



Communication and mobility behaviour – a trend and panel analysis of the correlation between mobile phone use and mobility

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ABSTRACT

The paper examines the assumption about the complementarity between telecommunications and transport on the level of individual persons. Taking into account that previous studies have shown the particularly strong correlation between mobile phone use and travel behaviour, telecommunications use is considered by focussing on the mobile phone. Using panel data from Germany for the years 2004 and 2007 the first step consisted in an investigation of changes in mobile phone use taking into consideration also the level from which potential changes started. About one half of the respondents had changed their mobile phone use, in most cases by an increase of use. In a second step a comparison was made to potential changes in travel behaviour of the observed persons. The results show that in those groups of persons where the mobile phone use was on a high level or even increased from a high level in 2003, travel behaviour in terms of travel frequency decreased less than for all other persons or even increased. The assumption that changes in “life circumstances” such as new place of residence or change of household size trigger the change in mobile phone use or travel behaviour could be generally confirmed.

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1. Introduction

During the last decades a steady growth could be observed for both telecommunications and travel. In Germany, for instance, the volume of telephone calls grew from 230.4 billion minutes in 1999 to 296.0 billion in 2006. While in 1999 about 8% of these calls were made by a mobile device, this rate rose to almost 20% in 2006. At the same time, the total travel volume grew by 3% in terms of trips and by 5% in terms of kilometres travelled (Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen, 2007). Although this parallel increase of both travel and telecommunications could be registered for many countries of the industrialised world, the scientific discussion about the interaction between telecommunications and travel is far from asserting an “automatism” between them.

The observations about the development and interaction of telecommunications and travel have been increasingly enriched by studies that aim at understanding how telecommunications may have an impact on travel behaviour of individuals (e.g. Schwaben and Kwan, 2008; Srinivasan and Raghavender, 2006). These studies also revealed that the relationship between telecommunications and travel differs by the means of telecommunications which is used (Nobis and Lenz, 2006; Nobis et al., 2005). At the same time, however, most analyses have tended to presume that the direction of influence is above all from telecommunications

to travel thus neglecting or at least underestimating the likely impact of travel on telecommunications. This aspect was “rediscovered” by the work of Choo and Mokhtarian (2004) who emphasized the mutuality of influence and provided empirical evidence using aggregate US time series data (Choo and Mokhtarian, 2005).

In the context of this research the present article has the objective to test if the bidirectional influence between telecommunications and travel can also be found on the individual level. As it was found in previous studies of the authors themselves that the strongest correlation was between the use of the mobile phone and travel, the article refers to this particular relationship. To realise the study panel data were used from 2003 and 2007 for Germany. These data were collected by order of the DLR Institute of Transport Research to allow for a survey of behavioural change with respect to both telecommunications and travel among the German-speaking population of 14+.

The organisation of the article provides a review of the discussion on complementarity and the indicators for complementarity in the first section. In the next step, it describes the approach taken for the data evaluation that is presented, and the relevant data basis. The empirical analysis starts by a trend analysis and then investigates the relationship between the development of mobile phone use and individual travel behaviour for the panellists. In this context the authors test if changes in life circumstances during the panel period might have been the causes for a change in telecommunications behaviour. The article ends with a summary and conclusions.

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2. Complementarity between telecommunications and travel

Research on the relationship of telecommunications and travel has been driven by the objective to understand the direction in which the use of telecommunication means alters mobility behaviour. To this purpose, Salomon had developed a scheme that categorised the potential effects into two basic types, namely “substitution” and “complementarity” (Salomon, 1986). He subdivided complementarity into “enhancement” which was the generation of additional travel due to the availability of additional telecommunications, and “increasing efficiency” suggesting that the efficiency of travel increased by the application of telecommunications and possibly leading to moderate substitution effects. “Increasing efficiency”, however, was basically ascribed to the supply side. So complementarity in Salomon’s understanding was the “increase in demand for transport resulting from the enhanced use of telecommunications” (Salomon 1986, p.226).

Based on the work of Salomon and others (e.g. Salomon, 1985, 1986; Mokhtarian, 1990; Market and Goulias, 1999; Hjortol, 2002) Senbil and Kitamura (2003) developed the SCMN typology suggesting four potential relationships between telecommunications and travel: Substitution (telecommunications leading to a decrease in travel demand through a reduction in total number of trips or in trip duration), Complementarity (generation of new trips due to the use of telecommunications), Modification (change of spatial and temporal characteristics of existing travel patterns by the use of telecommunications) and Neutrality (no impact of one medium on the other). While they added “modification” and made explicit – as already done earlier by Salomon – that telecommunications do not necessarily alter travel demand or travel behaviour, they kept the existing definition of “complementarity” as an effect that generates trips by the use of telecommunications.

In the political and transport planning arena expectations were high specifically concerning the reduction of physical transport by telecommunications through “substitution”. Doubts about the unidirectional relationship between ICT and transport were raised quite early on – for instance Salomon himself identified the interaction between telecommunications and travel as “mutual effects” (Salomon 1986, p.223).

One major problem was to find empirical evidence about the relationship between telecommunications and travel. This must also be regarded against the background that – at least in Europe – the rise of new information and communication technologies (ICT) started only in the second half of the 1990s thus leading to substantial change in the availability and use of telecommunications also in a private context. In an empirical study that was realised already in the year 1984 Claisse had found for the French case that about one-third of all [landline] telephone calls served to prepare, organise and coordinate activities that were linked to physical mobility (Claisse, 1989). The conclusion was that travel inducing effects were the most likely ones. Other empirical studies on the use of “new” telecommunications, like videoconferencing for instance, found that ICT use was substituting business travel for meeting purposes by about 10%, but that at the same time videoconferences were used to prepare and complement physical meetings, and: the increased efficiency that resulted from videoconferencing often lead firms their expand its activity space so that the net outcome was an increase in travel (Köhler, 1994).

The observation of a close correspondence in the levels of mobility and communication frequency was supported by other studies like the one of Zumkeller et al., 2000 who investigated the mobility and communication behaviour of 900 individuals in 402 households of Southern Germany (Zumkeller, 2005; Zumkeller, 1997). They found that the more people were mobile, the more they had contacts via telecommunication means particularly via telephone.

It is worthy to note that when the study was made in 1995 mobile phone and e-mail use were still at a low 1% level in the study as well as in Germany quite generally. With respect to the interdependence between telecommunications and transport the authors highlighted the role of telecommunications to shape “translocations” by supporting their preparation and their efficient realisation. In addition they found that telecommunications allowed keeping or even strengthening contacts over long distances. The main conclusion of the study was that the complementary relationship of telecommunications and travel lead to an increase in travel.

Moreover, the case for complementarity was found in specific telecommunications application fields like e-commerce. It could be demonstrated by both theoretical considerations and empirical investigations that the online shopping channel increased the number of single shopping activities (Franck and Frechen, 1998; Mindali and Salomon, 2007; Mokhtarian, 2003b).

Similar findings were reflected by Mokhtarian within the “big picture” that she offered in her review of concepts, theoretical approaches and empirical findings on the interrelation between telecommunications and travel (Mokhtarian, 2003a). While she highlighted the observation that complementarity mostly appeared as a longer-term effect, she also drew the general conclusion that given the current trends for telecommunications and for travel complementarity was likely to be reinforced in the future (Mokhtarian, 2003a, p.54). Re-examining this problematic in a later study by model estimations with aggregate data for the US, she addressed the problematic of mutual influence between telecommunications and travel together with Choo (Choo and Mokhtarian, 2005). Based on the finding that the relationship between telephone calls and travel demand is positive in both directions, but causal effects of travel demand on telephone demand being larger than those of the converse, Choo and Mokhtarian came to the conclusion “that the aggregate relationship between actual amounts of telecommunications and travel is complementarity, albeit asymmetric in directional weight” (Choo and Mokhtarian, 2005, p.232).

3. Basic hypothesis and approach

The purpose of this study is to test if complementarity can also be found on the level of the individual actor. In correspondence to the findings discussed above we assume that a change in the use of telecommunication means is paralleled by a change in travel behaviour: If travel demand affects telecommunications demand and vice versa, an increase in telecommunications use will be related to an increase in travel, while a decrease in telecommunications use will be related to a decrease in travel. Such direct evidence of telecommunications-determined changes in mobility behaviour on an intrapersonal level does not exist so far due to the lack of longitudinal data on the level of individual actors. Yet there are before-and-after studies like the one of Srinivasan and Raghavender about the effects of mobile phone use on travel behavior. The time frame they cover, however, is relatively short so that it cannot be said how permanent the observed effects are.

In order to test our assumption, we analysed the DLR panel data – which is a panel for Germany – for which there are two waves, from 2003 and 2007 (Krause et al., 2008). The panel presents a survey of communication, activity and mobility behaviour. As a longitudinal survey it addresses (1) the change of activity and mobility patterns: Where, when and how long are activities carried out and what is then the role of telecommunications use?, and (2) the possibilities to influence travel behaviour by telecommunications based information.

In what is presented here, the data exploration focuses on the mobile phone use, because of its strong correlation with mobility

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