Journal of Transport Geography 17 (2009) 104–114

Contents lists available at ScienceDirect

Journal of Transport Geography

journal homepage: www.elsevier.com/locate/jtrangeo

What is different about urban activities of those with access to ICTs? Some early evidence from Québec, Canada

Martin Lee-Gosselin [a,*], Luis F. Miranda-Moreno [b]

[a] École Supérieure d'Aménagement du Territoire et de Développement Régional, Centre de Recherche en Aménagement et Développement, Université Laval, Quebec City, Canada G1V 0A6
[b] Department of Civil Engineering and Applied Mechanics, McGill University, Montréal, Québec, Canada H3A 2K6

ARTICLE INFO

Keywords:
Activity
Travel
Spatio-temporal organization
ICTs
Mobile phone
Internet
Decision processes

ABSTRACT

The first wave, conducted in 2002–2003, of an in-depth panel survey in Quebec City, was used to compare the out-of-home activities of adults who had the use of mobile phones, or of internet at home, to those who did not. A unique feature of the survey was the inclusion of respondents' perceptions of the both the temporal and the spatial flexibility of all executed activities. We find, after statistical controls for other factors, that mobile phone use was positively associated with activity and trip levels, while internet access was negatively associated. These two ICTs also had mostly opposite relationships with the routinisation and pre-arrangement of activities and with some conventionally defined sub-classes of activity.

1. Introduction

The use of information and communication technologies (ICTs) to plan and facilitate the timing and location of day-to-day activities is arguably a key component of emerging patterns of urban mobility. A key characteristic of those patterns is a "post-modern" complexity, in which mobility is a reflection of expanding spatial and temporal choice, and of "on demand" consumption. The future trajectory of urban mobility is the subject of many speculations, but not so much empirical evidence. In part, this is because surveys of personal mobility, such as household travel surveys, focus primarily on the attributes of *executed behavior*, that is: trips and (sometimes) the activities that motivate the trips. Only rarely do surveys throw any light on *how* the trips and activities were considered and adopted for execution (Stopher, 2008). The main exceptions are surveys that target *underlying decision processes* and, in particular, seek data that help explain the spatial and temporal organization of personal and household activities. This paper uses one such, in-depth data source, the Quebec City Panel Survey (QCPS). We compare the attributes of activity and travel episodes that were planned by those with access to either or both of the two most ubiquitous "new" ICTs – mobile phones and the internet – to those who had no such access. In addition, we look at the characteristics of a limited number of activities that were planned within an hour of execution with help of mobile phones, pagers or e-mail versus those that were planned, also within an hour of execution, by landline telephones or face-to-face.

The paper first discusses the conceptual frameworks that have been proposed in the literature to explore the loosening of spatial and temporal ties that may result from ICT use, as well as new possibilities for parallel activities. Section 3 reviews the origin and design of the QCPS, the first wave of which yielded the data used for this paper. A unique feature of the survey was that respondents were trained to classify every activity that they executed, in or out of the home, according to whether they were "routine", "pre-arranged" or "impulsive" in time, and then in space. This provides some potentially valuable insights into the antecedents of the spatial and temporal fragmentation of activities.

In Section 4, we discuss the analysis approaches, and Section 5 we present first some descriptive statistics about ICT use in the sample and then the results of several statistical models, the implications of which are discussed in a final section. We look forward to a companion paper: the Wave 1 panel data used in this paper are from the period 2002–2003, at which time somewhat less than half of the sampled respondents had the use of a mobile phone, and about 70% had access to the internet. These proportions have increased since, and in the following paper the implications of this will be examined using three waves of panel data.

In two previously published papers (Lee-Gosselin et al., 2006; Miranda-Moreno and Lee-Gosselin, 2008), we have explored some very interesting longitudinal trends in the balance between routine, pre-arranged and impulsive activities within households and individuals, including a hypothesis that the amount of effort involved to decide on the spatial and temporal attributes of

* Corresponding author. Tel.: +1 418 656 7558; fax: +1 418 656 2018.
E-mail addresses: Martin.lee-gosselin@crad.ulaval.ca (M. Lee-Gosselin), luis-f.miranda-moreno.1@ulaval.ca (L.F. Miranda-Moreno).

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doi:10.1016/j.jtrangeo.2008.11.009

pre-arranged activities may be subject to a tolerance band, or budget. This paper is the first release of results from the disaggregate ICT variables in the QCPS, and helps identify the segments of the population for which rapidly diffusing ICTs are most likely to be a lever of change in urban mobility.

2. Background

ICTs such as the internet and mobile phones have now diffused to the extent that very significant proportions of people can now communicate in real time from almost anywhere. In principle, ICTs increase an individual's freedom to decide when, where, and how she wishes to execute daily activities and associated travel, and may include the displacement of some activities. Contrary to speculation that this would lead to the elimination of the need for some travel, the so-called information revolution has not been accompanied by a decrease in travel (e.g., see Choo and Mokhtarian, 2007). Empirical evidence has shown that the relationship between ICT and travel is not simply one of substitution (e.g., see Lenz and Nobis, 2007; Kenyon and Lyons, 2007). In recent years, a substantial body of travel behavior literature has sought to clarify the link between travel, daily activities and ICT. Some examples are: Kim and Goulias (2003), Bhat et al. (2003), Srinivasan and Raghavender (2006), Lenz and Nobis (2007), Kenyon and Lyons (2007), De Graaff and Rietveld (2007). In particular, theoretical and empirical research has explored the hypothesis that ICT can lead to a more flexible, and in some cases novel, organization of activities in time and space.

A number of studies have explicitly explored the links between travel and access to, or use of, communication technologies such as the internet and mobile phones (e.g., Mokhtarian and Salomon, 1996, 2002; Srinivasan and Raghavender, 2006; Wang and Law, 2007). This empirical work is mostly reported according to a conceptual framework for the interactions between ICT and travel that was developed by Salomon (1985). In his seminal work, Salomon identifies four potential different types of interaction: (i) travel *substitution* which refers to ICT improvements resulting in physical trips no longer being necessary, an interaction that has been a particular focus of much ICT research in recent years; (ii) *modification* of travel, for example by changing trip timing and routing; (iii) *generation* (or *complementary*) travel, which refers to the additional travel that would not have existed without the existence of ICT, even though little is known about how ICT may generate additional traffic; (iv) *neutrality,* for circumstances in which there is no significant interaction.

More recently, with the increased use of activity-based methodologies and activity diaries, some empirical studies have explored not only the link between ICT on travel but, more importantly, the complex relationships between ICT and daily activity patterns (Bhat et al., 2003; Srinivasan and Athuru, 2004; De Graaff and Rietveld, 2007; Hubers et al., 2006). Despite a relative paucity of data, and the number of questions remaining open in this area of research, a small number of conceptual studies have produced promising insights that seem to be supported by the empirical evidence. Among these, Couclelis (2000) introduced the notion of "fragmentation", which she defined as: "a process whereby a certain activity is divided into several smaller pieces, which are performed at different times and/or locations". Nobis and Lenz (2004, 2007) added the nuance of the interruption or cutting-in of one activity by another, and the subsequent continuation of the former enabled by the use of ICT. Thus, activity fragmentation can occur on several levels: in space, in time, or in the way they are performed: (i) *Spatial fragmentation* refers to the fact that in the past there was a close connection between specific activities and places. For example, most work activities were once performed on the premises of an employer, but in modern (and post-modern) society, activities can develop in many locations (for instance, work for some individuals can be done in the office, at home, when traveling, etc.). As argued by Couclelis, the spatial arrangement of fragmented activities may expand from one location per activity to a potentially indefinite number of locations. (ii) *Temporal fragmentation* refers to the division of activities into different time windows. As argued by Nobis and Lenz (2007), "activities previously performed uninterruptedly are now broken up into pieces that are accomplished at different times of the day or the week". For instance, e-shopping can be done at any time of the day or night, and can be fragmented into different *stages*, such as information search, price comparison and the execution of a purchase. The asynchronous nature of e-mail also lends itself to temporal fragmentation. (iii) *Fragmentation of the manner* in which activities are developed refers to the fact that activities are not associated with exclusive processes, be they travel or communication-specific. For example, shopping does not necessarily need to be done in a shop, and paying a bill may be done in a bank or online. Activities can be executed in both ways. Nobis and Lenz (2007) argue that fragmentation occurred before the availability of ICTs. In the words of these authors: "what is new when ICT are used is the independence of activities from time and place which leads to new combinations of time, place and activity with the tendency to increase travel, probably above all because fragmentation allows an increase in activities by compacting sequences of pieces of activities".

Despite the theoretical appeal of "fragmentation" to explain the complexity of emerging ICT use, travel and activity patterns, there are still few empirical studies, documented in the literature, that attempt to verify the notion. An exception is the very recent work of Nobis and Lenz (2007). They elaborate on some theoretical concepts, such as why individuals fragment their activities, and use a data set about activities, ICT use and travel behavior in Germany, from which they find how far an activity like work, which is particularly apt for fragmentation, shows signs of temporal and spatial disintegration. With the help of a cluster analysis they identify groups with different fragmentation behaviors and its activity patterns.

Another important activity-based concept, recently studied by Kenyon and Lyons (2007), is the notion of "*multitasking*". These authors define multitasking as the simultaneous realization of two or more activities during a given time period – for example, walking whilst talking by mobile phone. These authors argue that ITCs such as internet "....can enable individuals to reconfigure their spatio-temporal pattern of activity participation in such a way that participation is more efficient (thereby releasing more time for additional (discretionary) activities), is of higher quality or is more fulfilling." The same authors also suggest that the frequency and properties of multitasking must be observed in order to assess the impact of technology such as internet. More generally, participation in activities, and changes in activity participation, are not fully measured without consideration of multitasking.

If many activities, aided by ICTs, are becoming increasingly fragmented, then a key research question is how people go about organizing such patterns of behavior. Fragmentation implies various mixes of dovetailing, coordination with others and opportunism. It is therefore relevant to "look upstream" from fragmentation, and ask which parts of people's observed activity patterns required pre-arrangement, and which parts were impulsive – in time and/or location. This is the focus of the current paper. We attempt to learn from the observation, in the Quebec City Panel Survey, of respondents' perceptions of temporal and spatial flexibility in the organization of their activities. Further, we provide some empirical evidence about the relationship between such perceptions of flexibility and the availability of two ICTs: mobile phones and internet, and in addition we comment on the characteristics of a small