

Guest Editorial

The interaction between ICT and human activity-travel behavior

The interaction between information and communication technologies (ICT) and human activity-travel behavior has been an important theme in transportation research in recent years. Researchers have recognized that an increase in the use of ICT may lead to changes in the location, timing and duration of people's activities, and the widespread use of ICT will likely be associated with new patterns of activity and travel in space-time (Kwan, 2002; Dijst, 2004). Analyses of these patterns could provide part of the empirical basis and/or behavioral foundation for enhancing our understanding of the interaction between ICT, activity-travel behavior and urban form.

The earliest studies by transportation researchers focus largely on the effect of telecommuting on travel behavior. Several of them used the geocoded activity-travel data from the State of California Telecommuting Pilot Project collected in 1988–1989 to assess the impact of home-based telecommuting on travel. They observed a significant reduction in work-related travel and a contraction of activity space for telecommuters as a result of telecommuting. For instance, Pendyala et al. (1991) found that telecommuters not only substantially reduced their trip making and the total distance traveled, but also chose non-work destinations that are closer to home. Koenig et al. (1996) observed a significant reduction in the number of trips and vehicle-miles traveled (VMT) for telecommuters. Another study by Saxena and Mokhtarian (1997) has similar findings: the share of activities performed close to home increased considerably for telecommuters on telecommuting days, and there was a contraction in the size of the activity space for telecommuters on commuting days.

However, studies that used other data sets tend to suggest that ICT use at home may lead to an increase in non-work trips and activities. For instance, Henderson and Mokhtarian (1996) observed a considerable reduction in commute-related travel and a slight increase in non-work travel as a result of center-based telecommuting. Balepur et al. (1998) found that telecommuters undertook a significantly higher number of return home, eat meal, shopping, and social/recreation trips on telecommuting days when compared to non-telecommuting days. The results of other studies also support the tendency for non-work activities and trips to increase as a result of higher level of ICT use. For instance, Gould and Golob (1997) found that people working exclusively at home on a given day spent significantly more time shopping on the work day than did persons working away from home. Mokhtarian and Meenakshisundaram (1999) observed a predominant effect of generation – which occurs when the use of one mode increases the use of another (e.g., the greater the availability of information about activities and people of interest, the greater the travel to participate in those activities or meet those people). They found that increasing use of ICT is unlikely to reduce travel significantly.

While most of the early studies on the interaction between ICT and human activity-travel behavior focus largely on telecommuting, recent research has broadened this focus to include other types of interactions (e.g., shopping and leisure activities). For instance, Ferrell (2004) examined the impact of teleshopping on out-of-home shopping trips and travel distance. The results suggested that home shopping tends to increase shopping trips and the number of chained shopping trips with a reduction in the total travel distance. Farag et al. (2006) compared the impact of E-shopping on travel between the Internet users in Minneapolis (USA) and those in

Utrecht (The Netherlands). They showed that online shopping is influenced by social-economic factors, people's Internet experiences, and the spatial characteristics of the study areas.

In light of the substantial need to further advance research on the interaction between ICT use and human activity-travel behavior, we have initiated an international thematic network on "ICT: mobilizing persons, places and spaces" (ICT-PPS) to address pertinent research and policy issues. The network has five goals: (1) to foster from a multidisciplinary perspective a better understanding of the impact of ICT on people's everyday life, use of places and spaces in various cultural, spatial and institutional contexts; (2) to develop and discuss methodological approaches on data collection, data sharing, analytical methods and methods of representation; (3) to disseminate theoretical, methodological and empirical papers in the form of peer reviewed journals and books and a website; (4) to foster cutting edge joint research activities regarding the impact of new ICT on mobilizing people, places and spaces; and (5) to exchange knowledge among members of the network and in interaction with other academics. The articles in this special issue are from the contributions by the participants of the first international workshop we organized under the auspices of the ICT-PPS thematic network in November 2004 in Doorn, the Netherlands. Each of them examines a particular aspect of the interaction between ICT and human activity-travel behavior.

Farag, Schwanen, Dijst and Faber examine the relationships among the frequencies of online searching, online buying, and non-daily shopping trips, and how they are influenced by shopping attitudes and behavior, Internet behavior, sociodemographics, land use features, and lifestyle or personal characteristics. Based on data collected from 826 respondents of the Utrecht region in the Netherlands, structural equation modelling was used to examine the complex inter-relationships among the variables. The results show that searching online positively affects the frequency of shopping trips, which in turn positively influences online buying. An indirect positive effect of time-pressure on online buying was found and an indirect negative effect of online searching on shopping duration was observed. These findings suggest that e-shopping could be task-oriented and a means of saving time for some people but leisure-oriented for others. The authors also address the role of location factors on the interactions of e-shopping and in-store shopping. They found that urban residents shop online more often than suburban residents because they tend to have a faster Internet connection, and that the frequency of buying on-line is lower if people can reach more shopping opportunities within 10 min by bicycle.

De Graaff and Rietveld argue that both temporal and monetary constraints need to be taken into account in any analysis of the relationship between ICT use and teleworking (in order to control for the effects of income and substitution between activities). They consider commuting time as the price to be paid for out-of-home employment and a decrease in income as the price for working at home. They developed a microeconomic demand system that incorporates both time and income constraints. Using a subsample of the 1990 and 1995 Dutch time use surveys, De Graaff and Rietveld analyzed the trade-off between working at home and out-of-home, ICT and commuting time through estimating a translog indirect utility function. Based on this function they estimated substitution and price elasticities between working at home and out-of-home for the subsample. They found that working at home leads to a marginally significant reduction of the wage rate of about 19%, but this gap largely disappears when teleworkers have access to an Internet connection at home. In addition, their results show that changes in ICT and commuting time have weak substitution effects on working out-of-home and at home respectively, and individual characteristics (especially age and education) seem to be more important to the choice between working at home and out-of-home than ICT availability or commuting time.

Kenyon and Lyons argue that multitasking is an essential element in the assessment of the social and transportation effects of Internet use, and the neglect of the role of multitasking in previous research has contributed to serious flaws in our understanding of people's daily activity participation. They define multitasking as "the simultaneous conduct of two or more activities during a given time period" and suggest that activity participation and its change cannot be accurately measured without taking the parallel conduct of activities into account. Using data collected through a diary-based study from 90 participants in six locations in the south west of England, the results reveal the central importance of multitasking and highlight the underreporting of key activities when primary activities alone are considered. Their findings support the three hypotheses that they set out to examine: (1) failure to consider multitasking leads to the underreporting of key activities;

(2) misrepresentation of activity participation tends to be more pronounced for certain key groups; and (3) lack of awareness of multitasking could lead to the flawed measurement and thus misrepresentation of behavior change over time. They also found that multitasking behavior varies by the primary activity's offline or online status. Kenyon and Lyons conclude that taking multitasking into account is important in the study of travel, Internet use and interactions between the two.

Rotem-Mindali and Salomon examine consumers' Purchase and Delivery (PD) choices as part of a broader effort to understand the impact of ICT use on shopping behavior. They suggest that as consumers can acquire information, make purchase transactions and choose delivery arrangement from a remote location, E-tailing may result in a reduction of transport activities – as delivery by the supplier becomes an option as compared to self-delivery in traditional shopping. Rotem-Mindali and Salomon propose a conceptual model for describing the general structure of this behavior and for studying the impacts of E-tail on shopping-related travel. They used a data set with 510 valid questionnaires collected in the Tel-Aviv metropolitan area in the summer of 2004 to test the hypotheses that emanated from their conceptual model. They found that only a very small proportion of their respondents frequently use ICT for shopping purposes (although there is a larger proportion of respondents that use the Internet for collecting information). They observed a stronger tendency in using ICT for purchasing electronic goods and appliances than for buying groceries and perishable goods. Their analysis of the sequence of decision on shopping activities reveals that consumers usually make decisions about the location of purchase first and then decide on the mode of delivery. Rotem-Mindali and Salomon, however, conclude that it is difficult to predict the impacts of e-retail on travel, as suppliers and consumers are still experimenting with e-retail.

Drawing upon the notion of “fragmentation” proposed by Helen Couclelis, Lenz and Nobis examine how ICT use may lead to a reorganization of human activities in space and time. The fragmentation of activity, as Couclelis (1998, p. 342) suggests, refers to the tendency that “activities that used to be associated with a single location (e.g., my workplace) are now increasingly scattered among geographically distant locations (e.g., my office, home, associate's home, hotel room, car, train, or plane).” Fragmentation therefore may lead to an increase in travel as activities are no longer tied to particular places and/or times. The study explores why individuals fragment their activities and the associated mechanisms for this process. Specifically, they seek to answer the questions: “When is an activity broken up into pieces *due to the use of ICT*?” and “When does this become relevant for travel?” Using a data set of 3500 of German-speaking residents of the Federal Republic of Germany aged 14 and older, collected with a one-day activity diary and a questionnaire, the results show signs of temporal and spatial disintegration. Lenz and Nobis identified four groups with different fragmentation behavior and ICT use through cluster analysis. They observed that mobile computer users practice fragmentation in all kinds of their activities and have a high level of travel need. There is, however, no unambiguous evidence that fragmentation increases travel demand. The authors also question the causality between ICT use and travel behavior, arguing that high travel frequency induces demand for ICT rather than the other way round.

From the evidence provided by these studies, it is apparent that the interaction between ICT use and human activity-travel behavior is highly complex. It cannot be simply described in terms of substitution and/or generation. As Mokhtarian (1990, p. 240) suggested, the most important impact of ICT use is that “it permits much more flexibility in whether, when, where, and how to travel, and thus loosening the constraint of having to be at a certain place at a certain time.” She made the important point that including considerations of the decision, location, timing and duration of activities and travel in the analysis will likely be more fruitful than focusing only on one particular aspect of such interaction. We hope the articles in this special issue will help stimulate further research on the complex interaction between ICT and individual behavior, especially the fragmentations and regrouping of daily activities and trips.

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