SUMMARY IN ENGLISH

EXPLORING THE IMPACTS OF MOBILE TECHNOLOGIES ON HUMAN TRAVEL AND SPATIAL BEHAVIOUR. ANALYSIS OF EMPIRICAL EVIDENCE FROM 3 CASE STUDIES

This dissertation investigates the issue of the impact of mobile technologies - laptops, PDAs and mobile phones - on human spatial and travel behavior at the daily basis. It is grounded on empirical research which has been conducted to address three main research questions:

1. What factors are affecting the adoption (versus rejection) of mobile technologies?
2. What is the overall impact of mobile technologies on human travel behaviour at the daily and local basis?
3. How can new data generated from mobile technologies be used to measure human travel behavior on the aggregate scale, beyond the capability of current methods?

Three case studies have been selected, focussed on three different populations of mobile technology users:

- field police officers operating in the district of Groningen North (Netherlands), equipped with PDAs through which they ubiquitously access information while on the move;
- students of the Massachusetts Institute of Technology (i.e. MIT, USA), equipped with laptops in a campus where wireless Internet connectivity is ubiquitous;
- all subscribers and roamers using their mobile phones in the Amsterdam Metropolitan Region, through the KPN Mobile GSM network.

In Chapter 1, the relevance of the topic is introduced, together with an outline of the overall study, its main research questions as well as research methods applied.

In Chapter 2, relevant literature on technology adoption and ICT and travel is reviewed. A broad perspective has been embraced in the examination of the current socio-economic scenario, which is likely to affect the demand for travel. In the last paragraph of the Chapter, the issue is approached from the angle of mobile computing, emphasizing market forces behind adoption of mobile technologies.

Chapter 3 is dedicated to the research methods applied. We describe the main research paradigm (activity-based travel) within which most empirical data have been collected; we explain

the reasons for choosing our three case studies and how the main variables under investigation have been operationalized; we list the main research tools used for data collection and analysis. We conclude the Chapter with a section in which we enucleate the complementarities among the 3 case studies.

Chapter 4 includes our first case study, carried out in the city of Groningen to assess acceptance of new PDA applications by local field police officers. After introducing the research design and tools used for data collection, findings are presented, emphasizing qualitative aspects from face-to-face interviews. In the section 4.6 we account for a coherent explanation based on the scattered evidence emerging from different datasets.

Chapter 5 is dedicated to the case study conducted at MIT, in which quantitative data has been collected to assess how the availability of laptops impacts the daily spatial behaviour of students frequenting the campus. After providing details on the research design and the tools used for data collection, we present findings from descriptive statistics and regression analysis. In section 5.5 we present a discussion of findings, elaborating on the causal relationship between the two main variables under investigation (availability of laptop and travel behaviour).

Chapter 6 accounts for an analysis of more than five months of data on mobile phone traffic over the KPN Mobile network, for the Amsterdam Metropolitan Region. We determine the correlation over time between mobile communication (proxy: overall number of SMS sent) and travel behavior of users (proxy: number of calls initiated and received while moving). Also, we derive and comment those spatio-temporal network patterns which define different areas of Amsterdam in terms of mobile phone activities taking place within their boundaries. Finally, regression analysis is used to quantify the relationship between mobile phone activities and the land uses from which they originate.

In the conclusive Chapter 7, a summary of the research conducted and its main findings is presented, together with its policy implications, a proposed explanatory framework and possible directions for future research. The chapter concludes with an overview of emerging web 2.0 opportunities for activity-travel research.

All case study chapters (i.e. chapters 4, 5, 6) include a sub-section on "Research constraints" within the "Research design and data collection" section, as well as a conclusive section on "Lessons learned and recommendations for future researches".

The research conducted in Chapter 4 on police officers suggests that several factors affect the adoption of mobile technologies, such as easy of use and training to use, clear benefits and advantage over comparable tools. It was also found that cognitive and situational factors are playing a major role at the time of acceptance, in particular (Alavi and Joachimsthaler, 1992):

- cognitive styles, i.e. cognitive problems in accessing the information through the mobile technology;

- user-situational variables, i.e. elements of the environmental and social contexts of usage such as location, distraction, crowding, interaction, and privacy (see 4.6).

The research conducted on university students in Chapter 5 proves a positive correlation between laptop use and travel behaviour. When with a laptop, students spend more time on the move and carry out more trips; laptop availability emerges as a statistically significant predictor of such increase in the number of trips. Laptops are associated to greater flexibility and control over work resources.

The same positive correlation between usage of mobile technologies and travel is found in the case study about mobile phone usage in Amsterdam, in Chapter 6, when considering text messages sent (as a proxy of mobile communications) and calls performed on the move (as a proxy of trips), even if it would possibly apply to limited segments of users (as explained in section 6.7).

The rest of research conducted in Chapter 6 served to further investigate the opportunity to use mobile phone data as a proxy of human behaviour in space in time. The reconstruction of mobile phone usage patterns for different areas (section 6.5) and the correlation between land use and mobile phone usage (section 6.6) proved that spatial and temporal contexts have important implications on the type and quantity of mobile phone activities performed.

At an exploratory stage, the research presented in this dissertation may serve to build new insights on how travel behaviour may change in times when mobile phones and devices are ubiquitously diffused all over the world and when a growing number of corporations, universities and municipalities are promoting new ubiquitous wireless connectivity initiatives.

Some specific findings from each of the 3 treated case studies can be used to derive policy recommendations. Evidence from the research conducted in Groningen on police officers suggests that before the full implementation of a new professional mobile information system, a thorough assessment is needed to identify future contexts of usage and situational constraints. Evidence collected at MIT on the behaviour of university students may have implications on decisions related to new infrastructure needed for laptop usage (for example electricity outlets in certain places), as well as on the number of computer rooms needed at the institute level. It also offers a new level of understanding on how human behaviour may change in work and living environment where Internet connectivity is ubiquitous.

Finally, the research conducted in chapter 6 on the relationship between land use and mobile communication may have several policy implications at the urban scale, first of all to predict the impact of different land-use choices on mobility. The analysis of aggregate mobile phone data as a proxy for human presence may also be relevant to several fields of practice related to mobility, such as: emergency management, traffic monitoring, urban planning, public transport planning, tourism. It can be assumed that new mobile and Internet technologies have changed human mobility forever, but they also seem to be the best candidates to help us understand how.