of time: A Smartphone-based analysis of travel time perception in a suburban environment**. *Travel Behaviour and Society*, *9*, 2214–367. https://doi.org/10.1016/j.tbs.2017.07.001

no ha format part anteriorment de cap altra tesi doctoral, i RENUNCIA a presentar-los com a tal en el futur.



Barcelona, 5 de desembre de 2018

9.2. Example of individual tracking raw database

*Sin título2 [Conjunto_de_datos1] - IBM SPSS Statistics Editor de datos

Archivo Edición Ver Datos Transformar Analizar Marketing directo Gráficos Utilidades Ventana Ayuda

53366 : time 2015-05-02T19:20:58

	user_code	type	accuracy	lat	lon	power	provider	time	local_time
53373	CM1WJ42R	FIX	8,00	38,403993	-,583450	-1,000000	gps	2015-05-03T03:42:08	Europe/Madrid
53374	CM1WJ42R	FIX	8,00	38,403984	-,583467	-1,000000	gps	2015-05-03T07:56:22	Europe/Madrid
53375	CM1WJ42R	FIX	12,00	38,403877	-,583706	-1,000000	gps	2015-05-03T07:58:22	Europe/Madrid
53376	CM1WJ42R	FIX	8,00	38,403979	-,583416	-1,000000	gps	2015-05-03T08:30:39	Europe/Madrid
53377	CM1WJ42R	FIX	58,50	38,403216	-,582737	-1,000000	network	2015-05-03T08:32:04	Europe/Madrid
53378	CM1WJ42R	FIX	3,00	38,403897	-,583373	-1,000000	gps	2015-05-03T08:34:26	Europe/Madrid
53379	CM1WJ42R	FIX	12,00	38,403970	-,583296	-1,000000	gps	2015-05-03T09:44:27	Europe/Madrid
53380	CM1WJ42R	FIX	37,50	38,403216	-,582738	-1,000000	network	2015-05-03T09:46:12	Europe/Madrid
53381	CM1WJ42R	FIX	1,00	38,403912	-,583390	-1,000000	gps	2015-05-03T09:48:35	Europe/Madrid
53382	CM1WJ42R	FIX	12,00	38,404252	-,583270	-1,000000	gps	2015-05-03T09:54:07	Europe/Madrid
53383	CM1WJ42R	FIX	8,00	38,401205	-,578077	-1,000000	gps	2015-05-03T09:56:14	Europe/Madrid
53384	CM1WJ42R	FIX	6,00	38,401845	-,562170	-1,000000	gps	2015-05-03T09:58:11	Europe/Madrid
53385	CM1WJ42R	FIX	8,00	38,390809	-,536250	-1,000000	gps	2015-05-03T10:00:27	Europe/Madrid
53386	CM1WJ42R	FIX	24,00	38,388503	-,518025	-1,000000	gps	2015-05-03T10:02:09	Europe/Madrid
53387	CM1WJ42R	FIX	12,00	38,390925	-,503944	-1,000000	gps	2015-05-03T10:04:36	Europe/Madrid
53388	CM1WJ42R	FIX	4,00	38,388182	-,500735	-1,000000	gps	2015-05-03T10:06:26	Europe/Madrid
53389	CM1WJ42R	FIX	8,00	38,388499	-,500737	-1,000000	gps	2015-05-03T10:32:18	Europe/Madrid
53390	CM1WJ42R	FIX	6,00	38,390751	-,499809	-1,000000	gps	2015-05-03T10:34:36	Europe/Madrid
53391	CM1WJ42R	FIX	6,00	38,392537	-,512670	-1,000000	gps	2015-05-03T10:36:20	Europe/Madrid
53392	CM1WJ42R	FIX	8,00	38,387766	-,528425	-1,000000	gps	2015-05-03T10:38:28	Europe/Madrid
53393	CM1WJ42R	FIX	8,00	38,402184	-,549768	-1,000000	gps	2015-05-03T10:40:33	Europe/Madrid
53394	CM1WJ42R	FIX	8,00	38,422528	-,548856	-1,000000	gps	2015-05-03T10:42:28	Europe/Madrid
53395	CM1WJ42R	FIX	8,00	38,444690	-,564689	-1,000000	gps	2015-05-03T10:44:16	Europe/Madrid
53396	CM1WJ42R	FIX	6,00	38,470490	-,589921	-1,000000	gps	2015-05-03T10:46:25	Europe/Madrid
53397	CM1WJ42R	FIX	8,00	38,495949	-,603824	-1,000000	gps	2015-05-03T10:48:22	Europe/Madrid
53398	CM1WJ42R	FIX	8,00	38,523005	-,617655	-1,000000	gps	2015-05-03T10:50:27	Europe/Madrid
53399	CM1WJ42R	FIX	8,00	38,551179	-,641203	-1,000000	gps	2015-05-03T10:52:23	Europe/Madrid
53400	CM1WJ42R	FIX	12,00	38,579937	-,650948	-1,000000	gps	2015-05-03T10:54:22	Europe/Madrid
53401	CM1WJ42R	FIX	8,00	38,594626	-,613626	-1,000000	gps	2015-05-03T10:56:22	Europe/Madrid
53402	CM1WJ42R	FIX	8,00	38,610309	-,575297	-1,000000	gps	2015-05-03T10:58:16	Europe/Madrid
53403	CM1WJ42R	FIX	12,00	38,630221	-,529571	-1,000000	gps	2015-05-03T11:00:32	Europe/Madrid
53404	CM1WJ42R	FIX	12,00	38,642751	-,489140	-1,000000	gps	2015-05-03T11:02:22	Europe/Madrid
53405	CM1WJ42R	FIX	48,00	38,692105	-,455803	-1,000000	gps	2015-05-03T11:06:25	Europe/Madrid
53406	CM1WJ42R	FIX	8,00	38,720648	-,442409	-1,000000	gps	2015-05-03T11:08:31	Europe/Madrid
53407	CM1WJ42R	FIX	12,00	38,749834	-,418328	-1,000000	gps	2015-05-03T11:10:45	Europe/Madrid
53408	CM1WJ42R	FIX	8,00	38,779829	-,410228	-1,000000	gps	2015-05-03T11:12:33	Europe/Madrid
53409	CM1WJ42R	FIX	8,00	38,794435	-,438849	-1,000000	gps	2015-05-03T11:14:23	Europe/Madrid

Vista de datos Vista de variables

9.3. Interview guideline

This is the general guideline that was used in order to conduct the interviews that constitute one of the data sources for the analysis presented in Paper 5.3. This is not a rigid questionnaire, but instead a list of items to delve into as the conversations naturally evolved. Interviewees did not have direct access to this document.

Aspectes a comentar abans de començar:

Aquesta entrevista és la tercera part de l'experiment del Campus Mobility: la primera va ser l'enquesta i la segona va ser la participació amb l'app.

L'entrevista s'estructura en dues parts:

A. *Part d'entrevista més aviat tradicional vinculada amb les pautes de mobilitat quotidiana en general.*
B. *Una segona part enfocada a l'ús que fas del temps en el que et desplaces.*

- *Pot ser que alguna informació es repeteixi del que va respondre a l'enquesta, però demanem que es respongui igualment.*
- *Demanem permís per a gravar la conversa.*
- *Privacitat: aquestes dades són confidencials i seran tractades de forma agregada de la mateixa manera que l'enquesta i l'experiment Campus Mobility. Mai apareixerà el nom real ni dades personals que permetin identificar a la persona.*
- *L'entrevistat pot triar en quin idioma vol fer l'entrevista, català o castellà.*
- *Màxim dedicarem 45-60min.*
- *Pregunto si des de que va contestar l'enquesta i va participar amb l'app, ha canviat de residència. En cas afirmatiu, quant de temps fa que viu en l'actual residència.*
- *Preguntar per quines raons viu on viu, i treballa on treballa.*

Sobre els seus desplaçaments quotidians

0. Comencem amb una pregunta una mica general: tu com diries que t'organitzes el dia? Quin pes té el teu desplaçament a la UAB en aquesta organització?
1. Quan t'has de desplaçar, tant en general a la UAB com a d'altres indrets, què tens en compte a l'hora d'escollir com et desplaces?
2. Concretament, com valores és el temps en aquesta decisió? *(si no ha aparegut abans)* I què valores específicament? *Rapidesa total, menys temps d'espera (t. públic) o d'aparcament (privat), utilitat del temps, no dependre d'uns horaris concrets (flexibilitat), menys estona caminant, poder aprofitar aquell temps per d'altres motius, etc.*
3. Si no fos per tots aquests aspectes, com t'agradaria desplaçar-te? *No només a la UAB sinó també en general.*

4. Seguint amb el tema del temps, en un dia hipotètic i oblidant-te del que tu concretament has de fer en un dia normal, quin volum de temps creus que és acceptable per a dedicar a un dia a desplaçar-se? Fes un càlcul en hores/minuts.

5. Per altra banda, quin diries que és el temps òptim per a dedicar al desplaçament principal (feina/estudi?)? Per quins motius aquest i no d'altres?

6. Tenint en compte això, actualment quant de temps inverteixes al dia en desplaçar-te, considerant tots els teus desplaçaments? Fes un càlcul en hores/minuts.

7. Com valores el temps total que dediques en un dia a tots als desplaçaments? I en el desplaçament principal?

8. Pots valorar-ho utilitzant aquesta escala? *Escala Likert*

1	2	3	4	5
Molt insatisfactori	Insatisfactori	Satisfactori	Molt satisfactori	Extremadament satisfactori
Dedico un temps exagerat	Dedico massa temps	Dedico el temps just	Encara podria dedicar una mica més de temps	Estaria disposat a dedicar molt més temps

9. En el cas que desitgessis reduir el temps que dediques a desplaçar-te, de quina manera creus que podries fer-ho?

10. Si anessis en un mitja de transport diferent del que utilitzes, com creus que es veuria afectat el teu temps de desplaçament?

11. Si fos possible, pagaries una mica més (en benzina, en l'abonament, etc.) si el viatge fos més curt?

12. El temps que dediques a desplaçar-te, té algun efecte en les activitats que portes a terme durant el dia? T'agradaria fer alguna cosa que no puguis fer?

13. El temps que dediques a desplaçar-te, té algun efecte o està relacionat amb els desplaçaments/horaris que fan persones del teu entorn? *Familiars, amics, etc. En qüestió de temps o de canvi de ruta, etc.*

14. En els desplaçaments que portes a terme durant el cap de setmana, com valores el temps? Té el mateix pes que durant la setmana? Quant de temps estaries disposat a dedicar a desplaçar-te un dia del cap de setmana?

Sobre l'ús del temps en el desplaçament principal (*suposem UAB*)

15. Com valores l'ús que fas del temps en el que estàs desplaçant-te?

a. De què et serveix aquest temps? *És un temps útil? O és un temps perdut? Per quins motius?*

b. Què fas en aquesta estona? *Parlar, treballar, llegir, comunicar-te per telèfon, pensar/reflexionar/aïllar-te/escoltar música ("cocooning"), mirar per la finestra, etc.*

c. Et planifiques el que faràs amb aquest temps amb antelació? A partir de quin temps de desplaçament et comences a planificar el que faràs en aquella estona?

d. Diferències anada-tornada? Ex: el d'anada serveix per organitzar el dia, el de tornada pensant en com ha anat el dia, en el que faràs a l'arribar a casa, etc.?

e. Diries que forma part del teu horari laboral o del teu horari personal?

f. Pels que caminen/bici: vas ràpid, poc a poc? De què depèn?

g. Et passa ràpid? De què depèn? Factors interns, externs, periodicitat-experiència, d'anar o no acompanyat?

h. PÚBLIC: "PACKING-UNPACKING".

i. Si haguessis de descriure com et sents en aquella estona, com ho faries? (Hi ha algun punt en el teu desplaçament en el que et sentis impacient? I en general, pel conjunt del desplaçament, quina sensació tens?) Podries identificar algun altre moment del dia en el que et sentis o facis el mateix?

j. Té algun efecte en com et sents quan arribes a la feina o a casa?

k. T'agradaria fer alguna altra cosa mentre et desplaces?

l. Creus que invertiries millor el temps en un altre mode de transport?

m. Què creus que faries amb el teu temps si no et calgués desplaçar-te?

9.4. Thesis outreach

This annex collects material that is an indirect result of the thesis, such as participation in national and international conferences, which has helped in improving the content of the papers, talks and lectures given about the topic discussed in the dissertation and general impact in the media.

Participation in national and international conferences related to the thesis

1) Miralles-Guasch, C., Vich, G., **Delclòs-Alió, X**. "La movilidad sostenible se juega en las escalas metropolitanas". *Coloquio Internacional: Cultura territorial, innovación social y reorientación de los modelos territoriales en Valencia y el sur de Europa*. Valencia (España), May 30th – June 1st 2018.

2) **Delclòs-Alió**, X.; Maciejewska, M.; Miralles-Guasch, C. "Commuters suburbanos bajo el yugo del tiempo: un estudio de caso cualitativo en la Región Metropolitana de Barcelona". *XXV Congreso de la Asociación de Geógrafos Españoles*. Madrid (España), October 25-27th 2017.

3) Vich, G.; & **Delclòs, X.** "New approaches to the study of daily mobility at Universitat Autònoma de Barcelona". *I European Conference on Sustainable Mobility at Universities*. Universitat Autònoma de Barcelona (Cerdanyola del Vallès), March 8-10th 2017.

4) **Delclòs, X**., Vich, G., Marquet, O., Montané, D. & Miralles-Guasch, C. "La dimensión temporal de la movilidad cotidiana: ¿Cuánto tiempo dedicamos diariamente a desplazarnos?" *XV Coloquio Ibérico de Geografía. Foro de desarrollo y discusión de diversos aspectos de la Geografía*. Asociación de Geógrafos Españoles, Asociaçao Portuguesa de Geógrafos. Murcia, November 7-9th 2016.

5) **Delclòs, X**., Miralles-Guasch, C., Marquet, O. & Vich, G. "How well can we predict our daily travel time? Results from a personal tracking experiment conducted at the Autonomous University of Barcelona." *AAG Annual Meeting. Association of American Geographers*. San Francisco (USA), March 29th – April 2nd 2016.

6) Miralles-Guasch, C., **Delclòs, X** & Vich, G. "Nuevas fuentes de información para el análisis de la movilidad cotidiana: de las encuestas de movilidad a las aplicaciones para móviles." *XXIV Congreso de la Asociación de Geógrafos Españoles: Análisis espacial y representación geográfica: innovación y aplicación. Universidad de Zaragoza-AGE*. Zaragoza, October 28-30th 2015.

Talks given related to the thesis

1) Talk entitled "***Nuevas fuentes de información para el anàlisis de la movilidad cotidiana***",

1.1. 05/23/2015 – Official Master's Degree in Interdisciplinary Studies in Environmental, Economic and Social Sustainability ((Institut de Ciència i Tecnologia Ambientals – ICTA – Universitat Autònoma de Barcelona).
1.2. 04/07/2015 – Master's Degree in Urban Management and Assessment (Centre de política del Sòl i Valoracions – CPSV – Universitat Politècnica de Catalunya).
1.3. 04/28/2015 – Official Master's Degree in Population and Territorial Studies (Departament de Geografia – Universitat Autònoma de Barcelona).

2) Talk entitled "**New approaches to the study of daily mobility: from travel surveys to smartphone apps**",

2.1. 05/05/2015 – For visiting students from the Master's Degree at the Planning Department of Aalborg University (Denmark), held at the Ciutadella Campus of the Universitat Pompeu Fabra (Barcelona)
2.2. 10/07/2015 – Official Master's Degree in Interdisciplinary Studies in Environmental, Economic and Social Sustainability ((Institut de Ciència i Tecnologia Ambientals – ICTA – Universitat Autònoma de Barcelona).
2.3. 02/25/2016 - Official Master's Degree in Population and Territorial Studies (Departament de Geografia – Universitat Autònoma de Barcelona).

.

3) Talk entitled "**Un planteamiento *mixed-methods* para el estudio de la movilidad: De las encuestas al *tracking* individual**",
1.1. 12/12/2016 - Official Master's Degree in Interdisciplinary Studies in Environmental, Economic and Social Sustainability ((Institut de Ciència i Tecnologia Ambientals – ICTA – Universitat Autònoma de Barcelona).

4) Talk entitled "**Els temps de la mobilitat quotidiana. Una aproximació multimetodològica a la Regió Metropolitana de Barcelona**",
4.1. 02/22/2017 – Official Master's Degree in Population and Territorial Studies (Departament de Geografia – Universitat Autònoma de Barcelona).
4.2. 03/27/2017 - Official Master's Degree in Interdisciplinary Studies in Environmental, Economic and Social Sustainability ((Institut de Ciència i Tecnologia Ambientals – ICTA – Universitat Autònoma de Barcelona).
4.3. 04/16/2017 – Course "Research methodology in Social Science", Bachelor in Geography and Territorial Planning (Departament de Geografia – Universitat Autònoma de Barcelona)

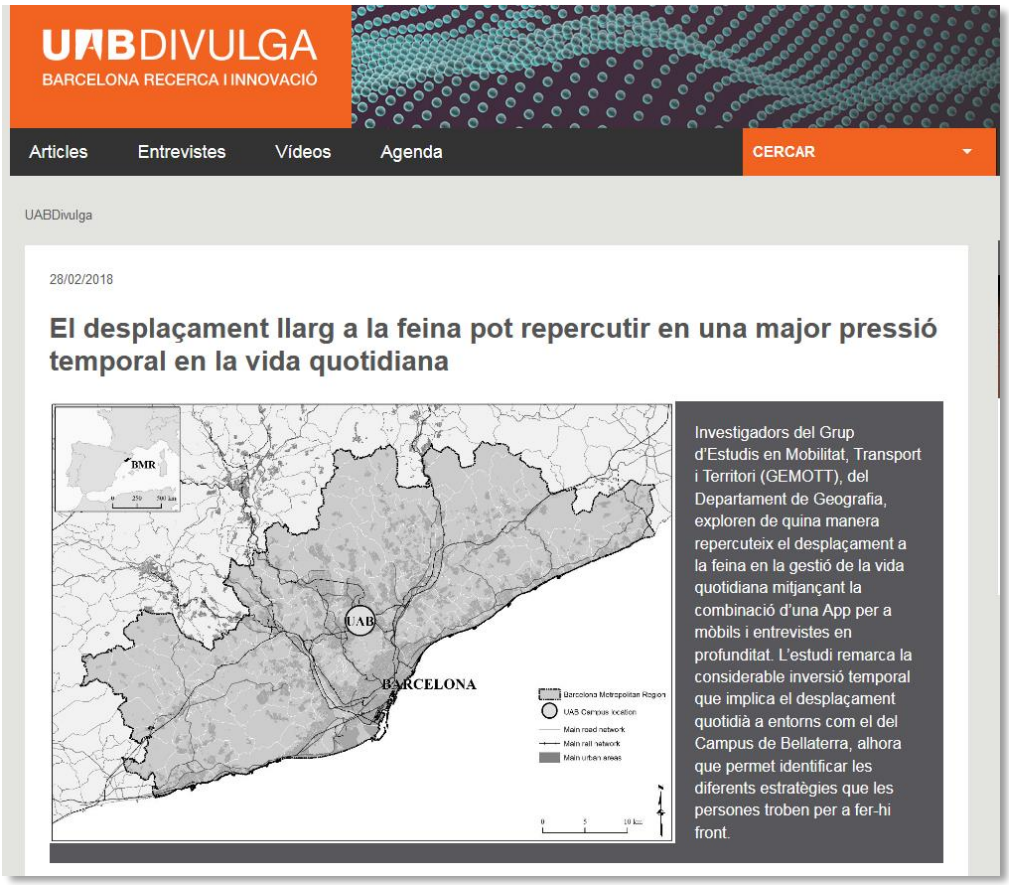
5) Talk entitled: "**Multiple dimensions of daily travel time: A mixed-methods approach in the Barcelona Metropolitan Region**",
5.1. 10/06/2017 – Department of Planning & Center for Mobilities and Urban Studies (C-MUS) (Aalborg University – Denmark).
5.2. 02/19/2018 – Official Master's Degree in Population and Territorial Studies (Departament de Geografia – Universitat Autònoma de Barcelona).

5.3. 03/14/2018 – Official Master's Degree in Interdisciplinary Studies in Environmental, Economic and Social Sustainability (Institut de Ciència i Tecnologia Ambientals – ICTA – Universitat Autònoma de Barcelona).

6) Talk entitled: "**Looking at Barcelona through Jane Jacob's eyes: Mapping the basic conditions for urban vitality in a Mediterranean conurbation**",
   6.1. 02/12/2018 - Official Master's Degree in Population and Territorial Studies (Departament de Geografia – Universitat Autònoma de Barcelona).
   6.2. 07/20/2018 – Urban Design and Spatial Analysis Lab (Department of Urban Planning and Engineering – Hanyang University, South Korea).
   6.3. 11/15/2018 – Course "Territorial Planning" Bachelor in Geography and Territorial Planning (Departament de Geografia – Universitat Autònoma de Barcelona)

Media impact of the results presented in this thesis

1) "**El desplaçament llarg a la feina pot repercutir en una major pressió temporal en la vida quotidiana**". UAB Divulga, 02/28/2018.



2) **"Mapegen la vitalitat urbana de Barcelona".** UAB Sala de Premsa, 07/10/2018.

Sala de premsa
Premsa i mitjans

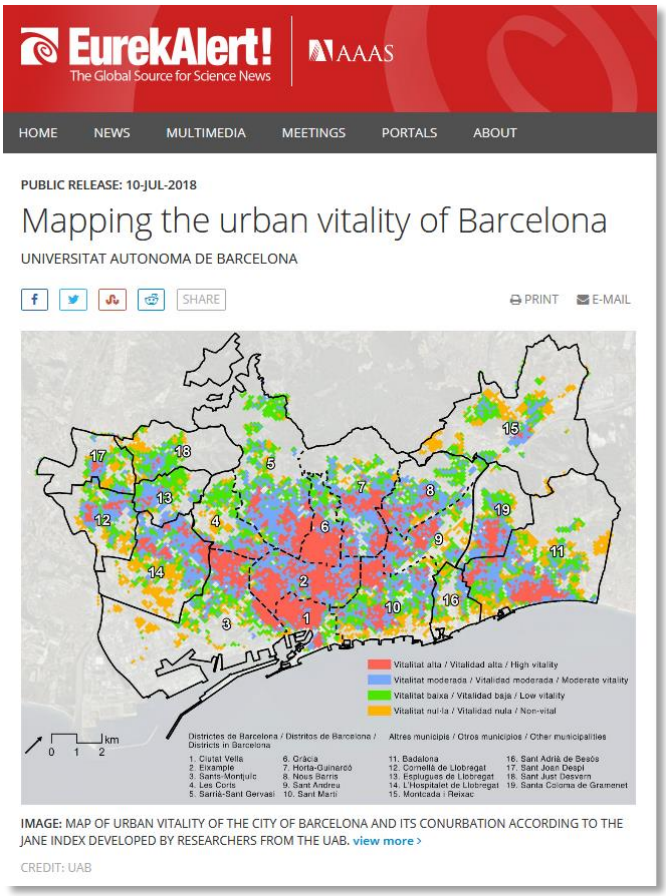
Universitat Autònoma de Barcelona > Sala de premsa > Detall de noticia

Mapegen la vitalitat urbana de Barcelona

Investigadors de la UAB han cartografiat Barcelona ciutat i 9 municipis del seu voltant amb una nova metodologia que aplica les idees de l'activista de l'urbanisme Jane Jacobs sobre com han de ser les ciutats per ser espais vitals. En un 25% del territori la vitalitat és alta, moderada en un 35% i baixa o nul·la al 40%.

10/07/2018

3) "Mapping the urban vitality of Barcelona". EurekAlert!, 07/10/2018.



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PUBLIC RELEASE: 10-JUL-2018

Mapping the urban vitality of Barcelona

UNIVERSITAT AUTONOMA DE BARCELONA

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Vitalitat alta / Vitalidad alta / High vitality
Vitalitat moderada / Vitalidad moderada / Moderate vitality
Vitalitat baixa / Vitalidad baja / Low vitality
Vitalitat nul·la / Vitalidad nula / Non-vital

km 0 1 2

Districtes de Barcelona / Distritos de Barcelona / Districts in Barcelona
1. Ciutat Vella
2. Eixample
3. Sants-Montjuïc
4. Les Corts
5. Sarrià-Sant Gervasi
6. Gràcia
7. Horta-Guinardó
8. Nou Barris
9. Sant Andreu
10. Sant Martí

Altres municipis / Otros municipios / Other municipalities
11. Badalona
12. Cornellà de Llobregat
13. Esplugues de Llobregat
14. L'Hospitalet de Llobregat
15. Montcada i Reixac
16. Sant Adrià de Besòs
17. Sant Joan Despí
18. Sant Just Desvern
19. Santa Coloma de Gramenet

IMAGE: MAP OF URBAN VITALITY OF THE CITY OF BARCELONA AND ITS CONURBATION ACCORDING TO THE JANE INDEX DEVELOPED BY RESEARCHERS FROM THE UAB. view more ›

CREDIT: UAB

4) "Calles vivas en los barrios, calles muertas en la nueva Barcelona". El Periódico de Catalunya, 07/10/2018.

MENÚ BUSCAR elPeriódico EDICIÓN CATALUNYA EDICIÓN GLOBAL INICIAR SESIÓN

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ESTUDIO DE LA UAB

Calles vivas en los barrios, calles muertas en la nueva Barcelona

Rambla Prim y la Via Júlia destilan la misma vida que las zonas más concurridas de la ciudad

El frente marítimo tiene una actividad nula y las grandes obras y edificios cortan toda opción de dinamismo

Carlos Márquez Daniel

Martes, 10/07/2018 | Actualizado el 11/07/2018 a las 17:34 CEST

Vida en la Rambla del Poblenou, este martes. / ELISENDA ROCA

Todos los debates sobre el **diseño de las ciudades** terminan por citar a **Jane Jacobs** (1916-2006). Madre, activista, periodista y urbanista, esta

SPORT

La provocación nunca vista de Cristiano en el derbi de Turín

woman

Marta Hazas celebra su nuevo trabajo con un desnudo integral

MOTOR

¿Cuáles son los coches que más se deprecian?

5) "El mapa de la vitalidad urbana de Barcelona". La Vanguardia, 07/10/2018.

LA VANGUARDIA | Barcelona

Al Minuto Internacional Política Opinión Vida Deportes Economía Local Gente Cultura Sucesos Temas

NUEVA METODOLOGÍA

El mapa de la vitalidad urbana de Barcelona

• Un 42% de la ciudad y su conurbación tienen una vitalidad social baja o nula, según el documento elaborado por geógrafos de la UAB

EFE, BARCELONA
10/07/2018 11:32

Actualizado a
10/07/2018 12:02

Temas relacionados

Vitalitat alta / Vitalidad alta / High vitality
Vitalitat moderada / Vitalidad moderada / Moderate vitality
Vitalitat baixa / Vitalidad baja / Low vitality
Vitalitat nul·la / Vitalidad nula / Non-vital

El mapa de vitalidad urbana, elaborado por geógrafos de la UAB (UAB)

Un **42 %** de **Barcelona** y su **conurbación** tienen una vitalidad social baja o nula, según el primer **mapa** de **vitalidad urbana**, elaborado por geógrafos de la **Universitat Autónoma** de **Barcelona** (**UAB**), que descubre cuáles son las zonas con más vida social y cuáles las más inhóspitas.

6) "Quina és la zona més vital de Barcelona?". El País (Ed. Català), 07/10/2018.

≡ EL PAÍS CATALUNYA

Quina és la zona més vital de Barcelona?

Un mapa elaborat per geògrafs de la UAB descobreix quines són les zones amb més vida social i quines són les més inhòspites de la capital catalana

EFE

Barcelona - 10 JUL 2018 - 12:05 CEST

Mapa de la vitalitat urbana de Barcelona.

Un 42% de Barcelona i la seva conurbació tenen una vitalitat social baixa o nul·la, segons el primer mapa de vitalitat urbana, elaborat per geògrafs de la Universitat Autònoma de Barcelona (UAB), que descobreix quines són les zones amb més vida social i quines són les més inhòspites.

7) "Un 42% de Barcelona y su conurbación tienen una vitalidad social baja". ABC, 07/10/2018.

ABC.es | AGENCIAS

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España Internacional Economía Sociedad Toros Madrid Local Ciencia Familia Defensa Opinión HoyCinema GuíaTv ABCfoto Casa Real

Noticias agencias

Un 42 % de Barcelona y su conurbación tienen una vitalidad social baja

10-07-2018 / 11:31 h EFE

Un 42 % de Barcelona y su conurbación tienen una vitalidad social baja o nula, según el primer mapa de vitalidad urbana, elaborado por geógrafos de la Universidad Autónoma de Barcelona (UAB), que descubre cuáles son las zonas con más vida social y cuáles las más inhóspitas.

Entre otras cosas, por ejemplo, el mapa revela que la Rambla Prim o la Vía Julia de Barcelona son ejemplos de proyectos de rediseño urbano con un elevado nivel de vida en la calle, mientras que la Vila Olímpica, el 22@ o la zona de Diagonal Mar, por el contrario, son zonas de baja o nula vitalidad.

El estudio, que comprende Barcelona ciudad y nueve municipios de los alrededores, con una población total de 2,4 millones de habitantes, concluye que el 23 % del territorio presenta una vitalidad alta y un 34 % moderada, mientras que una parte significativa ha sido clasificada como baja (25 %) o nula (17 %).

Por comunidades

- Andalucía
- Aragón
- Baleares
- Cantabria
- Castilla La Mancha
- Castilla y León
- Cataluña
- Ceuta
- Comunidad Valenciana
- País Vasco
- Córdoba
- Extremadura
- Galicia
- La Rioja
- Madrid
- Melilla
- Murcia
- Navarra
- Sevilla

8) "Un estudio de la UAB detecta más vitalidad urbana en barrios humildes de Barcelona". 20 Minutos, 07/10/2018.

20 minutos — Tu Ciudad | Nacional | Internacional | Opinión | Gente y TV | Cultura | Deportes | Más

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Un estudio de la UAB detecta más vitalidad urbana en barrios humildes de Barcelona

EUROPA PRESS 10.07.2018

- Zonas alejadas del centro y barrios humildes tienen un alta vida en la calle.
- Apunta que Gràcia, L'Hospitalet, Horta-Guinardó y Sant Andreu.
- El análisis también ha advertido de "escenarios de procesos de gentrificación o sobrepoblación" en Gràcia, Ciutat Vella y el Poblenou.

El mapa de la vitalidad urbana de Barcelona UAB

Los investigadores del departamento de Geografía y del Institut de Ciència i Tecnologia Ambientals de la Universitat Autònoma de Barcelona (ICTA-UAB), Xavier Delclòs y Carme Miralles, han mapeado la vitalidad urbana de Barcelona, apuntando que **zonas alejadas del centro y barrios humildes tienen un alta vida en la calle.**

BLOGS DE 20MINUTOS

COMUNICACIÓN NO VERBAL
Pablo Iglesias se disculpa con Mariló Montero ¿es sincero?

YA ESTÁ EL LISTO QUE TODO LO SABE
¿Por qué se llama 'pesebre' a la representación navideña del nacimiento de Jesús?

CAPEANDO LA CRISIS
Manifiesto por una transformación del sistema energético

9) "Un estudio de la UAB detecta más vitalidad urbana en barrios humildes de Barcelona". Europa Press, 07/10/2018.

europapress / catalunya

Un estudio de la UAB detecta más vitalidad urbana en barrios humildes de Barcelona

Publicado 10/07/2018 12:10:41 CET UAB

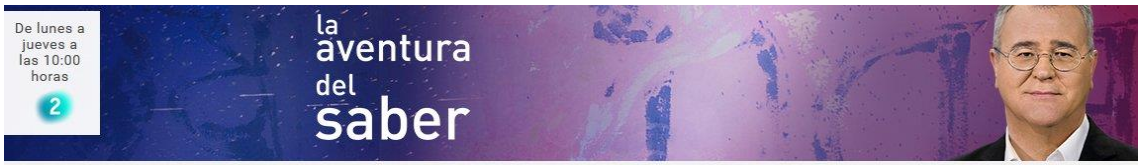
Apunta que Gràcia, L'Hospitalet, Horta-Guinardó y Sant Andreu tienen una alta vida en la calle

CERDANYOLA DEL VALLÈS (BARCELONA), 10 Jul. (EUROPA PRESS) -

Los investigadores del departamento de Geografía y del Institut de Ciència i Tecnologia Ambientals de la Universitat Autònoma de Barcelona (ICTA-UAB), Xavier Delclòs y Carme Miralles, han mapeado la vitalidad urbana de Barcelona, apuntando que zonas alejadas del centro y barrios humildes tienen un alta vida en la calle

10) "**Un grup d'investigadors de la Universitat Autònoma de Barcelona han estudiat la vitalitat dels barris de Barcelona. Declaracions de Carme Miralles, investigadora".** Cadena SER, el Balcó, 19:16h, minute 15:22, 07/10/2018.

11) **Interview for TV program "La aventura del saber", TVE. Recorded on December 11th 2018.** *Air date not available*.



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