

Chapter 11

The Substitution of Communications for Travel?

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Introduction

Typically an individual travels somewhere in order to engage in an activity at the destination. The travel itself is commonly considered a means to an end (though this can be challenged, as noted later). Patterns of travel then arise because activities are often spatially and/or temporally dispersed and constrained. People face what have been referred to as coupling constraints (the need to be at a certain place at a certain time to meet other people) and authority constraints (the need to perform activities before closing time) (Hägerstrand 1970) – one must be in the city centre for work at 8am; the children must be collected from school at 3pm; the cinema showing starts at 7pm; and on on.

What has long been appealing to transport planners is the prospect that by being able to change where one participates in an activity it may be possible to reduce or remove the derived travel. Much of the reason for travel is or has been the need to be co-present with other people or objects. In turn, the need for co-presence is associated with the need to access and exchange information – talking to friends, colleagues or clients; studying documents or watching presentations or shows; examining products for possible purchase. With a proliferation of information and communications technologies (ICTs) in modern society, information exchange can (in principle) increasingly take place without the need for co-presence and thus without the need for (as much) travel. From a transport demand management perspective the following question arises: can communications be used as a substitute for travel?

This chapter explores this question, drawing upon international evidence and literature but making particular reference to the situation in the UK. It begins with a broad consideration of the issues associated with travel, communications and the relationships between them and thus possibilities for demand management. Following this, two common activities are considered which give rise to substantial amounts of travel but which might also be a focus for significant if not substantial amounts of substitution, namely working and shopping.¹ The chapter ends with its reflections upon the potential significance of ICTs and substitution for transport demand

¹ In the UK, for example (as at 2005, DfT 2006a), commuting/business accounted for 19 percent of all trips (71 percent of which were by car) and shopping accounted for 20 percent of all trips (64 percent of which were by car). In terms of distance, commuting/

management and some of the challenges that are posed. However, to conclude the introduction, an important caveat concerning context is called for.

As with other measures that potentially contribute to transport demand management, it would be inappropriate to consider a single measure and its effectiveness in isolation. Effective transport demand management is about the combined use of carrots and sticks. If we focus upon phenomena such as teleworking and e-shopping in the absence of considering a wider context (which has perhaps been the case in the past) then our deductions and conclusions may be misplaced. The (future) level of uptake of teleworking or e-shopping and associated transport demand impacts may be very different depending upon the extent to which restraint measures such as road pricing are put in place.

Understanding Travel and Communications

Travel

The UK has seen a substantial increase in the amount of passenger distance travelled in the last quarter of a century – 62 percent from 1980 to 2005 (DfT 2006b). However, much of this increase occurred between 1980 and 1990 with growth slowing subsequently (*ibid.*). Use of the car accounted for 678 of the 797 billion passenger kilometres travelled in 2005 (*ibid.*). Between 1996 and 2004 the average distance travelled increased by 3 percent (to 7,208 miles per person per year); meanwhile the average time spent travelling per person per year increased by 4 percent (to 385 hours). However, the average number of trips per person *fell* by 5 percent (to 1044 trips per year) – could this be explained (in part) by the growth in the use of telecommunications (that is, virtual accessibility/mobility as opposed to physical accessibility/mobility)?

The amount of travel has been linked with the level of a country's economic activity (DETR 1999; Gilbert and Nadeau 2002; Banister and Stead 2003). In the UK in 1999 it was noted that 'the "transport intensity" of the economy has been increasing, that is, each unit of output is associated with a greater amount of movement of people or goods' (DETR 1999, 3). With an apparent 'coupling' between travel and economic activity there can be concerns that if travel is reduced (desirable in terms of transport demand management) economic activity might also be reduced. However, intriguingly, while transport intensity in the UK increased between 1980 and 1992, since 1992, the percentage increase in GDP (45 percent) has been greater than that in both road traffic (21 percent) and in overall travel (16 percent) suggesting that 'there has been some uncoupling of traffic and travel growth from economic growth' (DfT 2006b, 5). From 1995 to 2004, annual economic growth in Europe was on average 2.3 percent while annual growth in passenger transport was 1.9 percent (CEC 2006).

business accounted for 29 percent of all travel (77 percent of which was by car) and shopping accounted for 12 percent of all travel (83 percent of which was by car).

Could the modest decline in overall numbers of trips and this indication of some decoupling be attributable to substitution effects arising through the availability and use of telecommunications?

Telecommunications

The ability to communicate at a distance, without the need for the individual(s) concerned to travel, is not new. The postal service and land-line telephone have been longstanding features of modern society. However, from the 1990s onwards (coincident, in the UK, with the signs of reduced numbers of trips and reduced transport intensity of the economy noted above) a revolution in information and communications technologies (ICTs) has been taking place. The Internet has emerged (see again later) as a major new mainstream communications medium and mobile phones have not only overtaken land-line telephones in terms of sheer numbers in some countries but have been rapidly transforming from mere telephony devices into mobile multimedia communications devices. This revolution appears to be bringing with it a '24/7' society and an 'anytime, anyplace' culture. Commentators have referred to the 'death of distance' (Cairncross 1997) (though overall distance travelled, in the UK, has continued to increase) and point to the fact that where you are is increasingly a less reliable guide to what you are doing. Many of us are incorporating this communications revolution into our everyday lives. Consider for a moment what it is already technologically possible to do. Email is pervasive in both working and private lives (billions of messages are sent globally every day); documents, images and videos can be exchanged at increasing speed; Internet-only television channels are being established; multi-way conference calls can be set up involving people on the move; booking, purchasing and payment for goods and services can be done online; a global 'library' of information can be searched thanks to a myriad of websites and services such as Google and Wikipedia; social networks can be created involving people who have never met (such as MySpace) and who have previously met and want to meet again (such as Friends Reunited and more recently Facebook); and people can even 'live', interact, socialise, do business and make (real) money inside 'virtual' three dimensional worlds such as Second Life (which has over 8.6 million 'residents' and rising) (<http://secondlife.com/>). This has all emerged in the space of a few years. The theory of innovation diffusion (Rogers 2003) points to the prospect that while some of the above is currently associated with 'innovators', 'early adopters' and the 'early majority', over time these people will be joined by the 'late majority' and 'laggards' such that this growing array of telecommunications use will become increasingly commonplace.

Travel is undertaken to access people, goods, services and opportunities. Telecommunications is evidently enabling some people on some occasions to gain such access *without* the need to travel – virtual mobility instead of physical mobility (Kenyon et al 2003). However, one of the major challenges in this rapidly evolving 'information age' is for empirical evidence to be gathered and research to be conducted to monitor and understand what is happening in terms of the nature and scale of the influence of ICTs on access and mobility. What communications has made possible does suggest that *opportunities* for substitution could be increasing – but to what extent are these opportunities being exercised in practice?

There is a long established and developing field of research literature examining how telecommunications use and travel interact. A notable point of reference is the early work of Salomon and Mokhtarian (Salomon 1986; Mokhtarian 1990) who identified four different kinds of relationships:

- the *substitution* of telecommunications use for travel (leading to a decrease in travel);
- the *stimulation* of more travel because of telecommunications use;
- the improvement in *operational efficiency* of the transport system through the use of telecommunications; and
- *indirect*, long-term impacts upon travel via other changes (for example, to spatial configurations of people and activities) encouraged through telecommunications use.

The important and enduring empirical questions concern to what extent, at the level of the individual and at the aggregate, these relationships are at work. Mokhtarian (1997) notes (at the aggregate) that ‘Historically, transportation and communications have been complements to each other, both increasing concurrently, rather than substitutes for each other. And we have no reason to expect that relationship to change.’ This view has been echoed in other commentaries. Adams (2000) suggests that electronic mobility and physical travel are highly correlated over space and time and states that ‘The hope that extensive use of telecommunications will obviate the need for travel and the movement of goods, rests upon a decoupling of the trends of electronic and physical mobility for which there is no precedent.’

To the relationships above should be added a number of others:

- telecommunications can *supplement* travel (increasing levels of access and social participation without increasing levels of travel – that is, telecommunications can substitute for an increase in travel) (Kenyon et al 2002; Kenyon et al 2003);
- telecommunications can *redistribute* travel – even if the amount of travel (measured in vehicle or passenger miles travelled) does not change at the level of the individual or at the aggregate, when and between which locations travel takes place can be changed (with implications for levels of traffic flow and thus congestion) (for example, Lyons et al 2006); and
- telecommunications can *enrich* travel – whereby, through the support of telecommunications, travel time itself is used fruitfully, generating a ‘positive utility’ (Mokhtarian and Salomon 2001; Lyons and Urry 2005).

Recognising these many different relationships and the growing presence of telecommunications use in our everyday lives, it can be taken as a given that telecommunications impacts upon transport demand. However, with so many relationships potentially at work it is much less clear whether or not substitution does or could predominate. There has been past optimism that this might be the case.

However, Geels and Smit (2000) suggest that past optimism may have neglected a greater appreciation of social context. Functional thinking would suppose, for example, that the reason one goes shopping is to purchase goods that are needed and if this can be done via the Internet there would be no need to travel thanks to substitution. However, in practice going shopping may serve other important goals, such as social engagement, which cannot be provided through e-shopping. In addition, use of telecommunications may change pools of social practice such that while some travel is substituted for, virtual interactions generate other new travel.

Transport intensity in the UK and Europe has been decreasing but there is not, it appears, an acknowledgement of whether this may be attributable to telecommunications increasing levels of access and participation in society without the need for (as much of) an increase in physical mobility. So, what then has been the transport policy response to the possibilities of telecommunications impacting upon transport demand and of it potentially acting as a substitute for travel?

Telecommunications and Demand Management

Lyons (2002) has argued that in a multi-modal transport system, transport policymakers should think in terms of modes of access rather than modes of transport and, as such, telecommunications as one of the former should be accounted for in an integrated transport policy.

The European White Paper on transport (EC 2001) made only the briefest of references to telecommunications as a means to manage transport demand and in its mid-term review of 2006 (CEC 2006) little appears to have changed in this respect. In the UK, in its ten year spending plan for transport (DETR 2000) to support its integrated transport policy (DETR 1998), the government stated that ‘social and technological changes will also alter patterns of behaviour in unforeseen ways’ (DETR 2000, 9). However, there is little mention of the Internet. Its only explicitly identified role is as a medium for the provision of multi-modal traveller information. The spending plan acknowledged that ‘the likely effects of increasing Internet use on transport and work patterns are still uncertain, but potentially profound, and will need to be monitored closely’ (DETR 2000, 69). In 2004 a new UK White Paper ‘The Future of Transport – a network for 2030’ was produced (DfT 2004). This makes not a single direct reference to telecommunications, teleworking or e-shopping.²

So, it seems questionable whether transport policy recognises telecommunications as a transport demand management measure. It can be suggested that any policy standpoint on such a measure can either be:

- *proactive* (recognising or believing in the possibility that telecommunications can reduce travel and taking steps to bring this about);

² Though reference is made to government research published in parallel concerning ‘smarter choices’ (Cairns et al 2004) which does review research evidence concerning teleservices such as teleworking and e-shopping and examine their (potential) transport demand impacts.

- *reactive* (responding to trends being brought about through market forces so as to accentuate trends concerning telecommunications use substituting for travel); or
- *inactive* (deciding that telecommunications use is outside the purview of transport policy, whether or not it may be impacting upon travel).

It would appear that to date (as indicated above for the EU and UK) the policy standpoint is at best reactive but tending towards inactive. This may in part be because of the uncertain and dynamic nature of the relationships between telecommunications and travel as the information age continues to unfold.

The chapter will return at its conclusion to a consideration of whether and how telecommunications might play its part in transport demand management. However, first a closer look is now taken at teleworking and e-shopping.

Teleworking

The journey to work remains a dominant feature of people's daily lives (Lyons and Chatterjee n.d.) and this element of transport demand is the principal source of peak period congestion in urban areas. An upwards pressure on overall demand could be attributable to employment levels: the number of people in employment in the UK since 1971 has increased by 4.1 million to 28.7 million in 2005 (ONS 2006a, 50). However, while the number of people in employment has been increasing, the average number of (one-way) commute journeys made per worker per year in the UK has *decreased* from 374 in 1989/91 to 321 in 2002/03 (DfT 2005). It is suggested that fewer commute journeys can be explained in part by more people teleworking (ONS 2006a).

Teleworking (a term first coined in the 1970s by Nilles (1975)) is a form of flexible working. The latter in its broadest sense can mean time (such as flexitime, allowing the banking of hours worked) and space (such as the place of work) freedoms. Teleworking can be seen as an umbrella term which encompasses working at different locations to the conventional workplace – Nilles (1991) describes teleworking as an alternative to work related travel. However, as a term it is commonly associated with working from home when the term 'telecommuting' is also used. Handy and Mokhtarian (1996a) define telecommuting as 'the substitution of working at home for commuting to a usual work site, or the substitution of commuting to a telecentre, for commuting to the more distant usual work site'. Teleworking reinforcing the notion that 'work is what you do, not a place where you go' (Davenport and Pearlson 1998).

Defining and Quantifying Teleworking

The scale of transport demand impacts of teleworking clearly relates to the extent to which it is undertaken. This relates in turn to how many people are teleworkers and how much they telework. However, to quantify the scale of teleworking first requires that teleworkers and teleworking are defined. Notwithstanding some

reference to this above, matters of specific definition have spawned a range of interpretations across the literature (Mokhtarian 1991a; Sullivan 2003). Two factors are often evident across definitions, namely that telework is 'remote' work and that it involves the use of ICTs (for example, Gillespie et al 1995; Huws et al 1996; Kerrin and Hone 2001). Lyons (2002) points out that working from home may not always require the use of ICTs but notes that since ICTs are now integral to modern working environments it is increasingly likely that they become a prerequisite for teleworking. Varying definitions of teleworking make cross-national, international and/or longitudinal comparisons difficult to undertake (Mokhtarian et al 2005; Pratt 2005). However, there are longitudinal national surveys which have begun to consistently use definitions to allow comparison over time – for example, the UK Labour Force Survey (LFS).³

The LFS defines homeworkers as 'people who work mainly in their own home, or in different places using home as a base, in their main job' (Ruiz and Walling 2005). As a proportion of all workers, homeworkers have increased from 9 percent to 11 percent between 1997 and 2005 with over 3 million homeworkers in 2005. The LFS also defines a subset of homeworkers which it calls 'TC teleworkers' and defines as individuals 'who could not work at home, or in different places using home as a base, without using both a telephone and a computer' (ibid.). As a proportion of all workers, TC teleworkers have increased from 3 percent in 1997 to 7 percent in 2005. The majority of teleworkers (62 percent) in 2005 were self employed. However, these figures refer to individuals who use home as their base and, as such, do not have a daily commute. The LFS does also ask individuals to report if they worked at least one full day at home in the reference week of the survey. Such 'occasional teleworkers' (who do not *mainly* telework) are not included in the figures above but are said to have numbered around 1 million workers in 2005 (ibid.). Earlier figures for occasional teleworkers (see Hotopp 2002; Lyons 2002) suggest they numbered some 357,000 in 1999 and 513,000 in 2001 and occasional teleworkers (as at 2001) are predominantly employees (82 percent) (as distinct from self-employed) and most are in full-time paid employment (90 percent) (ONS 2001). Thus increases in the number of occasional teleworkers have been particularly dramatic.

Pratt (2005) provides a comparison of UK data with that collected from other official Labour Force Surveys in Hungary, Ireland, the Netherlands, and the US. This suggests that 'the incidence of work at home at least one day per week ranges from 8.9 percent of all employed persons in Ireland to 11.1 in the UK and 15 percent in the US' (Pratt 2005).

Given the notable proportions of teleworkers or homeworkers in national workforces, what then are considered to be the transport demand impacts of teleworking?

3 'The Labour Force Survey (LFS) is the principle source of statistics on teleworking in the UK' (Ruiz and Walling 2005). The LFS in fact covers Great Britain (GB) (England, Scotland and Wales) as opposed to the whole of the UK (England, Scotland, Wales and Northern Ireland).

The implications of teleworking for transport have been the focus of research for more than twenty years with notable work through the 1990s in the US by Mokhtarian (for example, Mokhtarian 1991a; Mokhtarian 1991b; Lund and Mokhtarian 1994; Mokhtarian et al 1995; Handy and Mokhtarian 1996a; Handy and Mokhtarian 1996b; Mokhtarian 1996; Mokhtarian 1997).

Travel substitution – the removal of the commute trip – is the primary direct impact of homeworking. Commute removal may either be on the given days when occasional homeworking is undertaken or could be the complete removal of all commute trips where an individual changes from being an employee at an ‘office’ to a self-employed home-based worker. Allied to commute removal (or its reduction in length where an individual is not working from home but from a telecentre) there can be implications for vehicle emissions (Mokhtarian et al 1995; Henderson and Mokhtarian 1996; Glogger et al 2003; Kitou and Horvath 2006).

However, taking substitution as given, there are potential secondary impacts of homeworking that could arise and which could offset the benefits of commute removal. Individuals may make additional trips on homeworking days that would previously have been combined with their commute or another household member may switch transport mode because a free vehicle is available at the house. A potential indirect effect of occasional homeworking could be that an individual is able to live further away from the conventional workplace such that longer commutes are compensated for (in terms of vehicle miles travelled) by there being fewer of them (Lund and Mokhtarian 1994; Mokhtarian et al 2004).

In an examination for the UK Department for Transport of the potential transport demand implications of teleworking, Cairns et al (2004) assessed reported international evidence of the impacts noted above. They concluded that (Cairns et al 2004, 258–9):

Teleworking does reduce the car mileage travelled by teleworkers, even allowing for some extra non-work car trips.

There is rather little evidence about the impact of teleworking on other household members. However, the evidence that is available points towards their travel remaining the same or perhaps even falling slightly, rather than increasing.

There is little evidence about the impact of teleworking on people’s choice of where to live. What there is, points towards teleworking being of rather little importance in choice of home location, although there are links between teleworking and trip distance that may indicate long run effects, as yet not understood.

This review of evidence has led to the suggestion (accounting for transport impacts and the current and (speculative) projected levels of uptake of teleworking) that ‘teleworking has the potential to deliver substantial reductions in car travel at peak hours’ (Cairns et al 2004, 275).⁴

4 In their review of evidence, Cairns et al (2004, 259) noted that ‘If growth rates of 12–13 percent p.a. continue for about 10 years, this would result in approximately 30 percent

A Shift in Thinking, a Shift in the Commute

Ongoing work by Lyons and colleagues (Lyons et al 2006, Lyons and Haddad 2008) is revisiting the matter of how teleworking or specifically homeworking is defined and in turn is highlighting that homeworking has the potential to redistribute travel by temporally *displacing* rather than (only) replacing the commute. They suggest that alongside occasional homeworking as considered earlier, individuals may also work at home for *part of a day* combined with working at their normal workplace. This form of homeworking they term ‘varied-spatiotemporal working’ (VST). In this research, a VST day is taken to be one in which at least 30 minutes of continuous work takes place at home and in the usual workplace.

Key findings from c1000 responses to a UK national Internet-based survey of full-time paid employees in 2005 were as follows (Lyons et al, 2006). The proportion of workers who undertake some VST is more than double that for full-day (occasional) homeworking (14 percent compared to 6 percent) and the number of days of VST occurring overall is also more than twice that for full-day homeworking. Blue collar workers practice more VST than full-day homeworking. Women are more likely to undertake VST compared to men while the reverse is true for full-day homeworking. VST, when compared to full-day homeworking, is associated with those living closer to the workplace. There is evidence of some temporal displacement of the commute on VST days (see again below).

Subsequent qualitative research (Lyons and Haddad 2008) has looked more closely at the practice of VST and the attitudes of individuals towards it; and has also brought to light another significant form of part-day homeworking which has been termed ‘*business varied spatio-temporal working*’ (BVST): *a working day in which at least 30 minutes of continuous work is undertaken at home as well as work being undertaken at business location(s) which may not include the usual “workplace”* (such as offsite visits, external meetings and on on)’ (Lyons and Haddad 2008, 5). This research has revealed that the nature of VST is mainly ad hoc (though sometimes planned) while BVST tends to be planned. Three key themes emerged as drivers for VST, namely work (for example, the need for a different or quieter working environment), domestic (for example, childcare responsibilities) and travel (for example, avoiding congestion) factors; whereas BVST is predominantly driven by travel (and indirectly work) reasons – notably a wish to avoid ‘excess’ driving. The ad hoc nature of VST may in part explain why it is more commonly practiced across the workforce overall than full-day homeworking. The presence of arranged meetings in people’s weekly schedules appears to be a particular barrier to full-day homeworking whereas VST can be engaged in at short notice because it can still accommodate such spatio-temporal constraints. This qualitative research underlines a clear temporal displacement of the commute at the individual level because of VST and this displacement is more evidently associated with the afternoon rather than the morning commute.

This research suggests that ICTs are facilitating changes to work practices and the communications culture of the workplace such that spatial and temporal

of the UK workforce teleworking for at least some of the time by the end of the period.’

constraints or traditions are becoming less rigid with consequences in turn for transport demand and travel patterns.

Discussion

It would appear that growing numbers of people are afforded some opportunity to telework. Being able to do so can allow them to respond more flexibly to the situations facing them in their everyday lives: juggling work and home lives and commitments; choosing different work settings for different tasks; and avoiding some of the negative effects of commuting, either through not making a commute trip or doing so at a time which allows the avoidance of encountering as much traffic and thus delay. Transport concerns may not necessarily be the primary motivation for teleworking but the transport consequences (for the individual and for the transport system) nevertheless occur.

The scale of transport demand impacts of teleworking at the aggregate is not clear. Research studies which have sought to examine this have tended to deal with small samples of individuals over limited time periods which certainly identify the primary benefit of commute substitution (Cairns et al 2004). However, the difficulty in gauging the overall impact of teleworking on car use and congestion arises because of at least two dynamic factors: the size of the workforce is changing over time and the number of people who can and do practice teleworking is changing over time. The key question in considering developments to date is: would (peak period) traffic congestion be worse than it is today if teleworking were not possible? It seems reasonable at least to suggest that the rate of increase of traffic levels would have been greater in its absence.

If teleworking is seen to be a measure that can positively contribute to transport demand management then of key interest is how the effectiveness of this measure can be maximised. This will relate to the amount of teleworking that takes place but also to where and when it takes place. The amount of teleworking that is possible will be a function of:

- the proportion of work tasks that can be undertaken (through the use of ICTs) remote from the workplace;
- the propensity of individuals to telework and for what proportion of a working week they are prepared to do so; and
- the willingness of employers to allow and to support and encourage their employees to telework.

In relation to the first point it should be noted that the makeup of economies is changing. For example, in the UK 'Employment in service sector jobs grew from 61 percent of the total in 1978 to 82 percent in 2005. Over the same period employment in manufacturing fell from 28 percent to 12 percent' (ONS 2006b, 5).

In terms of the second point, December 2003 survey results cited by Cairns et al (2004) concerning Internet users revealed that 'for those Internet users who are in employment but don't currently work from home (estimated to be 12 million employees), the NOP survey suggested that 77 percent do not want to telework, 17

percent want to but would not be allowed to and only 7 percent want to and would be allowed to.' (Cairns et al 2004, 262). However, these stated views are in the context of what survey respondents understood 'teleworking' to mean and would almost certainly have not accounted for part-day homeworking (even if part-week homeworking was in scope). Such results nevertheless suggest the potential for a significant further increase in the proportion of the workforce who telework. There is also the matter of an individual's frequency of teleworking. On average occasional homeworking appears to be practiced for about 1–2 days per week (DTLR 2002). While this will in part be a reflection of the proportion of work tasks that can be undertaken at home, the importance people attach to being co-present with work colleagues at the workplace will be another influencing factor. The research by Lyons and Haddad (2008) also indicates that teleworkers would make greater use of full and part-day homeworking as a response to worsening traffic congestion or the introduction of congestion charging.

Employers' principal attraction to teleworking (at least in the private sector) is likely to be financial – concerning employee productivity and retention. This is very much compatible with the motivations for employees who are seeking an attractive working regime to fulfil their role both at work and at home. From a transport demand management perspective, employers represent important agents for change in relation to teleworking such that policy carrots and sticks might be targeted at them as well as or instead of at individuals directly. Employers could receive greater encouragement and support to in turn facilitate and influence how much and where and when (times of day and days of week) teleworking and specifically homeworking takes place thus influencing transport demand.

E-shopping

In 1992, Hepworth and Ducatel observed that 'teleshopping in Britain is still at an experimental stage ... the number of households equipped with the technology for teleshopping – a computer terminal – is a minute proportion of the shopping population' and suggested that 'there is no natural way for grocery teleshopping to evolve alongside superstore retailing'. Yet a year earlier in 1991, the World Wide Web was launched, triggering the emergence of easy access to any form of information (documents, sounds, videos, and so forth) anywhere in the world. Commercial interest in the Web arose around the mid-1990s; the first virtual shopping mall and online bank were established in 1994. Powerful search engines made information gathering about products and services via the Internet ever easier. Nowadays, more than half (57 percent) of the households in Great Britain can access the Internet from home, while more than two-thirds (69 percent) of the households with Internet access have a broadband connection (ONS 2007). One of the increasingly popular uses of the Internet is for shopping purposes. 'E-shopping' can be defined as an activity to buy or to get information about consumer goods via the Internet (Mokhtarian 2004). A leader in Europe for Internet shopping, in 2005 the online retail market (for sale of online goods excluding services) in the UK was valued at £7.28 billion with online sales representing 3.26 percent of all retail sales – popular products to purchase online

are travel tickets and holidays, books, CDs/DVDs/videos, and clothing (OFT 2007). In terms of trends – ‘the value of internet sales by businesses to households was £21.4bn – an increase of 30 percent on the previous year, and more than four times higher than sales of £5.0bn in 2002’ (OFT 2007, 17). As the popularity of e-shopping increases, people’s travel behaviour and, ultimately, the use of transport systems and the spatial configuration of shops could change fundamentally. However, there is considerable uncertainty about the potential outcomes of e-shopping in the policy areas of transportation and spatial planning.

Conceptualisations of the Relationships Between E-shopping and Travel

Like other forms of ICT use, e-shopping could substitute, modify, or generate personal trips. The substitution of trips occurs when e-shopping replaces a (shopping) trip and no other trips are undertaken. The modification (or redistribution) of trips may happen when the destination choice, mode choice, or timing of the trip is adjusted because of e-shopping. The generation of trips occurs when e-shopping produces a trip that otherwise would not have been made. Additionally, a hybrid form of e-shopping and (physical) in-store shopping could occur (complementarity), such as searching for product information online, evaluating the chosen product in-store, and purchasing it online. Increasingly, people start their shopping process with an information search on the Internet before they go to the store and vice versa (Weltevreden 2007). Thus, e-shopping could relax the time and space constraints of the shopping process and bring more flexibility, leading ultimately to a fragmentation of the shopping activity in time and space (Couclelis 2004).

Both e-shopping and in-store shopping have certain advantages and disadvantages. Thanks to the capabilities of the Internet for handling information, e-shopping greatly facilitates price comparison and bargain hunting. E-shopping also provides almost unlimited selection across different websites (in contrast with the available stock in a store), convenience (no need to travel to a store), and speed (an e-shopping episode can typically be quicker than an in-store episode since no travel is involved) (Mokhtarian 2004). Time-pressured individuals in particular are likely to appreciate these features of online shopping, but so might people who like to find bargains, or who appreciate the comfort of shopping without going to a store. Meanwhile, in-store shopping provides certain advantages which e-shopping lacks, such as: sensory information about the products; the tangibility of the shopping environment (which could have entertainment aspects); the immediate possession of purchases made; the opportunity to socialize with other people; and the physical activity. It is assumed that e-shopping does not satisfy the social-recreational functions of in-store shopping (Couclelis 2004).

The debate in the literature has mainly been centred on the substitution and generation effects between ICT use and travel (as noted earlier). Although many researchers acknowledge that the net impact of e-shopping on travel is difficult to assess, they expect, however, e-shopping to increase or modify travel rather than decrease it (for example, Dijst, 2004; Visser and Lanzendorf 2004; Mokhtarian 2004). They argue that, if trips are substituted, the saved travel time can be used to make other trips. This effect could be explained by an intrinsic desire for mobility

(Mokhtarian and Salomon 2001). Another reason why the substitution of travel is not likely to occur is that people like to socialize (Geels and Smit 2000; Couclelis 2004; Dijst 2004). Shopping has a recreational function and can serve as an opportunity to meet people. Also, trip chaining makes it easy to combine shopping trips with other kinds of trips, which would also impede a decrease in travel. If the shopping trip is part of another trip, or if the electronic purchase replaces some, but not all of the items purchased in the store, the Internet purchase saves hardly any travel (Mokhtarian 2004). Finally, there is a need to sense a place directly and to experience the physical space (for example, sauntering round a shopping mall, exploring a bookstore) (Urry 2004). All this said, it is important to distinguish between grocery shopping and other forms of shopping (see below). Purchase of groceries accounts for nearly half of average household expenditure on goods in the UK (Cairns et al 2004).

Empirical Findings: Stated and Revealed Preference Studies

In comparison with other forms of ICT-use such as teleworking, empirical studies of e-shopping and (shopping) travel are very scarce – and tend not to distinguish between grocery and non-grocery shopping. A methodological distinction in empirical studies that do exist can be drawn between stated preference (people's potential behaviour is investigated by asking them how they would act in a given situation) and revealed preference (people's actual behaviour is investigated, either by letting respondents keep a diary or by asking retrospective questions).

Some stated preference studies that deal with the potential effects of e-shopping on travel expect a reduction in the number of shopping trips and kilometres travelled (Lenz et al 2003; Papola and Polydoropoulou 2006). Only a slight reduction in the number of grocery and non-grocery shopping trips is expected, however, ranging between 0.5 percent and 5.4 percent, depending on the adoption of e-shopping (Lenz et al. 2003). The greatest reduction in shopping trips is expected to occur for groceries, since this is the kind of shopping most frequently done; the smallest reduction is expected to occur for shopping trips for computer software and electronic goods such as computer hardware, mobile phones, and household appliances (Papola and Polydoropoulou 2006). Mixed results were found in a stated preference study when people were asked about their willingness to substitute their grocery and non-grocery shopping trips (Krzek et al 2005). A quarter of the respondents indicated they would be least likely to substitute grocery shopping, whereas nearly another quarter of the respondents (23 percent) said they would be *most* likely to substitute grocery shopping. Similar results were found for non-grocery shopping with 13 percent of the respondents stating they would be most likely to substitute it and 16 percent saying they would be least likely to substitute it. The study was carried out in three metropolitan areas in USA (Seattle, Kansas City, and Pittsburgh) using a questionnaire that was completed by 800 households. Even if substitution did occur, its effect on the frequency of shopping travel was believed to be small, mainly because e-shopping is not (yet) as widely used for shopping purposes compared to physical travel (Lenz et al 2003; Krzek et al 2005). An Australian study of stated preference estimates that about one-third of purchases made via the Internet replace

a shopping trip.⁵ Half these trips would have been undertaken solely for the purpose of shopping, without being chained to other trips, thus leading to a potential 15 percent of Internet transactions directly substituting for a shopping trip (Corpuz and Peachman 2003). No distinction was made between grocery and non-grocery shopping in this study.

A revealed preference study of Internet users reports a complementary relationship between e-shopping and city centre shopping for grocery and non-grocery products (Weltevreden 2007), but also found that a minority of e-shoppers made fewer trips to the city centre as a result of e-shopping. The following empirical studies did not distinguish between grocery and non-grocery shopping. A study using travel diaries conducted in California, USA, showed that people who search and/or buy online tend to make more trips than non-e-shoppers (Casas et al 2001). The authors concluded that people were changing their shopping behaviour (using the Internet as an additional shopping mode), but not necessarily changing their travel behaviour. A different conclusion was drawn by Douma and colleagues (2004), who found that people seem to use the Internet to modify their shopping behaviour, either by browsing for products before leaving home, or by using the Internet to make their trip more efficient. A Dutch study discovered that frequent online searchers tend to make more shopping trips, and frequent in-store shoppers tend to buy more frequently online (Farg et al 2007). These findings support the notion of a hybrid form of shopping in which online and in-store shopping are combined. Another empirical study conducted in the USA and the Netherlands showed that in both countries, searching for products online and buying them in-store seems to be a popular combination of shopping modes (Farg et al 2006a). Also, it was found that in both countries very few people visit new stores they have come to know via the internet, implying that currently e-shopping generates very few trips to new activity destinations. However, this situation might change in the future. Finally, a study about the influence of residential environment and shop accessibility on e-shopping tested the following two hypotheses empirically: (i) e-shopping is a predominantly urban phenomenon, because new technology usually starts in centres of innovation (innovation-diffusion hypothesis); and (ii) people are more likely to adopt e-shopping when their accessibility to shops is relatively low (efficiency hypothesis). The following three products were analysed in-depth: travel tickets, CDs/videos/DVDs, and clothing. Both hypotheses were confirmed by the findings, showing that people living in a (very) strongly urbanised area have a higher likelihood of buying online, but that people with a low shop accessibility buy more often online (Farg et al 2006b). Thus, the benefits of e-shopping seem to be greater for people with low shop accessibility than for people who have easier access to stores from their homes.

Overall, mixed results have been found concerning the relationships between e-shopping and (shopping) travel with stated preference studies mainly showing (small effects of) substitution, while revealed preference studies mostly point at complementarity or generation. These varying outcomes might be partly attributed to the diversity of research contexts. This said, in reviewing a number of small

5 A household travel survey and a supplementary Internet survey were completed by 6785 people in and around Sydney, Australia.

scale studies of grocery shopping (and noting the lack of mainstream research or literature on the topic), Cairns et al (2004, 316) have suggested that ‘while home shopping for groceries may generate some offsetting travel for other purposes, in general it is likely to reduce personal car-use; with motivations for using home shopping grocery services often being about reducing hassle and having more time for other activities’.

Discussion

E-shopping and in-store shopping probably mutually influence each other. Since we do not know how people who now e-shop travelled before they started doing so, the ‘generation or substitution?’ question regarding e-shopping and transport demand is difficult to answer.

Therefore it is better to recognise the complexity and context-dependency of these relationships. Individuals operate and make their decisions in certain social and time-space contexts. These contexts, together with individual characteristics (such as Internet experience and income), form a person’s individual decision context. Shopping behaviour (either online, in-store, or some hybrid form of these two) is shaped by such a decision context, which varies for each individual. This variation could cause different outcomes for interactions between e-shopping and in-store shopping, rendering it difficult to assess a net outcome. E-shopping and in-store shopping interactions could also differ between various groups in society. For example, people with sufficient time for shopping and a high income could use e-shopping as extra shopping next to their in-store shopping, while for time-pressured people and people with a low income, e-shopping might replace shopping trips.

Findings from empirical studies suggest that Internet users and e-shoppers make more trips than non-Internet users and non-e-shoppers (Casas et al 2001; Corpuz and Peachman 2003). Perhaps e-shoppers would travel even more than they already do if they did not shop online, suggesting that there might be relationships of substitution between e-shopping and in-store shopping (leading e-shopping to supplement travel). Furthermore, some shopping might occur that could not have taken place without the Internet – some products can only be bought online. Or one may make impulse purchases online; these purchases do not replace a shopping trip, since a trip to the store would not have been made in any case. Also, home shopping (ordering products via a catalogue, by telephone, and so forth) might be replaced by e-shopping rather than shopping trips. Finally, another factor that might influence the interaction between e-shopping and in-store shopping is product type. The purchase frequency of products that are bought online also shapes the relationship with travel behaviour.

E-shopping might affect indirectly, in the long term, the existence, function, and location of brick-and-mortar stores. Stores that sell information products that can be readily digitalized such as CDs and computer software might run the risk of closure in the long term unless they sell specialized niche merchandise or transform to provide showroom, pickup or aftersales functions for goods sold online.

Compared to teleworking, e-shopping is more difficult to address by government policy, since it is a discretionary activity. However, regulations concerning the

efficiency of the delivery of products ordered online may be appropriate. Virtual retailers are faced with logistic problems that centre on finding a balance between keeping distribution costs low and customers satisfied (Murphy, 2003). A possible solution could be to develop distribution centres near consumers' homes (Visser and Lanzendorf 2004). Further to reviewing a number of modelling assessments concerning the traffic impacts of grocery home delivery services, Cairns et al (2004, 313) summarise that 'If delivery vehicles directly substitute for car trips, the kilometres saved per shopping load are likely to be substantial – with reductions in the order of 70 percent or more.'

The travel impacts of C2C (Consumer to Consumer) e-commerce (for example, Ebay) could be greater than B2C (Business to Consumer) e-commerce. An increase in the popularity of C2C-commerce could cause more travel over longer distances, since individuals who 'meet' each other via the Internet may well visit each other in order to complete the transaction and deliver or pick up the product(s). Additionally, the recreational function of in-store shopping might become more important when people shop more often online, as consumers like to feel the added value of in-store shopping compared with e-shopping.

Future studies face the challenge to further unravel the relationships between e-shopping and travel. In doing so, they might discover new forms and combinations of shopping that have evolved gradually, because of the incorporation of new habits into the usual ways in which activities are being carried out. In general as well as specifically in relation to e-shopping, individuals might adapt new technologies in unforeseen ways, thereby creating whole new types of activity- and travel-patterns.

Concluding Discussion

This chapter has introduced and examined the following question: can communications be used as a substitute for travel? Through considering the cases of teleworking and e-shopping, it is evident that the answer to this question is 'yes'. Increasing numbers of people are undertaking working and shopping from their homes without a need to travel. It can be said that substituting for travel is becoming increasingly accessible as more people have access to ICTs and as technologies, services and communications formats continue to evolve in terms of usability and acceptability. Thus the opportunities for substitution are substantial or at least significant. However, the question then becomes: if we *can* use communications to substitute for travel, to what extent *will* we do so?

That increasing numbers of people (though far from everyone) can use communications to substitute for travel suggests that the *technological barriers* to substitution are becoming progressively less significant. However, *social barriers* and *institutional barriers* are likely to remain significant. Social barriers concern individuals' receptiveness to substitution, accounting for: their familiarity with and understanding of opportunities for substitution; their inherent needs and desires associated with physical mobility and co-presence; and habitual behaviours, norms and perceptions of the attitudes of significant other people towards them. Institutional barriers concern the other actors associated with the activities for which travel

substitution could occur – for example employers and retail service providers in the case of working and shopping; and transport system providers in relation to both. Institutional barriers concern the extent to which such actors impede substitution through operating practises and expectations.

However, where reference above is made to barriers, it could equally have been made to corresponding *opportunities*. Technology is certainly creating more opportunity for substitution. There are opportunities for social benefits from substitution in terms of more space-time flexibility, saved travel time for use in other activities and opportunities to better manage daily schedules of activities – both work and domestic. Perhaps most notably there are opportunities for institutional change – reorienting the relative attractiveness of co-presence and its associated physical travel and of virtual-presence and its associated virtual mobility. Herein, as has been noted earlier, there are opportunities for Government to influence, through legislation or fiscal incentives, the likes of employers and retail service providers as agents for change in turn at the level of individuals' choices between physical and virtual mobility.

Virtual mobility can be considered another mode of travel – or more appropriately another mode of access. It is important to recognise that the case for substitution does not imply wholesale replacement of physical mobility by its virtual counterpart. Virtual mobility should form part of the mix, securing a mode share in travel or access such that dependence on other modes (notably the car) is lessened.

At the average the amount of time spent travelling per person per year has changed very little in the UK over the past 30 years: 353 hours in 1972/73 360 in 1998/2000 (DTLR 2001) corresponding to a suggestion of the existence of travel time budgets (Schafer 1998). This could imply that substitution will be perfectly offset by generation. However, Mokhtarian and Salomon suggest that 'people seek to decrease their travel if it exceeds the desired optimum, but seek to increase travel if it falls short of their ideal amount' (2001, 712). Thus for some people, the mode share of virtual mobility will increase in order to reduce their travel; for other people either the virtual mobility mode share will remain low because (more) travel is desired or if the amount of virtual mobility increases, this will be offset by the generation of other travel. In the case of the latter, mode share remains important – if virtual mobility initially substitutes for car use or other motorised modes, the benefits of substitution can still be 'locked in' if the newly generated travel is by more sustainable modes such as walking or cycling.

The discussion above and prior considerations in the chapter highlight that the ability overall to 'simply' reduce total travel through substitution or to know by how much it could be reduced is unclear. However, an important caveat was set out at the start of the chapter, namely that the prospects for telecommunications and substitution must be set in a wider transport demand management context. It seems increasingly acknowledged that the problems of motorised mobility and congestion for economic and environmental reasons cannot persist unabated (Eddington 2006). Accordingly in the UK the possibility of national road pricing to combat congestion is now receiving serious attention. With an intention to discourage people from travelling at congested times and places it could well be the case that this dovetails extremely well with opportunities for travel substitution or indeed the displacement

of travel that telecommunications can help make possible. Indeed such a dovetailing could further raise the prospect of being able to increase the cost of travel (especially by car) to discourage such travel and thereby encourage more substitution such that total travel is reduced, while economic and social activity is maintained.

To date there appears to have been a reluctance for transport policy to explicitly acknowledge and respond to the role of telecommunications in transport demand management. It may be argued that this has in part been because of a lack of empirical understanding upon which to base policy formulation. However, given the growing importance of and need for transport demand management and the challenges it faces in reconciling economic, social and environmental objectives, a counter argument could now be put forward. To ignore the role of substitution (and displacement) in transport demand management is no longer an option – either greater resource must be urgently invested in research to advance empirical understanding or policy formulation will need to proceed on the basis of existing evidence and expert judgement.

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