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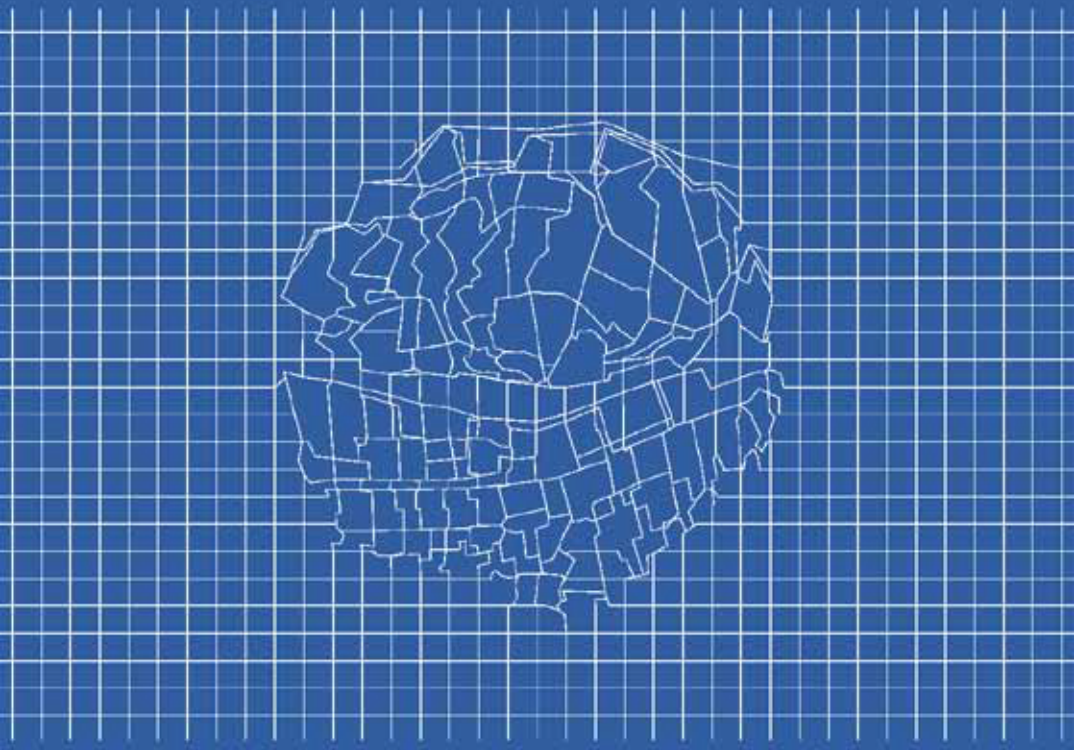

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Mobility Patterns and Urban Structure

Edited by

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Chapter 1
Introduction

Paulo Pinho and Cecília Silva

Context

Over the last few years there has been a growing consensus in the scientific literature on the need for innovative policy measures to reduce the environmental impact and the greenhouse gas emissions of urban mobility patterns. To make these actions efficient, policy measures must act on the factors influencing travel patterns and not simply on their symptoms. Therefore, a thorough understanding of the reasons underlying trip making is most required.

In both developed and emerging countries, travel has been rising, presenting more complex patterns and becoming more difficult to predict. The research areas concerned with the study of the factors and motivations underlying travel behaviour have also become increasingly complex, taking into consideration an ever-growing number of investigated aspects and disciplinary perspectives. The research field is vast but somehow disarticulated, lacking a systematic methodological approach, as well as, in most cases, a genuine concern on its applicability to policy making. Land use, transports and individual characteristics are generally considered part of the most important factors influencing travel behaviour.

Most publications reflecting on the factors influencing travel behaviour are individual case studies evaluating the influence of land use. Many of these case studies have arrived at different results and conclusions (for broad literature reviews on this topic see, for instance, Handy, 1996; Ewing and Cervero, 2010; van Wee, 2002). The volume of literature on how land-use patterns and the built environment influence urban travel demand has virtually exploded over the past decade. It is fair to say that most authors believe that land use does have an influence on travel behaviour (e.g., Handy, 1996; Cervero and Kochelman, 1997; Ewing and Cervero, 2010; van Wee, 2002) although, so far, many are sceptical about the composition and decisive nature of the influencing factors, because research methodologies do not seem solid enough, and the case study comparison of results is often difficult if not misleading. Indeed, many case studies have not produced conclusive findings reinforcing the scepticism on the real influence of land use on travel choice. Besides case studies and literature reviews, considerably less research is found on land use policy implications and recommendations. Furthermore, in spite of the extensive research carried out so far on the land use factors influencing travel behaviour, no general consensus has been reached.

This is also the case for research on the influence of transports or of individual characteristics on travel behaviour.

In the bibliography relating travel behaviour to individual characteristics a wide range of study themes can be found. The research in this field can be broadly categorized as focussing on demographic and socioeconomic characteristics of the populations in addition to motivational factors of a psychological nature. Examples of motivational factors, which can be found in this field of research, are, for instance, preferences (Scheiner and Kasper, 2002), value orientation (Scheiner and Kasper, 2002), needs, desires and symbolic affective motives (Steg et al., 2001), habits (Fujii and Kitamura, 2003), and beliefs and attitudes (Fujii and Kitamura, 2003). Case studies evaluating the influence of transport factors on travel behaviour are difficult to find. Research in this field seems to consider this influence as a matter of fact since it tends to concentrate on the formulation of policy measures. Within this research field, most studies evaluate attitudes towards and/or the effect of Transport Demand Management measures (or simply presented TDM measures), and their categorization (see, for example, Marshal and Banister, 1997; and Viegas, 2001). Although the influence of transport systems on travel behaviour is clear and therefore might be exempted from further considerations, the lack of research on the main factors responsible for that influence is one of the main flaws within this research area, especially bearing in mind the corresponding void in policy making this lack of understanding represents.

In spite of the amount of research centred on the factors influencing travel behaviour no consensus can be found in the literature on common orientations for further research. In this context, we intend to build a broader consensus on the factors influencing travel behaviour, being concerned, in particular, with both the influence of urban structure factors (namely, land use and transport system factors) and of motivational factors related to the social, economic and cultural characteristics of the individual traveller.

In recent years, in both developed and emerging countries, mobility patterns have undergone significant changes. The escalating use of the private car for the satisfaction of ever-growing travel needs has contributed, among other factors, to undermine the quality of life in many urban areas, as well as the economic competitiveness and the overall sustainability of larger metropolitan regions. It is, therefore, important to focus our attention on the reasons behind increasing travel needs within the framework of a post carbon society. The choice of urban mobility policies can no longer be solely directed towards fighting the effects of current travel patterns. A broader understanding of the aspects influencing travel behaviour is crucial for the definition of effective low carbon mobility policies.

The ‘predict and provide’ paradigm of traditional transport planning is clearly inadequate for the management of current mobility needs. Within the new ‘predict and prevent’ paradigm, urban mobility management policies are facing new challenges. In this respect, the European Commission standpoint can be summarized in the following two main objectives: reduction of travel needs, and making remaining travel more sustainable. However, these simple and

straightforward objectives go well beyond the normal scope of transport planning. Several authors argue that the effective reduction of the environmental impact and carbon footprint of urban mobility requires the adoption of a truly holistic attitude. Indeed, the need to integrate land use and transport policies has been widely recognized as a more effective approach to meeting these new mobility requirements, than traditional transport planning policies. Nevertheless, these integrated policies have seldom been applied into practice. Furthermore, policies intended to address personal behaviours and choices, taking into consideration socioeconomic and demographic conditions are also being increasingly suggested, although, again, seldom implemented into practice.

Objectives

The principal objective of this book is to present an assessment of the influence of alternative urban structures of metropolitan areas on corresponding mobility patterns. This research also recognizes the influence of socioeconomic and demographic characteristics. Although these characteristics are taken into consideration in our analysis, we will pay particular attention to the influence of urban structures on mobility, as the book title clearly suggests. In particular, two European metropolitan areas of similar sizes and different urban structures, Copenhagen and Oporto, will be compared. In the north, Greater Copenhagen portrays an essentially monocentric urban area with long established growth corridors, whereas Greater Oporto, in the south, still exhibits a marked polycentric structure, grounded in a distinct historic settlement pattern.

At a more detailed level, the reader will find the following associated or more operational objectives:

- to provide a deeper understanding of the relationship between urban structure and travel behaviour;
- to assess the accessibility potential of urban structures;
- to typify the relationships between travel behaviour and potential accessibility;
- to develop social profile and area based targeted policies to enhance low carbon mobility patterns in the case study areas of Greater Oporto and Greater Copenhagen;
- to recommend integrated land use and transport strategies tailored to the specific physical and functional characteristics of these two metropolitan areas; and
- to foster the combined application of structural and behavioural methodologies in mobility studies.

Methodological Approach

This book presents the results of the MOPUS project (MObility Patterns and Urban Structure), funded by the Fundação para a Ciência e a Tecnologia (FCT, the Portuguese Research funding agency) and was carried out between 2008 and 2010. The MOPUS project was based on two previous research projects concerned with complementary factors and motivations underlying urban passenger mobility patterns (Figure 1.1). One of these research projects, carried out in Portugal at the Research Centre for Territory, Transports and Environment (CITTA), was focused on the development of an innovative concept to be applied to urban and metropolitan areas, the so-called structural accessibility. This approach considers only structural factors, i.e., factors related to land use and transport systems, and was initially applied to Greater Oporto. The corresponding methodology, the *Structural Accessibility Layer* (SAL), was designed to reveal the potential of land use and transport systems to provide the necessary conditions (although not necessarily sufficient in themselves) for more energy efficient mobility. In parallel, this innovative methodology is also able to provide a design-support tool for low carbon mobility policies.

The other research project, carried out at Aalborg University (Denmark), developed a complementary methodology; the *Explanatory Qualitative-*

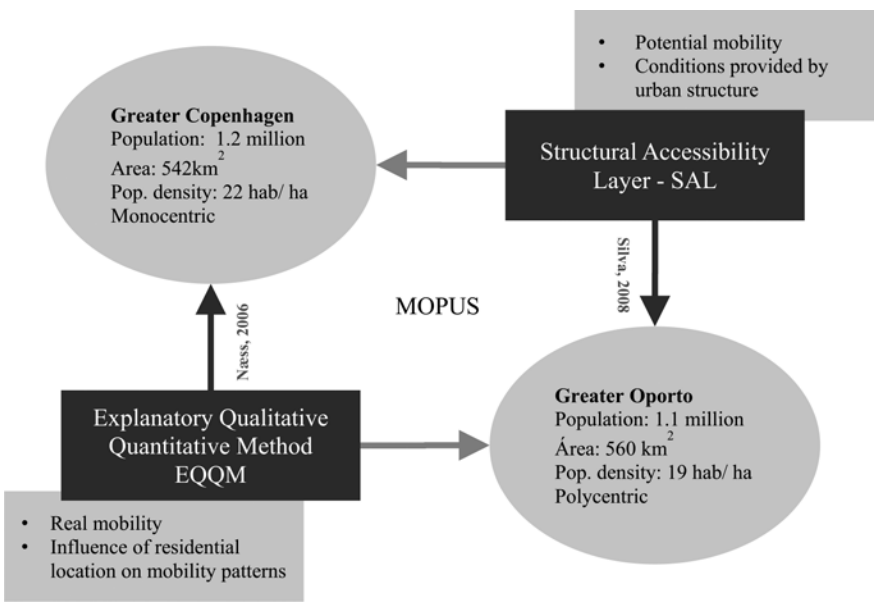

Figure 1.1 Research methodology: combined application of SAL and EQQM

Quantitative Method (EQQM), and was initially applied to the Copenhagen Metropolitan Area. The aim of this methodology, focusing on behavioural aspects, is to identify the overall relationships as well as the more detailed mechanisms through which the location of residence is able to influence travel behaviour. In a number of important aspects the Copenhagen metropolitan study goes beyond the scope of previous investigations into the complex relationships between urban land use and travel patterns, including a comprehensive analysis of the socioeconomic and the attitudinal characteristics of travellers.

The possibility to combine these two complementary research methodologies is the distinctive and innovative contribution of this book. In addition to the first two experiments, referred to above, this combination will involve the application of the SAL to Greater Copenhagen and the application of the EQQM to Greater Oporto. In this way, the structural and behavioural aspects of mobility patterns will be analyzed and compared in both case studies, taking advantage of the previous work already carried out in both research centres. Despite the significant differences between the social and economic characteristics of the metropolitan areas of Oporto and Copenhagen (although fairly similar in area and population size) this book will provide clear evidence of the real importance of different metropolitan structures on mobility patterns.

Indeed, MOPUS was able to compare the mobility patterns of two important European metropolitan areas with contrasting internal structures – one predominantly monocentric (Greater Copenhagen) and the other historically polycentric (Greater Oporto). The exercise was also able to reveal the potentials of these methodologies to support the formulation of planning and transport policies for low carbon metropolitan areas, coming at a time of profound restructuring of public transport systems in many European countries.

Book Structure

This book starts by presenting the research theme's background and motivation, as well as the principal and associated research objectives. This introductory chapter also includes a brief description of the general methodological approach adopted and the book's general outline.

The second chapter, on recent changes in urban areas, presents a brief overview of the cultural, social and demographic changes of contemporary societies and discusses their profound implications in people's travel behaviour and on the cities' mobility patterns. The chapter also addresses the relationships between the spatial and the functional structure of cities and related transport factors and motivations. The chapter concludes with a section on monocentric and polycentric models of urban development and associated implications for the emergence of distinctive urban travel patterns.

Chapter 3 presents a review of empirical evidences on the complex relationships between personal characteristics, urban structure and travel behaviour. The review

looks for motivations behind travel choices revealed by previous research, in particular research on the influence of personal characteristics and urban structure, namely land use and transport systems. With regard to the latter, particular attention was given to the influence of monocentric and polycentric urban structures on travel behaviour.

Chapter 4 presents the main case study areas – Greater Copenhagen and Greater Oporto – regarding geographical distribution of population and employment, the existing transport network and service level, as well as the main travel patterns identified.

The results of the literature review developed in Chapter 2 and Chapter 3 frames the research methods presented in Chapter 5 and Chapter 6, consisting of the combination of two previously developed, applied and tested methods: the *Structural Accessibility Layer* (SAL) and the *Explanatory Qualitative-Quantitative Method* (EQQM). Each method is presented in detail at the conceptual level, providing also insights for the practical applications on the two case study areas, briefly characterized in the previous chapter.

This is followed by two chapters (7 and 8) which present the results of the application of these two complementary methods in both case studies.

Chapter 7 summarizes the main results of the application of SAL to Greater Copenhagen and to Greater Oporto. This chapter discusses potential mobility choices made available (or disabled) by urban structure in each study area. The individual discussions are followed by the comparison of the potential mobility choices enabled by the two different urban structures in analysis. Results are compared to real modal choices in both areas in order to discuss connections between potential and real mobility patterns.

Chapter 8 summarizes the main results of the application of EQQM to both case studies. After a brief review of typical mobility patterns, this chapter presents the results of the analysis of the relationships between residential location and travel behaviour. Residential location is analyzed based on local density (combined population and job density), on the distance of residence to main and second order centres, to main railway stations and to main regional retail centres. Travel behaviour is analyzed based on travel distance (total and by mode) and mode share (based on values of mode travel distance). This chapter includes some remarks on the influence of residential location, such as distance to facilities and location of activities, on particular travel options. In addition, a discussion of the influence of residential location on travel across different population groups is also developed. In this discussion, especial attention is given to gender differences.

The book ends with Chapter 9 which summarizes the main lessons learned throughout the entire MOPUS research project, and the conclusions and recommendations, which are twofold: of a general nature for spatial and transport planning theory and practice, and of a specific nature, relevant to each metropolitan area under analysis.