E-shopping and its interactions with in-store shopping

The research reported in this book was conducted at the Urban and Regional research centre Utrecht (URU), Faculty of Geosciences, Utrecht University, which financially supported this publication. The research is part of the programme of the Netherlands Graduate School of Housing and Urban Research (NETHUR).

ISBN 90 6266 262 5

English correction: Dr. Anne Hawkins
Cover design and illustrations: Fred Trappenburg (GeoMedia, Faculty of Geosciences, Utrecht University)
Graphic design and cartography: Rien Rabbers (GeoMedia, Faculty of Geosciences, Utrecht University)

E-shopping and its interactions with in-store shopping

Interacties tussen winkelen via internet en winkelbezoek

(met een samenvatting in het Nederlands)

Proefschrift

ter verkrijging van de graad van doctor
aan de Universiteit Utrecht
op gezag van de rector magnificus, prof. dr. W.H. Gispen,
ingevolge het besluit van het college voor promoties
in het openbaar te verdedigen
op woensdag 17 mei 2006
des middags te 12.45 uur

door

Sendy Farag

geboren op 28 november 1975 te Hilversum

Promotor:	Prof. Dr. M. Dijst
Co-promotor:	Dr. T. Schwanen

Contents

Preface

Writing this thesis has been lots of fun. I have had the privilege to work with dedicated and skilled researchers in a friendly atmosphere. Thanks to them, I have learned a lot about doing research. Some people in particular have helped me enormously along the way.

Without my Mum, I might not have started this PhD project in the first place. With her example she has encouraged me throughout. Thanks Mum! Dad and Fad, thanks for your encouraging words, too.

Explaining a certain fact usually involves a combination of factors, each with its own strength in affecting the event. The same holds for finishing my thesis. I would like to thank Martin Dijst for daring to take on a sociologist who had no experience in either ICT-use or personal travel behaviour. His trust in me was a fundamental factor in getting my life as a PhD student started, and his guidance has been essential in reaching the end. Martin, I admire the way you combine developing new theoretical insights with a practical and down-to-earth realism. It has been great working with you, not least because of such pleasant surprises as flowers in my office during the tough time of collecting data.

Starting out as a roommate and ending up as my co-promoter, Tim Schwanen has always been involved in my research. Learning-on-the-job has been a very important, if not the major, source of my current skills and it was Tim who did most of the teaching. Time-pressured as he usually is, he has nonetheless never failed to free up time to discuss my work thoroughly. And when I say thoroughly, that is still a severe understatement. Tim, thank you for being such a tower of strength (or in Dutch: mijn rots in de branding)! Few PhD students are able to go out for dinner, see a film, or swing with their co-promoters: I have been one of these lucky ones.

Similarly, few PhD students start together on the same day on a similar project in the same research institute. Again, I was lucky to be able to exchange thoughts about my project with Jesse Weltevreden from the first day of my appointment. We helped each other a lot, especially in the first years, and organized an international seminar about ICT-use and spatial behaviour. Jesse, throughout these years it was a blessing to have you as a colleague so close by.

In these first years, Martin Lanzendorf and Ronald van Kempen were also involved in the supervision of my research project. Thank you both for your input. Tom de Jong proved to be indispensable in enabling me to bring some geography into the subject of e-shopping. Thank you, Tom, for enlightening me about accessibility measures and for your little jokes (dubbing me 'Semdy' after my proclaimed enthusiasm for SEM (structural equation modelling)).

One of the advantages of being a PhD student is that you can travel around, visiting conferences. This has produced a fruitful overseas cooperation with Kevin J. Krizek. How to write a paper together with one researcher stationed in Utrecht and the other in Minnesota, USA: ICT-use in practice! Thanks Kevin, it has been fun working, bowling, and eating sushi

with you. Another advantage of visiting conferences is that you get to meet the authors you read about in person. Someone whose work I draw on heavily and I was thrilled to meet in person was Patricia Mokhtarian. If you would like to trace back Tims' thoroughness, here is one of the clues. Pat, thank you for your inspiration!

I am a person who likes to be outdoors, and thankfully, I have found some colleagues who are like-minded about the best way to spend your lunch break, whether the sun is shining or not: Rebecca, Jasper, Taede, and Sjef can be considered as the real die-hards. Having nice colleagues is important, but having nice roommates even more so. My knowledge of South Africa and Australia has been given a lift after having Stephan and Christy as excellent (because funny, helpful, and quiet!) roommates. I have enjoyed the international character of our group of PhD students. Nikki, Tuna, and Javier: I hope we can keep in touch. Ivo, you have become a friend I could drag along to movies and the international film festival in Rotterdam. I was happy to enjoy the alternative Lowlands pop music festival together with you. Karien, it was nice to have you next door in the last phase, being able to drop in when I needed to complain! Femke, Saskia, Guillaume, Yvet, Michel, Anet, Robbert, and everyone from the fourth till the sixth floor: thanks for being such nice colleagues. The barbecues and football matches were lots of fun.

Thank you Alphons for the good cooperation during my data collection and the steady supply of paper and envelopes. Harm and Gerlach: thanks for assisting me so quickly and successfully in all my hostile computer encounters throughout the years. I would like to thank Anne Hawkins for her swift and accurate English correction, Rien Rabbers for the layout of the thesis, and Fred Trappenburg for the cheerful illustrations.

I am very grateful for the good time that I have had. Several people have contributed to this, but so has the organizational context in which I have worked. The two-weekly meetings of our transportation group have been very interesting and useful, not least in getting to know what the other PhD students were doing. Similarly, the courses I have followed were invaluable.

"What exactly have you learned in these four years?" Independently from each other, my best friend Gio and my sister asked me this question. Trying to formulate an answer, I realized that, besides the predictable skills such as writing and analysing, I had also acquired some (for me) unexpected ones, such as reviewing papers written by others and supervising students.

One thing is certain: for me, shopping will never be the same again.

Nederlandse samenvatting

Achtergrond

Voor veel mensen is een leven zonder internet tegenwoordig moeilijk voor te stellen. Het gebruik van internet is in het afgelopen decennium sterk toegenomen. Inmiddels heeft driekwart van de Nederlandse huishoudens thuis een internetverbinding, waarvan de helft over een snelle internetverbinding beschikt. Wereldwijd gezien behoort Nederland tot de top drie van landen met huishoudens die een snelle internetverbinding hebben.

Omdat het internet 24 uur per dag toegankelijk is, worden tijd- en ruimtebeperkingen opgeheven. Voor het uitvoeren van activiteiten zoals werken en winkelen is het niet langer noodzakelijk om je te verplaatsen. Winkelen via internet, ook wel e-shoppen genoemd (het zoeken van informatie over produkten en/of het kopen van produkten online), wordt steeds populairder. Vrijwel alle Nederlandse internetgebruikers zoeken informatie over produkten via internet en meer dan de helft heeft wel eens een produkt online gekocht. Dit kan het verplaatsingsgedrag van mensen sterk beïnvloeden.

In de wetenschappelijke literatuur is er tot nu toe weinig aandacht geweest voor het online zoeken naar produkten. Hoewel het zoeken en vergelijken van produkten vaak de meeste tijd kost, gaat het merendeel van de studies over online kopen. Daarbij is er nauwelijks gekeken naar de invloed die de ruimtelijke omgeving (zoals de nabijheid van winkels) kan hebben op e-shoppen. Bovendien zijn de meeste studies in de Verenigde Staten uitgevoerd, waardoor deze bevindingen niet zomaar naar de Nederlandse context kunnen worden gegeneraliseerd.

Het doel van dit onderzoek is om inzicht te verschaffen in het online zoek- en koopgedrag van consumenten en de manier waarop dit gerelateerd is aan hun winkelbezoek. Daartoe is de volgende onderzoeksvraag geformuleerd: "*In welke mate hangen winkelbezoek, sociaal-demografische factoren, Internet gedrag, ruimtelijke omgeving, en winkelattitudes samen met het online zoeken en kopen van produkten door consumenten*? Voor de beantwoording van deze vraag zijn vragenlijsten afgenomen in diverse Nederlandse geografische gebieden en zijn kwantitatieve analysetechnieken toegepast. Dit proefschrift bestaat uit artikelen die zijn gepubliceerd, of nog gepubliceerd worden, in internationale wetenschappelijke tijdschriften.

Resultaten

De resultaten laten zien dat e-shoppen complementair is aan winkelbezoek: hoe vaker men winkels bezoekt, des te vaker men online winkelt, en andersom. Mensen die vaak online zoeken, bezoeken vaker winkels dan mensen die minder vaak online zoeken. Tegelijkertijd kopen mensen die vaak winkels bezoeken ook vaak produkten online. Het is daarom onwaarschijnlijk dat e-shoppen het verplaatsingsgedrag van mensen zal reduceren, ook al zijn er aanwijzingen gevonden dat online winkelen het winkelbezoek kan vervangen. Bij mensen die vaak online zoeken duurt het winkelbezoek korter dan bij mensen die minder vaak online zoeken. Ook lijkt het erop dat hoe meer ervaring men heeft met online kopen,

des te minder geneigd men is om mediaprodukten (zoals boeken, CD's, computersoftware) in een winkel te kopen. Over het algemeen lijkt er een hybride vorm van winkelen plaats te vinden, waarbij winkelen via internet en winkelbezoek met elkaar worden afgewisseld. Zoeken gebeurt bijvoorbeeld via internet, terwijl het kopen in de winkel gebeurt.

Internetervaring is een heel belangrijke factor in de verklaring van e-shoppen. Hoe meer internetervaring men heeft, des te groter de kans is dat men via internet winkelt en des te vaker men dit doet. Ook het hebben van een snelle internetverbinding heeft een positief effect op e-shoppen. Verder winkelen mensen die een positieve attitude tegenover e-shoppen hebben vaker via internet in vergelijking met mensen die minder positief hiertegenover staan. De mate waarin de sociale omgeving e-shoppen goedkeurt en de mate waarin men vertrouwen heeft dat men via internet kan winkelen, bepalen mede de intentie om dit te doen.

Of men überhaupt via internet winkelt wordt sterker door sociaal-demografische factoren beïnvloedt dan hoe vaak men via internet winkelt. Mannen, hoger opgeleiden, en jongeren winkelen vaker via internet omdat zij meer internetervaring hebben en een positievere attitude tegenover e-shoppen hebben. Vrouwen kopen vaker kleding via internet dan mannen, terwijl mannen vaker CD's, video's, en DVD's kopen dan vrouwen. Vliegreizen worden door beide geslachten even vaak online gekocht, maar vaker door hoger opgeleiden dan door lager opgeleiden.

De ruimtelijke omgeving kan op twee manieren invloed hebben op e-shoppen. Enerzijds is de verwachting dat stedelingen zich sneller innovaties zoals e-shoppen zullen eigen maken dan mensen die buiten de stad wonen. Anderzijds kan men veronderstellen dat mensen op het platteland het meeste profijt zullen hebben van e-shoppen, omdat zij verder van winkels vandaan wonen en zo reistijd kunnen besparen. Er zijn aanwijzingen gevonden voor de bevestiging van de eerste hypothese, terwijl de resultaten voor de tweede hypothese gemengd zijn. Stedelingen hebben een grotere kans om via internet te winkelen en doen dit ook vaker. Echter, hoe meer winkels men dichtbij huis heeft, des te minder vaak men online winkelt. Het is te verwachten dat als mensen buiten de stad eenmaal via internet winkelen, zij dit vaker zullen doen dan stedelingen.

Conclusie

De toekomst ziet er rooskleurig uit voor winkelen via internet. Niet alleen kunnen technologische ontwikkelingen e-shoppen eenvoudiger en veiliger maken, ook groeit er een nieuwe generatie individuen met internet op die straks moeiteloos zal kunnen winkelen via internet. Waarschijnlijk zal e-shoppen gecombineerd worden met het bezoeken van winkels, om de voordelen van beide winkelmethoden optimaal te kunnen benutten. Op basis van de resultaten kan er meer in plaats van minder mobiliteit worden verwacht door e-shoppen. Meer mobiliteit betekent meer milieuvervuilling, daarom zullen beleidsmakers rekening moeten houden met mogelijke milieu-effecten van winkelen via internet. Vooralsnog lijkt het dat winkeliers niet bang hoeven te zijn voor sluiting door de toename van internetwinkelen. Op de lange termijn is dit echter niet ondenkbaar.


Sale
SALE

1 Introduction

1.1 The rapid rise of the Internet and e-shopping

The invention of the Internet could become as important as the invention of the automobile in shaping people's daily activities. Not only has the Western world embraced the several functions that the Internet enables, such as communication and information search; the embrace took place rapidly. The Internet permeates the whole of society, from the labour market where job search and applications are carried out online to the educational system, where most students start working on their assignments by gathering information via Google. The need to be at a certain place at a certain time to meet other people (coupling constraints (Hägerstrand, 1970)) and the need to perform activities before closing time (authority constraints) are being challenged by the rise of the Internet. Access to the Internet 24 hours a day lifts time and space constraints. Such activities as working and shopping can be conducted without travelling to activity places. How has all this come about?

The very early history of the Internet starts in the nineteenth century with the inventions of the telegraph, transatlantic cables, and the telephone. During the 1960s, packet-switching networks were developed which enabled data to be split into tiny packets that may take different routes to a destination and be reassembled on arrival (Internetvalley, 2005). In 1969, the research agency ARPANET was established and commissioned by the US Department of Defense to research networking (Internetvalley, 2005). With the connection

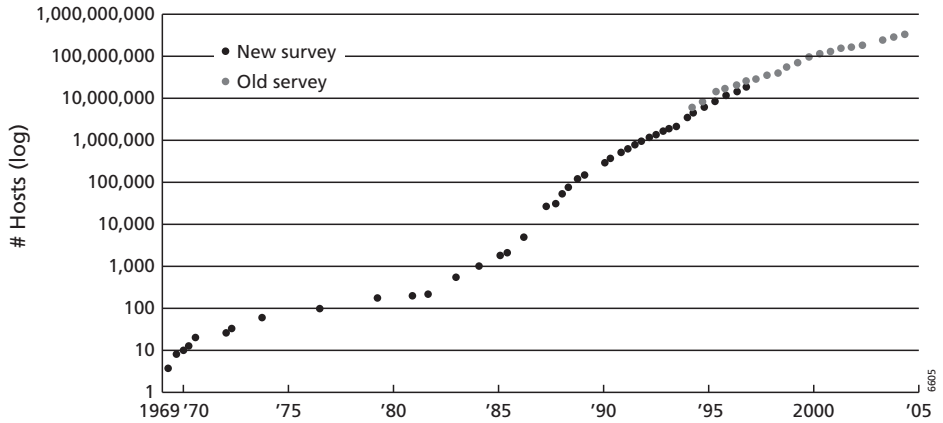


Figure 1.1 The logarithmic growth of the Internet by the number of hosts (Source: Zakon, 2005, http://www.zakon.org/robert/internet/timeline/)

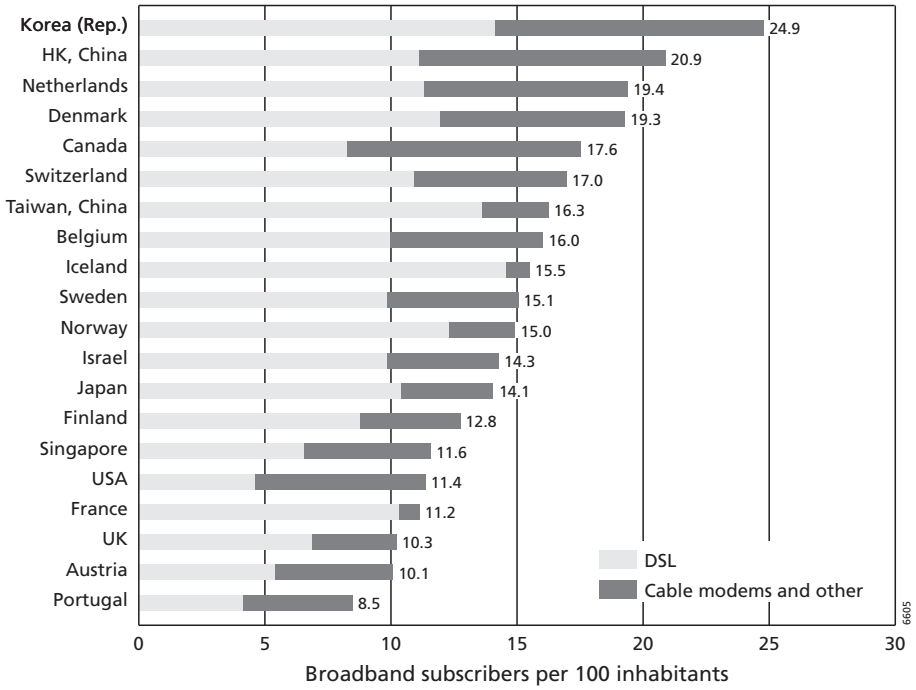


Figure 1.2 International comparison of broadband subscribers per 100 inhabitants (Source: International Telecommunication Union, 2005)

of four US host computers, the Internet was born. In the early 1970s, packets became the mode of transfer and a common language was created that allowed different computer networks to communicate with each other and send and receive data.

Advances in computer capacities and speeds (through the introduction of glass-fibre cables, for example) enabled the Internet to expand. In 1991, the World Wide Web was launched, enabling 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. Search engines were developed that facilitated information searches on the Web. This development was no exclusive luxury, given the exponential growth of websites over time: from one million websites in 1997 to more than ten million in 2000 (Zakon, 2005). Currently, there are more than seventy million websites in the world (Zakon, 2005). The logarithmic growth of the Internet expressed by the number of hosts (a computer system with a registered Internet Protocol (IP) address) is illustrated in Figure 1.1.

In the Netherlands, as in other countries, the Internet has spread quickly. More than 70 percent of Dutch households had Internet access at home in 2004 compared with only 16 percent in 1998: almost a fivefold increase (Statistics Netherlands, 2005). Compared with other European countries, the Netherlands ranks third in terms of households with Internet access: only Scandinavia (namely, Sweden and Denmark) have more homes with Internet access (Statistics Netherlands, 2005). Worldwide, the Netherlands ranks third in the number

of fast Internet connections per 100 inhabitants; South Korea and Hong Kong rank first and second respectively (see Figure 1.2). These broadband connections can be offered either via cable lines or DSL (Digital Subscriber Line) telephone lines. Half the Dutch households with Internet access had a broadband connection in 2004, while only one third had such a fast connection in 2003 (Statistics Netherlands, 2005). The location where people use the Internet most often is at home. The most popular Internet activities are searching for specific information and checking e-mail (TNO, 2004).

One of the increasingly popular uses of the Internet is for shopping purposes. Electronic commerce (e-commerce) can be divided into B2B e-commerce (Business-to-Business: e-commerce between firms), B2C e-commerce (Business-to-Consumer: e-commerce between firms and households), and C2C e-commerce (Consumer-to-Consumer: e-commerce between households) (Mokhtarian, 2004). The term *e-shopping* (electronic shopping) refers to the B2C segment of e-commerce, where consumers search for product information and/or buy products from virtual stores. Powerful search engines make information gathering about products and services via the Internet ever easier.

Figure 1.3 shows the trend in online buying of the Dutch population over the time period 1998-2003, together with trends in PC ownership and Internet access at home. The strongest growth has been in online buying: 2 percent of Dutch households had bought a product online at some time in 1998 compared with 37 percent in 2004 (Statistics Netherlands, 2005). Half the Internet users have at some time bought a product online (Thuiswinkel.org, 2005). However, despite the widespread Internet access in households and the fast Internet connection speeds, the Netherlands ranks as the sixth European country when it comes to online buying (Statistics Netherlands, 2005). Online buying is more popular in, for example, Germany and the UK. A possible explanation for this is the fear of credit-card fraud when paying online. Only 19 percent of Dutch Internet users mention the credit card as their preferred method of payment – the lowest percentage in Europe (for example, 44 percent of the British and 73 percent of the French Internet users mention the credit card as their preferred method of payment) (AC Nielsen, 2005). Nevertheless, despite the fear

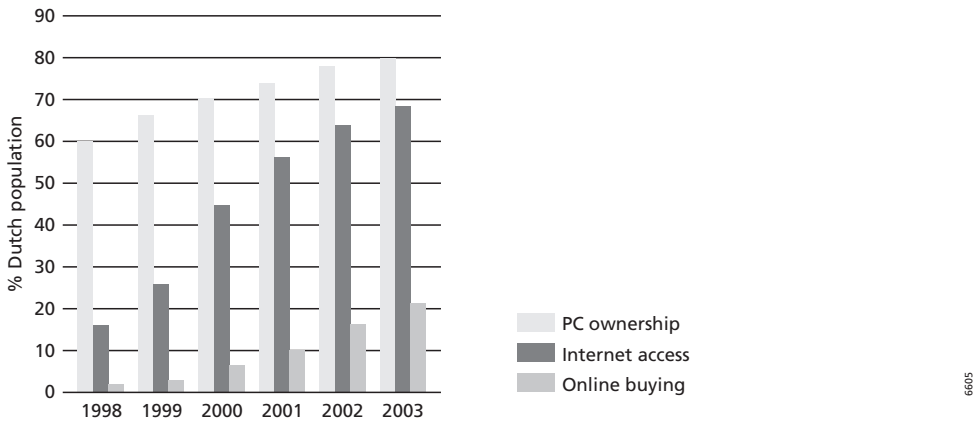


Figure 1.3 Development of PC ownership, Internet access at home, and online buying of the Dutch population, 1998-2003 (Source: Statistics Netherlands, 2005)

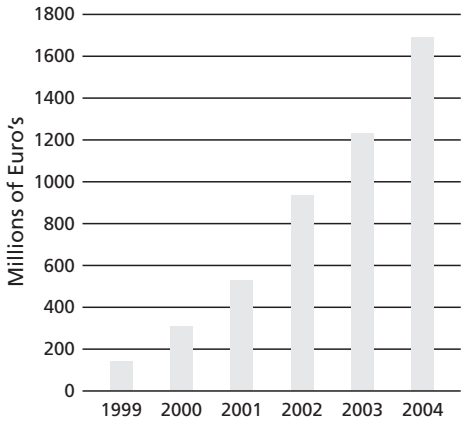


Figure 1.4 Total turnover of online sales (Source: Thuiswinkel.org, 2005)

of credit-card fraud, the Dutch online consumer-spending market is growing steadily; in 2004 this market had reached a total turnover of 1.68 billion euro, a growth of 36 percent on the turnover of 2003 (1.24 billion euro) (Thuiswinkel.org, 2005). Figure 1.4 shows the development of the total turnover of online sales from 1999 until 2004. The online booking of travel accounts for nearly half the total turnover. On average, Dutch online buyers spent 424 euro per year in 2004, compared with 318 euro in 2002. Popular products to purchase online are travel tickets and holidays, books, clothing, and CDs/DVDs/videos (Statistics Netherlands, 2005).

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. The Dutch government holds ambivalent views about the possible effects of e-shopping on travel and land use. On the one hand, the substitution of travel is anticipated (KPMG 1997; TNO Inro, 2002), while on the other hand travel generation is expected (MuConsult, 2003). There is considerable uncertainty about the potential outcomes of e-shopping in the policy areas of transportation and spatial planning.

Another concern of policy makers is that the potential benefits of e-shopping are out of the reach of people who do not have the resources or skills to access the Internet. There is a danger of social exclusion in an information society. The groups in society who are likely to lack the resources and/or skills to use the Internet are people in low-income households, older than 65 years, and poorly educated (Van Dijk et al., 2000; Rice & Katz, 2003; Statistics Netherlands, 2005). Urban residents have better access to Internet infrastructure than suburban or rural residents (TNO, 2004). The government is concerned about a potential digital divide (Statistics Netherlands, 2005). Policy makers are also curious to know whether urban residents shop online more often than non-urban residents do, since very little is known about the geographical distribution of e-shoppers (TNO Inro, 2002).

This thesis reports our study of the factors that influence the adoption of e-shopping and the implications this might have for consumers' in-store shopping behaviour. We have also investigated the geographical distribution of Internet users and e-shoppers.

1.2 The shopping process and factors associated with the adoption of e-shopping

The shopping process

Usually, people travel to fulfil certain needs by performing activities at their destination. Three kinds of everyday trip purposes can be distinguished (Salomon, 1985): subsistence trips (work commute, for example), maintenance trips (grocery shopping, for example), and leisure trips (visiting friends, for example). The boundaries between these types of activity and subsequent trips can be quite permeable, for the following reasons: (i) an activity may have multiple characteristics; (ii) an activity can be broken into smaller blocks and interspersed with fragments of other activities; (iii) the simultaneous conduct of multiple activities (multitasking) (Mokhtarian et al., 2003). Shopping could fulfil both maintenance and recreational needs; so the trip purpose of shopping could be either maintenance, leisure, or both at the same time.

In general, two major functions of shopping can be distinguished (Salomon & Koppelman, 1988): obtaining information that can reduce uncertainty about a purchase; attaining psychological benefits, such as entertainment and learning about new trends. The shopping process itself can be divided into the following phases: pre-, during, and post-transaction (Sindhav & Balazs, 1999). In the *pre-transaction* stage a desire is formed and a choice is made between alternative shopping modes (e.g., online or in-store shopping), followed by a product information search, trial, and evaluation; the item is purchased in the *during transaction* phase, while transportation or delivery of the item occurs in the *post-transaction phase*, as well as the return of items or the use of after-sales services (Salomon & Koppelman, 1988; Couclelis, 2004; Mokhtarian, 2004). Together, these phases form a shopping cycle that can be repeated if it does not lead to the satisfactory purchase of the desired product (Salomon & Koppelman, 1988).

Certain sub tasks, or even the complete shopping activity, could be fulfilled by e-shopping, Accordingly, a hybrid form of e-shopping and (physical) in-store shopping could occur, such as searching for product information online, evaluating the chosen product in-store, and purchasing it online. Shopping has become an activity that may be distributed over space and across time, thereby leading to its fragmentation (Couclelis, 2004). One may, for example, compare the prices of digital cameras after midnight if one so wishes, long after the closing time of brick-and-mortar stores. One can carry out this comparison at various places, such as the office or home. Increasingly, people start their shopping process with an information search on the Internet before they go to the store (Ward & Morganosky, 2002).

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 unlimited selection (in contrast with the available stock in a store), convenience (no need to travel to a store), and speed (web stores can be quicker than physical stores since no travel is involved) (Mokhtarian, 2004). Time-pressured individuals in particular are likely to appreciate these features of online shopping (working women, for example (Gould & Golob 2002)), but so might people who like to find bargains, or who appreciate the comfort of shopping without going to a store. 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 (Salomon & Koppelman, 1988; Couclelis, 2004).

Shopping online is not easy to do for all types of product. One can distinguish between search and experience goods (Alba & Lynch, 1997). *Search goods* are products, such as books and music, whose quality can readily be assessed prior to purchase without necessarily seeing or touching them. The value of *experience goods* such as clothing and perishable food items is more difficult to assess prior to purchase.

Quality assessment is only one of the criteria for differentiating products. Other criteria include: *perceived risk, effort expended,* and *information intensity* (Sindhav & Balazs, 1999). *Perceived risk* pertains to the assessment one makes of the consequences of making a purchase mistake, while *effort* reflects the amount of time and money purchasing a product takes. Naturally, these two aspects are related to the purchase frequency and the price of a product: buying a car involves a higher risk and more effort than buying some milk. The *information intensity* of products entails the amount of information that a product contains. For example, books, music, and computer software contain high levels of information, which can therefore be digitalized and put on the Internet. Hence, some products are more suited than others to online purchase. Empirical research has shown that search goods and products involving little risk or effort are more likely to be purchased online (Cao & Mokhtarian, 2005; Rotem & Salomon, 2004).

Factors associated with e-shopping: the special case of in-store shopping behaviour

The adoption of e-shopping involves several factors, one of which is consumers' in-store shopping behaviour. Visiting stores and shopping from home (ordering products via catalogue, telephone, and so forth) were the main options for shopping until the rise of the Internet and e-shopping. The way in which people habitually conduct their shopping activities could affect their adoption of e-shopping.

Potential interactions between e-shopping and in-store shopping can be seen as specific examples of the relationships between information communication technologies (ICT) and travel that have traditionally received considerable attention from many researchers (Salomon, 1985; Mokhtarian, 1990; Niles, 1994; Mokhtarian & Salomon, 2002; Krizek & Johnson, 2003, for example). Three types of relationship can be distinguished: 1) on the micro/macro level, 2) short term/long term, 3) direct/indirect (Salomon, 1986). Although we acknowledge the reciprocal nature of the interactions between e-shopping and in-store shopping, these relationships are usually specified in one direction, namely describing the potential effect of ICT-use on travel. A description is provided below of the potential direct and short-term relationships between ICT-use and travel on a micro level; expressed only in the one way that has been dominant in the literature.

First, ICT-use can reduce travel. This saving happens when a trip is replaced by ICT-use and no other trips are undertaken instead. E-shopping may replace a shopping trip; the consensus view is to label this kind of relationship *substitution* (Salomon, 1986; Mokhtarian, 1990; Graham & Marvin, 1996, for example). Sometimes the term *replacement* is used, but substitution clearly dominates. We have therefore also used this concept. Second, ICT-use can generate travel. Information that is acquired via the Internet enables the discovery of new, hitherto unknown places. New travel can be undertaken to these places. Social

contacts via the Internet can also stimulate face-to-face interactions that require travel. This relationship is often described as *complementarity* or *generation* (Salomon, 1986; Mokhtarian, 1990; Graham & Marvin, 1996 for example). *Stimulation* and *expansion* are also terms that refer to an increase of travel as a result of ICT-use. In the marketing literature, *complementarity* refers to the use of different shopping channels when shopping. This is also referred to as *multi-channel* shopping (Ward & Morganosky, 2002). When, for example, an information search is carried out online, but the purchase is made in-store, this is a hybrid form of shopping. To avoid confusion, in most cases we use the term *generation* to indicate that ICT-use produces travel and *complementarity* to indicate multi-channel shopping. Third, ICT-use can modify travel. A change in travel behaviour that does not necessarily lead to an increase or decrease in travel could occur. The timing of a trip or the mode choice may be changed as a result of ICT-use. In the literature, this relationship has received considerably less attention than substitution or generation. Usually, the term *modification* is used (Salomon, 1986, for example). Finally, ICT-use may not interact with travel. In that case there is no relationship between ICT and travel; they coexist independently. We think the term *neutrality* best reflects this relationship (Mokhtarian, 2000).

The debate in the literature has mainly been centred on the substitution and generation effects between ICT and travel. Much attention has been paid to substitution, but generation has become more popular among scientists since the mid-1980s (Salomon, 1985; Mokhtarian, 2002 for example). Many researchers acknowledge that the net impact of ICT on travel is difficult to assess, because the effects of substitution and generation could occur simultaneously and therefore neutralize each other (also referred to as *counteracting effects*) (Niles, 1994; Mokhtarian & Salomon, 2002; Golob & Regan, 2001 for example). Substitution could appear in the short term at the micro-level of individuals, while generation could turn out to be a long-term effect on the macro-level of society (Niles, 1994; Mokhtarian, 2000). Many researchers, however, expect ICT-usage to increase or modify travel rather than decrease it (Salomon, 1985; Dijst, 2004; Visser & Lanzendorf, 2004; Mokhtarian, 2004 for example). 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* (Salomon, 1985; Mokhtarian & Salomon, 2001). Gould and Golob (1997) found that people who telecommute spend more time on shopping activities than other people do. They argue that, analogous to the finding that saved travel for work is converted into new trips, saved shopping travel might be converted into other types of travel. Other researchers expect saved travel time to be used mainly for leisure trips, since many maintenance trips can be replaced by ICT-usage (such as e-shopping) (Keyzers & Wagenaar, 1989; Dijst, 2004). Another reason why the substitution of travel is not likely to occur is that *people like to socialize* (Couclelis, 2004; Dijst, 2004). Shopping has a recreational function and can serve as an opportunity to meet people. E-shopping would not, therefore, lead to a decrease in trips (Salomon & Koppelman, 1992). Niles (1994) expects a simultaneous increase in ICT-usage and travel since interactions established through ICT are likely to generate a demand for face-to-face interactions that require travel. *Trip chaining* makes it easy to combine shopping trips with other kinds of trips, which would also impede a decrease in travel (Salomon 1986; Gould 1998). 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 (Urry, 2004). For example, some travel is usually first required in order to saunter round a fashionable shopping mall or explore a favourite bookstore.

An overview of conceptual and empirical studies of ICT-use and travel classified as subsistence, maintenance, and leisure trips is provided by Krizek & Johnson (2003). They show that relatively little research has been undertaken on maintenance and leisure trips. However, more attention has been paid recently to the effects of computer use, Internet use, e-mail, and mobile phone use on maintenance and leisure trips. The findings of empirical studies include: no direct relationships between ICT-use and travel (Mokhtarian & Meenakshisundaram, 1999); modification (Srinivasan & Raghavender, 2006); simultaneous substitution and complementarity (Srinivasan & Athuru, 2004); predominantly substitution (Bhat et al., 2003; Tonn & Hemrick, 2004); and predominantly generation (Zumkeller, 1997) for various types of trips (maintenance, leisure, and subsistence). Thus, there is as yet no consensus about which relationships between ICT-use and travel dominate.

In comparison with other forms of ICT-use, empirical studies of e-shopping and in-store shopping are very scarce. A methodological distinction in empirical studies 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). Salomon and Koppelman (1988, 1992) were among the first researchers to pay attention to e-shopping. Their study of stated preference in the adoption of e-shopping shows that only a few respondents agree with the statement that e-shopping will substitute for shopping trips (Koppelman, Salomon, & Proussaloglou, 1991). The study was conducted in the suburbs of Chicago, USA, using a mail-back questionnaire. Of the 388 respondents, 59 percent were women and 42 percent were 55 years of age or older. More recent studies of stated preference 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 & Polydoropoulou, 2006). Only a slight reduction in traffic 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 & Polydoropoulou, 2006). Furthermore, public transport is expected to undergo the greatest reduction in trips (Lenz et al., 2003). 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 (Krizek et al., 2004a). The study was carried out in three metropolitan areas in USA (Seattle, Kansas City, and Pittsburgh) using a questionnaire that was completed by 744 households. Even if substitution did occur, its effect on travel was believed to be small (Lenz et al., 2003; Krizek et al., 2004a). An Australian study of stated preference estimates that about one-third of purchases made via the Internet replace a shopping trip. 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 & Peachman, 2003). A household travel survey and a supplementary Internet survey were completed by 6785 people in and around Sydney, Australia.

Early studies of revealed preference were carried out in the Netherlands using mail questionnaires (Keyzers et al. 1989; Tacken 1990). Buying groceries, mainly via telephone, but also via the computer was surveyed. A substitution of grocery shopping trips was found. On the other hand, 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 of Internet users found indications that online buyers make fewer trips to the city centre as a result of e-shopping (Weltevreden & Van Rietbergen, 2006). However, their results also indicated that the higher the perceived attractiveness of the city centre, the less inclined were Internet users to replace shopping trips with e-shopping. In general terms, we can conclude that mixed results have been found concerning the relationships between e-shopping and in-store shopping. This mixture might be partly attributed to the diversity of research contexts and the varying methods of data collection and analysis. Table 1.1 summarizes the most important empirical studies of e-shopping and in-store shopping.

Other factors associated with e-shopping: sociodemographics, Internet behaviour, land use features, and shopping attitudes

In-store shopping is associated not only with the adoption of e-shopping, but with other factors as well. With respect to the effect of sociodemographics on e-shopping it can be said that, in general, males, highly educated people, and individuals on a high income are more likely to shop online (Chang et al., 2005). Mixed results have been found for age. Other sociodemographic factors, such as household composition, have not been taken into consideration very often. Neither have the possible effects on e-shopping of lifestyle indicators, such as time-pressure. However, empirical results show that Internet experience and online buying experience affect e-shopping positively (Chang et al., 2005).

The impact of land-use features on e-shopping has so far received very little attention in studies of the adoption of e-shopping. An early descriptive study carried out in the Netherlands of people's intentions to use teleshopping showed that the greater the distance from one's home to shopping facilities for non-daily shopping, the more often is one willing to teleshop (De Smidt et al., 1987). A more recent descriptive analysis shows that residents of heavily urbanized areas as well as residents of rural areas often search products online (Statistics Netherlands, 2005). Using multivariate analysis techniques, a study from USA concludes that spatial attributes, such as distance from the respondents' home to the Central Business District (CBD), and the number of retail establishments for a respondent's zip-code, do not appear to play a substantive role in affecting e-shopping (Krizek et al., 2004b). However, the results of this study may not be capable of being generalized to the Dutch context, since the USA has a different urbanization pattern.

Finally, shopping attitudes can be either more task-oriented (wanting to obtain information and complete the shopping quickly) or more leisure-oriented (shopping for the fun it brings), reflecting the two major functions of shopping mentioned above. Empirical research shows that positive attitudes towards e-shopping play an important part in its adoption (Chang et

Table 1.1 Empirical studies about the relationships between e-shopping and in-store shopping

Study	Outcome	Dependent variable(s)	Independent variables	Product(s)	Country	Data collection	Method of analysis
Keyzers, E.C.M. & Wagenaar, P.C.M. 1989	Substitution	- Frequency grocery shopping trips	- Buying via computer and telephone - Sociodemogr.	Groceries	the Netherlands	Mail questionnaire n=150 people	Revealed preference Descriptive
Tacken, M. H.H.K. 1990	Substitution Modification	- Frequency grocery shopping trips - Mode grocery shopping trips	- Buying via computer and telephone - Sociodemogr.	Groceries	the Netherlands	Mail questionnaire n=146 people	Revealed preference Descriptive
Casas, J., Zmud, J. & Bricka, S. 2001	Neutrality Generation	- Person trip rates - Shopping trip rates	- E-shopping= online searching + online buying - Sociodemogr.	Not stated	USA Sacramento, California	- Interview - Travel diary (one-day) n=9132 people	Revealed preference Descriptive
Lenz, B., Luley, T., & Bitzer, W. 2003	Substitution	- Frequency shopping trips - Distance shopping trips - Mode shopping trips	- Attitudes towards e-shopping - Product characteristics - Sociodemogr.	- book/magazine - CD/video/DVD - electronics - software - admission tickets - travel - toys/sports equipment - clothing/shoes - stationary - pharmaceutical goods - cameras/optical goods - foodstuffs	Germany, Stuttgart region	- Telephone survey n=513 people - Online survey n=445 people	Stated preference

Study	Outcome	Dependent variable(s)	Independent variables	Product(s)	Country	Data collection	Method of analysis
Ferrell, C. E. 2004	Generation	- Frequency shopping trips - Distance shopping trips - Chaining shopping trips	- Homeshopping= buying via television, catalogue, Internet - Sociodemogr. - Geographical	Not stated	USA San Francisco Bay Area, California,	Activity diaries (two-day) n=14 563 households	Revealed preference Multivariate
Douma, F., Wells, K., Horan, T.A., & Krizek, K.J. 2004	Modification	- Internet-use before making a shopping trip	- E-shopping= online searching + online buying - Sociodemogr. - Geographical - Internet connection type	Not stated	USA Minneapolis, Minnesota	- Mail questionnaire n=446 households - Travel diary (four-day) n= 170 people	Revealed preference Descriptive
Ferrell, C. E. 2005	Substitution	- Frequency shopping trips - Distance shopping trips - Travel time shopping trips	- Homeshopping= buying via television, catalogue, Internet - Sociodemogr. - Geographical - Lifestyle	Unknown	USA San Francisco Bay Area, California	Activity diaries (two-day) n= 18 026 people	Revealed preference Multivariate
Papola, A. & Polydoropoulou, A. 2006	Substitution	- Frequency shopping trips	- Internet behaviour - Sociodemogr.	- groceries - electronics - book/CD/DVD - clothing/ cosmetics - toys/video - financial services - travel - software - household articles	- United Kingdom - the Netherlands - Italy - Greece - Israel	Online survey n=319 people	Stated preference

al., 2005). A wide range of attitudes has been researched, varying from the perceived quality of web stores to the importance attached to shopping for bargains. Unfortunately, these attitudes are seldom operationalized as appropriately as they are in psychological studies.

1.3 Research gaps

Despite the increasing attention for e-shopping and its explanation, a few research gaps can be identified. What becomes apparent when looking at empirical studies of e-shopping and personal travel behaviour (see Table 1.1), is that many studies are of a descriptive nature; they often consider e-shopping as part of home shopping (shopping by catalogue, television, fax, or telephone), and do not state explicitly what products are being researched. Multivariate analysis techniques offer the opportunity to account for other influencing factors such as attitudes or sociodemographics when analysing the relationships between e-shopping and in-store shopping. Until now, such techniques have seldom been employed. Moreover, very few studies have included attitudes (defined as a subjective evaluation of a behaviour, which disposes a person to behave in a certain way towards it (Gärling et al., 1998)), although the importance of attitudes in the adoption of e-shopping has been recognized (Gould, 1998; Chang et al. 2005). The interactive nature of the Internet, and hence of e-shopping, is clearly distinct from other types of home shopping. By choosing the navigation route, the consumer can exercise control over the content displayed and can make logical operations such as sorting, comparing, and querying data. E-shopping should therefore be considered on its own when its relationship with in-store shopping is being assessed. Only a few studies pay attention to specific product categories. It is important to distinguish between different types of products, because the product determines not only the purchase frequency, but also the choice of shopping mode (e-shopping or in-store shopping), the physical shopping place, and the means of travel to that place (Lenz, 2003). At least a basic distinction between grocery and non-grocery products must be drawn, because the likelihood of buying these items online differs and the frequency of their purchase could affect shopping travel.

Most studies have been carried out in USA and not in Europe. Further evidence from Europe is needed. Not only do the socio-cultural and planning contexts differ from those in the US; so do the urbanization patterns. The spatial structure of shopping centres in urban areas in the Netherlands follows a hierarchical pattern more closely than in most other countries (Borchert, 1998). Central place theory explains that hierarchical shopping nucleations exist because their distribution functions for goods and services differ for different geographical areas; Borchert uses a fivefold classification, ranging from small convenience centres to metropolitan CBDs (Central Business District). The Netherlands has a rather traditional retail structure, with almost no large-scale hypermarkets or shopping malls. Uncontrolled retail growth at the fringes of urban areas was barred for decades by a restrictive national retail planning policy, although this has recently been abandoned (Evers, 2002). Nonetheless, approximately half of all the shops in the Netherlands are located in the central areas (CBDs) of towns and cities (Locatus, 2003). Of all shopping trips in the Netherlands, nearly half (48 percent) are made on foot or by bicycle; these forms of travel account for 15 percent of all kilometres travelled for the purpose of visiting shops (Ministry of Transport, Public Works, and Water Management, 2004). Thus, the specific characteristics

of the Dutch retail structure and the shopping travel behaviour of the Dutch population have to be kept in mind when studying potential interactions between e-shopping and in-store shopping.

Most studies concentrate on online buying and pay very little attention to the explanation of online searching for consumer goods and services. This focus is remarkable, since it is plausible that most of the time devoted to shopping is spent searching for and comparing products and stores. The actual purchase itself would take much less time than the process of information gathering that preceded it. Moreover, potential interactions of e-shopping with in-store shopping are likely to occur during the information-gathering sub task of the shopping process, since more shopping trips may be undertaken if the information found is not satisfactory. One of the few empirical studies of online searching shows that males search more often than females for commercial products and services online (Statistics Netherlands, 2005). Also, younger and highly-educated people search more often online than older and less-well-educated people. Concerning household composition, it has been found that couples without children search online more often than other household types.

Another deficiency in most empirical studies of the adoption of e-shopping is that land use features such as shop accessibility or residential environment are rarely considered. This neglect is probably the result of the perspective of the retail and marketing disciplines, which are less concerned with geographical variables (for an overview, see Cao & Mokhtarian, 2005; Chang et al., 2005). Nevertheless, living in an urban environment or having many shops around one's home might affect the likelihood of shopping online. On the one hand, according to Rogers' innovation diffusion theory (1983), innovations usually start in urban areas; consequently, urban residents would be more inclined to shop online than suburban residents would. On the other hand, more travel time can be saved when people's accessibility to shops is relatively low. Since there is a dense network of supermarkets in the Netherlands, time would mainly only be saved by the online purchase of non-daily goods such as books and clothing. The time-space constraints for shopping could thus be lifted. Via the Internet, people would also have access to a wider variety of goods. Thus, the consideration of land-use features could be relevant when studying the adoption of e-shopping, in addition to other factors such as sociodemographics, Internet behaviour, and shopping attitudes.

Finally, many empirical studies fail to define attitudes appropriately and include various psychological concepts on an *ad hoc* basis in their explanations of e-shopping. Moreover, attitudes and behaviour are often linked with each other directly rather than indirectly via intention. Various sociopsychological theoretical frameworks, such as the theory of planned behaviour, have been used to explain e-shopping (implicitly more often than explicitly) (Cao & Mokhtarian, 2005). The theory of planned behaviour (Ajzen, 1991) explains actual behaviour by the motivation (intention) people have and the ability they think they have to perform the behaviour (perceived behavioural control). The theory also incorporates the influence of perceived social pressure by important others, such as relatives, to perform a behaviour or not (subjective norms), as well as attitudes towards the behaviour, and past experience.

The Extended Model of Goal-directed Behaviour (EMGB) (Perugini & Conner, 2000) builds further on attitude theory by also considering the goals that people ultimately want to achieve. Like other models based on attitude theory, relationships between attitudes

and behaviour are mediated by intention, while taking into account other behavioural factors. However, the EMGB pays little attention to the constraints that could limit people's intentions and, hence, behaviour. Also, it is unclear what causes the variation in several psychological constructs such as perceived behavioural control (that is, the confidence an individual has in undertaking a particular behaviour in a certain situation). External variables such as sociodemographics and land-use features should therefore be added to the EMGB in order to assess their importance in explaining various psychological constructs. Such a theoretical framework would be useful in the quest for more insight in the underlying psychological drives and constraints to shop online.

1.4 Research goal and question

As has been shown in previous sections, e-shopping has grown rapidly in recent years. As yet, it is unknown how-store shopping might be affected in the short and long term. If consumers' in-store shopping behaviour changes, this will affect physical stores. Policy makers are therefore curious to know how e-shopping and in-store shopping relate to each other. The few empirical studies that have investigated relationships between e-shopping and personal travel behaviour are mostly of a descriptive nature and do not distinguish between shopping travel for groceries (daily goods) and non-daily goods such as clothing and books. Moreover, online searching has not as yet received much attention, which is remarkable given the important phase it comprises in the shopping process. Additionally, in most explanations of e-shopping, land-use features are not included, although such factors as shop accessibility can be expected to influence the decision to shop online or in-store.

Consequently, the aim of this research has been to provide insight into consumers' adoption of online searching and buying and the implications this might have for their in-store shopping behaviour. To achieve this aim, the following research question was formulated:

To what extent are in-store shopping behaviour, sociodemographics, Internet behaviour, land use features, and shopping attitudes associated with the adoption of online searching and buying of products by consumers?

Some key concepts are explained below. *E-shopping* is defined as *searching product information online and/or buying products online by consumers*. Information search can be divided into *directed search*, during which an individual is actively seeking information, and *undirected search*, during which an individual is unconsciously exposed to different external stimuli (store-window displays, advertisements on billboards, or pop-ups on a computer, for example) (Salomon & Koppelman, 1988). We define *online searching* as *directed information search via the Internet during which a person actively seeks information about a commercial product or service*. This activity can range from general browsing online (to acquire some initial ideas) to visiting specific websites in order to compare products and/or prices. A product does not necessarily need to be paid for online to classify as an online purchase, the online establishment of the transaction suffices. E-shopping could fulfil the same functions as in-store shopping, so the frequency of shopping trips and the duration of the shopping activity have been investigated. The focus is on non-daily shopping (books, clothing, for example) as opposed to daily grocery shopping, since most products bought online are

non-daily products (AC Nielsen, 2005). Understanding the relationships between the two types of shopping requires the study of the online and in-store shopping of the same type of products.

The research question has been addressed in several articles prepared for refereed academic journals. Over time, different datasets and diverse methods of analysis have been used. A chronological ordering of the articles has been chosen in order to reflect the research process. New insights were gained during this process, so the research gaps that have been identified above are not dealt with in all chapters. Table 1.2 summarizes the main topics and variables researched that have been reported in each article. Below, a short overview is provided of the main issues addressed.

Interactions between e-shopping and in-store shopping are reported in Chapters 4 and 5, while the hypotheses generated about such interactions are set out in Chapter 2. A distinction has been drawn between shopping travel for daily (grocery) and non-daily goods and services (clothing, books, for example). Chapter 4 reports the study of the impact of online buying on both daily and non-daily shopping trips. In Chapter 5, we have described the analysis of the relationships between the frequencies of online searching, online buying, and shopping trips for non-daily products, with accessibility measures at the neighbourhood level and life style indicators such as time-pressure along with sociodemographics, Internet behaviour, and shopping attitudes as explanatory variables.

A distinction has also been drawn between online searching and online buying: the adoption of online searching is addressed in Chapters 3 and 5, while the adoption of online buying is considered in all chapters. Determinants of online buying have been compared with a USA sample of Internet users in Chapter 4, and certain product types that are often bought online (travel tickets, CD/video/DVD, for example) have been specifically considered in Chapter 3. A theoretical framework that draws on attitude theory (Extended Model of Goal-directed Behaviour (EMGB), Perugini & Conner, 2000) has been used in Chapter 6 to explain the intention to buy media products (books, CDs, videos, DVDs, computer software) online and in-store within the coming month, and has been compared with other theoretical models. Constraints (sociodemographics, land use features, for example) have been added to this framework in order to take into account people's social and spatial context. Main conclusions and a sketch of future developments are provided in Chapter 7.

1.5 Datasets used

Research for this thesis started in 2002 – a time when only a few empirical datasets about e-shopping were available, and information about potential relationships with in-store shopping was lacking. Hence, the first analyses were carried out on an e-shopping dataset that was collected by the Dutch online research agency Multiscope (see Table 1.3). In order to relate e-shopping to in-store shopping, data from the 1998 Netherlands National Travel Survey (NTS) were also used. In 2003, two data collections took place, both in Utrecht and surroundings. Details of these data collections can be found in Table 1.3. A brief description of the main data collection (Own data 2) that took place in November/December 2003 is provided below.

Table 1.2 Overview of main topics and variables per chapter

Chapter	Topic	Dependent variables	Independent variables	Dataset[1]	Method of analysis
2	Explanation of online buying Formulation of hypotheses about e-shopping and travel	Ever bought online Shopping activity duration (in minutes per shopping event)	Sociodemographics Internet behaviour Land use features	Multiscope data Netherlands National Travel Survey	Logistic regression
3	Dynamics in the geographical distribution of Dutch Internet users and online buyers in 1996 and 2001 Impact of land use features on e-shopping	Ever searched online Ever bought online Frequency online buying CD/video/DVD bought online Clothing bought online Travel ticket bought online	Sociodemographics Internet behaviour Land use features	Multiscope data	Logistic regression Ordinary Least Squares (OLS) regression
4	Determinants of online buying compared with the US Impact of online buying on daily and non-daily shopping frequency and activity duration	Ever bought online Frequency online buying Frequency daily shopping trips Duration daily shopping activity Frequency non-daily shopping trips Duration non-daily shopping activity	Sociodemographics Internet behaviour Shopping attitudes Land use features	Own data 1	Logistic regression Ordinary Least Squares (OLS) regression
5	Interactions between frequencies of online searching, online buying, and non-daily shopping trips How these frequencies are influenced by endogenous and exogenous variables	Frequency online searching Frequency online buying Frequency in-store shopping E-shopping attitude In-store shopping attitude Home shopping experience Shopping trip chaining Shopping duration per trip Internet experience Fast Internet connection	Sociodemographics Internet behaviour Shopping attitudes Shopping behaviour Lifestyle/Personality variables Land use features	Own data 2	Structural Equation Modeling (SEM)

Chapter	Topic	Dependent variables	Independent variables	Dataset[1]	Method of analysis
6	Application of the EMGB on the volition (=intention) to purchase media products (e.g, books, CDs) online and in-store within the coming month Assessing the impact of external variables on various psychological constructs in the EMGB	Goal desire Attitude Subjective norms Perceived behavioural control Behavioural desire Past behaviour	Goal desire Attitude Subjective norms Perceived behavioural control Behavioural desire Past behaviour Sociodemographics Internet behaviour Lifestyle/Personality variables Land use features	Own data 2	Structural Equation Modeling (SEM)

1 See Table 1.3 for an explanation of the various data sets.

Our research population consisted of Internet users, since our focus is on e-shopping, which requires Internet use. An Internet user is defined as someone using the Internet for work or private reasons. People who do not have Internet access at home could also participate in our surveys, since the main criteria of an Internet user is that he or she *uses* the Internet, not necessarily owning a PC with an Internet connection. As has been mentioned earlier, two-thirds of Dutch households have an Internet connection at home (Statistics Netherlands, 2005). We have not specified a minimum amount of time that needs to have been spent online in order to be considered an Internet user. Therefore, only people who have never used the Internet for work or private reasons are regarded as non-Internet users.

To gain more insight into the adoption of e-shopping, a shopping survey and a two-day travel diary were designed. The shopping survey consisted of questions about daily and non-daily in-store shopping habits, Internet use, e-shopping habits, attitudes towards e-shopping and in-store shopping, and sociodemographics. Respondents were asked to complete the travel diary on a Friday and Saturday, since most in-store shopping takes places on these days (Ministry of Transport, Public Works, and Water Management, 2004). Unfortunately, owing to time constraints the travel diaries could not be analysed, so the reported analyses are all based on the shopping survey.

Four municipalities (Utrecht, Nieuwegein, Culemborg, and Lopik) were selected on the basis of their different urbanization and shop-availability levels. Eight thousand households were drawn randomly using the municipalities' population administration (4000 in Utrecht and 4000 in the suburban municipalities). These households received a selection questionnaire by mail asking about their Internet use and online shopping behaviour, together with their in-store shopping behaviour and sociodemographics. Interested people could indicate on the questionnaire whether they wanted to participate in the main survey and how they would prefer to participate: via a paper-and-pencil survey or via an online survey. Nearly a quarter (24 percent) of the households returned the selection questionnaire; of these, 80 percent were willing to participate in the main survey (1566 respondents). Of the respondents willing to participate, 77 percent were Internet users and therefore belonged to our research population (1210 respondents). Nearly half (46 percent) of the 1210 respondents preferred to participate in the online survey. These 1210 respondents received a shopping survey and a two-day travel diary, either online or by mail. Reminders were sent by post and by e-mail to the participants. Respondents could win three main prizes of 200, 150, and 100 euro respectively, and twelve minor prizes of 25 euro each. In total, 826 people completed both a shopping survey and a travel diary. Of these respondents, 44 percent participated online.

Households could choose to complete the questionnaire either online or by paper-and-pencil, thus ensuring that both frequent and infrequent Internet users would participate. The main difference between the online and paper-and-pencil survey is that some of the questions in the Internet survey have a built-in check, making it impossible to go on with the questionnaire without answering the question. The quality of the Internet data is therefore better at some points, but otherwise at least comparable with the mail data. Research has shown that males, highly-educated people, people on a higher income, and urban residents are over-represented among the respondents who chose to fill out the online questionnaire (De Blaeij et al., 2006). Internet respondents also have more Internet experience and a faster

Table 1.3 Overview of datasets used

Datasets Year of collection	Research areas	Survey instruments	Response rates	Remarks
Netherlands National Travel Survey 1998 (collected monthly)	The Netherlands	Telephone survey One-day travel diary Topics: - Sociodemographics - Trip characteristics	Unknown n= approximately 130 000 people	This survey has been held since 1978 by Statistics Netherlands.
Multiscope data April and May 2001	The Netherlands	Online questionnaire Topics: - Internet use - Online buying - Sociodemographics	Multiscope Internet research panel: 13% Pop-up window at nine different web sites: 3%-10% n=2220 people	The questionnaire was distributed to a sample of the agency's panel. Additionally, the questionnaire opened at random for one out of 200 visitors via pop-up windows.
Own data 1 March 2003	Utrecht neigbourhoods: Vogelenbuurt (n=219) high shop availability Lunetten (n=282) medium shop availability De Meern (n=296) low shop availability	Questionnaire Topics: - Internet use - Online searching - Online buying - In-store shopping - Sociodemographics - Attitudes	1396 households approached face-to-face: 58% n= 807 people	The questionnaire could either be filled out by the respondents or by the interviewer.
Own data 2 November and December 2003	Utrecht (population: 260 625, high shop availability) Culemborg (population: 26 613, high shop availability, distance to Utrecht 17 km) Nieuwegein (population: 61 806, medium shop availability, distance to Utrecht 7 km) Lopik (population: 13 869, low shop availability, distance to Utrecht 18 km)	Mail selection questionnaire Mail or online main questionnaire Mail or online two-day travel diary Topics main questionnaire: - Daily in-store shopping (attitudes & behaviour) - Non-daily in-store shopping (attitudes & behaviour) - Internet use (attitudes & behaviour) - E-shopping (attitudes & behaviour) - Sociodemographics	8000 households approached by mail: 24% Willing to participate and Internet user: n=1210 people Filled out both survey and diary: n=826 people	Respondents could choose how they wanted to participate in the main survey.

Internet connection at home compared with respondents who completed the surveys with paper-and-pencil.

To give an indication of the representativeness of our sample, we compared it with a nationwide sample of Internet users (defined as people who have ever used the Internet) (Statistics Netherlands, 2005b). Of the Dutch Internet users in 2003, most were male (54 percent) and aged between 25 and 44 years (44 percent). Women form the majority (61 percent) in our sample. A possible explanation of this high percentage of females in our study is that shopping appeals more to women than to men. Hence, women would be more willing to complete a questionnaire about shopping than men would. Of the respondents in our sample 54 percent are aged between 25 and 44 years, which is a higher percentage than in the national sample. A major difference between the samples concerns education. In the nationwide sample, 28 percent of the Internet users had completed an academic degree, while in our sample 57 percent of the respondents had done so. Thus, our sample is characterized by an over-representation of highly educated people, females, and older people. This over-representation has to be kept in mind when interpreting the empirical findings of our research; as does the fact that our research goal was to obtain more insight into the adoption of e-shopping and its interactions with in-store shopping rather than to generalize the results to other Internet populations.

References

AC Nielsen, 2005, "Global Online Shopping Habits. AC Nielsen Global Online Survey October 2005" http://www2.acnielsen.com/press/documents/ACNielsen_OnlineShopping_GlobalSummary

Ajzen I, 1991, "The theory of planned behavior" *Organizational Behavior and Human Decision Processes* **50** 179-211

Alba J, Lynch J, 1997, "Interactive home shopping: consumer, retailer, and manufacturer incentives to participate in electronic market places" *Journal of Marketing* **61** 38-54

Bhat C R, Sivakumar A, Axhausen K W, 2003, "An analysis of the impact of information and communication technologies on non-maintenance shopping activities" *Transportation Research B* **37** 857-881

Borchert J G, 1998, "Spatial dynamics of retail structure and the venerable retail hierarchy" *GeoJournal* **45** 327-336

Casas J, Zmud J, Bricka S, 2001, "Impact of shopping via Internet on travel for shopping purposes", paper presented at the 80th Annual Meeting of the Transportation Research Board, Washington D.C.

Cao X, Mokhtarian P L, 2005, "The intended and actual adoption of online purchasing: a brief review of recent literature", ITS, Department of Civil and Environmental Engineering, UC Davis, http://www.its.ucdavis.edu/publications/2005/UCD-ITS-RR-05-26.pdf

Chang M K, Cheung W, Lai V S, 2005, "Literature derived reference models for the adoption of online shopping" *Information & Management* **42** 543-559

Corpuz G, Peachman J, 2003, "Measuring the impacts of Internet usage on travel behaviour in the Sydney Household Travel survey", paper presented at the 26th AustralasianTransport Research Forum, Wellington, New Zealand

Couclelis H, 2004, "Pizza over the Internet: E-commerce, the fragmentation of activity and the tyranny of the region" *Entrepreneurship & Regional Development* **16** 41-54
Douma F, Wells K, Horan T A, Krizek K J, 2004, "ICT and travel in the Twin Cities metropolitan area: enacted patterns between Internet use and working and shopping trips", paper presented at the Transportation Research Board 83rd Annual Meeting, Washington D.C.
De Blaeij A, Dijst M, Farag S, 2006, "Effects of data collection methods in travel behaviour surveys; comparing an Internet and a mail sample", paper presented at the Transportation Research Board 85th Annual Meeting, Washington D.C.
De Smidt M, Van Oudheusden J C, Rimmelzwaan H T, 1987, *Teleshopping in Spatial Perspective* (in Dutch) (Stichting Toegepast Geografisch Onderzoek (STOGO), Utrecht)
Dijst M, 2004, "ICTs and accessibility: an action space perspective on the impact of new information and communication technologies", in *Transport Developments and Innovations in an Evolving World* Eds. M Beuthe, V Himanen, A Reggiani, L Zamparini (Springer, Berlin) pp 27-46
Evers D, 2002, "The rise (and fall?) of national retail planning" *Tijdschrift voor Economische en Sociale Geografie* **93** 107-113
Ferrell C E, 2004, "Home-based teleshoppers and shopping travel: Do teleshoppers travel less?", paper presented at the 83rd Annual Meeting of the Transportation Research Board, Washington D.C.
Ferrell C E, 2005, "Home-based teleshopping and shopping travel: Where do we find the time?", paper presented at the 84th Annual Meeting of the Transportation Research Board, Washington D.C.
Gärling T, Gillholm R, Gärling A, 1998, "Reintroducing attitude theory in travel behavior research" *Transportation* **25** 129-146
Golob T F, Regan A C, 2001, "Impacts of information technology on personal travel and commercial vehicle operations: research challenges and opportunities" *Transportation Research C* **9** 87-121
Gould J, Golob T F, 1997, "Shopping without travel or travel without shopping? An investigation of electronic home shopping" *Transport Reviews* **17** 355-376
Gould J, Golob T F, 2002, "Consumer e-commerce, virtual accessibility, and sustainable transport" in *Social change and sustainable transport* Eds W R Black, P Nijkamp (Indiana University Press, Bloomington)
Graham S, Marvin S, 1996 *Telecommunications and the City: Electronic Spaces, Urban Places* (Routledge, London)
Hägerstrand T, 1970, "What about people in regional science?" *Papers in Regional Science* **24** 7-21
Internetvalley.com, 2005, http://www.internetvalley.com/archives/mirrors/davemarsh-timeline-1.htm
Keyzers E C M, Wagenaar P J M, 1989, *Teleshopping: Time and Space Effects* (in Dutch), Report 19, (Research Institute for Urban Planning and Architecture, Delft)
Koppelman F, Salomon I, Proussalogou K, 1991, "Teleshopping or store shopping? A choice model for forecasting the use of new telecommunications-based services" *Environment and Planning B* **18** 473-489

KPMG, 1997 *The Impact of the Information Society on Traffic and Transportation* (in Dutch) (Bureau voor Economische Argumentatie, Hoofddorp)
Krizek K J, Johnson A, 2003, "Mapping the terrain of information and communications technology (ICT) and household travel", paper presented at the 82nd Annual Meeting of the Transportation Research Board, Washington D.C.
Krizek K J, Li Y, Handy S L, 2004a, "ICT as a substitute for non-work travel: a direct examination", working paper, Active Communities Transportation (ACT) Research Group, University of Minnesota-Humphrey Institute of Public Affairs
Krizek K J, Li Y, Handy S L, 2004b, "Spatial attributes and patterns of use in household-related ICT activity", working paper, Active Communities Transportation (ACT) Research Group, University of Minnesota-Humphrey Institute of Public Affairs
Lenz B, Luley T, Bitzer W, 2003, "Will electronic commerce help to reduce traffic in agglomeration areas?", paper presented at the Transportation Research Board 82nd Annual Meeting, Washington D.C.
Locatus, 2003 *Retail Guide 2003* (in Dutch) (Locatus, Woerden)
Ministry of Transport, Public Works, and Water Management, 2004 *Passenger Transport in the Netherlands: Key Figures 2004* (AVV Transport Research Centre, Ministry of Transport, Public Works, and Water Management, Rotterdam)
Mokhtarian P L, 1990, "A typology of relationships between telecommunications and transportation" *Transportation Research A* **24** 231-242
Mokhtarian P L, Meenakshisundaram R, 1999, "Beyond tele-substitution: disaggregate longitudinal structural equations modeling of communication impacts" *Transporation Research C* **7** 33-52
Mokhtarian P L, 2000, "Telecommunications and travel", paper presented at the Transportation Research Board 79th Annual Meeting,Washington D.C.
Mokhtarian P L, Salomon I, 2001, "How derived is the demand for travel? Some conceptual and measurement considerations" *Transportation Research A* **35** 695-719
Mokhtarian P L, Salomon I, 2002, "Emerging travel patterns: do telecommunications make a difference?", in *In Perpetual Motion: Travel Behaviour Research Opportunities and Application Challenges* Ed H S Mahmassani (Pergamon Press/Elsevier, Oxford, UK) pp 143-182
Mokhtarian P L, 2002, "Telecommunications and travel: the case for complementarity" *Journal of Industrial Ecology* **6** 43-57
Mokhtarian P L, Salomon I, Handy S, 2003, "The impacts of ICT on leisure activities and travel: a conceptual exploration", paper presented at the 10th conference of the International Association for Travel Behaviour Research (IATBR), Switzerland
Mokhtarian P L, 2004, "A conceptual analysis of the transportation impacts of B2C e-commerce" *Transportation* **31** 257-284
MuConsult, 2003 *ICT, Space, and Mobility. The Consequences of the Rise of ICT for Land Use and Transportation* (AVV, Rotterdam)
Niles J, 1994 *Beyond Telecommuting: A New Paradigm for the Effect of Telecommunications on Travel*, Report DOE/ER-0626, US Department of Energy, Offices of Energy Research and Scientific Computing

Papola A, Polydoropoulou A, 2006, "Shopping-related travel in an rich ICT era. A case study on the impact of e-shopping on travel demand", paper presented at the Transportation Research Board 85th Annual Meeting, Washington D.C.
Rice R E, Katz J E, 2003, "Comparing Internet and mobile phone usage: digital divides of usage, adoption, and dropouts" *Telecommunications Policy* **27** 597-623
Rogers E M, 1983 *Diffusion of Innovations* (The Free Press, New York)
Rotem O, Salomon I, 2004, "The impacts of e-retail on the choice of shopping travel and delivery: some preliminary results", paper presented at the ICT Specialist Meeting, Doorn, The Netherlands
Salomon I, 1985, "Telecommunications and travel. Substitution or modified mobility?" *Journal of Transport Economics and Policy* **19** 219-235
Salomon I, 1986, "Telecommunications and travel relationships: a review" *Transportation Research A* **20** 223-238
Salomon I, Koppelman F, 1988, "A framework for studying teleshopping versus store shopping" *Transportation Research A* **22** 247-255
Salomon I, Koppelman F, 1992, "Teleshopping or going shopping: an information acquisition perspective" *Behaviour and Information Technology* **11** 189-198
Sindhav B, Balazs A L, 1999, "A model of factors affecting the growth of retailing on the Internet" *Journal of Market Focused Management* **4** 319-339
Srinivasan S, Bhat C R, 2004, "Modeling the generation and allocation of shopping activities in a household", paper presented at the 83rd Annual Meeting of the Transportation Research Board, Washington D.C.
Srinivasan K K, Raghavender P N, 2006, "Impact of mobile phones on travel: empirical analysis of activity-chaining, ride-sharing, and virtual shopping", paper presented at the Transportation Research Board 85th Annual Meeting, Washington D.C.
Statistics Netherlands, 2003, *The Digital Economy 2003* (in Dutch) CBS,Voorburg
Statistics Netherlands, 2005, *The Digital Economy 2004* (in Dutch) CBS,Voorburg
Thuiswinkel.org, 2005, "Home shopping in the Netherlands", http://www.thuiswinkel.org
TNO Inro, 2002, *Towards an Environmental Navigator ICT, Land Use, and Mobility* (in Dutch) (AVV, Rotterdam)
TNO, 2004, *Report of Trends in Postal and ICT Infrastructure 2004* (in Dutch) (Ministerie van Economische Zaken, Den Haag)
Tonn B E, Hemrick A, 2004, "Impacts of the use of e-mail and the Internet on personal trip-making behavior" *Social Science Computer Review* **22** 270-280
Urry J, 2004, "Connections" *Environment & Planning D* **20** 27-37
Van Dijk L, De Haan J, Rijken S, 2000, *Digitalization of the Environment. A Study of Information- and Communication Technology and Social Inequality* (in Dutch) (SCP, Den Haag)
Visser E, Lanzendorf M, 2004, "Mobility and accessibility effects of B2C e-commerce: a literature review" *Journal of Economic and Social Geography* **95** 189-205
Ward M R, Morganosky M, 2002, "Consumer acquisition of product information and subsequent purchase channel decisions" in *Advances in applied microeconomics: The economics of the Internet and E-Commerce*. Ed M R Baye (Elsevier Science, Amsterdam) pp 231-255

Weltevreden J, Van Rietbergen T, 2006, "City centre shopping in the Internet era: the case of the Netherlands", paper submitted for publication, copy available from weltevreden@rpb.nl

Zakon R H, 2005, "Hobbes' Internet Timeline v8.1", http://www.zakon.org/robert/internet/timeline/

Zumkeller D, 2002, "Transportation and telecommunication: first comprehensive surveys and simulation approaches", in *In Perpetual Motion: Travel Behaviour Research Opportunities and Application Challenges* Ed H S Mahmassani (Pergamon Press/Elsevier, Oxford, UK) pp 183-207


e
D
S
e-shopping
delivery service
eDS

2 Exploring the use of e-shopping and its impact on personal travel behavior in the Netherlands

Sendy Farag, Martin Dijst, and Martin Lanzendorf
Adaptation of a publication in *Transportation Research Record* number 1858, 47-54, 2003

Abstract
The Internet makes it possible to conduct activities such as working and shopping without traveling to activity places. As e-shopping becomes popular, it can fundamentally change travel behavior. The presented study uses a literature review, an Internet survey of e-shoppers, and the Netherlands National Travel Survey to analyze the possible impact of e-shopping on travel behavior. The findings indicate that people living in areas with relatively many shopping opportunities buy online as often as do people who live in areas with relatively few shopping opportunities. People who spend a lot of time on in-store shopping typically are women, are more than 60 years old, have a low level of education, are on a low income, and live in a more urbanized area. Online buyers can be characterized as men between ages 25 and 40 who are highly educated, have a high income, and live in a less urbanized area. Four hypotheses were derived to describe the future impact of e-shopping on travel. First, some shopping time will be saved and used for other maintenance or leisure activities instead. Second, the enlargement and fragmentation of an individual's action spaces will be fostered and so lead to increased travel distances. Third, e-shopping will affect travel behavior most in the urbanized western part and in the less urbanized parts of the Netherlands. Finally, a reduction in car travel in the less urbanized areas of the Netherlands and a reduction in walking and cycling in the more urbanized areas of the Netherlands are expected.

2.1 Introduction

Information and communication technology (ICT) poses important challenges to transportation planners. The Internet makes it possible to conduct activities such as working and shopping without traveling to activity places. As the popularity of shopping via the Internet (e-shopping) increases, it could fundamentally change people's travel behavior and ultimately the use of transport systems and the spatial configuration of shops. 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 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.

Telecommuting has received considerable attention (Pendyala et al., 1991; Mokhtarian & Salomon, 1994; Handy & Mokhtarian, 1995). In contrast, e-shopping and its relationship with personal travel behavior have received far less attention; few studies have been conducted (Casas et al., 2001; Golob & Regan, 2001). Many published reports are hypothetical or theoretical. Most empirical studies tend to consider e-shopping as part of home shopping (shopping by catalogue, television, fax, or telephone) and not as an activity via the Internet. Finally, most studies have been carried out in the United States, not in Europe. Further evidence from Europe is needed because not only sociocultural and planning contexts but also urbanization patterns differ from those in the United States (Schwanen et al, 2002).

This study develops hypotheses on the relationships between e-shopping and personal travel behavior. Two questions are of interest: What is the impact of personal and residential environment characteristics on e-shopping? and, What is the potential impact of e-shopping on travel behavior?

2.2 Literature review

Factors that affect e-shopping

E-shopping can be defined as an activity to buy or to get information about consumer goods via the Internet (Mokhtarian, 2004). Of course, both buying and obtaining information are activities that can take place via the Internet. However, e-shopping also enables a spatial and temporal fragmentation and recombination of several stages in the shopping process (Mokhtarian, 2004). For example, one can obtain information about a certain product by in-store shopping and then purchase the product via the Internet. It is also possible to use the Internet to obtain information about a product and then buy it in a brick-and-mortar store. Additionally, e-shopping differs from other in-home shopping forms (like catalogues or television shopping channels) in interactivity and logical capability (Sindhav & Balazs, 1999).

The Internet is an interactive medium – the consumer decides on the navigation route and thus exercises control over the content being displayed. Logical operations like sorting, comparing, and querying data are easy to make, which enlarges the capabilities of the Internet for handling information, compared with other in-home shopping forms. For example, grocery-shopping lists can be created and saved for future use. In the literature, four factors can be identified that affect behavioral choices in the shopping process: shopping motive, product characteristics, shopping mode characteristics, and individual characteristics (Salomon & Koppelman, 1988; Salomon & Koppelman, 1992).

First, ICT use could affect the motives for participating in shopping, or any other activity (Salomon & Koppelman, 1992; Gould & Golob, 1997; Mokhtarian, 1998). Shopping activities have several functions. One of these is the economic function, such as buying a product. Shopping may also fulfill some social functions (meeting people, conversation) and recreational functions (physical exercise, entertainment). Psychological needs may also be met by this activity, such as the need for exposure to information or to fresh stimuli. The functions that shopping activities have for individuals at a given time will influence the decision whether to buy online or to buy in a store (Dijst, 2004). Second, product characteristics can affect e-shopping. The products popularly purchased via e-shopping

are computers, computer hardware and software, CDs, books, travel tickets, and cinema and concert tickets, as well as fast food delivery, such as pizzas (Szymanski & Hise, 2000; Vrechopoulos et al., 2001; Lee, 2002). However, people prefer to buy in-store such items as clothes, furniture, and cosmetics. Of the online grocery shoppers, most would not buy meat, dairy, produce, or other perishables online. It can be concluded that "search goods," such as books and CDs, are more suited to Internet purchase than "experience goods," such as fresh vegetables (Salomon & Koppelman, 1988). Third, e-shopping rates relatively low in comparison with in-store shopping for such shopping mode characteristics as product information, product sales, security of transactions, and ease of returning merchandise (Koppelman et al., 1991; Lee, 2002; Raijas, 2002). E-shopping is rated relatively high on timesaving and flexibility in shopping hours. The preferred payment method for e-shopping is either cash on delivery or credit card on the Internet (Vrechopoulos et al., 2001; Lee, 2002). Fourth, e-shopping is done mainly by young male graduates in professional occupations who have high incomes (Lohse & Johnson, 1999; Zmud & Arce, 2000; Vrechopoulos et al., 2001; Forsythe & Shi, 2003). Another type of profile is prevalent for online grocery shoppers: young, highly educated women with high incomes and at least one child (Morganosky & Cude, 2000; Raijas, 2002). Income positively affects online buying and the intention to buy online (Sim & Koi, 2002; Forsythe & Shi, 2003).

Verhoef and Langerak found a positive relationship between time pressure and the intention to buy groceries online (Verhoef & Langerak, 2001). In general, the most frequently cited reasons for online shopping are convenience and time savings, along with the opportunity to purchase unique products and (physical) mobility constraints for in-store shopping (Morganosky & Cude, 2000; Vrechopoulos et al., 2001; Lee, 2002, Sim & Koi, 2002). However, a study by Maher et al. of women's attitudes toward and use of shopping modes failed to find any effect on e-shopping from convenience (Maher et al., 1997). Other studies also have failed to find the expected relationship between time pressure and the intention to buy different kinds of products online (Lohse & Johnson, 1999; Sim & Koi, 2002). The contradictory findings can perhaps be accounted for by differences in methods or by sample size and composition.

Besides sociodemographic variables, other personal (behavioral) variables could also be relevant. Research shows that past behavior and attitudes toward e-shopping have an impact on e-shopping. The number of months of experience on the Internet, the frequency of Internet use, Internet search for product information, Internet purchase experience, and mail-order experience positively affect the intention to buy online as well as actual online buying behavior. Computer education also positively influences the intention to buy online (Liao & Cheung, 2000). A positive attitude toward e-shopping, such as the perceived quality of vendors on the Internet, also positively affects the intention to buy online (Maher et al., 1997; Lohse & Johnson, 1999; Liao & Cheung, 2000; Shim et al., 2001; Sim & Koi, 2002).

This short literature review on the use of e-shopping shows that the choice for e-shopping is influenced by personal and household attributes, such as education, income, gender, age, presence of children, employment, time pressure, and computer and Internet experience, but choice is also influenced by attributes of the shopping activity, such as the function of the shopping activity, characteristics of the product, product information, security, and payment method. A main reason for e-shopping is to save time. The relative weight on e-shopping of

time-pressured personal and household attributes, such as labor participation and childcare, must be analyzed in more detail.

Unfortunately, the literature provides very little information on the potential impact of urban form attributes on e-shopping. A possible reason for this omission is that most researchers who have analyzed the use of e-shopping are marketing researchers who do not have a primary interest in the impact of spatial contexts (Lohse & Johnson, 1999; Morganosky & Cude, 2000; Verhoef & Langerak, 2001; Vrechopoulos et al., 2001; Lee, 2002, Sim & Koi, 2002). In any case, urban form may have an impact on e-shopping. It may be expected that households in the suburbs, or in rural areas at a greater distance from shopping locations than urban households, are more inclined to buy online, because these households could save relatively more shopping travel time.

Impact of e-shopping on personal travel behavior

Much of the literature about ICT and travel deals with telecommuting (Kumar, 1990; Pendyala et al., 1991; Mokhtarian & Salomon, 1994). In comparison with telecommuting, empirical studies about e-shopping and travel are scarce.

The only empirical study that compares the travel behavior of e-shoppers with non-e-shoppers was carried out by Casas et al. (Casas et al., 2001). They analyzed the impact of Internet shopping on the frequency of in-store shopping trips. Data were used from a household travel survey of 3,931 households (9,132 people) in Sacramento, California. The survey concentrated on weekday travel. The data were collected by means of interviews and 1-day travel diaries. Of all respondents, 37% were classified as Internet shoppers – people who had used the Internet either to search for product information or to purchase a product. Unfortunately, no indication is given of what kind of products were searched for or purchased. Controlled for gender, age, and income, the results showed that Internet shoppers made more trips in general, as well as more shopping trips in particular, than non-Internet shoppers. High trip rates were associated with income and age. Casas et al. attributed their findings to the active lifestyle of Internet shoppers. The authors concluded that shopping via the Internet has not substituted for store shopping trips, and nor has a reallocation of shopping trips to other types of travel taken place. According to Casas et al., e-shopping is used as an additional shopping method that does not change trip-making behavior but does change shopping behavior. A German simulation study of travel reduction through online shopping by Luley et al. showed that a slight substitution is to be expected in the frequency of trips (Lenz et al., 2003). Overall, more rather than less traffic is expected as use of e-shopping increases. For example, in the Netherlands, e-shopping is likely to increase vehicle mileage, because in the urban areas van deliveries will often substitute for cycle or foot trips (Smith et al., 2002).

Other empirical studies concentrate on analyzing shopping activities via other media. An early study of the effects of e-shopping on the frequency of shopping trips was carried out by Keyzers and Wagenaar (Keyzers & Wagenaar, 1989). They surveyed 150 users of a grocery teleshopping service in a medium-sized Dutch town that accepted orders via the computer or telephone. A 1-week travel diary and a questionnaire were used. The majority of respondents were women (85%). One-third of the respondents did not own a car. The findings indicated that there was a slight substitution of shopping trips. Most people spent the saved travel time at home.

A study of the impact of general computer use on the frequency of trips was made by Hjorthol (Hjorthol, 2002). Although a slight reduction of work trips was found among computer owners compared with those who did not own computers, there was no difference in total trips between the two groups. This means that more trips for other purposes must have been made. In this case, the trips were related to taking children to different activities. This finding supports Gould and Golob's notion that a portion of the travel time saved is likely to be used for maintenance activities (Gould & Golob, 1997). Hjorthol pointed out that the spatial flexibility gives a temporal flexibility, which can lead to a greater dispersion of trips over the day. Similarly, Mokhtarian remarked that besides substitution or generation, the flexibility that ICT could bring to people's lives should not be forgotten (Mokhtarian, 1990).

Other characteristics of travel behavior, such as distance, mode, timing, and duration, have been studied less often than the frequency of trips. Cairns studied the potential mileage savings from home delivery services in the United Kingdom and concluded that savings were likely to occur (Cairns, 1998). The German simulation study by Lenz et al. showed that slight substitution was to be expected in the distance of trips (Lenz et al., 2003). Dijst pointed out the potential expansion of people's action spaces as a result of e-shopping (Dijst, 2004). Action space refers to the area in which a set of opportunities is located that could be or have been used by people for their activities. Searching for information online, for example, could lead to the discovery of previously unknown places and thus to an increase of shopping trips. This could mean that the activity places visited were at a greater distance from home and more widely dispersed. Cairns also carried out a feasibility study of home delivery services for groceries and concluded that car travel for food shopping could be reduced (Cairns, 1996). Other research about travel mode found that e-shopping led to a change in modal split; people used the car less and walked or cycled more often (Tacken, 1990). The timing of trips appears to be affected by e-shopping. People avoid peak-period travel (Tacken, 1990). A study by Viswanathan and Goulias indicated that Internet use was associated with a reduction in the duration of trips (Viswanathan & Goulias, 2001).

Dholakia et al. related the travel effects of e-shopping to the type of product that is purchased (Dholakia et al., 2002). They expected substitution to occur for maintenance and convenience products, such as groceries and books. In the present study, it is expected that grocery-shopping travel is more likely to be affected by e-shopping than is other shopping travel, since grocery shopping has fewer recreational and social aspects than other types of shopping. In short, the literature review does not give much consistent information about the impact of e-shopping on travel behavior. It can be hypothesized that e-shopping has the potential to reduce travel time for shopping purposes and reorder visits to shops in terms of time and space. In this respect, the role of the residential environment has been little explored in the literature. This needs further analysis.

2.3 Research design and data

Conclusions drawn from the literature review raise the following questions, to be addressed in the empirical part of this study:

- What is the impact of sociodemographic variables related to time pressure in relation to other potentially relevant independent variables, such as residential environment, on e-shopping?
- Which categories of people spend most time on shopping activities (activity duration and travel time) in various residential environments? To what extent do sociodemographic characteristics of in-store shoppers differ from online buyers?

To answer the first question, a dataset on e-shopping in the Netherlands, collected by the online research agency Multiscope in April and May 2001, is used. An online questionnaire was distributed to a sample of the agency's Internet research panel; the questionnaire also opened via pop-up windows on nine different websites at random for one out of 200 visitors. In total, about 2,220 people completed the questionnaire; 401 of these were from the agency's panel members, giving a response rate of 13%. The rest were from the pop-up windows, which had a response rate of between 3% and 10%. In the data set, no distinction was drawn between groceries and other kinds of products.

The second question was answered by using data from the 1998 Netherlands National Travel Survey (NTS). This survey has been made every year since 1978 by Statistics Netherlands among approximately 70,000 households, who are asked to complete a 1-day trip diary. Household and personal information is also gathered by telephone. Data were collected in 1998 by surveying households each month. The survey thus yields information about the travel behavior of some 130,000 individuals (Statistics Netherlands, 1998). Of all the trips covered by the NTS, 14% were for shopping (N = 58,070). Unfortunately, the NTS does not distinguish between different types of shopping; therefore, in this analysis, shopping as a maintenance activity and shopping as a leisure activity could not be differentiated.

Both data sets contained the respondent's place of residence. For the analysis, a classification of Dutch municipalities in five categories was used. This classification combines city size, residential density, and land use mixing. The urbanization level of the municipalities was used as a criterion for categorization, together with the location of the municipality in the heavily urbanized western part of the Netherlands (the Randstad Holland):

- Core cities and medium-sized cities in the Randstad (of which Amsterdam, Rotterdam, and the Hague are the biggest),
- Growth centers in the Randstad,
- Suburbs in the Randstad,
- More urbanized areas outside the Randstad, and
- Less urbanized areas outside the Randstad.

Growth centers were developed in the 1970s as suitable suburban locations for firms and households moving away from the larger cities in accordance with national spatial planning policy (Schwanen et al., 2002). The growth centers evolved, however, into dormitory towns and have become the Dutch equivalent of the new towns developed in various European countries in the 1960s and 1970s. Since their inhabitants exhibit travel patterns that deviate from other municipality types, they have been considered as a separate category. The

number and accessibility of shops are highest in the core and medium-sized cities of the Randstad, somewhat lower in the Randstad suburbs, and lowest of all in the less urbanized areas outside the Randstad.

2.4 E-shopping in the Netherlands

The Netherlands has one of the highest rates of Internet use in the world (NIPO, 2001). In 2001, 74% of Dutch households owned a computer, and 57% had Internet access (Statistics Netherlands, 2002). Although the absolute number of e-shoppers is still relatively low, the growth rates of e-shopping are very high. While in 1998, only 2% of Dutch households e-shopped, 11% were doing so in 2001 (Statistics Netherlands, 2002). The most popular online products are books, CDs, and computer hardware and software. Furthermore, tickets and reservations, electronic products, videos, and clothing are frequently bought online (Ernst & Young, 2001). E-shopping for groceries is only of minor importance, although the share of Dutch e-shoppers who buy groceries online has risen from 5% in 2000 to 8% in 2001 (NIPO, 2001).

In the Multiscope data set, 48% of the respondents had bought online at some time. The reasons cited most often for e-shopping are convenience, time savings, and independence from shop hours. While the majority of people sometimes doubt the safety of transactions via the Internet, only 10% reported having a negative experience when buying online.

The first research question about the personal, spatial, and time-pressure factors that affect e-shopping is addressed in two steps. First, some bivariate findings about Dutch shopper characteristics are discussed; then, the results of a multivariate logit analysis are presented.

A characterization of online buyers supports the findings from the literature review:

- Men buy more often online (61%) than women (43%).
- People between 25 and 55 years old buy more often online (58%) than younger or older people (40%).
- People with a high level of education (61%) and a high income (67%) buy more often online than people with a medium or low level of education (46%) and a medium or low level of income (48%).
- Members of households with two or more members buy more often online (56%) than singles (47%).
- Employed (including self-employed) workers buy more frequently online (59%) than others, such as students, housewives, retired, or unemployed (39%).

It was found that inhabitants of the core and medium-sized cities (57%) and the suburbs (53%) within the Randstad, as well as inhabitants of the less urbanized areas outside the Randstad (53%), are more likely to buy online than people living in a growth center (49%) or in the more urbanized areas outside the Randstad (46%). Different figures are presented in Table 2.1, showing a characterization of e-shoppers across various residential environments. There are some unexpected findings compared to earlier findings in the literature. For example, women in the less urbanized areas outside the Randstad are more likely to buy

Table 2.1 Sociodemographic characteristics of e-shoppers in different residential environments

Sociodemographic variables	Residential environment					
	Core+ medium sized cities Randstad	Growth centres Randstad	Suburbs Randstad	More urbanized areas outside Randstad	Less urbanized areas outside Randstad	All residential environments
Gender						
Male	56	59	55	62	48	57
Female	44	41	45	38	52	43
	100	100	100	100	100	100
Age						
< 25	27	23	29	32	26	29
25-40	49	41	35	41	43	42
40-55	21	35	30	24	27	26
>55	3	1	6	3	4	3
	100	100	100	100	100	100
Education						
Low	10	16	15	14	20	14
Medium	37	38	38	42	44	40
High	53	46	47	44	36	46
	100	100	100	100	100	100
Income						
Low	19	17	24	31	26	24
Medium	47	49	38	44	45	44
High	34	34	38	25	29	32
	100	100	100	100	100	100
Household type						
Single	45	29	36	40	32	39
Household without children	30	25	21	27	27	27
Household with children	25	46	43	33	41	34
	100	100	100	100	100	100
Labour market situation						
Worker	77	83	73	70	69	74
Student	17	10	18	24	15	18
Other[1]	6	7	9	6	16	8
	100	100	100	100	100	100

Note: N = 1,128.
1 Housewives, pensioners, the unemployed.
Source: Multiscope, E-commerce Research 2001, The Netherlands

online than men. Among e-shoppers in the less urbanized areas, there are relatively many people with less education and people without paying jobs. In the Netherlands, housewives frequently are less educated and often do not have paying jobs. Therefore, the women in the less urbanized areas who are more likely to buy online than men could be housewives. An

additional analysis shows that housewives in the less urbanized areas are more likely to buy online compared to housewives in other areas.

E-shoppers in the core and medium-sized cities in the Randstad are mostly singles, while e-shoppers in the growth centers and suburbs in the Randstad are mostly households with children. This can be explained by the fact that singles live more often in core cities, while households with children live more often in suburbs. Also, outside the Randstad, e-shoppers in the more urbanized areas are mostly singles, while in the less urbanized areas e-shoppers are mostly households with children.

The literature review shows that past behavior is an important predictor for online buying. Therefore, some behavioral variables were included in the analysis. The results show that Internet and home shopping experience are important for online buying: 63% of those who already had Internet access in 1998 or earlier, 57% of those who use the Internet frequently, and 56% of those who have previously used other home shopping methods, such as catalogue or telephone, have already shopped online. Furthermore, people with a credit card are more likely to buy online (63%) than people without one (41%).

A binomial logistic regression model was calculated to explain online buying by Dutch Internet users to control for the multivariate effects of the independent variables (see Table 2.2). The results partly confirm the findings of the descriptive analysis. They indicate that being male, having Internet or home shopping experience, using the Internet frequently, and having a credit card positively affect the likelihood of online buying. The relationship with age is nonlinear; therefore, the optimum of the parabolic age function was sought by taking the derivative and setting it equal to zero. Up to the age of 35, the probability of online buying increases, but it decreases thereafter. That is to say, the youngest (under 25 years) and oldest (above 55 years) age groups are the least likely to buy online. People with a high level of education are more likely to buy online than people with a low or medium level of education. Living in an urbanized area outside the Randstad has a negative effect on the likelihood of buying online compared with living in other residential environments, such as in the (heavily urbanized) Randstad. This finding can perhaps be ascribed to a different type of people living in strongly urbanized areas. Casas et al. (Casas et al, 2001), for example, referred to the active lifestyle of e-shoppers. A significant effect of income on online buying was not found here. Nor was it found that sociodemographic variables related to time pressure (workers and households with children) significantly affect online buying.

Since a quarter of the respondents search the Internet for product information for offline buying but have not yet bought anything online, to what extent do these people differ from online buyers? The analysis did not yield any major differences, however – there were no differences in gender, age, or household composition. Nevertheless, people who are less well educated, who have a low income, or who have little Internet experience are more likely to search online for products without buying online than do other people. The same finding applies to residents of the growth centers in the Randstad and the more urbanized areas outside the Randstad.

To summarize, no impact of personal characteristics related to time pressure was found in the multivariate analysis of e-shopping. This could be because of the absence of a distinction between grocery and nongrocery shopping. However, the residential environment does have an effect on online buying. It was found that people living in urbanized areas outside the

Randstad are less likely to buy online compared to people living in the core and medium-sized cities in the Randstad.

Table 2.2 Results of logistic regression analysis of online buying

Sociodemographic variables	**B**	**Odds ratio**	**χ^2 change**
Gender			
Male (reference)			
Female	-0.450***	0.637	21.464
Age in years	0.117**	1.124	10.151
Age in years squared	-0.002***	0.998	13.000
Education			
Low and medium (reference)			
High	0.333*	1.396	50.789
Income			
Medium and high (reference)			
Low	0.198	1.218	374.053
Household composition			
Households with and without children (reference)			
Single	-0.200	0.819	14.039
Labour market situation			
Other[1] (reference)			
Worker	0.210	1.233	9.218
Spatial variable			
Residential environment			
Other residential environments (reference)			
More urbanized areas, outside Randstad	-0.257*	0.773	426.049
Behavioural variables			
Year of Internet access			
In 1999 or after (reference)			
In 1998 or before	0.758***	2.133	42.925
Hours of Internet use per week	0.021**	1.021	10.683
Credit card ownership			
No (reference)			
Yes	0.676***	1.966	39.076
Home shopping experience			
No (reference)			
Yes, via telephone	0.288*	1.333	4.235
Constant	-2.641***	0.071	

Note: N = 1,310. (Reference) is the baseline point of comparison.
Dependent variable: 1 = ever bought online; 0 = never bought online
Model χ^2 = 197.259; df=12; Nagelkerke ρ^2 = 0.187
* = $p < 0.05$ ** = $p < 0.01$ *** = $p < 0.001$
1 Housewives, pensioners, the unemployed.
Source: Multiscope, E-commerce Research 2001, The Netherlands

2.5 In-store shoppers and online buyers in the Netherlands

This section addresses the second research question, about time spent on in-store shopping in different residential environments and differences in sociodemographic characteristics between in-store shoppers and online buyers.

In general, half the shopping trips were covered by car, almost one-third by bicycle, and 18% on foot. Public transport is almost never used for shopping. People living in the core and medium-sized cities in the Randstad use the car least often for shopping, while people living in the less urbanized areas outside the Randstad use the car most often for shopping. One-third of the shopping trips are linked with other trip purposes. Trip chaining allows shoppers to combine several activities efficiently and so to save travel time.

In-store shoppers spend on average 80 min per day for shopping activities and associated travel (see Table 2.3). However, the average shopping durations differ across the residential environments from 72 to 88 min. As Table 2.3 shows, people living in the core and medium-sized cities, or the growth centers of the Randstad, and those living in the more urbanized areas outside the Randstad spend the most time on in-store shopping. As shown earlier, these characteristics contrast to a certain extent with characteristics of online buyers. E-shoppers do not tend to live in the Randstad growth centers and in the more urbanized areas outside the Randstad. The following groups of people spend relatively much time on in-store shopping:

- Women, compared with men;
- People over age 60, compared with younger people;
- People with a low level of education, compared with people with a high level of education;
- People with a low or medium income, compared with people with a high income;
- Households without children, compared with singles and households with children; and
- Housewives, pensioners, and the unemployed, compared with employed workers.

To summarize, a comparison of the individual and residential characteristics of e-shoppers with those of people with long shopping durations shows that people who spend relatively little time on shopping activities already buy online. For example, women in the suburbs and less urbanized areas spend the least time on shopping and buy most often online. This finding leads back to one of the central findings in the literature review – time-pressured households are expected to be e-shoppers. If people are time-pressured, they minimize their shopping durations, because other activities have higher priority. Thus, when e-shopping allows for a further reduction in the time needed for shopping, time-pressured people will use it – under the condition that technical feasibility and costs are not additional constraints hindering use. However, the results of the multivariate analysis appear to contradict this statement, since they did not show any impact of indicators for time-pressured households. For example, households with children did not show a significantly higher probability for e-shopping than other households. This inconsistent finding might reflect a sample of individuals that are, perhaps, relatively less time-pressured, having enough time to respond to a survey. Furthermore, it must be remembered that the analysis did not distinguish between daily groceries and other online products – although only the first category of products is of major importance for the time budget and, thus, the time savings for time-

pressured households. Therefore, it is hypothesized that in the future, time-pressured households can be expected to be more likely to e-shop more frequently for grocery products than households that are not time-pressured.

Table 2.3 Average daily shopping time of in-store shoppers, in minutes

	Residential environment					
Sociodemographic variables	**Core+ medium sized cities Randstad**	**Growth centres Randstad**	**Suburbs Randstad**	**More urbanized areas outside Randstad**	**Less urbanized areas outside Randstad**	**All residential environments**
Gender						
Male	81.3	82.2	70.5	80.3	69.6	76.7
Female	91.9	84.9	75.1	84.6	73.5	81.5
Age						
< 25	89.5	77.4	70.7	80.7	71.6	79.0
25-40	78.0	76.4	66.9	74.8	66.3	72.0
40-60	89.3	85.8	76.3	86.2	73.9	82.0
>60	98.2	98.8	80.7	91.6	80.4	89.0
Education						
Low	97.6	90.5	76.0	90.0	75.2	84.7
Medium	86.1	79.9	71.6	80.0	69.3	77.2
High	77.5	75.8	71.5	74.8	68.7	74.0
Income						
Low	91.7	82.6	73.0	84.7	70.5	80.0
Medium	85.8	83.8	73.0	81.7	74.0	79.5
High	82.3	83.5	71.7	80.2	71.2	77.8
Household type						
Single	77.1	78.1	72.3	72.3	66.4	73.3
Household without children	92.1	89.4	76.1	87.8	76.4	84.1
Household with children	86.6	80.7	71.1	80.3	69.1	76.8
Labour market situation						
Worker	81.3	80.1	72.5	78.5	70.1	76.4
Student	88.5	79.0	63.2	77.7	68.6	76.3
Other[1]	96.0	89.6	75.9	89.2	74.6	84.1
Shopping time per residential environment	87.5	83.9	73.5	82.9	72.1	79.7

Note: N = 33,893
1 Housewives, pensioners, the unemployed.
Source: Statistics Netherlands, 1998

2.6 Conclusions

E-shopping has emerged in the last few years with high growth rates. As yet, little is known about its impact on travel behavior. For this study, three sources of information were combined to contribute to the developing research field on e-shopping. The research intended to disentangle factors affecting the use of e-shopping and its potential impact on travel behavior. With a literature review and the analysis of an Internet survey, it was shown that sociodemographic variables, such as gender and age, together with behavioral variables, such as Internet and home shopping experience, affect e-shopping. However, no effect of time-pressure indicators was found. This result can perhaps be ascribed to the absence of a distinction between grocery and nongrocery shopping. Interestingly, the residential environment also affects e-shopping. The expectation that households in the suburbs or in rural areas at a greater distance from shopping locations would be more inclined to buy online than urban households was partly supported by the findings. However, for people living in the Randstad (the heavily urbanized Western part of the Netherlands), the likelihood to buy online is greater compared to people living in more urbanized areas outside the Randstad. By using the Netherlands National Travel Survey data, it was shown that across different types of residential environments, the people who spend relatively less time on in-store shopping activities have the same sociodemographic characteristics as those who buy online (such as workers, people with a high level of education, and people with a high income).

From the findings, four hypotheses are put forward about the possible future impact of e-shopping on travel. The last two hypotheses are specific to the Dutch context. First, time-pressured households are expected to save time by online grocery shopping. This strategy could be used as a substitution for, or a complement to, other timesaving strategies. The time saved could be used for maintenance or leisure activities (Gould & Golob, 1997). Second, an individual's action spaces can change as a result of increasing use of e-shopping. When shopping stores lose importance, other places, such as those for leisure activities, can become more important for an individual's action space. Together with the time-space convergence by increased travel speeds, larger and more fragmented action spaces will cause, eventually, more travel (Dijst, 2004). Third, personal travel behavior is expected to be most affected by e-shopping in the core and medium-sized cities, as well as the suburbs, in the Randstad and in the less urbanized areas outside the Randstad. It is in these areas that e-shopping is most often done. Fourth, if e-shopping substitutes for grocery-shopping trips, a reduction in car travel in the less urbanized areas of the Netherlands can be expected, while a reduction in walking and cycling in the more urbanized areas of the Netherlands can be expected. Currently, people living in the less urbanized areas use a car more often for shopping trips, while people living in the more urbanized areas walk or cycle more often (Schwanen et al., 2002).

Acknowledgements

The authors are grateful for the use of e-commerce data made available by Multiscope. The authors thank Tim Schwanen and Stephan Krygsman of Utrecht University for their support and their help with the analyses.

References

Cairns S, 1998, "Promises and problems: using GIS to analyse shopping travel" *Journal of Transport Geography* **6** 273-284

Cairns S, 1996, "Delivering alternatives. Successes and failures of home delivery services for food shopping" *Transport Policy* **3** 155-176

Casas J, Zmud J, Bricka S, 2001, "Impact of shopping via Internet on travel for shopping purposes", paper presented at the 80th Annual Meeting of the Transportation Research Board, Washington D.C.

Dholakia N, Xiao J J, Dholakia R R, Mundorf N, 2000, "The impact of retail e-commerce on transportation: a conceptual framework" Research Institute for Telecommunications and Information Marketing, http://ritim.cba.uri.edu/wp2001/wpdone4/Transport-Retail-E-Commerce.pdf

Dijst M, 2004, "ICTs and accessibility: an action space perspective on the impact of new information and communication technologies", in *Transport Developments and Innovations in an Evolving World* Eds. M Beuthe,V Himanen, A Reggiani, L Zamparini (Springer, Berlin) pp 27-46

Ernst and Young, 2001, "Global Online Retailing", http://www.ey.nl/downloads/global_online_retail_report.pdf

Forsythe S, Shi B, 2003, "Consumer patronage and risk perceptions in Internet shopping" *Journal of Business Research* **56** 867-875

Golob T F, Regan A C, 2001, "Impacts of information technology on personal travel and commercial vehicle operations: research challenges and opportunities" *Transportation Research C* **9** 87-121

Gould J, Golob T F, 1997, "Shopping without travel or travel without shopping? An investigation of electronic home shopping" *Transport Reviews* **17** 355-376

Handy S, Mokhtarian, P L, 1995, "Planning for telecommuting" *Journal of the American Planning Association* **61** 99-112

Hjorthol R J, 2002, "The relation between daily travel and use of the home computer" *Transportation Research A* **36** 437-452

Keyzers E C M, Wagenaar P J M, 1989, *Teleshopping: Time and Space Effects* (in Dutch), Report 19, (Research Institute for Urban Planning and Architecture, Delft)

Koppelman F, Salomon I, Proussalogou K, 1991, "Teleshopping or store shopping? A choice model for forecasting the use of new telecommunications-based services" *Environment and Planning B* **18** 473-489

Kumar A, 1990, "Impact of technological developments on urban form and travel behaviour" *Regional Studies* **24** 137-148

Lee P, 2002, "Behavioral model of online purchasers in e-commerce environment" *Electronic* Commerce Research **2** 75-85

Lenz B, Luley T, Bitzer W, 2003, "Will electronic commerce help to reduce traffic in agglomeration areas?", paper presented at the Transportation Research Board 82nd Annual Meeting, Washington D.C.

Liao Z, Cheung M T, 2001, "Internet-based e-shopping and consumer attitudes: an empirical study" *Information and Management* **38** 299-306

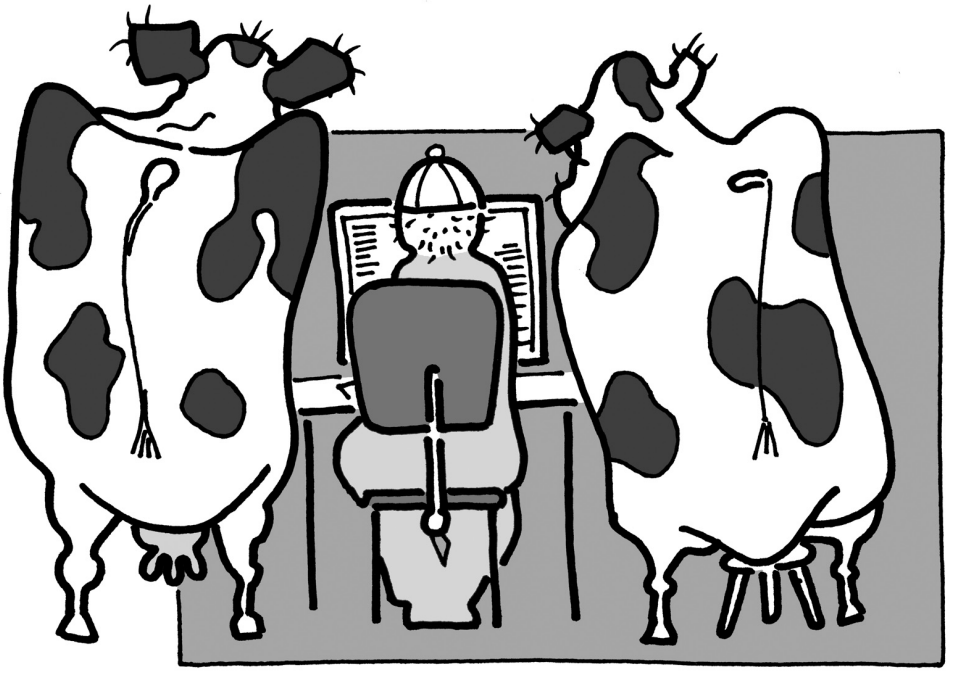
Lohse G L, Johnson E J, 1999, "Consumer buying behavior on the internet: findings from panel data" *Communications of the ACM* **42** 32-38

Maher J K, Marks L J, Grimm P E, 1997, "Overload, pressure, and convenience: testing a conceptual model of factors influencing women's attitudes toward, and use of, shopping channels" *Advances in Consumer Research* **24** 490-498
Mokhtarian P L, 1990, "A typology of relationships between telecommunications and transportation" *Transportation Research A* **24** 231-242
Mokhtarian P L, Salomon I, 1994, "Modeling the choice to telecommute: Setting the context" *Environment and Planning A* **26** 749-766
Mokhtarian P L, 1998, "A synthetic approach to estimating the impacts of telecommuting on travel" *Urban Studies* **35** 215-241
Mokhtarian P L, 2004, "A conceptual analysis of the transportation impacts of B2C e-commerce" *Transportation* **31** 257-284
Morganosky M A, Cude B J, 2000, "Consumer response to online grocery shopping" *International Journal of Retail and Distribution Management* **28** 17-26
NIPO, 2001, "World wide e-commerce research 2001: Internet has become a substantial element in the buying process of products and services" (in Dutch), NIPO (Dutch Institute for Public Opinion and Marketing Research), Amsterdam, http://www.tns-nipo.com/
Pendyala R M, Goulias K G, Kitamura R, 1991, "Impact of telecommuting on spatial and temporal patterns of household travel" *Transportation* **18** 383-409
Raijas A, 2002, "The consumer benefits and problems in the electronic grocery store" *Journal of Retailing and Consumer Services* **9** 107-113
Salomon I, Koppelman F, 1988, "A framework for studying teleshopping versus store shopping" *Transportation Research A* **22** 247-255
Salomon I, Koppelman F, 1992, "Teleshopping or going shopping: an information acquisition perspective" *Behaviour and Information Technology* **11** 189-198
Schwanen T, Dijst M, Dieleman F M, 2002, "A micro level analysis of residential context and travel time" *Environment and Planning A* **34** 1487-1507
Shim S, Eastlick M A, Lotz S L, Warrington P, 2001, "An online prepurchase intentions model: The role of intention to search" *Journal of Retailing* **77** 397-416
Sim L L, Koi S M, 2002, "Singapore's Internet shoppers and their impact on traditional shopping patterns" *Journal of Retailing and Consumer Services* **9** 115-124
Sindhav B, Balazs A L, 1999, "A model of factors affecting the growth of retailing on the Internet" *Journal of Market Focused Management* **4** 319-339
Smith N, Chjow G, Ferreira L, 2002, "E-business challenges for intermodal freight: some international comparisons" *Transportation Research Record* number 1790 20-28
Statistics Netherlands, 1998 *National Travel Survey 1998: Documentation for Tape Users* (in Dutch) CBS, Voorburg
Statistics Netherlands, 2002, *The Digital Economy 2002* (in Dutch) CBS,Voorburg
Szymanski D M, Hise R T, 2000, "E-Satisfaction: an initial examination" *Journal of Retailing* **76** 309-322
Tacken M, 1990, "Effects of teleshopping on the use of time and space" *Transportation Research Record* number 1285 89-91
Verhoef P C, Langerak F, 2001, "Possible determinants of consumers' adoption of electronic grocery shopping in the Netherlands" *Journal of Retailing and Consumer Services* **8** 275- 285

Viswanathan K, Goulias K G, 2001, "Travel behavior implications of information and communications technologies in Puget Sound Region" *Transportation Research Record* number 1752 157-165

Vrechopoulos A P, Siomkos G J, Doukidis G I, 2001, "Internet shopping adoption by Greek Consumers" *European Journal of Innovation Management* **3** 142- 152

Zmud J, Arce C, 2000, "E-mobility (electronic travel): measuring new and evolving behaviour", paper presented at the 9th International Association for Travel Behaviour Research Conference, Australia; copy available from Dr Zmud, Central Texas Regional Mobility Authority, 13640 Briarwick Drive, Austin, TX 78729



3 E-shopping in the Netherlands: Does geography matter?

Sendy Farag, Jesse Weltevreden, Ton Van Rietbergen, Martin Dijst, Frank Van Oort
Environment and Planning B 33, 59-74,

Abstract
Why consumers shop via the Internet, is a frequently asked question. As yet, the impact of spatial variables on e-shopping has received little attention. In this paper we report our investigation of the spatial distribution of Internet users and online buyers in the Netherlands for the time period 1996-2001 and the impact of spatial variables (residential environment and shop accessibility) on e-shopping. Two hypotheses are tested empirically. The first is that e-shopping is a predominantly urban phenomenon, because new technology usually starts in centres of innovation (innovation-diffusion hypothesis). The second is that people are more likely to adopt e-shopping when their accessibility to shops is relatively low (efficiency hypothesis). Our findings indicate that Internet use and online buying are still largely urban phenomena in the Netherlands, but that there is a trend towards diffusion to the weakly urbanised and rural areas. Not only the innovation diffusion hypothesis, but also the efficiency hypothesis is confirmed by our findings. People living in a (very) strongly urbanised area have a higher likelihood of buying online, but people with a low shop accessibility buy more often online. The analysis also shows that the support for the two hypotheses depends on the type of product. Airline tickets are still mainly bought in very strongly urbanised areas, whereas compact discs, videos, DVDs, and clothing are bought relatively more often in weakly urbanised areas. In conclusion, geography seems to matter for e-shopping.

3.1 Introduction

The use of the Internet is expanding very quickly. In 2002, with more than 5000 Internet users per 10 000 inhabitants, Internet use was highest in the USA, South Korea, Singapore, the Scandinavian countries (including Iceland), and the Netherlands (ITU, 2003). The Internet offers many opportunities to participate `at a distance' in such activities as telecommuting, e-banking, and online shopping. With the emergence of the Internet, a new shopping channel has become available for all parts of the shopping process, such as searching for product information, communication and selection, transaction, delivery (of digital goods), and after sales. We define online shopping, or e-shopping, as searching and/or purchasing consumer goods and services via the Internet (Mokhtarian, 2004). In this

paper we focus on B2C (business-to-consumer) e-commerce, which means that person-to-person websites such as eBay are not included. Because the majority of products that are bought online are non-daily goods [for example, books, compact discs (CDs), and clothing], this study is primarily about the adoption of e-shopping for this product category.

E-shopping can be seen as a disruptive process innovation that can make existing business models obsolete. The history of retailing is replete with these innovations, such as the introduction of department stores and mail order. In the early days, e-shopping was mainly the domain of pure-play (that is, virtual) e-tailers and major mail order companies, of which the latter could easily adopt the new technology because the process of selling over distance was already part of their routine (Boschma and Weltevreden, forthcoming). This stage was followed by the exodus of many pure-play e-tailers, who were unable to achieve profitability, and the rise of traditional retailers that pursued a dual or multichannel strategy by operating an online store alongside their physical stores (Wrigley et al, 2002).

Among US Internet users, those who had ever bought online has grown from 48% (about 41 million Americans) in 2000 to 61% (about 67 million Americans) in 2002 – an increase of 63% (Pew Internet and American Life Project, 2004). In the Netherlands nearly half (48%) of the Internet users (8.5 million people) have ever bought a product online (Thuiswinkel.org, 2004). The total amount of online retail sales in 2002 in the Netherlands was nearly € 980 million, which is approximately 1.2% of the total retail sales (Thuiswinkel.org, 2004). The share of e-shopping in total retail sales is thus rather small. However, the growth figures are impressive. Whereas the average annual increase of total retail sales was only 3.8% between 1999 and 2002, online retail sales underwent an average annual growth of 138% in the same period. Further growth of this new form of commerce could have implications for the spatial distribution of economic activities. E-shopping, for instance, could alter consumers' physical shopping patterns, a change which would have implications for the function of shopping centres. Insight is therefore needed both into the spatial diffusion of e-shopping and into the factors that determine the adoption of e-shopping.

Research concerning the adoption of e-shopping has been driven largely by disciplines outside geography, such as marketing. To date, little geographical research has been conducted concerning the spatial distribution of e-shoppers and the explanatory value of spatial variables for e-shopping behaviour. In this paper we have sought to fill these gaps. Our goal was therefore twofold. First, we have described how Dutch Internet users and online buyers were spatially distributed in 1996 and 2001. Second, we have ascertained the explanatory value of spatial variables (residential environment and accessibility to shops) for e-shopping behaviour in the Netherlands in 2001.

According to Aoyama (2003, page 1206) "the sociospatial dimensions that shape technological adoption in a society involve an interplay between consumer behavior and urban form, the relationships of which are at times contradictory, at times cumulative."' Anderson et al (2003) formulated two hypotheses concerning the impact of spatial variables on e-shopping. On the one hand, e-shopping can be treated as a mainly urban phenomenon, because new technology usually starts in centres of innovation (see also Graham and Marvin, 1996). Consumers in urban areas are more likely to shop online, because they are younger, better educated, have higher incomes, and are more time constrained. Furthermore, they have a higher social status, make more use of the media, are more inclined to take the initiative, have a more cosmopolitan orientation, actively seek information about innovative

products, have higher product awareness, have more contacts with `agents of change' and are more influenced by others, as Rogers (1983), one of the founding fathers of the innovation-diffusion literature, concluded. The innovation-diffusion hypothesis postulates that new innovations follow a conventional pattern from large to small settlements (Hägerstrand, 1967). On the other hand, consumers with a relatively low shop accessibility will adopt e-shopping more rapidly. Via the Internet, consumers with low shop accessibility, such as people living in the country, have access to a larger variety of goods and services and can save both travel time and shopping time. This assertion is referred to as the efficiency hypothesis. However, Anderson et al have not tested these hypotheses empirically. This paper reports a first attempt to do so.

In the next section we provide a short review of the determinants of e-shopping and its potential impact on in-store shopping. In section 3.3 we describe our data and methodology. The spatial distribution of Internet users and online buyers is discussed in section 3.4, followed by the results of our multivariate analyses in section 3.5 of e-shopping in general and online buying of certain products in particular. We conclude by summarising the main findings and some points of discussion.

3.2 Literature review

Most researchers who have investigated the factors affecting the adoption of e-shopping are marketing researchers, who pay scant attention to spatial attributes (for example, Lee, 2002; Lohse et al, 1999; Morganosky and Cude, 2000; Sim and Koi, 2002; Verhoef and Langerak, 2001; Vrechopoulos et al, 2001). Very few geographers have examined e-shopping from a spatial perspective. After combining several datasets, Zmud and Arce (2000) found in a large-scale survey that most online shoppers in the USA reside in metropolitan areas and on the East Coast. However, the authors did not control for sociodemographic or behavioural variables. In their comparative study of Minneapolis, in the USA and Utrecht, in the Netherlands Farag et al (2006) found that Dutch respondents who live far from shops are less likely to buy online. This result suggests that the adoption of e-shopping could probably be better explained by the innovation-diffusion hypothesis than by the efficiency hypothesis. However, Sinai and Waldfogel (2004) found that the further people live from their nearest book or clothing store, the more books or clothing they buy online or via catalogues, relative to their offline expenditure. This finding supports the efficiency hypothesis. Several datasets were combined in this study, containing 29 027 households in metropolitan areas in the USA (Sinai and Waldfogel, 2004). Unfortunately, Sinai and Waldfogel drew no distinction between online shopping and catalogue shopping. This could be a problem because the choices for each channel could be influenced by different factors. Furthermore, differences exist with respect to the means of conveying information and maintaining customer relationships (for example, personalised product offerings) between the two channels (Anderson et al, 2003). Therefore, it is important to distinguish between the shopping modes.

The factors capable of affecting e-shopping can be divided into four sets of characteristics: shopping motives, product characteristics, shopping mode characteristics, and individual characteristics (Farag et al, 2003). The shopping motives (recreational or functional, for

example) of individuals affect the decision whether to buy online or to buy in-store (Dijst, 2004; Li et al, 1999). Recreational shoppers are usually attracted more to 'the real thing', whereas time-pressed functional shoppers are more inclined to shop via the Internet. Product characteristics also affect e-shopping. Search goods, such as books and CDs, are more suited to purchase via the Internet than experience goods, such as fresh vegetables (Lee, 2002; Vrechopoulos et al, 2001). Furthermore, consumer intentions to shop online for intangible products, such as computer software or airline tickets, are higher than for tangible products, such as furniture or clothing (Vijayasarathy, 2002). With respect to shopping-mode characteristics, such as the security of transactions and the ease of returning merchandise, e-shopping scores relatively poorly in comparison with in-store shopping, but it does very well on time-saving and flexibility in shopping hours (for example, Lee, 2002; Raijas, 2002). Personal characteristics can be divided into sociodemographic characteristics, attitudes, and past experience. E-shopping is done mainly by young male graduates in professional occupations and on high incomes (for example, Lohse et al, 1999; Sim and Koi, 2002; Vrechopoulos et al, 2001). Another type of profile is prevalent for online grocery shoppers: young, highly educated women with high incomes and at least one child (Morganosky and Cude, 2000; Raijas, 2002). A positive attitude towards e-shopping, such as the perceived quality of vendors on the Internet, positively affects the intention to buy online (for example, Liao and Cheung, 2001; Shim et al, 2001; Sim and Koi, 2002). The frequency of Internet use, Internet search for product information, and mail-order experience also positively affect the intention to buy online as well as actual online buying behaviour (for example, Liao and Cheung, 2001; Lohse et al, 1999; Shim et al, 2001; Sim and Koi, 2002).

E-shopping facilitates a spatial and temporal fragmentation and recombination of several stages of the shopping process (Mokhtarian, 2004). For example, information can be obtained about a certain product through in-store shopping and the product can be subsequently purchased online. Conversely, the Internet may be used to obtain information about a product, which is then bought in a store. In their study of the impact of online shopping on city-centre shopping behaviour of 3218 Dutch Internet users, Weltevreden and van Rietbergen (2004) found that for the last three online purchases 20% of all Internet users first searched for information in the city centre. The reverse, however, is also apparent. For their last three purchases in the city centre, 15% of all Internet users gathered information online. The coexistence of these two options makes it clear that it is necessary to study consumers' online search behaviour and not only their online buying behaviour. To date, most researchers have focused on explaining online buying rather than online searching. More precisely, their datasets have contained figures on the intention to buy online (for example, Lee, 2002; Li et al, 1999; Lohse et al, 1999; Sim and Koi, 2002; Verhoef and Langerak, 2001). In this study we have not limited ourselves to intentions, but have analysed both actual online searching and actual online buying behaviour. To obtain a better understanding of the adoption of online buying, we have also studied its frequency. However, a limitation of our data involves a lack of some important factors, such as shopping motives and attitudes towards e-shopping, as discussed above.

3.3 Methodology

The Dutch retail and transport context

Some background information is given below of the Dutch retail and transport context. First, the Netherlands is a small and strongly urbanised country. The contrast between urban and rural areas in the Netherlands is therefore less than in other major Western countries such as the USA, Canada, France, and Germany. Second, compared with other Western nations, the Netherlands has a more traditional retail structure. Uncontrolled retail growth at the fringes of urban areas was prevented by a restrictive retail planning policy that was in force for more than five decades, and traditional shopping centres were protected. A traditional functional retail hierarchy was perpetuated, without any large-scale hypermarkets or shopping malls (Evers, 2002). At the present time, approximately 51% of all shops in the Netherlands are located in the centres of towns and cities (Locatus, 2003). Furthermore, the Netherlands differs from other West European countries in terms of the share of total distance that is covered by slow transportation modes. In 1990 the share of walking and cycling in the total distance travelled was 12% for the Netherlands compared with 4% for Western Europe as a whole (Schwanen et al, 2004). Of all shopping trips in the Netherlands more than half are made on foot or by bicycle: these modes account for 20% of all the kilometres travelled for the purpose of visiting shops (Dieleman et al, 2002).

Data employed

To investigate the impact of spatial variables on e-shopping, we used Dutch e-shopping datasets that have been collected annually from 1996 until 2001 by Multiscope.With a panel of more than 100 000 people, Multiscope is one of the leading agencies in online market research in the Netherlands. Respondents, who are all Internet users, were recruited via advertisements in electronic magazines, popups and banners on websites, and from the panel formed by the agency over the years. One must be aware that recruitment via popups and banners could cause self-selection by respondents. As a result, a bias in the data may occur because people with an affinity for the research are more likely to participate (Nauta, 2003). However, this problem also occurs in offline research. To test the reliability of the data, the 2001 Multiscope sample was compared with a nationwide representative sample from Statistics Netherlands (2003; 2004). Overall, both samples show the same pattern with regard to the spatial distribution of Internet users and online shoppers in the Netherlands. In the course of time there were small differences in data-collection methods. Nevertheless, we were able to compare Internet use and online buying in the Netherlands in 1996 and 2001, because the 1996 and 2001 questionnaires had a number of questions about e-shopping in common. In addition, because both datasets included the respondents' four-digit zip codes, we were able to include spatial variables. The 1996 questionnaire resulted in 1172 usable responses. In 2001 a total of 2190 people completed the questionnaire satisfactorily. For the multivariate analyses only the 2001 dataset has been used, because it provides the most detailed information about the e-shopping behaviour of Dutch Internet users. Unfortunately, some important factors, such as attitudes towards e-shopping and in-store shopping, are not available in the dataset.

Operationalisation of variables

In order to test the innovation-diffusion hypothesis, we used a classification of Dutch municipalities with five categories representing different levels of urbanisation. The classification is based on the number of street addresses per square kilometre (Statistics Netherlands, 2004):

1. very strongly urbanised (52500 street addresses per km^2): Amsterdam, Rotterdam,The Hague, for example;
2. strongly urbanised (1500-2500 street addresses per km^2);
3. moderately urbanised (1000-1500 street addresses per km^2);
4. weakly urbanised (500-1000 street addresses per km^2);
5. nonurbanised (4500 street addresses per km^2).

Figure 3.1 (see over) is a map of the Netherlands that displays the location of the five types of residential environment. Most of the (very) strongly urbanised areas are located in the western part of the Netherlands, referred to as the Randstad Holland. The weakly urbanised and nonurbanised areas of the Netherlands are located largely in the north and the southwest of the country.

An important assumption of the innovation-diffusion hypothesis is that different types of people live in urbanised and rural areas.We checked whether this was indeed the case for our sample. Chi-squared tests of sociodemographic and behavioural variables across the residential environments indicate that in (very) strongly urbanised areas residents are significantly more often young, highly educated, single or a couple without children, hold a job, own a credit card, and have more Internet experience than residents in weakly urbanised and rural areas. However, the inhabitants of less urbanised settlements more often have home shopping experience (via catalogue or telephone, for example) than do residents in (very) strongly urbanised settlements. We can, therefore, conclude that different types of people live in urbanised and rural areas: their sociodemographic and behavioural characteristics would lead urban residents to be considered more likely to innovate than rural residents.

To test the efficiency hypothesis, we developed several shop-accessibility measures using Flowmap version 7 (Van der Zwan et al, 2003). We used retail data from the Netherlands Institute for Spatial Research that had been collected by Locatus, a research agency that collects retail data in the Netherlands. This dataset contains the total number of shops for both daily and nondaily shopping goods and the total floor space in square metres per zip code. The retail data also include the number of shops per zip code differentiated by retail category. Analyses could therefore be conducted for individual products that are frequently bought online. We were able to develop the shop-accessibility measures by combining the retail data at the zip code level (destination) with the respondent's zip code (origin) and a roadmap of the Netherlands (street-network-based travel distances). We used a regular proximity count, which calculates the total number of shops for nondaily goods a respondent can reach by car from the place of residence in a certain time distance, ranging from 5 to 45 minutes.

As the Netherlands is a small and strongly urbanised country, we did not include the total number of shops a respondent could reach by car in more than 45 minutes. Neither did we calculate accessibility measures for daily goods, because consumers in our sample bought mainly nondaily goods via the Internet. This is consistent with the findings of other e-shopping surveys (for example, NIPO, 2001; Statistics Netherlands, 2003). Besides

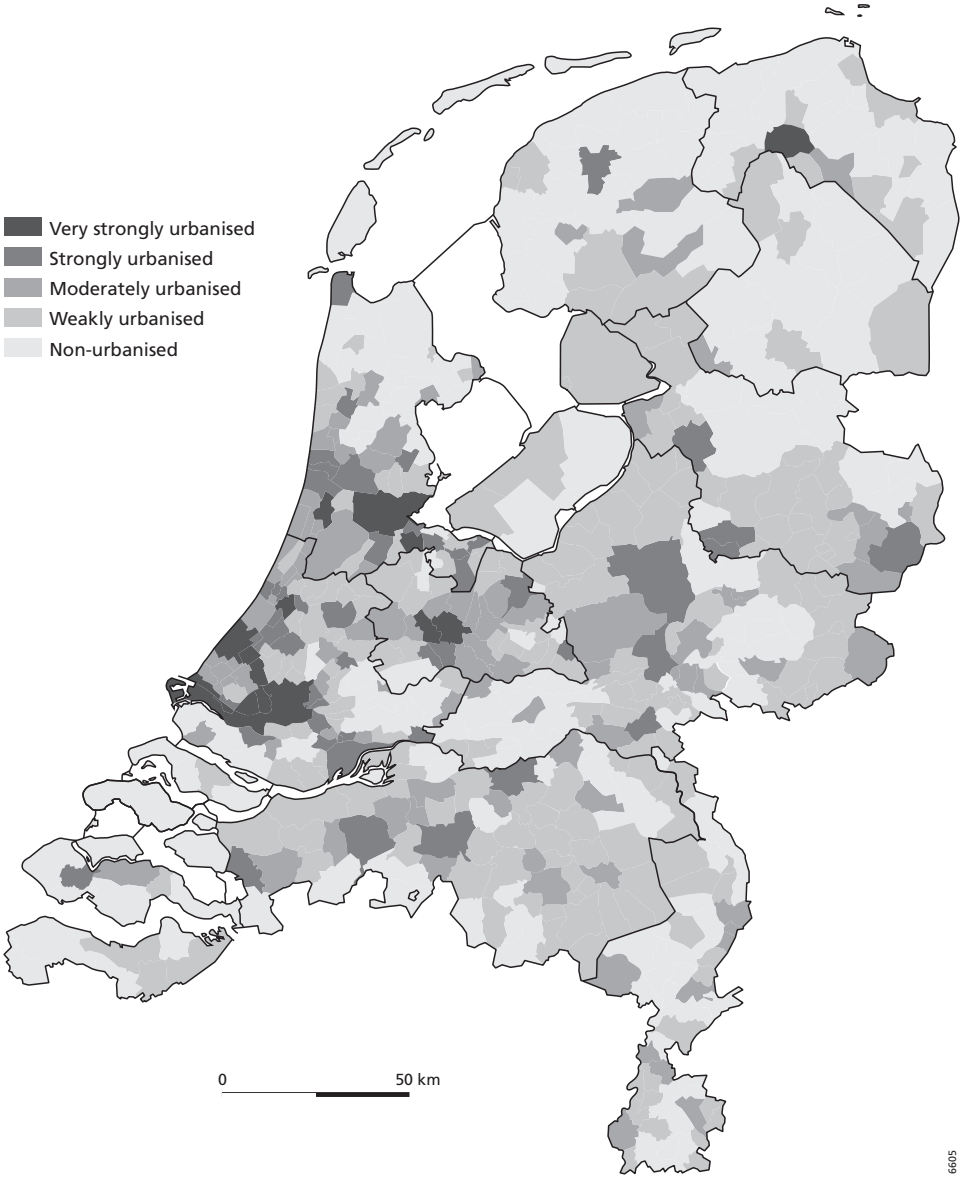


Figure 3.1 Urbanisation in the Netherlands 2001 (source: Statistics Netherlands, 2004)

proximity counts, we also calculated gravity measures, which give comparable results with the proximity counts in the analysis discussed below. For that reason these gravity measures have been left out of the analysis. Additionally, we looked not only at the number of shops, but also at the amount of floor space in square metres that a respondent could reach by car; again, this yielded similar results.

In order to analyse the impact of spatial variables on e-shopping, we took into account the adoption of online searching and online buying, as well as the number of online purchases made in 2000. We calculated binomial logistic and ordinary least squares regression models to explain these dimensions of e-shopping. In all the analyses we used sociodemographic, spatial, and behavioural variables. The sociodemographic variables include gender (male = 0, female = 1), age (in years, continuous variable), level of education (low, medium, high) income (low, medium, high), household composition (singles, households without children, households with children), and employment situation (0 = nonworker, 1 = worker). The spatial variables include shop accessibility (the number of shops for nondaily goods within reach of the respondent's home in a certain amount of time by car), and residential environment (five urbanisation categories, see figure 3.1). Finally, the behavioural variables include Internet experience (Internet experience in years, continuous variable), frequency of Internet use (in hours per week), credit card ownership (0 = no, 1 = yes), and home shopping experience (via catalogue, telephone, television, or fax (0 = no, 1 = yes). All discrete variables on a nominal or ordinal level were turned into dummy variables for the multivariate analysis. The final binomial logistic regression models were constructed after log-likelihood tests had been carried out to check whether the statistical significance of the model deteriorated when insignificant variables were left out. For this reason, some nonsignificant variables have been left in the final models.

3.4 The spatial distribution of Internet users and online buyers in the Netherlands

In this section the spatial distribution of Internet users and online buyers in the Netherlands is described for the years 1996 and 2001. In addition, we compare the distribution of Internet users and online buyers with the distribution of the total population in the Netherlands (see table 3.1). This descriptive analysis was performed to give a first indication of whether the innovation-diffusion hypothesis could be supported for online buying.

In contrast with the population as a whole, in 1996 Internet users and online buyers were both concentrated in (very) strongly urbanised areas. Also, in that year 40% of the total population and approximately 60% of the Internet users and online buyers were located in the (very) strongly urbanised areas. In 1996 the weakly urbanised and nonurbanised areas, with 43% of the total population, accommodated only approximately 20% of the Internet users and online buyers. As mentioned in section 3.2, we have distinguished between searching online and buying online. Buying products via the Internet can be further characterised by frequency. The occurrence of these different types of e-shopping behaviour by urbanisation level is shown in table 3.2 (see over).

Half the sample searches online without buying online. Slightly more than half of the sample had bought online, and one fifth had done so frequently. Nearly half of the sample had made their first online purchase before the year 2000. Of the people who had ever

Table 3.1 The spatial distribution of online buyers and Internet users compared with the total population in the Netherlands in 1996 and 2001

	1996 (in %)			2001 (in %)			Change 1996-2001 (index: 1996 = 100)		
Residential environment	**online buyers**	**Internet users**	**total population[a]**	**online buyers**	**Internet users**	**total population[a]**	**online buyers**	**Internet users**	**total population[a]**
Very strongly urbanised	32.0	31.2	18.2	27.1	24.3	18.8	84.6	77.9	103.3
Strongly urbanised	29.2	27.4	21.7	33.1	34.5	22.3	113.3	125.9	102.7
Moderately urbanised	21.0	20.6	17.2	18.9	19.3	17.5	90.0	93.4	101.3
Weakly urbanised	10.8	13.2	20.5	13.9	13.6	19.9	129.2	102.5	97.1
Nonurbanised	7.1	7.5	22.3	7.1	8.3	21.5	100.1	110.6	96.3
Total	100	100	100	100	100	100			
N	353	1 087	15 567 100	1 086	2 098	15 987 070			

a Source: Statistics Netherlands, 2004.

Table 3.2 Characterisation of e-shoppers by residential environment in 2001 (in row percentages)

Residential environment	Searching online		Buying online		Frequency of buying online[1]	
	yes	total	yes	total	frequent	total
Very strongly urbanised	60	100	58	100	19	100
Strongly urbanised	52	100	50	100	19	100
Moderately urbanised	45	100	51	100	22	100
Weakly urbanised	46	100	53	100	26	100
Nonurbanised	51	100	43	100	28	100
Total	51	100	52	100	21	100
N	973		2 110		735	
χ^2	9.888*		14.254**		4.496	
Dependent variable	Yes = searched online and never bought online		Yes = ever bought online		Frequent = at least 1 purchase per 2 months	

* $p < 0.05$, ** $p < 0.01$
1 Among the people who ever bought online.

bought online, approximately 5% did not buy online again. Most online searching is done in (very) strongly urbanised areas. In very strongly urbanised areas people are more likely to buy online (58%). However, as table 3.2 shows (although the differences are not statistically significant), people living in nonurbanised areas buy most frequently online (28%); the comparative share of people living in (very) strongly urbanised areas was 19%.

An important question is: what do people purchase when using the Internet as a shopping mode? Table 3.3 presents an overview of the five products most frequently purchased online according to residential environment. Other less frequently bought products include cinema or theatre tickets, flowers, gifts, games, and collectors' items. Daily goods such as groceries, and health and personal care products were hardly ever bought online by Dutch e-shoppers in 2001.

Table 3.3 shows that, in the Netherlands, goods such as CDs and books, which are the most often searched for online, also have the highest proportion of online purchasers; this finding is in accordance with the results of Lee (2002) in Singapore and Vrechopoulos et al (2001) in Greece. Online buying seems to be related to residential environment. In general, with the exception of clothing, the residents of nonurbanised municipalities are less likely to have bought products online than are the residents of other municipalities. This finding could be explained by the greater home shopping experience (for example, via catalogue) in the less urbanised areas of the country. Originally, this shopping mode mostly offered clothing. Ward (2001) found that online shopping and catalogue shopping tend to be positively correlated, and asserts that online shopping is a closer substitute for catalogue shopping than for in-store shopping. There seems to have been a shift from catalogue shopping to online shopping (Thuiswinkel.org, 2004). Table 3.3 also shows that buying travel tickets online is quite popular in the very strongly urbanised settlements.

Table 3.3 Purchase of products by urbanisation category in 2001 (percentage of online buyers per urbanisation category)

	Books	CD/Video/DVD	Clothing	Travel tickets	Hardware and software
Very strongly urbanised	30	32	11	20	16
Strongly urbanised	27	30	10	14	17
Moderately urbanised	33	34	15	13	20
Weakly urbanised	33	36	14	11	16
Nonurbanised	29	29	16	5	12
Total	30	32	12	15	17
N	1 090	1 091	1 090	1 092	1 091
χ^2	3.459	3.270	5.041	14.766**	3.130

** $p < 0.01$

On the basis of these descriptive results, it seems that Internet use and online buying are marginally stronger in urban areas in the Netherlands. However, a small trend towards more convergence between the urbanisation categories can be observed. This convergence seems to confirm the innovation-diffusion hypothesis. On the other hand, we have shown that the frequency of online buying tends to be higher in less urbanised areas. The inhabitants of these areas seem to compensate for low shop accessibility by shopping via the Internet. These results should, however, be treated with some caution, because they could also be influenced by small differences between the data-collection methods used in 1996 and 2001. Furthermore, these results have not been corrected for sociodemographics or behavioural attributes. This correction is the subject of the next section.

3.5 E-shopping and the explanatory value of spatial variables

From the short review of the literature presented in section 3.2, it is evident that, besides spatial attributes, sociodemographics and behavioural attributes are also related to e-shopping. We estimated some models to determine which of the two hypotheses (the innovation-diffusion hypothesis or the efficiency hypothesis) was most capable of explaining the spatial distribution of e-shopping. First, we discuss three models of searching online, buying online, and frequency of online buying. We then discuss the models for buying specific products online. As shown by ρ^2 and R^2, the performance of the three models is relatively poor, especially for searching online and the frequency of buying online (see table 3.4). Consequently, only part of the variation in e-shopping can be attributed to differences in the personal, household, residential environment, or behavioural variables included in the literature and in our models. The model for online searching shows that men, more highly educated people, and those with Internet experience are significantly more likely to search for product information online. People living in very strongly urbanised areas are significantly more inclined to search online than are people living in other areas.

The model for online buying confirms findings from earlier research in the sense that being male, having a high educational level, a credit card, Internet and home shopping

Table 3.4 Regression analyses results of e-shopping in 2001

	Searching online			Buying online			Frequency of buying online	
Sociodemographic variables	**B**	**Odds ratio**	**χ^2 change**	**B**	**Odds ratio**	**χ^2 change**	**B**	**β**
Female	-0.512**	0.600	17.283	-0.465***	0.628	24.351		
Age in years				0.132***	1.141	16.395		
(Age in years)^2				-0.002***	0.998	19.831		
Low education level	-0.489*	0.613	31.791					
High education level				0.214#	1.239	50.612		
Medium income							-0.609#	-0.081
High income	0.149	1.161	243.167	0.074	1.077	432.582		
Worker	0.092	1.096	9.682	0.121	1.128	12.797	1.036**	0.132
Spatial variables								
Very strongly urbanised area	0.451*	1.570	33.063	0.215#	1.240	65.166		
Shops (x 1000) in 30 minutes by car							-0.037**	-0.109
Behavioural variables								
Internet experience in years	0.191***	1.210	21.399	0.172***	1.188	41.608	0.170*	0.100
Hours of Internet use per week				0.021***	1.021	13.017	0.038*	0.101
Credit card ownership	0.122	1.129	12.677	0.647***	1.910	45.829		
Home shopping experience	0.136	1.145	10.283	0.292**	1.339	50.238	0.593*	0.07
Constant	-0.218	0.804		-3.090***	0.046		3.204***	

Sociodemographic variables	Searching online			Buying online			Frequency of buying online	
	B	Odds ratio	χ^2 change	B	Odds ratio	χ^2 change	B	β
Type of model	Logistic regression			Logistic regression			OLS regression	
Dependent variable	1 = ever searched online (N = 381) 0 = never searched online (N = 324)			1 = ever bought online (N = 854) 0 = never bought online (N = 731)			Number of purchases in 2000[a] (continuous)	
Number of cases	705			1 585			647	
Degrees of freedom	8			11			6	
R^2							0.055	
Adjusted R^2							0.046	
χ^2	55.333			239.223				
Log-likelihood at convergence	-458.696			-947.250				
Log-likelihood at constant	-486.362			-1 093.861				
ρ^2	0.057			0.109				
Adjusted ρ^2	0.040			0.099				

# $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
a Among the people who ever bought online.

Table 3.5 Logistic regression analyses results of online buying of different products

	Travel tickets			CD/Video/DVD			Clothing		
Sociodemographic variables	**B**	**Odds ratio**	**χ^2 change**	**B**	**Odds ratio**	**χ^2change**	**B**	**Odds ratio**	**χ^2 change**
Female				-0.324#	0.723	6.987	0.578**	1.782	10.749
Age in years				0.164**	1.178	7.882	0.136*	1.146	4.409
(Age in years)^2				-0.002**	0.998	9.386	-0.002#	0.998	3.685
High education level	0.658**	1.930	18.107	-0.224	0.800	24.438	-0.470#	0.625	21.870
High income	0.072	1.075	77.250	0.311	1.365	184.884	0.084	1.087	105.930
Household with children				-0.549**	0.578	24.168			
Worker				-0.124	0.884	5.058			
Spatial variables									
Weakly urbanised area				0.317#	1.373	6.746			
Moderately urbanised area							0.458#	1.581	4.139
Very strongly urbanised area	0.421*	1.523	16.943						
Music stores (x 1000) in 10 minutes by car				-0.011#	0.989	18.936			
Clothing stores (x 1000) in 20 minutes by car							2.6×10^{-4}	1.000	12.807
Behavioural variables									
Internet experience in years	0.076#	1.079	10.467	0.066#	1.068	6.607			
Hours of Internet use per week				0.017*	1.017	4.005			
Credit card ownership	1.017***	2.764	26.667	0.367	1.444	11.741	-0.029	0.971	4.994
Home shopping experience	0.240	1.272	34.718	0.024	1.024	37.607	0.266	1.304	25.894
Constant	-3.388***	0.034		-3.593***	0.028		-4.945***	0.007	

Sociodemographic variables	Travel tickets			CD/Video/DVD			Clothing		
	B	Odds ratio	χ^2 change	B	Odds ratio	χ^2change	B	Odds ratio	χ^2 change
Dependent variable	1 = bought travel tickets online (N = 134) 0 = did not buy travel tickets online (Internet buyers only; N = 728)			1 = bought CD/Video/DVD online (N = 258) 0 = did not buy CD/Video/DVD online (Internet buyers only; N = 574)			1 = bought clothing online (N = 105) 0 = did not buy clothing online (Internet buyers only; N = 744)		
Number of cases	862			832			849		
Degrees of freedom	6			13			9		
χ^2	60.495			46.941			21.725		
Log-likelihood at convergence	-342.181			-491.686			-306.819		
Log-likelihood at constant	-372.428			-515.156			-317.682		
ρ^2	0.081			0.046			0.034		
Adjusted ρ^2	0.065			0.020			0.006		

# $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

experience, and using the Internet frequently, positively affect the probability of buying online. The relationship between online buying and age is not linear: up to the age of 33 years the likelihood to buy online increases; after that age, it decreases. Table 3.4 also shows that, all else being equal (that is, controlling for sociodemographic and other confounding factors), people in very strongly urbanised areas are more likely to buy online. Hence, in the Netherlands, not only online searching, but also online buying is more often done in urbanised areas. Again, the analysis seems to confirm the basic idea of the innovation diffusion hypothesis, namely that urban consumers are more inclined to adopt innovations and that others living elsewhere follow in due course.

The results of the descriptive analysis concerning the frequency of buying online were also confirmed by the multivariate analysis. If people's accessibility to shops decreases, the number of products bought online increases. In an additional analysis, we found that for people living in nonurbanised areas the number of products bought online increases. Finally, the frequency of online buying is higher for workers, people with Internet and home shopping experience, and frequent Internet users (see Table 3.4). People with a medium-level income buy online less frequently than do people with a low or high level income. Perhaps people with a low income (students, for example) use the Internet more often to buy products at a cheaper price, whereas people with a high income can afford to buy products more frequently online. Thus, in the first case, the Internet may more often replace in-store shopping, whereas in the second, it may more often supplement it. No significant effects were found of household type on e-shopping.

We have also estimated models for several products frequently bought online (See Table 3.3 for an explanation of the various data sets). Table 3.5 includes the models for buying travel tickets, CDs/video/DVDs, and clothing. Although the performance of these models is relatively poor, some interesting conclusions can nevertheless be drawn. The models show that different types of consumers are interested in the three product types. Highly educated people and credit card owners are more inclined to buy travel tickets online. These characteristics are not related, however, to online buying of CDs or clothing. The probability of buying CDs, videos, and DVDs is high for men, young people, households without children, and people with a lot of Internet experience. Clothing is most often bought online by young to middle-aged women with a low to medium level of education. It is striking that Internet experience does not affect the online buying of clothing, whereas it does affect the other product types. This seems to indicate that many of the people who buy clothing online formerly bought it by catalogue. Even though they may not have much Internet experience, they are encouraged by their mail order companies to use this new form of technology; catalogue firms were among the first to appreciate the advantages of the Internet.

The impact of spatial attributes also varies by product category. The likelihood of buying travel tickets online is higher in the very strongly urbanised settlements. However, for the other two product categories, consumers can be found in moderately urbanised areas (for clothing) or in areas with a low shop accessibility for music stores (for CDs and so forth). This analysis shows that the innovation-diffusion hypothesis applies best to travel tickets, whereas the findings for CDs, videos, and DVDs match the efficiency hypothesis better. We find, as did Sinai and Waldfogel (2004), that people tend to buy certain products more online if they live further away from the stores that sell those products. However, we did not find this effect for books and clothing as they did, but for music. These different results can be

attributed to differences in research method, sample characteristics, and the fact that Sinai and Waldfogel (2004) did not distinguish between buying online and buying by mail order.

3.6 Conclusions

Although e-shopping has recently received considerable attention, especially in marketing literature, very little research has been done as yet to investigate the effect of spatial variables on e-shopping. The title of this paper poses the question whether geography matters for understanding e-shopping in the Netherlands. We investigated for the time period 1996-2001 the spatial distribution of Internet users and online buyers in the Netherlands and the impact of spatial variables on e-shopping. We combined data from e-shopping surveys of Internet users with geographical data about residential environment and shop accessibility.

Two hypotheses were formulated concerning the impact of spatial variables on e-shopping. On the one hand, the innovation-diffusion theory predicts that e-shopping is more likely to occur in urban areas, because new technology usually starts in centres of innovation, where consumers live who are more inclined to adopt innovations. On the other hand, the efficiency hypothesis predicts that e-shopping is more likely to occur when people's accessibility to shops is relatively low. Although the impact of the spatial attributes (type of residential environment and shop accessibility) varies for the different stages of the e-shopping process and for the type of product, we found indications that geography does indeed matter for e-shopping.

Our findings indicate that Internet use and online buying tend to be urban phenomena in the Netherlands, although a small trend can be observed of more diffusion of Internet use and online buying into the weakly urbanised and rural areas. E-shopping seems to be following a traditional innovation-diffusion pattern, which suggests that it is likely to grow in these areas in the near future. We also found that both residential environment and shop accessibility had an impact on e-shopping, after sociodemographic and behavioural variables had been controlled for. That is to say, our findings supported both the innovation-diffusion hypothesis and the efficiency hypothesis. On the one hand, people living in a very strongly urbanised area are more likely to search online and/or to buy online. On the other hand, people with low shop accessibility, as in less urbanised or nonurbanised areas, buy more products online. The analyses also show that the support for the two hypotheses depends on the type of product. Buying travel tickets online supports the innovation-diffusion hypothesis, whereas buying CDs and similar products online is more likely in areas with a low shop accessibility.

If e-shopping becomes more widespread in the Netherlands, physical shops may experience a loss of revenues. This revenue decline is expected to be larger in rural areas than in urban areas because consumers with a low shop accessibility buy more (nondaily) products online. This may lead to the closing of shops or a process of cumulative deterioration, which is characterised by growing online sales combined with a declining shop accessibility in rural areas. Weltevreden and van Rietbergen (2004) found that for nondaily goods, such as books and CDs, 8% to 12% of all e-shoppers already buy those products less often in-store because of online shopping. On the other hand, Farag et al (2006) found that online buyers make more shopping trips than do nononline buyers, which seems to imply

that more shopping trips are likely to occur if e-shopping continues its popularity, rather than fewer shopping trips. Thus, a change in travel patterns given the trends in e-shopping would entail generation rather than substitution. However, which process ultimately will take place depends largely on the product involved and the (locational) characteristics of the e-shopper.

With regard to the importance of geography for understanding e-shopping, progress in future research lies in three areas. First, future research should include a more complete set of explanatory variables, such as attitudes towards e-shopping and in-store shopping. A limitation of this study is the incomplete dataset. The effects of spatial attributes on e-shopping that we found, could perhaps be proxies for such attitudinal effects. Individuals might self-select into residential locations consistent with their attitudes. Additionally, different dimensions of choice behaviour (searching online and buying online, for example) should be analysed jointly in order to reduce the chance of bias in model estimations. Second, a future study could incorporate more refined and behaviourally sound accessibility measures at the neighbourhood level. Most conventional accessibility measures "ignore the role of individual time budget and space-time constraints in determining personal accessibility" (Kwan, 1999, page 212). To overcome this problem, researchers should seek to include space-time accessibility measures in their analyses (Dijst and Kwan, 2005). Third, future research should feature a comparison between countries that vary in urbanisation patterns. The Netherlands is a small, highly urbanised country, where even in rural areas consumers have relatively good shop accessibility in comparison with larger countries such as Germany, the United Kingdom, Canada, or the USA. In these countries, with more spread out populations and high Internet use, the impact of spatial variables on e-shopping could be greater than in the Netherlands.

Acknowledgements

We are most grateful to Multiscope, a Dutch online research agency, for making the e-shopping data available to us. We would like to thank Dr Tom de Jong for his advice on accessibility measures, the preparation of the data to construct these measures, and making the urbanisation map of the Netherlands. We also wish to thank Francisca Huijser for the preparation of the retail data. Finally, we are grateful to Dr Tim Schwanen for his comments on the analysis of the data.

References

Anderson W P, Chatterjee L, Lakshmanan T R, 2003, "E-commerce, transportation and economic geography" *Growth and Change* **34** 415-432

Aoyama Y, 2003, "Sociospatial dimensions of technological adoption: recent M-commerce and E-commerce developments" *Environment and Planning A* **35** 1201-1221

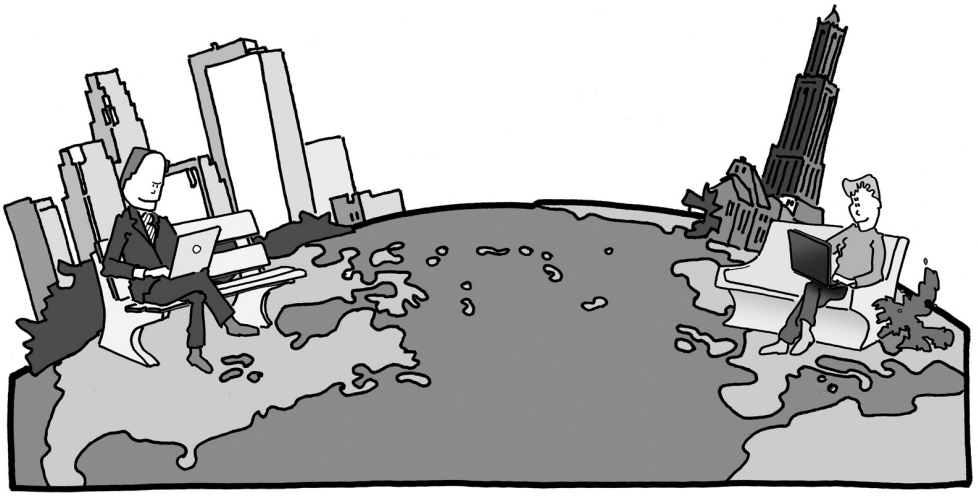
Boschma R A,Weltevreden J WJ, forthcoming, "The evolutionary nature of b2c e-commerce in inner cities", in *E-commerce, E-business and the Dynamics of Economic Development* Eds M Taylor, S O Park (Ashgate, Aldershot, Hants)

Dieleman F M, Dijst M, Burghouwt G, 2002, "Urban form and travel behavior: micro-level household attributes and residential context" *Urban Studies* **39** 507-527

Dijst M, 2004, "ICTs and accessibility: an action space perspective on the impact of new information and communication technologies", in *Transport Developments and Innovations in an Evolving World* Eds M Beuthe,V Himanen, A Reggiani, L Zamparini (Springer, Berlin) pp 27-46
Dijst M, Kwan M-P, 2005, "Accessibility and quality of life: time-geographic perspectives", in *Social Dimensions of SustainableTransport:Transatlantic Perspectives* Eds K Donaghy,

S Poppelreuter, G Rudinger (Ashgate, Aldershot, Hants) pp 109-126
Evers D, 2002, "The rise (and fall?) of national retail planning" *Tijdschrift voor Economische en Sociale Geografie* **93** 107-113
Farag S, Dijst M, Lanzendorf M, 2003, "Exploring the use of e-shopping and its impact on personal travel behavior in the Netherlands" *Transportation Research Record* number 1858, 47-54
Farag S, Krizek K J, Dijst M, 2005, "E-shopping and its relationship with in-store shopping: empirical evidence from the Netherlands and the US" *Transport Reviews* **26** 43-61
Graham S, Marvin S, 1996 *Telecommunications and the City: Electronic Spaces, Urban Places* (Routledge, London)
Hägerstrand T, 1967 *Innovation Diffusion as a Spatial Process* (University of Chicago Press, Chicago, IL)
ITU, 2003 World Telecommunication Indicators International Telecommunication Union, http://www.itu.int/ITU-D/ict
Kwan M-P, 1999, "Gender and individual access to urban opportunities: a study using space- time measures" *The Professional Geographer* **51** 210-227
Lee P, 2002, "Behavioral model of online purchasers in e-commerce environment" *Electronic Commerce Research* **2** 75-85
Li H, Kuo C, Russell MG, 1999, "The impact of perceived channel utilities, shopping orientations, and demographics on the consumer's online buying behaviour" *Journal of Computer Mediated Communication* **5**, http://www.ascusc.org/jcmc/vol5/issue2/hairong.html
Liao Z, Cheung M T, 2001, "Internet-based e-shopping and consumer attitudes: an empirical study" *Information and Management* **38** 299-306
Locatus, 2003 *Retail Guide 2003* (in Dutch) (Locatus, Woerden)
Lohse G L, Bellman S, Johnson E J, 1999, "Consumer buying behaviour on the Internet: finding from panel data" *Journal of Interactive Marketing* **14** 15-29
Mokhtarian P L, 2004, "A conceptual analysis of the transportation impacts of B2C e-commerce" *Transportation* **31** 257-284
Morganosky M A, Cude B J, 2000, "Consumer response to online grocery shopping" *International Journal of Retail and Distribution Management* **28** 17-26
Nauta H, 2003, "Online research: a reliable alternative?" (in Dutch), master's thesis, Economic Geography, Utrecht University, Utrecht
NIPO, 2001, "World wide e-commerce research 2001: Internet has become a substantial element in the buying process of products and services" (in Dutch), NIPO (Dutch Institute for Public Opinion and Marketing Research), Amsterdam, http://www.tns-nipo.com/
Pew Internet and American Life Project, 2004, "America's online pursuits: the changing picture of who is online and what they do", http://www.pewinternet.org/reports/ toc.asp?Report=106
Raijas A, 2002, "The consumer benefits and problems in the electronic grocery store" *Journal of Retailing and Consumer Services* **9** 107-113
Rogers E M, 1983 *Diffusion of Innovations* (The Free Press, New York)
Schwanen T, Dijst M, Dieleman F, 2004, "Policies for urban form and their impact on travel: the Netherlands experience" Urban Studies **41** 579-603

Shim S, Eastlick M A, Lotz S L, Warrington P, 2001, "An online prepurchase intentions model: the role of intention to search" *Journal of Retailing* **77** 397-416
Sim L L, Koi S M, 2002, "Singapore's Internet shoppers and their impact on traditional shopping patterns" *Journal of Retailing and Consumer Services* **9** 115-124
Sinai T, Waldfogel J, 2004, "Geography and the Internet: is the Internet a substitute or a complement for cities?" *Journal of Urban Economics* **56** 1-24
Statistics Netherlands, 2003 *The Digital Economy 2003* (in Dutch) CBS,Voorburg
Statistics Netherlands, 2004 *Statline* (in Dutch), http://statline.cbs.nl/
Thuiswinkel.org, 2004, "Home shopping in the Netherlands", http://www.thuiswinkel.org
Van der Zwan J, van der Wel R, Ritsema van Eck J, de Jong T, Floor H, 2003 *Manual Flowmap 7* Faculty of Geosciences, University of Utrecht, Utrecht
Verhoef P C, Langerak F, 2001, "Possible determinants of consumers' adoption of electronic grocery shopping in the Netherlands" *Journal of Retailing and Consumer Services* **8** 275- 285
Vijayasarathy L R, 2002, "Product characteristics and Internet shopping intentions" *Internet Research: Electronic Networking Applications and Policy* **12** 411-426
Vrechopoulos A P, Siomkos G J, Doukidis G I, 2001, "Internet shopping adoption by Greek Consumers" *European Journal of Innovation Management* **3** 142-152
Ward M R, 2001, "Will online shopping compete more with traditional retailing or catalog shopping?" *Netnomics* **3** 103-117
Weltevreden J W J, van Rietbergen T, 2004, "Are shops disappearing? An examination of the impacts of online shopping for city centre retailing" (in Dutch), Section of Economic Geography, Urban and Regional Research Centre Utrecht, Utrecht University, Utrecht
Wrigley N, Lowe M, Currah A, 2002, "Retailing and e-tailing" *Urban Geography* 23 180- 197
Zmud J, Arce C, 2000, "E-mobility (electronic travel): measuring new and evolving behaviour", paper presented at the 9th International Association for Travel Behaviour Research Conference, Australia; copy available from Dr Zmud, Central Texas Regional Mobility Authority, 13640 Briarwick Drive, Austin, TX 78729



4 E-shopping and its relationship with in-store shopping: empirical evidence from the Netherlands and the USA

Sendy Farag, Kevin J. Krizek, Martin Dijst
Transport Reviews 26, 43-61,

Abstract

Despite considerable examination of the impact of telecommunications on travel, little empirical evidence sheds light on the impact of e-shopping on travel – a recent and increasingly popular form of telecommunications. This paper analyses determinants of online buying and their relationship with in-store shopping, using empirical data obtained from Minneapolis, USA, and Utrecht, the Netherlands. Based on chi-square tests and logistic and ordinary least-squares regressions, the results indicate that online buying is affected by sociodemographics and spatial characteristics of people, their Internet experience, and their attitudes towards in-store shopping. US respondents who prefer to see products in person are less likely to buy online. Dutch respondents are more likely to buy online as travel times to shops are shorter. At first sight, this counterintuitive result might be related to an urban, innovative lifestyle that supports e-shopping. A more detailed analysis of Dutch online buyers reveals that they make more shopping trips than non-online buyers and have a shorter shopping duration. The results indicate that the relationship between online buying and in-store shopping is not one of substitution but of complementarity.

4.1 Introduction

New forms of information and communications technology (ICT) are emerging as primary forces influencing people's daily activities. Such developments include computers equipped with faster and cheaper microchips, increased transmission speeds for the Internet, a growth in the number of web-pages on the Internet, and portable wireless equipment. Published work to date examining relationships between ICT and travel has been pursued from a variety of perspectives. One need only to refer to previous reviews (e.g. Salomon, 1986; Mokhtarian and Salomon, 2002; Golob, 2001) to glean a better understanding of the range of issues associated with this general line of inquiry. But such reviews are limited in part because the bulk of most of the literature focuses on one aspect of ICT-travel relationships: the work commute.

Everyday use of ICT is now infiltrating shopping and banking, as evidenced by the following statistics showing burgeoning rates of use. For example, the Boston Consulting Group (2002) estimates that online retailing in North America alone totalled US$27 billion in 1999 and US$45 billion in 2000. While this figure still comprises a relatively insignificant margin of total retail sales (1.7%), its amount has increased by over 67% since 1999. While most e-commerce forecasters anticipate that the sheer growth in proportion of sales will likely subside, the availability of such services is likely to be of increasing impact on retailing. One need only examine trends in personal use. Among US Internet users alone, those who had ever bought online has grown from 48% (about 41 million people) in 2000 to 61% (about 67 million people) in 2002 – an increase of 63% (Pew Internet and American Life Project, 2004). In the Netherlands, nearly half (48%) of Internet users (8.5 million people) have ever bought a product online. The total turnover of online purchases in 2003 rose by 32% to € 1.24 billion compared with 2002 (Thuiswinkel.org, 2004).

While e-shopping is widespread in many developed countries, little research to date has empirically tackled this phenomenon head on. This paper, therefore, focuses on one dimension of the ICT-travel relationship: shopping via the Internet and its potential to affect household in-store shopping. It analyses the determinants of online buying as well as their relationship to in-store shopping. To do so, the paper employs data from two independent administered surveys: one in the city of Utrecht, the Netherlands; the other one in and around the city of Minneapolis in Minnesota, USA. Although the sampling and survey methods were different, similar research questions relating to electronic and in-store shopping make a comparison between the USA and the Netherlands ripe for analysis.

Such a comparison can increase one's insight into the impact of different sociocultural and urban contexts on e-shopping. The USA and the Netherlands differ fundamentally in their urbanization pattern. In the Netherlands, smaller cities and medium-sized towns predominate; many cities have historic cores with high densities and mixed land use that stimulate walking, cycling and the use of public transport (Schwanen et al., 2002). The two countries also differ in retailing structure. Since 1973, Dutch retail policy has been highly effective in prohibiting the establishment of out-of-town hypermarkets and shopping malls. These were encountered as a threat to the vitality of town centres and likely to generate extensive private car use. As a consequence, in contrast to the USA, many shops in the Netherlands are still within the built-up areas of cities and towns, and within walking and cycling distance for local residents (Evers, 2002).

The next section reviews the determinants of e-shopping and its potential impact on in-store shopping. The third section describes the surveys and employed methodology. The determinants of online buying are analysed in the fourth section; the relationship between online buying and in-store shopping is analysed in the fifth section. A concluding section summarizes the main points.

4.2 Background literature

E-shopping has been parsimoniously defined as an activity to buy or receive information about consumer goods via the Internet (Mokhtarian, 2004). Using this definition as the basis, two questions help the focus of the analytical part of this paper:

1. the importance of different factors influencing online purchasing behaviour, and
2. the relationship between online buying and in-store shopping.

A quick review of the literature suggests several background factors are important to consider.

First, online purchase behaviour is related to sociodemographics. Previous study has shown that in general, most online buyers are male; however, most online grocery shoppers are female (Casas et al., 2001; Vrechopoulos et al., 2001; Morganosky and Cude, 2000; Raijas, 2002; Farag et al., 2003). Age is inversely related to e-shopping in a non-linear manner; people up to the age of 40 are inclined to buy online, while the probability of buying online decreases after that age (Vrechopoulos et al., 2001; Farag et al., 2003). Not surprisingly, individuals with a higher income and education shop online more often (Casas et al., 2001; Vrechopoulos et al., 2001; Sim and Koi, 2002). Other factors appear to be inconclusive. Some studies find a positive relationship between shortage of time and the intention to buy online, while others do not find such a relationship (e.g. Verhoef and Langerak, 2001; Sim and Koi, 2002).

Besides sociodemographics, the supply of shopping opportunities in one's residential environment could affect e-shopping. The Internet could compensate for rather scarce retail opportunities offered in non-urban settings. Farag et al. (2005) tested the impact of residential environment and shop accessibility on e-shopping for the Netherlands, controlling for sociodemographics and behavioural attributes. They found that residents of strongly urbanized areas have a higher likelihood of buying online, but that people with a low level of shop accessibility buy more often online. However, Krizek et al. (2004b) suggest that the spatial attributes such as retail accessibility or distance to central business districts do not strongly influence the propensity to engage in online behaviour.

Finally, behavioural and attitudinal variables affect e-shopping. Internet experience and frequency of Internet use have a positive effect on buying online (Liao and Cheung, 2001; Sim and Koi, 2002). A positive attitude towards e-shopping, such as the perceived quality of vendors on the Internet, also stimulates the use of the Internet for shopping purposes (Shim et al., 2001; Sim and Koi, 2002). The possibility to obtain products cheaply is also an important motivation for e-shopping (Swinyard and Smith, 2003).

Based on this short review of the literature, formulated below are hypotheses describing the impact of four clusters of variables that affect online buying. The first line of enquiry investigates online purchase behaviour. It is expected that the variables have the following relationships to the prevalence of online buying, here measured by 'ever bought online', where '+' is a positive impact and '–' is a negative impact:

- Sociodemographics: + male; – age; + education; + income; + time-pressured.
- Spatial: + low accessibility of shops.
- Behavioural and attitudinal: + Internet experience; – prefer to previewing products before buying.

The second focus of this paper is the relationship between online buying and in-store shopping. As articulated by Salomon (1985, 1986), these interactions could play out in a variety of ways:

- Substitution of shopping travel refers to the elimination of trips – trips that are no longer required as a result of participation in e-shopping.
- Modification refers to travel that is likely to be altered: in the context of this publication primarily by a shift in the duration of shopping and types of shops visited.
- Generation refers to any generation of shopping travel that would not have occurred but for the existence of e-shopping.
- Neutrality refers to those instances in which e-shopping has no foreseeable effect on household travel behaviour.

Even four categories, however, are not exhaustive (Mokhtarian, 2004). For example, the Internet could be used to prepare for in-store shopping. Prices and brands are easily compared via the Internet and also often much quicker than in a store. Therefore, searching online could be the starting point of a shopping cycle in order to gain basic information about a product. If people prefer to preview an item themselves before they purchase, then a substitution of online shopping for in-store shopping is unlikely (the 'complementarity effect' of e-shopping).

Handy and Yantis (1997) and Krizek et al. (2004a) examined the potential substitutability of three different types of activities: movie watching, shopping (non-grocery) and banking. Relying on a US-based survey in three cities, they explored individual participation in and choices about each activity. The results suggest complex relationships between in-home activities and those requiring physical travel. For the most part, they found that out-of-home versions of movie-watching, shopping and banking offer qualities that are not currently duplicated by the in-home versions. This absence of substitution effects is also hypothesized by Dijst (2004), suggesting that e-shopping could lead to a revaluation of other motives linked with in-store shopping such as meeting other customers or enjoying the recreational aspects of shopping. Further support by Underhill (1999) suggests that consumers prefer using their senses for many types of shopping, for example trying on a shirt, smelling perfume, sitting in a chair (also Dholakia et al., 2000). Casas et al. (2001) found that Internet shoppers in Sacramento, California, do not make less but in fact make more shopping trips than non-Internet shoppers. They attribute this result to the active lifestyle of Internet shoppers.

However, research from Germany by Luley et al. (2002) suggests one could expect a slight reduction in the frequency of trips as a consequence of online shopping. An early study of Keyzers and Wagenaar (1989) of users of a grocery teleshopping service in a Dutch middle-sized town also showed a substitution of shopping trips. Cairns et al.'s (2004) overview of the literature concerning the travel impacts of home shopping mainly suggests a potential reduction in the number of shopping trips and in car use. Although no information is available for shopping, Viswanathan and Goulias (2001) indicated that Internet use in general was associated with a reduction in the duration of trips.

Based on the scarce literature, evidence on the impact of e-shopping on in-store shopping is limited and in some cases contradictory. Our hypothesis is that online buying will have a decreasing effect on trip frequency and the duration of shopping activity, but that this relation is different for daily (e.g. groceries) and non-daily shopping (e.g. books and clothes), because most products that are purchased online are non-daily products.

4.3 Methodology

Research designs of Utrecht, the Netherlands, and Minneapolis, Minnesota, USA

Our analyses are based on primary data collection efforts in the USA and the Netherlands; each was administered independently of one another yet contained similar questions relating to Internet and in-store shopping. The US survey was based in and around the city of Minneapolis, Minnesota. The data were collected as part of a larger research project funded by the Minnesota Department of Transportation which aimed to gauge the impact of ICT on travel behaviour. The responses analysed in this research represent a subset of the larger research effort. The Netherlands survey was administered in and around the city of Utrecht and was funded by Utrecht University to gain more insight in the relationship between e-shopping and in-store shopping. Slight differences exist between the characteristics of the survey (e.g. sample size, sample strategy, content of survey instrument). However, similar research questions about the phenomena under investigation here provide a compelling opportunity for cross-cultural analysis. Rarely do research efforts have the opportunity to explore in detail burgeoning phenomena from two international settings.

The Netherlands is among countries with the highest Internet use in the world. More than 75% of Dutch households own a computer and 61% have Internet access (Statistics Netherlands, 2003). E-shopping is mostly done in the core cities of the heavily urbanized Western part of the country: Amsterdam, Rotterdam, Utrecht and The Hague (Farag et al. 2005). The setting explored here – Utrecht (population 260 625) – lies in the heart of the Netherlands. Three communities in Utrecht were selected that differed in degrees of shop accessibility so that an analysis could be made of the impact of the quantity and quality of shops in the immediate surroundings of people on online shopping behaviour. Vogelenbuurt (219 households) is near the centre of Utrecht, thereby exhibiting 'high' shop accessibility; Lunetten (282 households) is a first-ring community a bit further from the centre, and thereby has 'medium' shop accessibility; and De Meern (296 households) is a suburban community farthest (7 km) from the centre and therefore deemed 'low' shop accessibility. The three communities are similar in the per cent of households with children, their educational level and income level. In March 2003, 2517 households were initially targeted, but many people were not at home during the research period. In total, 1396 households were approached face-to-face by interviewers, of which 807 households participated yielding a response rate of 58% from both Internet and non-Internet users. The survey consisted of the following five parts: (1) general Internet use, (2) searching online, (3) buying online, (4) average shopping travel and (5) sociodemographics. Attitudes towards in-store shopping and online shopping were asked as well.

For the US setting, Internet use, attitudes and general travel patterns were gauged from a direct mail survey administered in November 2002. The survey was sent using a clustered sampling strategy to households distributed in three areas. These areas were identified in advance as having a relatively high probability of home Internet availability (both dial-up and high-speed). One area was in a residential urban area of South Minneapolis (i.e. the Kingfield neighbourhood). The remaining two areas were suburban in character: Apple Valley is a municipality (population of 45 527) 40 km south of downtown Minneapolis; Lakeville is a municipality (population of 43 128) 51 km south of Minneapolis. Of the 2000 total surveys sent, 446 heads of households participated, yielding a response rate of 23%.

The sample was equally distributed across the three areas and comprised both Internet and non-Internet users. Each of the above described survey instruments is available from the authors upon request.

Sample comparison

While the Minnesota and Utrecht surveys differ in design and administration, almost a dozen similar questions enable direct comparisons between each sample. The present analysis was narrowed to Internet users, who were the focus of this study. In both samples, this amounted to 80% of the respondents (in the Netherlands case, $n = 634$; in the US case, $n = 360$). In terms of sociodemographic characteristics, each sample showed a relatively mature population. More males (56%) in the USA completed the survey versus 41% in the Netherlands. The average age in the USA was 46 years versus 42 years in the Netherlands. Approximately two-thirds of the respondents in both samples were married or living together. Slightly more of the US households had children (50 versus 40%). About 45% of the respondents in each sample were defined as having a relatively high income (i.e. in the USA this was gross household income greater than US$60 000; in the Netherlands this was a net household income greater than €28 800, i.e. approximately US$35 000). Comparing similar measures of car ownership provided an interesting challenge because it is widely recognized that rates of car ownership are considerably less in the Netherlands than in the USA (fewer than 3% of Minneapolis households own no cars, and fewer than 1% of our sample). Because the Dutch walk and cycle more often for daily travel, only a minority of the households in the sample own two or more cars. To best capture meaningful differences between these samples, it was chosen to bifurcate this measure by aggregating 0 and 1 car households and comparing them to two plus car households. Even after doing so, the US population still exhibited surprisingly higher auto ownership rates, although, a relatively surprising number of single car households was found in the USA (28%), the bulk of which came from the sub-sample in the urban-oriented (Minneapolis) neighbourhood. In terms of Internet use and experience, there are notable differences between the two samples. US respondents have more Internet experience (4.7 years) than Dutch respondents (4.1 years) and they also use the Internet more frequently; 74% use the Internet at least once per day versus 62% of the Dutch respondents. The Internet is most frequently used at home, although many US respondents also use it frequently at work (46 versus 19% of Dutch respondents). The type of Internet connection at home varies greatly between the two samples: 47% of the Dutch sample uses a fast connection such as cable or digital subscriber line (DSL) versus 27% in the USA.

The US sample mirrors the population of the larger Minneapolis metropolitan area reasonably well in terms of sociodemographics. Compared with regional census figures, the surveyed sample has a slightly higher rate of middle-aged respondents (36-65 years). In terms of Internet use, an overwhelming majority (87%) expressed more than 2 years of experience with the Internet. This is higher than the estimated 60% of the overall population from the Upper Midwest of the USA (which is also close to the national average) who indicated more than 2 years of familiarity with the Internet (Pew Internet and American Life Project, 2004). Heightened Internet experience is largely a reflection of the sampling strategy, pulling households from neighbourhoods in the Minneapolis area that had higher rates of Internet availability. The Dutch sample of Internet users mirrors in general

the Dutch population of Internet users for gender, age, Internet experience, income and having children (Statistics Netherlands, 2003). In terms of comparing the US sample with the Dutch sample, however, they do not differ considerably from each other in important sociodemographic characteristics other than gender.

Operationalization of variables

This research operationalized online buying in two ways. For the descriptive analysis, two categories of individuals were identified: those who have and have not bought online. In the multivariate analysis, the frequency of online buying for those who ever bought online was also analysed. In the US sample, a frequent online buyer is defined as someone who has bought a product online at least once a month in the past. In the Dutch sample, someone is considered a frequent online buyer when he or she has bought a product online at least once every two months in the past. In-store shopping is operationalized as the average number of trips (per week for daily shopping; per month for non-daily shopping) and the average shopping duration in minutes per trip. The multivariate analyses controls for sociodemographic, spatial, behavioural and attitudinal variables, all of which were operationalized in the same manner in both samples. The sociodemographic variables include gender (male = 0, female = 1), age (years, continuous variable), education (low, medium, high), income (low, medium, high) and car ownership (no car or one car = 0, two cars or more = 1). Five types of households were classified to capture varying degrees of time pressure (as determined by the amount of hours worked by both partners and the presence of children): (1) one-income households without children (including both couples and singles), (2) one-income households with children, (3) dual-income households without children, (4) dual-income households withchildren and (5) other households (students, pensioned, etc.).

The spatial variables include travel time to shops for daily (e.g. groceries) and non-daily (e.g. clothes) goods. In the Dutch survey, the travel time was asked in the number of minutes from home to the shops one usually visits for daily and non-daily shopping (the usual mode for shopping was asked as well). In the US questionnaire, respondents were asked if they have daily and non-daily shopping stores within walking distance of home or within a short drive from home.

The behavioural variables include Internet experience (years, continuous variable), frequency of Internet use (0 = infrequent Internet user, 1 = frequent Internet user, which is defined as a person who uses the Internet at least once a day), and Internet connection type (0 = slow connection: dial up modem, or ISDN, 1 = fast connection: DSL or cable).

Finally, the attitudinal variables include two statements that were measured on a five-point scale ranging from strongly disagree to strongly agree. The first statement measures preferences for in-store shopping; the second measures the importance of seeing products in person before buying (both coded as: 0 = disagree or neutral, 1 = agree). Table 4.1 describes the frequency distribution of the variables included in the analyses.

Table 4.1 Frequency distribution of variables in the analyses

	US				NL			
	N	**%**	**Mean**	**SD**	**N**	**%**	**Mean**	**SD**
Gender								
Male	203	56			262	41		
Female	157	44			374	59		
Age in years	360		46.3	12.31	629		42.07	15.91
Education								
Low	35	10			198	31		
Medium	130	36			104	17		
High	198	55			330	52		
Income								
Low	39	11			110	20		
Medium	144	41			201	35		
High	169	48			259	45		
Household type								
1-income no kids	105	31			138	23		
1-income + kids	38	11			144	24		
2-income no kids	67	20			75	12		
2-income + kids	116	34			86	14		
Other	17	5			164	27		
Car ownership								
No car or 1 car	100	28			506	81		
Two cars or more	253	72			121	19		
Travel time daily shopping from home								
Within walking distance	130	36						
Not within walking distance	230	64						
Travel time in minutes					600		5.57	3.09
Travel time non-daily shopping from home								
Within a short drive	319	88						
Not within a short drive	42	12						
Travel time in minutes					626		15.50	7.75
Internet experience in years	358		4.72	2.61	628		4.11	2.29
Frequency Internet use								
Infrequent Internet user	93	26			241	38		
Frequent Internet user	271	74			398	62		
Internet connection type								
Slow connection	242	73			313	53		
Fast connection	88	27			273	47		
In-store shopping is fun								
Disagree or neutral	224	62			281	45		
Agree	136	38			350	55		
In-person product viewing is necessary								
Disagree or neutral	120	33			253	40		
Agree	241	67			375	60		

4.4 Determinants of online buying

Characterization of online buyers

Attention is now turned to examining differences in online purchasing behaviour by the four groups of explanatory factors mentioned above. In terms of distribution of the sample, this amounts to three-quarters of US respondents who have ever purchased a product online versus 57% in the Dutch case. Of those people who ever bought online, 30% indicated in the US survey to purchase online at least once a month on average. In the Dutch survey, respondents had bought in the past year on average 4.6 times online (standard deviation = 4.4). To help examine explanatory factors, Table 4.2 shows chi-square tests describing differences between online and non-online buyers.

Initial analysis suggests that there are statistically significant differences between online and non-online buyers for each explanatory factor. The confidence level at which the chi-square test results are accepted as being statistically significant is 95%. Males are more likely to buy online (in both samples) and so do younger respondents (in the US sample). As expected, higher education and higher income respondents are most likely to buy online. This is not surprising considering the capital cost required for a home computer and (fast) Internet access. Because e-shopping could be considered a time-saving strategy, it is interesting to see that online purchasing differs by household type. For the Netherlands, dual-income households are more likely to buy online than other types of households. For the US, one-income households with children are most likely to buy online, followed by dual-income households.

Households in the Netherlands with two or more cars have a greater predilection of e-shopping, perhaps as an additional time-saving strategy. In the USA, however, where car use is considerably more widespread, car ownership does not reveal any statistically significant differences in terms of e-shopping, despite the surprising percentage of households owning one or no car (28%). This difference between Utrecht and Minneapolis could be explained by differences in opportunities to park a car. Shops in the Netherlands are predominantly within the built-up areas of cities and towns, which offer fewer opportunities to drive and park a car (free of charge) than many out-of-town shopping centres in the USA, particularly since two-thirds of the US sample is from suburban settings. Consequently, in the Netherlands e-shopping may reduce the hassle of driving and finding a place to park the car.

Travel time to shops was compared for daily and non-daily goods among online and non-online buyers. One would expect that individuals with large travel times to shops would shop more online, since they can gain more in travel time. However, this does not seem to be the case. In the US case, no significant difference was found; while in the Dutch case it was found that online buyers with short travel times actually are significantly more likely to shop online than individuals with larger travel times. An argument for this result could be the differences in life styles between people who live in or near a city centre which offers in the Dutch traditional retailing structure a large supply of non-daily products, and people who live more remote from the city centre or in a suburb. Perhaps the former are more likely to be early adopters of innovations, such as e-shopping, than the latter (Farag et al., 2005). Furthermore, young urban residents could be more interested in specific products that are offered on the Internet such as computer equipment and mobile phones than middle-aged suburban residents.

Table 4.2 Characterization of US and Dutch online buyers (in row percentages)

	US				NL			
	Never bought online	Ever bought online	N	χ^2 (p-value)	Never bought online	Ever bought online	N	χ^2 (p-value)
Gender								
Male	18	82	203	6.6	34	66	260	12.6
Female	29	71	157	(0.014)	48	52	374	(0.000)
Age								
<25	0	0	0	22.0	49	51	123	5.1
26-35	10	90	63	(0.000)	43	57	108	(0.442)
36-45	21	79	113		40	60	168	
46-55	22	78	102		44	56	95	
56-65	31	69	58		35	65	72	
>65	54	46	24		38	62	45	
Education								
Low	40	60	35	6.9	47	53	198	11.6
Medium	23	77	130	(0.031)	54	46	103	(0.003)
High	20	80	198		37	63	329	
Income								
Low	41	59	39	24.6	52	48	109	23.2
Medium	31	69	144	(0.000)	50	50	198	(0.000)
High	12	88	169		31	69	260	
Household type								
1-income no kids	27	73	105	14.1	40	60	136	38.5
1-income + kids	11	89	38	(0.002)	51	49	144	(0.000)
2-income no kids	19	81	67		28	72	76	
2-income + kids	20	80	116		23	77	86	
Other	53	47	17		55	45	164	
Car ownership								
No car or 1 car	27	73	100	1.1	46	54	504	10.5
Two cars or more	22	78	253	(0.292)	30	70	120	(0.005)

	US				NL			
	Never bought online	Ever bought online	N	χ^2 (p-value)	Never bought online	Ever bought online	N	χ^2 (p-value)
Travel time daily shopping from home								
Within walking distance	21	79	130	0.5				
Not within walking distance	24	76	230	(0.495)				
<=5 minutes					42	58	450	0.3
>5 minutes					46	54	155	(0.569)
Travel time non-daily shopping from home								
Within a short drive	24	76	319	1.9				
Not within a short drive	14	86	42	(0.165)				
<=10 minutes					36	64	220	6.4
11-20 minutes					45	55	317	(0.040)
> 20 minutes					49	51	86	
Internet experience								
<=1 year	40	60	40	45.4	82	18	61	71.7
2-3 years	44	56	66	(0.000)	51	49	210	(0.000)
4-5 years	15	75	94		38	62	215	
6-7 years	6	94	88		24	76	87	
>7 years	10	90	70		17	83	46	
Frequency Internet use								
Infrequent Internet user	44	56	93	32.1	64	36	239	71.6
Frequent Internet user	16	84	271	(0.000)	30	70	394	(0.000)
Internet connection type								
Slow connection	27	73	242	10.7	48	52	310	13.5
Fast connection	10	90	88	(0.001)	33	67	272	(0.000)
In-store shopping is fun								
Disagree or neutral	18	82	224	6.5	37	63	279	6.6
Agree	29	71	136	(0.011)	47	53	350	(0.010)
In-person product viewing is necessary								
Disagree or neutral	4	96	120	34.5	42	58	252	0.0
Agree	32	68	241	(0.000)	43	57	373	(0.967)

Other than gender, education and income, the most consistent similarity between the two samples not surprisingly relate to Internet experience and Internet connection type. Online buyers have more years of Internet experience than non-online buyers, as well as a higher frequency of Internet use. Internet connection type differs among online and non-online buyers; users with a fast Internet connection are more likely to buy online than users with a slow (e.g. dial-up) connection. Based on our data, the direction of causality between, on the one hand, a fast Internet connection and frequency of Internet use and, on the other hand, online buying is hard to determine.

Finally, attitudes toward in-store shopping were investigated. Online buyers seem to enjoy in-store shopping less than non-online buyers. For the US case, online buyers also find in-person product viewing less important than non-online buyers.

Results of logistic regression analyses explaining online buying and its frequency

Because the results described above do not control for multivariate effects, binomial logistic regression models were estimated to examine the effect of each variable on online buying whilst controlling for the effects of all the other variables (Table 4.3). To provide insight into the adoption of e-shopping, the frequency of online buying was also studied. Originally, the models for the US and Dutch cases included the same explanatory variables. However, the low levels of explanation that these models offered led us to search for the best ones for each data set. Final models were specified based on chi-square tests and conceptual plausibility; therefore, some insignificant variables remain in the final models. Table 4.3 shows two models for online buying and two for the frequency of online buying for both countries. For example, in the first model for online buying in the USA, the parameter *B* of -0.029 indicates a small decline in the likelihood of online buying with an increase in age. The odds ratio expresses the effect of the independent variable on the likelihood of online buying in comparison with the likelihood of the reference category. For instance, the ratio of 11.313 for high income indicates that the odds (the ratio of the probability of buying online versus not) are 11.313 times higher for high-income than for low-income categories, which is the reference category not shown in Table 4.3. The chi-square statistics provide an indication of the relative weight of the variables in the model.

Sociodemographic variables are important in explaining online buying, although the set of included variables differs between the two samples. In the Dutch case females are less likely to buy online, while in the USA case older respondents are less likely to buy online. In both cases, people with high incomes are most likely to buy online. Dutch household types with relatively more time (e.g. students, pensioned) are least likely to buy online, which is as expected. This finding is consistent with the results of the descriptive analysis (Table 4.2). Timesaving and the convenience of e-shopping could be important motives to buy online. A supplementary analysis shows that Dutch dual-income households with children prefer online shopping the least. This result seems to indicate that e-shopping is mainly done by this household type for functional reasons (e.g. time saving) than for recreational reasons (shopping via the Internet as another means to shop). There is no support for the hypothesis that residents with longer travel time to shops are more likely to buy online. Actually, the opposite result is found for Dutch respondents: people with a short travel time to shops for non-daily goods are more likely to buy online. As discussed above, this could be explained by differences in lifestyles between urban and suburban residents in the traditional Dutch

retailing structure. Internet experience and the frequency of Internet use both contribute to explaining online buying. Greater Internet experience (measured in years) and frequent Internet use increase the likelihood to buy online. In the US case, a fast Internet connection is also positively related to online buying, although the direction of causality is unclear. Finally, attitudes toward in-store shopping affect online buying in the US sample. Respondents who prefer to view a product in person before purchasing it are less likely to buy online.

The impact of sociodemographics, accessibility of local shops, Internet experience and attitudes toward in-store shopping on frequency of online buying were also analysed (Table 4.3). US respondents more frequently buy online (24% make purchases at least once a month online) than Dutch respondents (23% buys at least once every 2 months online). Approximately the same variables that explain online buying also explain the frequency of online buying (Table 4.3). In the US case, females buy more often online than males. In an additional analysis, it was found that females like e-shopping better than males. Another explanation is the type of product bought online. Groceries, for example, are mostly bought online by females (Morganosky and Cude, 2000; Raijas, 2002). US respondents with a medium education (a college diploma) are least likely to buy frequently online. In both samples, one's experience with the Internet positively correlates with the frequency of online buying. As already stated, the direction of causality is difficult to determine.

In general, the variables that affect online buying do not differ much between the US and Dutch samples. In both samples, sociodemographic and behavioural variables correlate with online buying mostly in expected directions. An effect (not as expected) of the spatial variables on online buying was only found in the Dutch sample, while an effect (as expected) of the attitudinal variables was only found in the US sample.

4.5 Relationship between online buying and in-store shopping

This section focuses on exploring the relationships between online buying and in-store shopping. It first describes various combinations of e-shopping and in-store shopping, followed by an analysis of the effect of online buying on the frequency of shopping trips and duration of shopping trips. The first combination between e-shopping and in-store shopping investigated was searching for product information online and then buying the product in a store. In both samples, nearly one-third of the respondents had done this at least once a month, 40% had done this at least once a year and one-third had never done so. Apparently, the difference in retail structure between the USA and the Netherlands does not have an effect on the occurrence of this combination. In the Dutch survey, respondents were also queried about how often they search product information in a store and then buy the product online. This 'reverse complementarity effect', however, is rarely pursued; more than three-quarters of the respondents reported never having done this.

The third combination of online buying and in-store shopping analysed involved making a shopping trip that otherwise would not have been made due to searching product information online. Only 10% of the respondents in both samples reported that this occurred at least once a month, and nearly two-thirds of respondents reported that this has never occurred. This finding suggests that it seems unlikely e-shopping will generate substantial new trips.

Table 4.3 Logistic regression analyses results of online buying in the US and in the Netherlands

	Online buying						Frequency of online buying					
	US			NL			US			NL		
	B	Odds ratio	χ^2 change	B	Odds ratio	χ^2 change	B	Odds ratio	χ^2 change	B	Odds ratio	χ^2 change
Sociodemographic variables												
Female				-0.486*	0.615	4.300	0.624#	1.866	4.579			
Age in years	-0.029#	0.972	3.286	0.011	1.011	26.569	-0.049**	0.953	10.960	0.013	1.013	5.929
Medium education							-0.675#	0.509	3.908			
Medium income	1.063#	2.894	3.365									
High income	2.426***	11.313	12.957	0.444#	1.560	61.509	0.478	1.612	17.661	0.087	1.091	25.423
1-income households no children	0.512	1.669	11.881				0.671	1.957	2.466			
2-income households no children							0.519	1.681	1.643			
Other (e.g. students, pensioned)				-0.771**	0.462	31.551				-0.886#	0.412	17.528
Owning two cars or more	-0.912	0.402	7.692									
Spatial variables												
Travel time non-daily shopping				-0.036*	1.013	21.503						
Travel time daily shopping				0.012	0.965	7.786				0.054	1.055	7.804
Behavioural variables												
Internet experience in years	0.320***	1.378	25.829	0.290***	1.337	31.013				0.179*	1.196	10.949
Frequent Internet user	0.685#	1.984	3.122	1.088***	2.968	19.578	1.095*	2.990	5.771	1.346**	3.841	10.606
Fast internet connection	0.970#	2.638	35.673	0.327	1.387	52.155	0.563#	1.756	30.675			
Attitudinal variable												
Important to see products in person	-2.716***	0.066	28.813				-1.479***	0.228	22.609			
Constant	1.945	6.993		-1.231*	0.292		0.088	1.092		-3.893***	0.020	

	Online buying						Frequency of online buying					
	US			NL			US			NL		
	B	Odds ratio	χ^2 change	B	Odds ratio	χ^2 change	B	Odds ratio	χ^2 change	B	Odds ratio	χ^2 change
Dependent variable	1=ever bought online 0=never bought online			1=ever bought online 0=never bought online			1=frequent online buyer 0=infrequent online buyer			1=frequent online buyer 0=infrequent online buyer		
Number of cases	295			451			305			281		
df	9			9			9			6		
χ^2	104.987			111.447			69.459			32.198		
Log likelihood at convergence	-100.503			-248.047			-131.954			-140.529		
Log likelihood at constant	-153.000			-303.770			-166.683			-156.628		
ρ^2	0.343			0.183			0.208			0.103		
Adjusted ρ^2	0.291			0.157			0.160			0.070		

= p < 0.10, * = p < 0.50, ** = p < 0.01, *** = P < 0.001

The following analysis focuses on how sociodemographic, spatial, behavioural, and attitudinal variables shape the overall frequency and duration of shopping travel. Such analysis did not uncover any significant results for the US case, most likely due to the small number of cases (87) included in the analysis. For this reason, this paper focuses on the ordinary least-squares regression models for the Dutch case only. The impact of online buying on trip frequency and shopping activity duration was analysed by controlling for the effects of variables mentioned above. The neighbourhood where the respondent resides was added as an additional spatial variable in the analysis (Vogelenbuurt = 1, De Meern and Lunetten = 0). The frequency of shopping trips and the duration of store visits were investigated for non-daily shopping and daily shopping separately (Table 4.4) to test the hypothesis that online buying will relate differently to non-daily shopping travel compared with daily shopping travel. Non-daily shopping includes, for example, shopping for clothes, books, CDs or gifts, while daily shopping includes shopping for groceries and other sundries. On average, respondents report making three non-daily shopping trips per month and three daily shopping trips per week. The average shopping duration per trip for non-daily shopping is nearly 2 hours, while for daily shopping it is slightly more than 30 min. Table 4.4 shows standardized regression (β) coefficients that enable a comparison of the strength of the effects of variables.

Analysis shows that the frequency of non-daily shopping trips increases if people buy frequently online (Table 4.4, significant $\beta = 0.609$). It seems that frequent online buyers like shopping in general, whether it is in-store or online. This finding renders it unlikely that e-shopping will substitute for in-store shopping trips on a large scale. A rather counterintuitive result is that experienced Internet users make fewer shopping trips after controlling for the effect of the frequency of online buying. It is difficult to speculate on the reasons why this is the case. Perhaps two types of Internet users exist: those who shop frequently online and also frequently make shopping trips, and those who do not make shopping trips frequently. Overall, it seems that e-shopping is related to generation or complementarity rather than to substitution. The results further show that households with relatively more time (e.g. students, pensioned) make more non-daily shopping trips than other households, while people who have more travel time to shops make fewer trips. The frequency of non-daily shopping trips increases if respondents live in Vogelenbuurt (which is very near the city centre, thus rendering it easy to visit stores), and if respondents find it important to see products in person.

Besides complementarity effects, evidence was also found for modifications of shopping behaviour. The average non-daily shopping duration decreases if people buy frequently online. It seems plausible that since frequent online buyers visit stores more often, they would need less time to spend inside the stores, thus leading to a relatively short store visit duration. The results further indicate that females have a longer non-daily shopping duration compared with males, while individuals with low incomes have a shorter shopping duration than individuals with higher incomes. The non-daily shopping duration increases for people who have a long travel time to shops and for people who like in-store shopping.

For daily shopping, the same effect is found as for non-daily shopping: the frequency of shopping trips increases if people buy frequently online (Table 4.4). This is contrary to expectations. Perhaps frequent online buyers are people who normally used to shop a lot before they started shopping online, and maybe they are active 'on-the-go'-type people, as

Table 4.4 OLS regression analyses results of in-store shopping in the Netherlands

	Non-daily in-store shopping				Daily in-store shopping			
	Number of trips		Shopping duration		Number of trips		Shopping duration	
	B	Beta	B	Beta	B	Beta	B	Beta
Sociodemographic variables								
Female			13.685*	0.086	0.276#	0.082		
Low income			-17.357*	-0.087	0.798***	0.190		
High income							9.241***	0.193
2-income households no children					-0.425#	-0.078		
Other (e.g. students, pensioned)	0.386*	0.094						
Spatial variables								
Travel time non-daily shopping	-0.023*	-0.093	1.886***	0.193			0.337**	0.114
Travel time daily shopping							1.268***	0.195
Vogelenbuurt	0.522**	0.120			0.407**	0.111		
Behavioural variables								
Internet experience in years	-0.089**	0.115					-1.098**	-0.117
Infrequent online buyer			-12.488#	-0.080				
Frequent online buyer	0.609*	0.105	-21.951*	-0.095	0.571**	0.117		
Attitudinal variables								
Like to shop in-store			22.686**	0.145	0.336*	0.102		
Important to see products in person	0.292#	0.075					5.558**	0.117
Constant	2.601***		77.985***		2.808***		21.233***	
Dependent variable	Average number of trips per month		Average shopping duration in minutes per trip		Average number of trips per week		Average shopping duration in minutes per trip	
Number of cases	542		540		503		636	
df	6		6		6		5	
R^2	0.082		0.098		0.089		0.118	
Adjusted R^2	0.072		0.088		0.079		0.111	

Casas et al. (2001) suggest. Additional analysis showed that people who buy frequently in-store are more likely to buy frequently online. The direction of causality between e-shopping and in-store shopping is difficult to determine since no data are available about in-store shopping habits before e-shopping. Additionally, the analysis shows that the frequency of daily shopping trips increases for females, for individuals with low incomes (who possibly work fewer hours and have more time to shop), for individuals living in Vogelenbuurt (who often shop by walking or cycling, thereby making it difficult to carry many goods) and for individuals who like in-store shopping. The frequency of daily shopping trips decreases for those in dual-income households without children who are often time-pressured.

Online buying does not affect the duration of daily store visits, which is as expected. The daily shopping duration decreases for individuals with a long Internet experience, and it increases for individuals with high incomes, with a long travel time to shops and who find it important to see products in person.

4.6 Conclusions and discussion

Existing studies uncovering the relationships between ICT and travel are burgeoning. Most work has focused on the work commute; considerably less work has focused on non-work travel, and even less on e-shopping behaviour and its impact on in-store shopping. With rapidly rising rates of e-shopping there is a pressing need to understand better the factors that affect such travel and its public policy implications. This analysis fills part of this gap by investigating the determinants of online buying and its relationship with in-store shopping. Two surveys on e-shopping were administered in the USA and in the Netherlands for this purpose.

The findings indicate that online buying can be explained by sociodemographic, spatial, behavioural and attitudinal variables. In general, the variables that affect online buying do not differ much between the US and Dutch samples. In both samples, respondents with high incomes who frequently use the Internet are more likely to buy online. US respondents who find it important to see products in person are less likely to buy online; while Dutch respondents who live far from shops are less likely to buy online. The latter finding indicates that e-shopping could be connected with an urban lifestyle characterized by early adoption of innovations such as e-shopping.

As far as frequency is concerned, findings from this research generally support Mokhtarian's (2004) claim that online buying complements in-store shopping. The Dutch in-store shopping analysis shows that whilst controlling for the effect of, for example, the proximity of shop concentrations, the frequency of shopping trips increases if individuals frequently buy online. Although there might be individual instances of substitution, these findings render it unlikely that e-shopping will substitute in-store shopping trips on a large scale. However, a modification of in-store shopping could occur. The results indicate that if people frequently buy online, the average shopping activity duration decreases.

However, based on our surveys, the direction of causality between online buying and in-store shopping is difficult to determine. Future research should try to unravel the complicated relations between the online searching for information, online buying and in-store shopping, preferably in a longitudinal study. Also, other research questions ask for

answers. Shopping via the Internet, for example, could increase knowledge of the formerly unknown shopping opportunities, which could diminish the chaining of shopping activities and lead to a spread of visited shops (Dijst, 2004). As a consequence, shops outside shopping centres will improve their competivity, which could stimulate further congestion, auto-reliant travel and centrifugal forces of land uses in both Europe and North America. However, it is also feasible that specialist outlets in town centres might improve their viability by also selling to Internet customers. In this way they improve their position in relation to 'one-stop for all goods' non-specialist out-of-town hypermarkets. Researchers, modellers and policy officials are likely to demand a more detailed understanding of these impacts of e-shopping on travel and the use of space.

Acknowledgements

The authors thank Professor P.L. Mokhtarian and Dr T. Schwanen for insightful comments on the paper and useful suggestions on the analysis of the data. The authors also appreciated greatly the stimulating and constructive comments of the reviewers. Yi Li assisted with data analysis portions for the US sample; the US survey was administered by the State and Local Policy Program (University of Minnesota) in cooperation with Frank Douma, Kim Wells and Tom Horan. Students of Human Geography, Utrecht University, are acknowledged for their efforts in the Dutch data collection. Finally, the authors are thankful for the support provided by the STELLA programme, without which such collaboration would not have been initiated.

References

BCG (Boston Consulting Group), 2002, "The state of retailing online 5.0" BCG, Boston, MA http://www.bcg.com

Cairns S, Sloman L, Newson C, Anable J, Kirkbride A, Goodwin P, 2004 *Smarter Choices: Changing the Way we Travel* (Department for Transport, London)

Casas J, Zmud J, Bricka S, 2001, "Impact of shopping via Internet on travel for shopping purposes", paper presented at the 80th Annual Meeting of the Transportation Research Board, Washington D.C.

Dholakia N, Xiao J J, Dholakia R R, Mundorf N, 2000, "The impact of retail e-commerce on transportation: a conceptual framework" Research Institute for Telecommunications and Information Marketing, http://ritim.cba.uri.edu/wp2001/wpdone4/Transport-Retail-E-Commerce.pdf

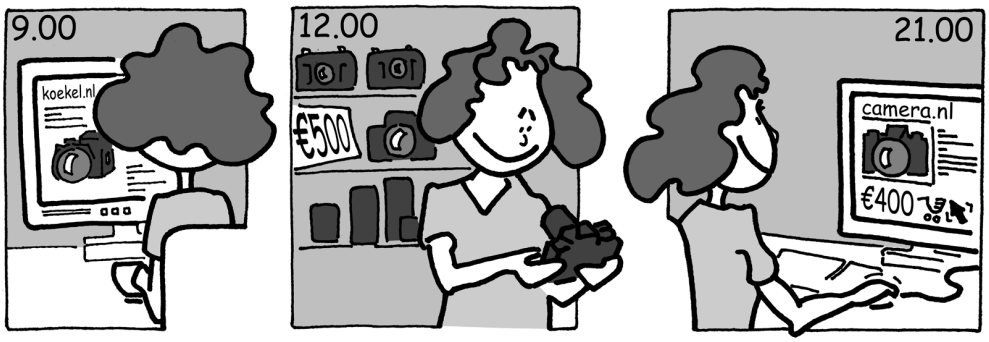
Dijst M, 2004, "ICTs and accessibility: an action space perspective on the impact of new information and communication technologies", in *Transport Developments and Innovations in an Evolving World* Eds. M Beuthe,V Himanen, A Reggiani, L Zamparini (Springer, Berlin) pp 27-46

Evers D, 2002, "The rise (and fall?) of national retail planning" *Tijdschrift voor Economische en Sociale Geografie* **93** 107-113

Farag S, Dijst M, Lanzendorf M, 2003, "Exploring the use of e-shopping and its impact on personal travel behaviour in the Netherlands" *Transportation Research Record* number 1858, 242-251

Farag S, Weltevreden J, Van Rietbergen T, Dijst M, Van Oort F, 2006b, "E-shopping in the Netherlands: Does Geography Matter?" *Environment and Planning B* **33** 59-74
Golob T F, 2001, "Travelbehaviour.com: activity approaches to modeling the effects of information technology on personal travel behaviour" in *Travel Behavior Research, The Leading Edge* Ed D Hensher (Elsevier/Pergamon, Oxford) pp 145-184
Handy S, Yantis T, 1997 *The Impacts of Telecommunications Technologies on Nonwork Travel Behavior* (Southwestern Region University Transportation Center, Austin, TX)
Keyzers E C M, Wagenaar P J M, 1989, *Teleshopping: Time and Space Effects* (in Dutch), Report 19, (Research Institute for Urban Planning and Architecture, Delft)
Krizek K J, Li Y, Handy S L, 2004a, "ICT as a substitute for non-work travel: a direct examination", working paper, Active Communities Transportation (ACT) Research Group, University of Minnesota-Humphrey Institute of Public Affairs
Krizek K J, Li Y, Handy S L, 2004b, "Spatial attributes and patterns of use in household-related ICT activity", working paper, Active Communities Transportation (ACT) Research Group, University of Minnesota-Humphrey Institute of Public Affairs
Liao Z, Cheung M T, 2001, "Internet-based e-shopping and consumer attitudes: an empirical study" *Information and Management* **38** 299-306
Luley T, Bitzer W, Lenz B, 2002, "Travel substitution by electronic commerce? A simulation model for the Stuttgart region" (in German) *Zeitschrift für Verkehrswissenschaft* **73** 133-155
Mokhtarian P L, Salomon I, 2002, "Emerging travel patterns: do telecommunications make a difference?", in *In Perpetual Motion: Travel Behaviour Research Opportunities and Application Challenges* Ed H S Mahmassani (Pergamon Press/Elsevier, Oxford, UK) pp 143-182
Mokhtarian P L, 2004, "A conceptual analysis of the transportation impacts of B2C e-commerce" *Transportation* **31** 257-284
Morganosky M A, Cude B J, 2000, "Consumer response to online grocery shopping" *International Journal of Retail and Distribution Management* **28** 17-26
Pew Internet and American Life Project, 2004, "America's online pursuits: the changing picture of who is online and what they do", http://www.pewinternet.org/reports/ toc. asp?Report=106
Raijas A, 2002, "The consumer benefits and problems in the electronic grocery store" *Journal of Retailing and Consumer Services* **9** 107-113
Salomon I, 1985, "Telecommunications and travel. Substitution or modified mobility?" *Journal of Transport Economics and Policy* **19** 219-235
Salomon I, 1986, "Telecommunications and travel relationships: a review" *Transportation Research A* **20** 223-238
Schwanen T, Dijst M, Dieleman F M, 2002, "A micro level analysis of residential context and travel time" *Environment and Planning A* **34** 1487-1507
Shim S, Eastlick M A, Lotz S L, Warrington P, 2001, "An online prepurchase intentions model: The role of intention to search" *Journal of Retailing* **77** 397-416
Sim L L, Koi S M, 2002, "Singapore's Internet shoppers and their impact on traditional shopping Patterns" *Journal of Retailing and Consumer Services* **9** 115-124
Statistics Netherlands, 2003, *The Digital Economy 2003* (in Dutch) CBS,Voorburg
Swinyard W R, Smith S M, 2003, "Why people (don't) shop online: A lifestyle study of the Internet consumer" *Psychology & Marketing* **20** 567-597

Thuiswinkel.org, 2004, "Home shopping in the Netherlands", http://www.thuiswinkel.org
Underhill P, 1999 *Why We Buy: The Science of Shopping* (Simon & Schuster, New York)
Verhoef P C, Langerak F, 2001, "Possible determinants of consumers' adoption of electronic grocery shopping in the Netherlands" *Journal of Retailing and Consumer Services* **8** 275-285
Viswanathan K, Goulias K G, 2001, "Travel behavior implications of information and communications technologies in Puget Sound Region" *Transportation Research Record* number 1752 157-165
Vrechopoulos A P, Siomkos G J, Doukidis G I, 2001, "Internet shopping adoption by Greek consumers" *European Journal of Innovation Management* **3** 142- 152


9.00
koekel.nl
12.00
€500
21.00
camera.nl
€400

5 Shopping online and/or in-store? A structural equation model of the relationships between e-shopping and in-store shopping

Sendy Farag, Tim Schwanen, Martin Dijst, Jan Faber
Forthcoming in *Transportation Research A*

Abstract
Searching product information and buying goods online are becoming increasingly popular activities, which would seem likely to affect shopping trips. However, little empirical evidence about the relationships between e-shopping and in-store shopping is available. The aim of this study is to describe how the frequencies of online searching, online buying, and non-daily shopping trips relate to each other, and how they are influenced by such factors as attitudes, behaviour, and land use features. Questionnaire data were collected from 826 respondents residing in four municipalities (one urban, three suburban) in the centre of the Netherlands. Structural equation modelling was used to examine the variables' multiple and complex relationships. The results show that searching online positively affects the frequency of shopping trips, which in its turn positively influences buying online. An indirect positive effect of time-pressure on online buying was found and an indirect negative effect of online searching on shopping duration. These findings suggest that, for some people, e-shopping could be task-oriented (a time-saving strategy), and leisure-oriented for others. Urban residents shop online more often than suburban residents, because they tend to have a faster Internet connection. The more shopping opportunities one can reach within ten minutes by bicycle, the less often one searches online.

5.1 Introduction

The Internet has rapidly become an indispensable tool in Western society. Nowadays, many people use the Internet daily for work or private purposes. Searching for product information or buying goods online have also become popular activities (TNS Interactive, 2002). The Internet provides quick and easy comparison of many different types of products. Conceptually, several relationships between e-shopping and in-store shopping can be distinguished (Mokhtarian, 2004). On the one hand, e-shopping could substitute for shopping trips, while on the other it could also generate trips that otherwise might not have been made. Modification happens when e-shopping alters certain shopping trip

characteristics such as mode or timing, while neutrality is said to occur when e-shopping has no effect on trip making.

A hybrid form between e-shopping and in-store shopping is evolving. Empirical research shows that, nowadays, many individuals tend to start their shopping process with an information search on the Internet before they go to the store (Ward and Morganosky, 2002). Another mixture involving e-shopping and in-store shopping is to search for a product online, check it out in-store, and finally buy it online. Thus, e-shopping could lift 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).

Little empirical evidence about the relationships between e-shopping and in-store shopping is available, however. The few empirical studies that hitherto have been carried out either do not distinguish between online shopping and other types of home shopping (buying via catalogue, telephone, or television, for example), or do not separate online buying from online searching (Ferrell, 2004; Casas et al., 2001, for example). The studies are also relatively limited by a failure to take relevant factors such as Internet behaviour or shopping attitudes into account, and because multivariate analysis techniques are not always applied. Moreover, no empirical research has yet investigated the effects of online searching on shopping trips. This gap is remarkable, since information gathering and evaluation are usually important parts of the shopping process (Mokhtarian, 2004).

The aim of this study is twofold: first, to describe how the frequencies of online searching, online buying, and non-daily shopping trips relate to each other; and second, to explain how these frequencies are influenced by shopping attitudes and behaviour, Internet behaviour, sociodemographics, land use features, and lifestyle/personality characteristics. To the best of our knowledge, this approach has not previously been followed so explicitly. We have concentrated on non-daily (e.g., books, clothing) shopping trips, because most products searched for or bought online are non-daily products, such as books, clothes, and electronic devices (TNS Interactive, 2002).

Because few data are available about the relationship between e-shopping and in-store shopping, we have collected data ourselves, using a shopping survey in four municipalities (one urban, three suburban) in the centre of the Netherlands, with different levels of shop availability as reflected in the quantity and quality of shops available. Our research population was confined to Internet users (persons who use the Internet for work or private reasons), since Internet access is a prerequisite for e-shopping. Structural equation modelling was employed to deal with the complexity of the relationships between e-shopping and in-store shopping. This method of analysis is capable of explaining several dependent variables simultaneously and enables the relationships between variables to be decomposed into total, direct, and indirect effects (Jöreskog and Sörbom, 2001).

The following section consists of a literature review together with our hypotheses concerning the relationships among e-shopping, in-store shopping, and other variables. The research design and methodology are explained in section 3. Section 4 contains the results of our analysis. Finally, a summary of the main findings and a discussion of their implications are given in section 5.

5.2 Theoretical framework

As stated above, e-shopping could replace, generate, or modify shopping trips (Mokhtarian, 2004). Substitution takes place when e-shopping replaces a shopping trip; generation occurs when e-shopping results in a shopping trip that otherwise would not have been made; and modification occurs when e-shopping changes the mode, timing, or other characteristics of a shopping trip. These relationships could occur simultaneously, making it difficult to classify them simply in terms of generation or substitution (Mokhtarian, 2004).

The findings reported by empirical studies of the relationships between e-shopping and in-store shopping are mixed. Ferrell (2004, 2005) has analysed activity diaries using multivariate analysis techniques to investigate the relationship between teleshopping (shopping by Internet, catalogue, or television) and shopping travel. On the personal level, results indicate that teleshoppers make fewer shopping trips and travel shorter distances for shopping (Ferrell, 2005). Using travel diaries, Casas and colleagues (2001) show that e-shoppers tend to make more shopping trips than non-e-shoppers. Casas and colleagues defined e-shopping as searching or buying online. However, no multivariate analysis techniques were used in this study. By analysing questionnaire data with OLS regression, Farag and colleagues (2006a) found that online buyers tend to make more shopping trips and have shorter shopping activity durations than non-online buyers. At that time the authors did not, however, take online searching into account, confining their interests to online buying.

Authors from other disciplines, including economics and marketing, have also paid attention to the relationships between e-shopping and in-store shopping. They have investigated the information and purchase decisions of consumers across different shopping channels, also termed 'multi-channel shopping' (Ward and Morganosky, 2002; BCG, 2001, for example). Information search in one channel could lead to purchases in another (online search leading to store purchase, for example). This behaviour is referred to as complementarity. Results of an online questionnaire of nearly 12,000 European Internet users show that most (88 percent) Internet users browse the Internet for product information (BCG, 2001). Three-quarters of the browsers who made a decision online purchased the product offline (BCG, 2001). Similarly, using regression analysis, Ward and Morganosky (2002) found that online searching tends to increase purchases made via in-store shopping. However, off-line product information gathering tends not to be related to online purchasing (Farag et al., 2006a). With regard to the relationship between online searching and buying, research results show that searching online positively affects buying online (Bellman et al., 1999).

We expected the frequencies of e-shopping and in-store shopping to be related to the following factors:

- Shopping attitudes: attitudes towards e-shopping and in-store shopping;
- Shopping behaviour: home shopping experience, shopping trip chaining, shopping duration;
- Internet behaviour: Internet experience in years, frequency of Internet use, Internet connection type;
- Lifestyle/personality indicators: active lifestyle, adventure-seeking, subjective time-pressure;

- Land use features: shop accessibility, urbanization level;
- Sociodemographic characteristics: gender, age, education, income, and so forth.

How these sets of variables are observed to relate empirically to shopping is discussed briefly below.

Shopping attitudes: There are several motives for people to shop: acquiring goods, socializing, learning about new trends, for example (Ng, 2003). Shoppers can be task-oriented (minimizing the time spent on shopping) or leisure-oriented (deriving pleasure from the act of shopping itself) (Ng, 2003). Swinyard and Smith (2003) found that e-shoppers perceive online shopping to be more entertaining and straightforward than do non-e-shoppers. People who like to see and handle products before buying them make fewer online purchases, while people who like to save time spent on shopping buy online more frequently (Li et al., 1999). People who associate e-shopping with the risk of time loss because they find in-store shopping easier and faster are less likely to buy online, as are people who associate e-shopping with financial risk because of credit card misuse (Forsythe and Shi, 2003). Individuals who like to shop in-store tend to make more shopping trips (Farag et al., 2006a). The relationship between attitudes and behaviour is not straightforward, since attitudes could affect behaviour, but behaviour could also affect attitudes (Golob, 2001, for example).

Shopping behaviour: Prior home-shopping experience (shopping via catalogue, telephone, or television, for example) has a positive effect on online buying (Bellman et al., 1999; Swinyard and Smith, 2003; Forsythe and Shi, 2003). Ferrell (2004) found that teleshoppers chain their shopping trips more often than non-teleshoppers do, although no such effect was found in his second study (Ferrell, 2005). He remarks that both teleshopping and trip chaining could be used as 'travel-efficiency tools'. Concerning shopping duration, a study of Gould and Golob (1997) shows that females and persons on a higher income, and persons with a driving licence tend to have a longer shopping duration per activity episode, while persons from bigger households and from households with older children tend to have a shorter shopping duration. 'General' and 'major' shopping were combined as a single shopping activity in this study. The shopping duration per activity episode of males, females, and their joint shopping duration for daily shopping has been studied by Srinivasan and Bhat (2004). They conclude that several person-level (e.g., age, employment status) as well as household-level characteristics (e.g., number of vehicles) affect the duration of shopping. A study about the impact of land use features on shopping duration per activity episode shows that shopping duration during workdays tends to be longer in more urbanized environments, but that the magnitude of this effect varies with the time of day and gender (Schwanen, 2004). In this study, no distinction has been made between daily and non-daily shopping. Observed shopping durations vary from 48 minutes per shopping activity episode on all days of the week (Gould and Golob, 1997) and 33 minutes per activity episode on a workday (Schwanen, 2004), to 78 minutes for females and 65 minutes for men per activity episode on a weekend day (Srinivasan and Bhat, 2004).

Internet behaviour: Both Internet experience and a fast Internet connection have a positive effect on online buying (Swinyard and Smith, 2003; Farag et al., 2006a).

Lifestyle/personality indicators: Casas and colleagues (2001) suggest that the positive relationship that they found between online buying and the frequency of shopping trips may be the result of an active 'get-up-and-go' lifestyle. Similarly, an adventurous inclination could

positively affect in-store shopping. Schwanen and Mokhtarian (2005) show that people with an adventurous inclination tend to travel more miles per week in general and by private vehicle. Other studies have used sociodemographic variables (the number of small children in a household, for example) as proxies for time-pressure. 'Time-starved' working female heads of households tend to teleshop more, but they also make more shopping trips and chain their shopping trips more often (Ferrell, 2005). Perhaps for them teleshopping is more functional than recreational (Ferrell, 2005). Bellman and colleagues (1999) found a positive relationship between total household working hours and online buying: the more hours people work, the greater is their inclination to buy online. These authors conclude that time-pressure positively influences the decision to shop online.

Land use features: Very few studies have addressed the impact of land use and accessibility characteristics on e-shopping. A study conducted by Krizek and colleagues (2004) did not find any effect of shop accessibility on online buying. However, Farag and colleagues (2006b) find that people living in urbanized areas in the Netherlands are more likely to search and buy online than are people in less urbanized areas. This result is consistent with the innovation diffusion hypothesis that states that the spatial distribution process of new innovations follows a pattern from large to small settlements (Hägerstrand, 1967). Nevertheless, good shop accessibility has also been shown to have a negative impact on the frequency of online buying (Farag et al., 2006b). Perhaps e-shopping loses part of its attraction if visiting stores does not take very much effort and products can be experienced directly with one's senses relatively easy.

With respect to in-store shopping, more trips can be expected to occur in areas with many activity places (such as shops, schools, restaurants) than in areas with few activity places. This higher trip frequency occurs because a person living in an area with a high level of shop accessibility can travel to stores more frequently than someone living in an area with inferior accessibility to stores. Empirical support for a positive relationship between shop accessibility and trip frequency is available in Meurs and Haaijer (2001), Srinivasan and Bhat (2004), and Van and Senior (2000). Ferrell (2005) has also shown that people living near retail opportunities make more shopping trips and chain their shopping trips more often. He also found that people whose homes have high retail accessibility tend to spend more time shopping both inside and outside the home. This finding could mean that what individuals see in-store induces them to shop online, or vice versa.

Sociodemographic characteristics: Empirical studies have indicated that men, the more highly educated, and people in the higher-income groups are more likely to buy online than are women, the less-well-educated, and lower-income groups (Li et al., 1999; Forsythe and Shi, 2003; Swinyard and Smith, 2003). Few empirical studies have investigated the frequency of non-daily shopping trips. Studies concentrating on overall shopping trip generation report that females, people on high incomes, older people, and households with children tend to engage in shopping more often than do males; people on low incomes, younger people, and households without children (Yun and O'Kelly, 1997; Srinivasan and Bhat, 2004, 2005). Households with one or more cars tend to make fewer grocery-shopping trips than households without a car, possibly because they can transport more groceries at a time (Van and Senior, 2000; Srinivasan and Bhat, 2005).

We now present various hypotheses about the relationships among online searching, online buying, and shopping trips. On the basis of previous empirical research, we expected

searching online to affect buying online positively, and online buying to be positively related to in-store shopping. Products can be compared speedily via the Internet. We therefore expected people looking for certain specific products to save time by searching online, because fewer in-store comparisons of the product would be needed. Hence, online searching could replace shopping trips primarily undertaken for task-oriented motives. This replacement does not apply to leisure-oriented shopping trips or impulse in-store purchases. Thus, we expect that task-oriented online searches are more likely to affect shopping trips than leisure-oriented searches. It is important to note that online searching in itself could be leisure-oriented (and even leading to impulse online purchases) as well as task-oriented. Nevertheless, for task-oriented shoppers, gathering and evaluating information at home via the Internet could lead to more efficient store visits. Time-pressured people in particular could shop more often online for this reason. With respect to the effect of land use features on e-shopping, we assume that urban residents shop more often online than suburban residents as a result of the diffusion of innovations described earlier. In line with the empirical findings, we expected a negative relationship between shop accessibility and e-shopping, but a positive relationship between shop accessibility and shopping trips.

5.3 Research design and methodology

Data employed

A shopping questionnaire and a two-day travel diary were designed to examine the relationships between e-shopping and in-store shopping. We asked respondents to complete a travel diary on a Friday and Saturday, since most in-store shopping takes place on these days (Ministry of Transport, Public Works, and Water Management, 2004). The shopping questionnaire consisted of questions about daily and non-daily in-store shopping habits, Internet use, e-shopping habits, attitudes towards e-shopping and in-store shopping, and sociodemographic data. In this paper we only draw on the information obtained from the shopping questionnaire. The data were collected in November and December 2003. Non-Internet users were excluded from the study, because the aim was to investigate how e-shopping (which requires Internet use) relates to in-store shopping. Two-thirds of Dutch households have an Internet connection at home (Statistics Netherlands, 2005a). However, one does not necessarily need to have an Internet connection at home in order to use the Internet. Therefore, Internet users were defined as persons who use the Internet for their work or for private purposes, regardless of the location where they do so.

The research area consists of four municipalities located in the centre of the Netherlands; they were selected on the basis of their urbanization and shop-availability levels (Figure 5.1). Shop availability in a municipality was measured as the total amount of floor space for non-daily goods, expressed in square metres (Locatus, 2003). We selected Utrecht (population 270 243), since it is the core settlement in a strongly urbanized area and its inhabitants have a high level of shop availability (333 880m^2 total floor space, 1417m^2 floor space per 1000 inhabitants). Three suburban municipalities in the immediate surroundings of Utrecht differing in shop availability and distance to Utrecht were also selected. Nieuwegein (population 61 806) has a relatively low level of shop availability (48 408m^2 total floor space, 779m^2 floor space per 1000 inhabitants), but is near to Utrecht (7 kilometres). Culemborg

(population 26 613) has a high level of shop availability (61 965m² total floor space, 2365m² floor space per 1000 inhabitants), but is relatively far from Utrecht (17 kilometres). Finally, Lopik (population 13 869) has a low level of shop availability (3667m² total floor space, 481m² floor space per 1000 inhabitants) and is relatively far from Utrecht (18 kilometres). It should be remembered that the Netherlands has a rather traditional retail structure, with almost no large-scale hypermarkets or shopping malls. Uncontrolled retail growth at the fringes of urban areas was barred by a restrictive national retail planning policy for decades, although this policy has recently been abandoned (Evers, 2002). Nonetheless, approximately half of all shops in the Netherlands are located in the central areas (CBDs) of towns and cities (Locatus, 2003). Of all shopping trips in the Netherlands, nearly half (48 percent) are made on foot or by bicycle; these forms of travel account for 15 percent of all kilometres travelled for the purpose of visiting shops (Ministry of Transport, Public Works, and Water Management, 2004).

The data collection took place in two stages. For the first stage, 8000 households were drawn randomly using the municipalities' population administration (4000 in Utrecht and 4000 in the suburban municipalities); the households were sent a selection questionnaire asking whether they would like to participate in the main questionnaire, and if so, how: online or with paper-and-pencil. Nearly a quarter (24 percent) of the households returned the selection questionnaire; of these, 80 percent were willing to participate in the main questionnaire (1566 respondents). Of the respondents willing to participate, 77 percent were Internet users and therefore belonged to our research population (1210 respondents). The question that was used to distinguish Internet users ran as follows: "How often do you use the Internet for work and/or private purposes?" (see Table 5.1 for the answer categories). If persons indicated that they had never used the Internet for work or private reasons, they were regarded as non-Internet users and were not sent a shopping questionnaire and travel diary. Nearly half (46 percent) of the 1210 respondents preferred to participate via the online questionnaire. In the second stage, the 1210 respondents received a shopping questionnaire and a two-day travel diary. Paper-and-pencil respondents received a written copy of the questionnaire and travel diary by mail, while online respondents received an invitation by e-mail that enabled them to log on to the websites containing the questionnaire and travel diary. In total, 826 people completed both a shopping questionnaire and a travel diary, which means that 68 percent of the individuals who had agreed to participate in the main survey actually did so. Of these respondents, 44 percent participated online.

One-third of the respondents search less frequently than once a month or never for product information online, while 37 percent do so at least once a week. The majority (58 percent) has bought a product online at some time. Only 14 percent of the respondents have neither searched nor bought online. A quarter searches online, but does not buy online. Thus, most respondents (60 percent) search as well as buy online. See Farag et al. (2005) for a descriptive analysis relating e-shopping and in-store shopping to sociodemographic, attitudinal, and land use variables.

To give an indication of the representativeness of our sample we compared it with a nationwide sample of Internet users (defined as persons who have ever used the Internet) (Statistics Netherlands, 2005b). Of the Dutch Internet users in 2003, the majority was male (54%) and mostly aged between 25 and 44 years (44%). Women form the majority (61%) in our sample. A possible explanation of this high percentage of females in our study is that

Figure 5.1 Shop accessibility (within ten minutes by bicycle) per postal code zone in the research areas

shopping appeals more to women than to men. Hence, women would be more willing to fill out a questionnaire about shopping than men. Of the respondents in our sample 54% is aged between 25 and 44 years, which is a higher percentage than in the national sample. A major difference between both samples exists regarding education. In the nationwide sample, 28% of the Internet users has completed an academic degree, while in our sample 57% of the respondents has done so. Thus, our sample is characterised by an over-representation of highly educated persons, females, and older persons. This has to be kept in mind when interpreting the empirical findings of our research.

Method of analysis

We chose SEM as our method of analysis because of the complexity of the relationships between e-shopping and in-store shopping. In SEM, a variable can be both an outcome variable and an explanatory variable at the same time. Moreover, SEM distinguishes between direct, indirect, and total effects (Jöreskog & Sörbom, 2001). A total effect consists of a direct and one or more indirect effects.

A SEM analysis consists of two parts: a measurement model and a structural model. In the measurement model, latent variables are explained by their indicators (observed variables). In the structural model, relationships between the latent variables can be modelled. The structural model captures the regression effects of exogenous (independent) variables on

endogenous (dependent) variables, and the regression effects of endogenous variables on each other.

Covariance analysis is used to estimate the coefficients in a SEM model. A model covariance matrix is fitted on a sample covariance matrix, while iteratively minimizing the differences between the predicted and observed values. There are several goodness-of-fit measures that can be used to assess the outcome of a SEM analysis. Frequently used measures include (Golob, 2003): the root mean square error of approximation (RMSEA), which is based on chi-square values and measures the discrepancy between observed and predicted values per degree of freedom (a good model has an RMSEA value of less than 0.05); the comparative fit index (CFI), which compares the proposed model with a baseline model with no restrictions (a good model should exhibit a value greater than 0.90); the consistent Akaike information criterion (CAIC), which compares the model fit with the degree of parsimony of the model (the smaller the value, the better); and goodness-of-fit measures, which compare the sample and model-implied variance-covariance matrices, such as the standardized root mean square residual (SRMR) (a value less than 0.05 is considered a good fit) and the adjusted goodness of fit index (AGFI) (the greater the value, the better). Another goodness of fit measure is the Satorra-Bentler chi-square, which takes non-normality into account by using an asymptotic covariance matrix (Jöreskog, 2001).

First, we checked our data for outliers and multicollinearity. Maximum likelihood estimation was used as the method of estimation. In addition to a covariance matrix, an asymptotic covariance matrix was calculated as input for the analysis. In this way, standard errors and chi-squares were corrected for non-normality (Jöreskog, 2001). We estimated a non-recursive structural equation model with latent variables using LISREL software version 8.54 (Jöreskog and Sörbom, 2001). A measurement model for some of the variables was developed (Internet experience, attitudes towards e-shopping and in-store shopping, and adventurousness). In the structural model, parameters were estimated of the relationships between the endogenous and exogenous variables, and among the endogenous variables. The measurement model and the structural model were estimated simultaneously.

Operationalization of variables

The frequency distribution and operationalization of the variables included in the structural equation model analysis are shown in Table 5.1. The question regarding online searching ran as follows: "How often do you **search for information** about products and/or stores via the Internet?". This means that all kinds of information search are included, ranging from the business hours or location of a store, to tracking down product features and comparing prices. The consequence of this broad operationalization is that simple and complex information searches cannot be distinguished from each other, which makes it difficult to establish the effect of both types of information search on personal travel behaviour. Our data indicate that products which are often searched for online are approximately the same type of products that are often bought online: airplane tickets or holidays (26%), entrance tickets for concerts or movies (13%), second hand items (11%), books (10%), and electronic devices such as a mobile phone, television, or stereo (8%). The given percentages pertain to the number of responses, since respondents could give multiple answers on the question for which products they have most often searched information online.

Table 5.1 Frequency distribution and definition of variables

Variables		N	%	Mean	SD
Key variables					
Frequency online searching of information about products and/or stores		815			
1. Never			11		
2. Less than once a month			21		
3. Once a month			13		
4. Several times a month			18		
5. Once a week			11		
6. Several times a week			17		
7. Once a day			4		
8. Several times a day			5		
Frequency online buying for private use in the past year (continuous)		805		2.23	3.51
Frequency of non-daily (e.g., clothes, books) shopping trips per month (continuous)		823		2.20	2.01
Shopping behaviour					
Home shopping experience=frequency buying via catalogue, telephone, television, or fax in the past year (continuous)		788		1.45	2.49
Shopping trip chaining= "I often combine my shopping trips with other activities (for example, with a visit to friends)" (1= completely disagree, 7= completely agree)		807		2.76	1.72
Shopping duration per shopping trip = average number of minutes spent in one or more stores when buying non-daily goods (excluding travel time to the store) (continuous)		783		84.6	57.6
Internet behaviour					
Frequency of Internet use for work and/or private reasons	1. Less than once a month	825	6		
	2. Once a month		3		
	3. Several times a month		5		
	4. Once a week		6		
	5. Several times a week		23		
	6. Once a day		12		
	7. Several times a day		45		
Number of years using the Internet for work and/or private reasons (continuous)		806		4.85	2.67
Internet availability at home	1. No Internet connection	807	9		
	2. Slow Internet connection (modem, ISDN)		51		
	3. Fast Internet connection (cable, ADSL)		40		

Variables		N	%	Mean	SD
Lifestyle/Personality variables					
Number of holiday or business trips in the past year (continuous)		811		1.98	1.41
Adventurous (1= completely disagree, 7= completely agree)	I like to try something new	808		4.94	1.37
	I am adventurous	807		4.40	1.51
	I am ambitious	807		4.71	1.49
	I like variety	813		5.36	1.20
Time-pressured= "I do not have enough time for myself" (1=completely disagree, 7=completely agree)		812		4.15	1.82
Land use variables					
Shop accessibility= the number of square metres floor space for non-daily goods one can reach from home by bicycle within ten minutes (divided by 100,000) (continuous)		818		0.22	0.28
Urbanization level= the number of addresses in a cell of 250 by 250 m^2 (divided by 100) (continuous)		819		2.77	1.81
Sociodemographic variables					
Gender	1 Female	826	61		
Age (continuous)		824		41.37	12.43
Education	1 Low (elementary school)	791	6		
	2 Medium		36		
	3 High (academic degree)		57		
Net household income per month	1 Low (1213 or less – 2062 US dollars)	789	31		
	2 Medium (2062 – 3761 US dollars)		41		
	3 High (3761 or more US dollars)		28		
Household composition	1 Single	823	28		
Car ownership	1 No car	812	21		
	2 1 car		55		
	3 2 or more cars		24		
Credit card ownership	1 Yes	808	62		

The shopping questionnaire was divided into separate sections dealing with daily and non-daily shopping. It was made clear to the respondents in the instructions for filling out the questionnaire that 'daily' shopping pertains to grocery shopping such as food items, explaining that these items need not necessarily be bought every day. The following examples were given to clarify what was meant with 'non-daily' shopping: clothing, books, and electronic items. The exact question wordings for the frequency of non-daily shopping trips and the duration of the non-daily shopping activity per trip were: "How often **per month** do you do **non-daily** shopping (for example, clothing, books)?" and "How much time do you spend on average **each time** in one or more stores when you buy non-daily products. Please do not count the travel time to the store(s)!". Thus, the total duration of a stay for non-daily shopping only (e.g., in a shopping mall or a downtown shopping district) was measured. In-store shopping could entail only looking at products without purchasing them, as well as buying products. It has to be kept in mind that some products are more suitable for e-shopping than other types of products (Mokhtarian, 2004). Therefore, persons who often acquire goods that are suited for e-shopping would tend to shop frequently online. Additionally, the type of product that is purchased depends on individual characteristics and preferences. When interpreting the results of this study, one has to be aware of the relationships that exist between the types of non-daily products that individuals often purchase, their personal attributes, and their travel behaviour. Since the data were collected in a season of holiday shopping (November and December), the average shopping trip frequency and shopping duration could be higher than usual. Homeshopping was defined as buying products via catalogue, telephone, television, or fax, in the past year. The majority of the sample (60%) has not shopped from home. Half of the individuals with home shopping experience ordered products once or twice, while the other half has bought products from home at least three times in the past year.

Several shop accessibility measures were developed using Flowmap version 7 (Van der Zwan et al., 2003). These measures combined the total floor space in square meters for non-daily shopping goods per four-digit postal code zone (destination) with the respondent's postal code zone (origin) and a roadmap of the Netherlands (street-network-based travel distances). Regular proximity counts were used which measure the summarized floor space for non-daily goods in square metres a respondent can reach from the place of residence either by foot or by bicycle within five or ten minutes respectively. Since nearly half of all shopping trips in the Netherlands are made on foot or by bicycle, these slow modes were focused on in defining shop accessibility (Ministry of Transport, Public Works, and Water Management, 2004).

5.4 Structural equation modelling results

Indices of overall model fit show that the model performs reasonably well (Table 3). Although the Satorra-Bentler scaled chi-square is significant at 572.046 ($df = 505$, $p = 0.021$), other indices are good. The RMSEA (Root Mean Square Error of Approximation) is 0.013, and the CFI (Comparative Fit Index) is 0.878.

Measurement model

Table 5.2 shows the standardized parameter estimates and t-values of the observed indicators that were used for constructing the latent variables. In order to obtain a scale that can be interpreted for a latent variable, we fixed one of its observed indicators on one (Hox and Bechger, 1998). Judging by the t-values, all observed indicators for the latent variables perform well. People with a positive in-store shopping attitude like to take their time when shopping (Table 5.2). Individuals who do not find it important to see and feel a product before buying it, and who find e-shopping as easy to do as visiting a store, score highly on having a positive e-shopping attitude.

Relationships among the endogenous variables

Tables 5.3 and 5.4 present the outcomes of our model in direct and total effects. In these tables standardized coefficients are given, which facilitates the comparison of the magnitude of the effects. All the coefficients presented are significant at $p < 0.01$, unless indicated otherwise. Figure 5.2 represents the relationships between the endogenous variables in the model. The rectangle boxes represent observed variables, while the ellipses represent latent variables (Hox and Bechger, 1998).

Table 5.3 shows that online searching affects the frequency of shopping trips positively. Frequent online searchers tend to make more shopping trips than infrequent online

Table 5.2 Standardized parameter estimates of the observed indicators for the latent variables (N = 622)

Latent variables	Parameter estimate	t-value
Positive in-store shopping attitude		
I like to shop	0.850[a]	
I prefer to shop as quickly as possible *	0.687	6.431
I often make unplanned purchases	0.396	4.572
Positive e-shopping attitude		
Online shopping is less fun than visiting a store *	0.656[a]	
Online shopping is more complex than visiting a store *	0.610	8.259
Online shopping is cheaper than visiting a store	0.336	4.052
The supply of products on the Internet is inferior to that in the stores *	0.331	3.689
It is convenient that you can shop online without having to leave home	0.323	3.649
It is annoying to have to wait for a product to be delivered if you buy it online *	0.461	6.899
Paying with a credit card online is to be trusted	0.441	6.143
I find it important to be able to see and feel a product before I buy it *	0.844	10.837
None of my friends shop online *	0.400	3.993
Internet experience		
Frequency of Internet use	0.913[a]	
Number of years using the Internet	0.515	6.942
Adventurous		
I like to try something new	0.698[a]	
I am adventurous	0.658	9.419
I am ambitious	0.522	6.842
I like variety	0.688	16.992

a = Item fixed on 1.00

* = Reversed items were recoded before being included in the analysis

Table 5.3 Direct effects given in standardized coefficients (significant at $p < 0.01$ unless indicated otherwise, $N = 622$)

	Dependent variables									
Explanatory variables	**Frequency online searching**	**Frequency online buying**	**Frequency in-store shopping**	**Positive e-shopping attitude**	**Positive in-store shopping attitude**	**Home shopping experience**	**Shopping trip chaining**	**Shopping duration per trip**	**Internet experience**	**Fast Internet connection**
Endogenous variables										
Key variables										
Frequency online searching			0.118*							
Frequency online buying										
Frequency in-store shopping		0.176						-0.104*		
Shopping attitudes										
Positive e-shopping attitude[a]	0.210	0.354								
Positive in-store shopping attitude[a]			0.272					0.356		
Shopping behaviour										
Home shopping experience		0.181		0.258						
Shopping trip chaining						0.109				
Shopping duration per trip										
Internet behaviour										
Internet experience[a]	0.386	0.318		0.225#						0.441
Fast Internet connection	0.099			0.153						
Exogenous variables										
Lifestyle/Personality variables										
Holiday/business trips						0.092				
Adventurous[a]	0.153#									
Time-pressured						0.118	0.141			
Land use variables										
Shop accessibility (10 min. by bike)	-0.066		0.080							
Urbanization level										0.062

Explanatory variables	Dependent variables									
	Frequency online searching	Frequency online buying	Frequency in-store shopping	Positive e-shopping attitude	Positive in-store shopping attitude	Home shopping experience	Shopping trip chaining	Shopping duration per trip	Internet experience	Fast Internet connection
Sociodemographic variables										
Female			0.217	-0.221	0.337	0.078*			-0.299	
Age			-0.105	-0.227			-0.164		-0.204	
Education						-0.215			0.318*	
Income			0.280							-0.203
Single							0.179			-0.535
Car ownership			-0.170	0.251						
Credit card ownership									0.196	

Goodness-of-fit indicators: Standardized Root Mean Square Residual (SRMR) =0.056; Root Mean Square Error of Approximation (RMSEA) = 0.013, with *p*-value for RMSEA < 0.05 = 1.000; Comparative Fit Index (CFI) =0.878; Adjusted Goodness of Fit Index (AGFI) = 0.842; Satorra-Bentler Scaled Chi-Square =572.046 ($p = 0.021$), df = 505; Independence Consistent Akaike Information Criterion (CAIC)=14340.6; Model CAIC=1814.4; Saturated CAIC=5139.3

a = latent variable

* = $p < 0.05$; # = $p < 0.10$

Table 5.4 Total effects given in standardized coefficients (significant at $p < 0.01$ unless indicated otherwise, $N = 622$)

	Dependent variables									
Explanatory variables	**Frequency online searching**	**Frequency online buying**	**Frequency in-store shopping**	**Positive e-shopping attitude**	**Positive in-store shopping attitude**	**Home shopping experience**	**Shopping trip chaining**	**Shopping duration per trip**	**Internet experience**	**Fast Internet connection**
Endogenous variables										
Key variables										
Frequency online searching		0.021*	0.118*					-0.012		
Frequency online buying										
Frequency in-store shopping		0.176						-0.104*		
Shopping attitudes										
Positive e-shopping attitude[a]	0.210	0.359	0.025*					-0.003*		
Positive in-store shopping attitude[a]		0.048	0.272					0.328		
Shopping behaviour										
Home shopping experience	0.054	0.274	0.006#	0.258				-0.001*		
Shopping trip chaining	0.006*	0.030	-	0.028*		0.109		-0.000#		
Shopping duration per trip										
Internet behaviour										
Internet experience[a]	0.491	0.432	0.058*	0.293*				-0.006		0.441
Fast Internet connection	0.131	0.057	0.015#	0.153				-0.002*		
Exogenous variables										
Lifestyle/Personality variables										
Holiday/business trips	0.005#	0.025	-	0.024*		0.092		-		
Adventurous[a]	0.153#	-	-					-		
Time-pressured	0.007#	0.036	-	0.034*		0.133	0.141	-		
Land use variables										
Shop accessibility (10 min. by bike)	-0.066	0.013	0.072					-0.008		
Urbanization level	0.008*	0.004*	-	0.010*				-0.000#		0.062

Explanatory variables	Dependent variables									
	Frequency online searching	Frequency online buying	Frequency in-store shopping	Positive e-shopping attitude	Positive in-store shopping attitude	Home shopping experience	Shopping trip chaining	Shopping duration per trip	Internet experience	Fast Internet connection
Sociodemographic variables										
Female	-0.189	-0.133	0.286	-0.288	0.337	0.078*		0.090#	-0.299	-0.132
Age	-0.149	-0.193	-0.123	-0.291		-0.018*	-0.164	0.013*	-0.204	-0.090
Education	0.145*	-	-	-		-0.215		-0.002#	0.318*	0.140*
Income	-0.027	0.038*	0.277	-0.031				-0.029*		-0.203
Single	-0.069	-0.025	-0.008#	-0.077		0.019*	0.179	0.001*		-0.535
Car ownership		-0.030#	-0.170					-		
Credit card ownership	0.149	0.175	0.018*	0.309				-0.002	0.196	0.086

a = latent variable
* = $p < 0.05$; # = $p < 0.10$; – = not significant

searchers. This finding was not expected, since we assumed that online searching would facilitate reaching a purchase decision, which would result in fewer shopping trips. Perhaps people use the Internet to help them decide which products to choose, but still shop in-store to have a look at the product before buying it either online or in-store. This result is consistent with the findings of Casas and colleagues (2001), who found that e-shoppers tend to make more shopping trips than non-e-shoppers. The result also seems to be consistent with the finding of Ward and Morganosky (2002) that online searching tends to increase in-store purchases. This conclusion remains speculative, however, since we do not have any information about the acts conducted in-store (searching or buying).

Additionally, a positive direct effect of the frequency of shopping trips on online buying was found. People who shop often in-store also buy often online. The results suggest that, probably, these people buy at least as often in-store as online rather than using in-store shopping as a means to orient themselves to products they ultimately purchase online (Farag et al., 2006a). A similar result was found by Krizek and colleagues (2004) who report that individuals who frequently shop in-store for non-grocery items tend to buy more often online. It seems that individuals who like to shop will do so in various ways, using different shopping modes. No direct effect of online searching on online buying was found, although there is an indirect effect via in-store shopping: people who often make shopping trips (such as frequent online searchers), also often buy online. Generally speaking, the results for the frequencies of e-shopping and in-store shopping suggest relationships of complementarity

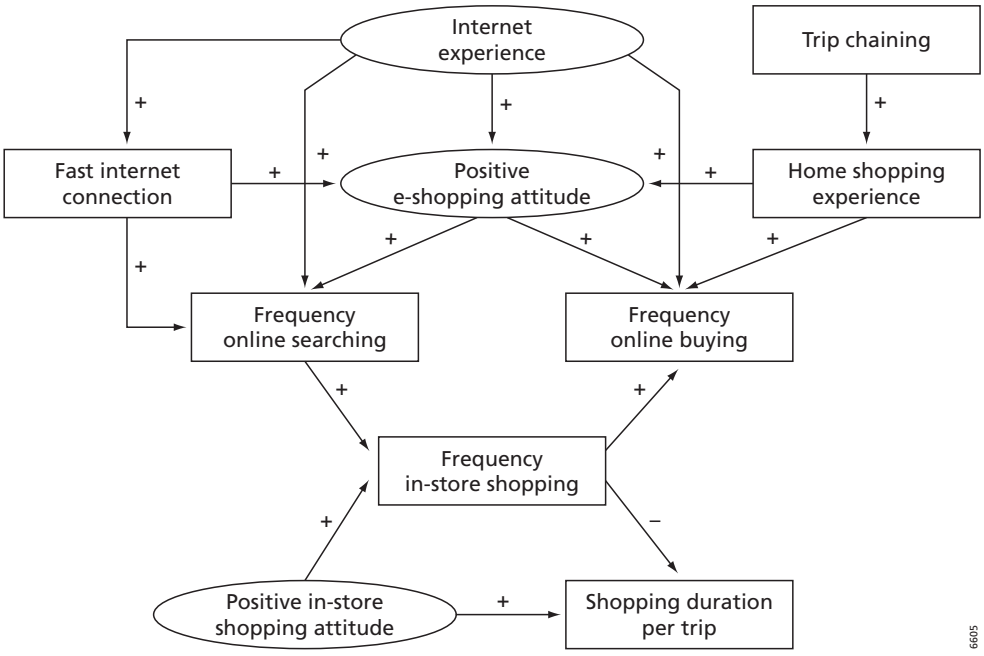


Figure 5.2 The observed relationships between endogenous variables

(that is, parts of the shopping process are conducted via different channels) or generation rather than substitution.

As expected, people with a positive e-shopping attitude search and buy online more often and those with a positive in-store shopping attitude shop in-store more often. A positive in-store shopping attitude also affects online buying positively, via the frequency of shopping trips (Figure 5.2). Similarly, a positive e-shopping attitude affects the frequency of shopping trips via online searching, although this total effect is weaker than the effect of a positive in-store shopping attitude on online buying (Table 5.4). These results indicate that individuals who like to shop use different channels to do so. During the model building process, we also specified paths leading from behaviour to attitudes, but the corresponding coefficients were considerably weaker than if attitudes affect behaviour. In the final model, we therefore chose to have attitudes influence behaviour instead of the other way round.

Frequent home shoppers (buying via catalogue, telephone, and so forth) often buy online, while a positive total effect of trip chaining has been found on e-shopping. This is because people who frequently chain their shopping trips are more likely to have home shopping experience (Figure 5.2). This effect may reflect time-saving strategies: both the chaining of shopping trips and home shopping may function as ways of making more time available for activities other than shopping. Home shopping experience also has a positive impact on e-shopping attitude, which in turn results in more e-shopping. These findings suggest that people who are experienced in 'buying at a distance' have less trouble with doing so than those who are less familiar with this concept.

Experienced Internet users search and buy online more often than do inexperienced Internet users, while people with a fast Internet connection frequently search online (Table 5.3). Additionally, a fast Internet connection has a total positive effect on online buying via a positive e-shopping attitude: because people with a fast Internet connection tend to think positively about e-shopping, they buy more frequently online (Figure 5.2). Internet experience not only affects e-shopping, but also in-store shopping via online searching: because experienced Internet users search online often, they make more shopping trips (Figure 5.2). Similarly, paths can be seen in Figure 5.2 leading from Internet connection and home shopping experience to the frequency of shopping trips, signifying that people with a fast Internet connection and experienced home shoppers make more shopping trips.

As previously reported, online searching does not lead to fewer shopping trips, indicating that in-store comparisons of products are still being made. Indirectly, however, online searching negatively affects shopping duration (Figure 5.2). Frequent online searchers tend to have a shorter shopping duration. This means that, ultimately, e-shopping leads to more efficient store visits, not by making fewer visits, but through shorter visits. Shopping duration is also adversely influenced by the frequency of shopping trips: the more shopping trips people make, the shorter their shopping duration tends to be. Note, however, that the above does not necessarily imply that the total time spent on in-store shopping during a given time period is also shorter. The shorter duration per trip may be offset by more frequent trips, so that in the end frequent online searchers may still spend an equal amount of time or even more than those who search online only infrequently or not at all. Experienced Internet users, experienced home shoppers, people with a fast Internet connection, and people with a positive e-shopping attitude also have a shorter shopping duration, because they search

online more and/or make more shopping trips (Figure 5.2). Not surprisingly, there is a direct positive influence of in-store shopping attitude on shopping duration (Table 5.3).

Relationships between the endogenous and exogenous variables

With respect to the lifestyle/personality indicators, the following results were obtained. People with an active lifestyle (measured by the number of holidays or business trips they made in the past year) have a lot of home shopping experience (Table 5.3). This leads indirectly to a positive effect on e-shopping, confirming (although indirectly) the notion of Casas and colleagues (2001) that e-shoppers tend to be 'active get-up-and-go' people. No effect of an active lifestyle on the frequency of in-store shopping trips was found. People who consider themselves adventurous search more often online (Table 5.3). Time-pressure affects online buying indirectly via home shopping experience: because time-pressured individuals often shop from home, they frequently buy online (Figure 5.2; Table 5.4). Time-pressured people also chain their shopping trips more often. It has previously been shown that trip chaining positively affects home shopping experience. Time-pressure also affects the frequency of on-line searching indirectly: because time-pressured people shop more often from home they have a more positive e-shopping attitude and hence search more often online (Figure 5.2; Table 5.4). A more objective time-pressure variable (the number of hours of paid work per week) has also been tested, but it did not have any significant effects on any of the endogenous variables and was hence excluded from the final model specification.

Land use variables also contribute to the explanation of the frequency of online and in-store shopping. Shop accessibility (the total amount of floor space in m^2 for non-daily goods within a ten-minute travel time by bicycle from home) has a negative effect on online searching: the more shopping opportunities one can reach within ten minutes by bicycle, the less often one searches online (Table 5.3). This finding might suggest that the utility of searching online increases when there are little or no shopping opportunities available in the vicinity of the home. Similar findings were obtained for the amount of floor space that can be reached within five minutes by bicycle and within ten minutes on foot. Furthermore, the more shopping opportunities a person can reach by bicycle within ten minutes, the greater the number of shopping trips made, which is consistent with the findings in the literature (Section 2). A total positive effect of shop accessibility on online buying occurs because it is positively related to the frequency of shopping trips: the greater the number of shopping opportunities that can be accessed within ten minutes by bicycle, the more often one buys online. Having shops nearby could encourage people to explore a product in-store, but ultimately buy it online, because there it may be cheaper. This finding seems to support the notion that e-shopping and in-store shopping tend to complement or generate each other.

People living in more urbanized areas are more likely to have a fast Internet connection than people living in less urbanized areas. This finding is consistent with the innovation diffusion hypothesis, which states that the spatial distribution process of new innovations follows a pattern from large to small settlements (Hägerstrand, 1967). Thus, because urban residents have a faster Internet connection, they search and buy online more often. No significant effect of urbanization level on the frequency of shopping trips was found. This finding suggests that locational differences in in-store shopping are only a function of differences in accessibility and thus the ease with which shopping opportunities can be reached.

Only total effects, but no direct effects of sociodemographic variables on e-shopping were found (Table 5.4). Females and older individuals have less Internet experience and a more negative e-shopping attitude than males and younger individuals, so that females and older people shop less often online. More highly educated people have more Internet experience than the less well educated, which explains the total positive effect of education on e-shopping. Contrary to our expectations, individuals with a higher income search less often online. This total effect is the result of people with a higher income having a relatively slow Internet connection. Perhaps price differences between fast and slow Internet connections have become so small in the Netherlands over the past years that many lower-income households can afford to have a fast Internet connection. As expected, individuals with a higher income buy more often online than individuals with a lower income, because the former make more shopping trips (Table 5.4). It seems that people with a high income like to spend their money on shopping, whether online or in-store. Singles shop online less often than other household types, because they have a fast Internet connection less often. Research from Statistics Netherlands (2005) has shown that households with children most often have a fast Internet connection at home. Finally, credit card owners have more Internet experience and a more positive e-shopping attitude than people who do not own a credit card, which explains the positive total effect of credit card ownership on e-shopping.

In contrast with e-shopping, sociodemographic variables have a direct impact on in-store shopping. The positive effect of income on the frequency of shopping trips has already been mentioned and is consistent with earlier findings (Section 2). Other results in line with earlier studies are that females, those without a car, and younger respondents make more shopping trips than males, people who own one or more cars, and older people. No significant effects of education and household type on in-store shopping could be detected.

5.5 Conclusion

The study reported in this paper has sought to provide more insights into the relationships among the frequencies of online searching, online buying, and non-daily shopping trips, while taking account of other factors known to affect shopping behaviour in a structural equation modelling analysis. The findings show that people who frequently search online make more non-daily shopping trips, and that frequent in-store shoppers are frequent online buyers. It thus appears that, in terms of shopping trip frequencies, e-shopping and in-store shopping tend to complement or generate each other. Yet, with respect to shopping duration we found that frequent online searchers tend to have a shorter shopping duration per visit (to one or more stores), because they make more shopping trips. Thus, the shorter shopping duration of online searchers is most likely due to their higher shopping trip frequency. Moreover, the results indicate that people who feel time-pressured frequently chain their shopping trips and have considerable home shopping experience (shopping via catalogue or telephone, for example). Home shopping experience positively affects online buying, so we can observe an indirect effect on it from time-pressure.

Our results thus indicate that substitution and generation may occur simultaneously (Mokhtarian, 2004), and suggest that looking beyond the traditional 'substitution or generation' issue and recognizing the more complex relationships between e-shopping

and in-store shopping is important. It seems that the decision how to shop (online, in-store, or both) depends not only on the type of product and its price, but also on people's shopping motives (task-oriented or leisure-oriented). In order to gain additional insights into the complex relationships between e-shopping and in-store shopping, data are required that distinguish the acts making up the total shopping activity from each other, such as information gathering, evaluation, selection, and purchase. We have distinguished between online searching and online buying, but not for shopping trips. Future studies should address this limitation and differentiate between the various acts which shopping comprises.

Concerning the effect of other factors, we found that Internet experience and a positive e-shopping attitude positively affect online searching and buying. These factors can be explained by certain sociodemographic attributes. As expected, men and younger people tend to have more Internet experience and a more positive attitude towards e-shopping, while more highly educated people also tend to have more Internet experience. The results also show that the urbanization level indirectly affects e-shopping positively via Internet connection type. Urban residents tend to have a faster Internet connection, so they search and buy online more often. However, all else being equal, shop accessibility has a negative effect on online searching: the more shopping opportunities one can reach within ten minutes by bicycle, the less often one searches online. This assertion might suggest that, if shopping trips can be made from home with little effort, handling a product in-store is preferred to e-shopping. However, the more shopping opportunities within reach, the more shopping trips one makes, which is positively related to online buying. It seems that having shops nearby induces people to make more shopping trips, perhaps to explore a product in-store. Some people will ultimately buy the product online, because that is cheaper. Probably, persons who like to shop in-store also like to shop online.

These findings reinforce our earlier suggestion that future studies should try to enhance our understanding of hybrid shopping activities in which different parts of the shopping cycle are conducted via diverse channels. In particular, the measurement of shopping activity duration needs further refinement. It is also important to distinguish between several types of products, since an individuals' attitude towards shopping and his or her actual shopping behaviour could differ per type of product. Consequently, this could lead to different relationships between e-shopping and in-store shopping depending on product type. Additionally, more objective measurements of behaviour are required, which rely less on the respondents' perception and recollection of their behaviour, thereby facilitating comparison across respondents. Cross-validation of the study results is required to find out whether the conclusions also hold in other space-time contexts, or whether they are specific to the data employed here. Finally, future research should try to acquire more insight into peoples' motives to shop online. Our findings seem to indicate that e-shopping could be undertaken for task-oriented (time-saving, for example) reasons, but also for leisure-oriented reasons. Depending on the motives to shop online and in which part of the shopping cycle e-shopping occurs, shopping trips might ultimately be substituted, modified, or generated.

Acknowledgements

The authors wish to thank Dr Anne Boomsma, University of Groningen, for his helpful suggestions concerning the analysis. Dr Tom de Jong's help in making the map of shop accessibility is gratefully acknowledged. The insightful comments of the reviewers have significantly improved the paper.

References

Bellman S, Lohse G L, Johnson E J, 1999, "Predictors of online buying behaviour" *Communications of the Association for Computing Machinery* **42** 32-38

BCG (Boston Consulting Group), 2001, "The multi-channel consumer: the need to integrate online and offline channels in Europe" BCG, Boston, MA http://www.bcg.com/publications/files/MultichannelConsumer_summary.pdf

Casas J, Zmud J, Bricka S, 2001, "Impact of shopping via Internet on travel for shopping purposes", paper presented at the 80th Annual Meeting of the Transportation Research Board, Washington D.C.

Couclelis H, 2004, "Pizza over the Internet: E-commerce, the fragmentation of activity and the tyranny of the region" *Entrepreneurship & Regional Development* **16** 41-54

Evers D, 2002, "The rise (and fall?) of national retail planning" *Tijdschrift voor Economische en Sociale Geografie* **93** 107 – 113

Farag S, Schwanen T, Dijst M, 2005, "Online searching and buying and their relationship with shopping trips empirically investigated" *Transportation Research Record* number 1926, 242-251

Farag S, Krizek K J, Dijst M, 2006a, "E-shopping and its relationship with in-store shopping: empirical evidence from the Netherlands and the US" *Transport Reviews* **26** 43-61

Farag S, Weltevreden J, Van Rietbergen T, Dijst M, Van Oort F, 2006b, "E-shopping in the Netherlands: Does Geography Matter?" *Environment and Planning B* **33** 59-74

Ferrell C E, 2004, "Home-based teleshoppers and shopping travel: Do teleshoppers travel less?", paper presented at the 83rd Annual Meeting of the Transportation Research Board, Washington D.C.

Ferrell C E, 2005, "Home-based teleshopping and shopping travel: Where do we find the time?", paper presented at the 84th Annual Meeting of the Transportation Research Board, Washington D.C.

Forsythe S, Shi B, 2003, "Consumer patronage and risk perceptions in Internet shopping" *Journal of Business Research* **56** 867-875

Golob T F, 2001, "Joint models of attitudes and behavior in evaluation of the San Diego I-15 congestion pricing project" *Transportation Research A* **35** 495-514

Golob T F, 2003, "Structural equation modeling for travel behaviour research" *Transportation Research B* **37** 1-25

Gould J, Golob T F, 1997, "Shopping without travel or travel without shopping? An investigation of electronic home shopping" *Transport Reviews* **17** 355-376

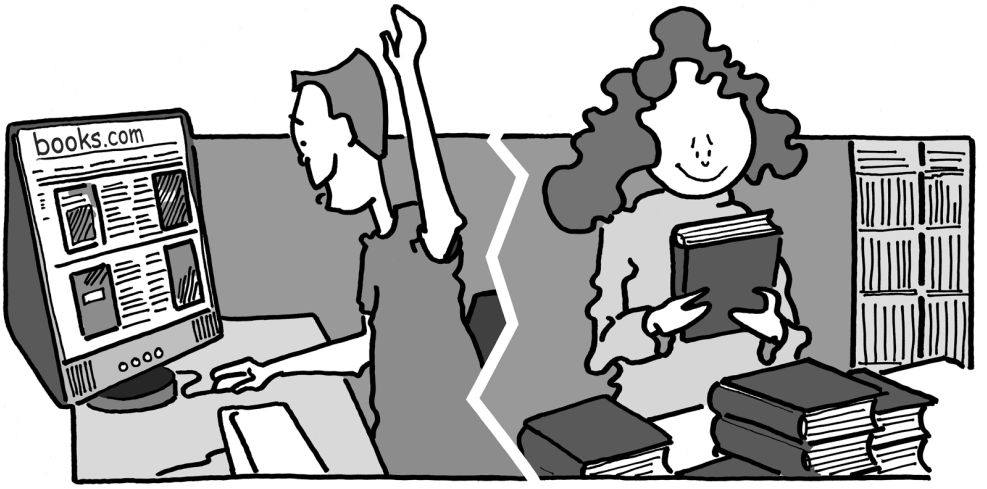
Hägerstrand T, 1967, *Innovation Diffusion as a Spatial Process* (University of Chicago Press, Chicago, IL)

Hox J J, Bechger T M, 1998, "An introduction to structural equation modeling" *Family Science Review* **11** 354-373
Jöreskog K G, 2001, "Analysis of ordinal variables 2: Cross-sectional data", http://www.ssicentral.com/lisrel/ord2.pdf
Jöreskog K G, Sörbom D, 2001, *LISREL 8: User's Reference Guide* (Scientific Software International, Lincolnwood)
Krizek K J, Li Y, Handy S L, 2004, "Spatial attributes and patterns of use in household-related ICT activity", working paper, Active Communities Transportation (ACT) Research Group, University of Minnesota-Humphrey Institute of Public Affairs
Li H, Kuo C, Russell MG, 1999, ``The impact of perceived channel utilities, shopping orientations, and demographics on the consumer's online buying behavior" *Journal of Computer Mediated Communication* **5**, http://www.ascusc.org/jcmc/vol5/issue2/hairong.html
Locatus, 2003, *Retail Guide 2003* (Locatus, Woerden) (in Dutch)
Meurs H, Haaijer R, 2001, "Spatial structure and mobility" *Transportation Research D* **6** 429-446
Ministry of Transport, Public Works, and Water Management, 2004 *Passenger Transport in the Netherlands: Key Figures 2004* (AVV Transport Research Centre, Ministry of Transport, Public Works, and Water Management, Rotterdam)
Mokhtarian P L, 2004, "A conceptual analysis of the transportation impacts of B2C e-commerce" *Transportation* **31** 257-284
Ng C F, 2003, "Satisfying shoppers' psychological needs: From public market to cyber-mall" *Journal of Environmental Psychology* **23** 439-455
Schwanen T, 2004, "The determinants of shopping duration on workdays in the Netherlands" *Journal of Transport Geography* **12** 35-48
Schwanen T, Mokhtarian P L, 2005, "What if you live in the wrong neighbourhood? The impact of residential neighbourhood dissonance on distance travelled" *Transportation Research D* **10** 127-151
Srinivasan S, Bhat C R, 2004, "Modeling the generation and allocation of shopping activities in a household", paper presented at the 83rd Annual Meeting of the Transportation Research Board, Washington D.C.
Srinivasan S, Bhat C R, 2005, "Modeling household interactions in daily in-home and out-of- home maintenance activity participation" *Transportation* **32** 523-544
Statistics Netherlands, 2005a, Broadband Internet quickly gaining popularity (in Dutch) http://www.cbs.nl/nl/publicaties/artikelen/algemeen/webmagazine/artikelen/2005/1644k.htm
Statistics Netherlands, 2005b, Internet use of the Dutch population in 2003, (Received upon request 11 November 2005 from Statistics Netherlands, Heerlen)
Swinyard W R, Smith S M, 2003, "Why people (don't) shop online: A lifestyle study of the Internet consumer" *Psychology & Marketing* **20** 567-597
TNS Interactive, 2002, "Global e-Commerce Report 2002", http://www.tnsofres.com/ger2002/
Van U P, Senior M, 2000, "The contribution of mixed land uses to sustainable travel in cities" in *Achieving Sustainable Urban Form*. Eds K Williams, E Burton, M Jenks (E & F N Spon, London/New York) pp 139-148

Ward M R, Morganosky M, 2002, "Consumer acquisition of product information and subsequent purchase channel decisions" in *Advances in applied microeconomics: The economics of the Internet and E-Commerce*. Ed M R Baye (Elsevier Science, Amsterdam) pp 231-255

Van der Zwan J, Van der Wel R, Ritsema van Eck J, De Jong T, Floor H, 2003, *Manual Flowmap, Version 7* (Faculty of Geosciences, Utrecht University, Utrecht)

Yun D S, O'Kelly M E, 1997, "Modeling the day-of-the-week shopping activity and travel patterns" *Socio-Economic Planning Sciences* **31** 307-319


books.com

6 A comparative study of attitude theory and other theoretical models for in-store and online shopping

Martin Dijst, Sendy Farag, Tim Schwanen
Paper submitted for publication

Abstract
In this study, we investigated whether our understanding of the adoption of e-shopping and in-store shopping could be advanced through the estimation of three models that explain intentions differently: (1) a Customary Model which directly links attitude and external variables (e.g., sociodemographics) to intention, (2) a simplified version of the Extended Model of Goal-directed Behaviour which links attitude to intention via behavioural desire, and (3) a Hybrid Model which integrates the two former models. Using survey data about the intention to buy media products (books, music, DVDs, for example) online and in-store collected in four locations in the Utrecht region, the Netherlands, we find that shopping behaviour is reasonably well explained by the simplified EMGB. Past behaviour, perceived behavioural control, and subjective norms all have a statistically significant impact on the intention to shop online, while goal desire and perceived behavioural control significantly affect the intention to shop in-store. The results of the Hybrid Model indicate that it is important to take external variables into account when explaining shopping behaviour. People who have media stores within twenty minutes' cycling distance from their home have a weaker intention to buy media products online, because (among other reasons) they experience social pressure not to buy online when stores are relatively near the residence. Frequent online buyers tend to perceive less control over making a shopping trip to buy media products. Thus, shop accessibility negatively affects the volition to buy online, while online buying experience negatively affects the volition to shop in-store. Substitution between e-shopping and in-store shopping seems likely to occur for media products.

6.1 Introduction

Inspired by psychological and economic disciplines, there is a long tradition in transportation studies of investigating the relationships between attitudes and behaviour. Two major strands can be distinguished. The first is stated choice modelling, which has its roots in micro-economic theory (Louviere et al, 2000, for example). The second strand comprises studies that investigate the relationships between attitudes and revealed behaviour. Most of these

revealed preference studies have investigated how attitudes affect behaviour (Koppelman & Pas, 1980; Mokhtarian & Salomon, 1997; Schwanen and Mokhtarian, 2005). There are also studies that allow for simultaneous two-way causality between attitudes and behaviour (Golob et al. 1979; Reibstein et al. 1980; Golob, 2001). In this way, cognitive dissonance reduction mechanisms, for instance, are taken into account (Festinger, 1957).

Studies about the relationships between attitudes and revealed behaviour can be criticized from an attitude theory perspective in two ways. First, preferences for choice alternatives are not stable, but are partly contingent on situations that are not taken into consideration directly in micro-economic utility functions (Fujii & Gärling, 2003). Second, previous research has indicated that the correspondence between attitudes and behaviour tends to be rather low. This implies that attitudes are often poor predictors of behaviour (Wicker, 1969; Kraus, 1995, for example). To address such shortcomings, social psychologists have developed theoretical models in which the relationships between attitudes and behaviour are studied, while other behavioural factors are taken into account (Armitage & Conner, 2001). Examples include the Theory of Planned Behaviour (Ajzen, 1991) and the Extended Model of Goal-directed Behaviour (Perugini & Conner, 2000). In these models the relationship between attitude and behaviour is mediated by intention or stated choice (Gärling et al., 1998). It should be noted that, in these studies, attitude is defined in a strict way as an evaluative response to an object which disposes a person to behave in a certain way towards it (Ajzen, 1987, for example). In many transportation studies, however, the term attitude is used more loosely.

The models advanced by social psychologists can nevertheless also be criticized. It is unclear what causes the variation in psychological constructs such as perceived behavioural control and subjective norms. There is an implicit assumption that the psychological mechanisms work in the same way for every individual across different contexts. It has, however, been recognized that external and internal constraints could affect these mechanisms in several ways: for example, by constricting the opportunity set and moulding the formation of preferences (Hägerstrand, 1970; Desbarats, 1983; Mokhtarian & Salomon, 1994). Thus, intentions are only partly explained, since a conceptualization of the constraints within which intentions and behaviour occur is largely omitted in attitude theory. This omission could be resolved by using external variables such as shop accessibility and Internet experience as proxy for these constraints.

The aim of this paper is to show the relevance of three different types of models for understanding behavioural choices in transportation. In each model the mechanism for behavioural choices is different. The first model, the Customary Model (CM), is akin to models for explaining realized behaviour in many transportation studies. In this model various sociodemographic and land use variables, skills, and personality traits are applied to explain shopping choices. A modified version of the Extended Model of Goal-directed Behaviour (EMGB) developed by Perugini and Conner (2000), is the second model we will apply. This model represents one of the main streams of attitude theory developed by social psychologists. Finally, a Hybrid Model (HM) is developed which is based on a combination of the CM and simplified EMGB. With investigating the insights that each of these models provides, we hope to advance the understanding of various mechanisms of behavioural choices in transportation. All models have been estimated using data from a Dutch study on online and in-store shopping (Farag et al., 2006a). Structural Equation Modeling has been

used as the method of analysis. By applying the three models we hope to arrive at a better understanding of the adoption of e-shopping and in-store shopping.

The role of attitudes in the adoption of online shopping is well recognized (Chang et al., 2005). Similarly, the application of attitude theory on the intention of puchasing online (Shim and colleagues, 2001; Hansen and colleagues, 2004), or in-store shopping (Bagozzi and colleagues, 1992; Shim and Eastlick, 1998) has been investigated. However, to the best of our knowledge there is as yet no integral study in which various models for explaining e-shopping and in-store shopping are considered simultaneously and compared to one another. In the next section a theoretical framework will be presented in which the three models will be discussed. Section 3 explores some methodological issues of this paper. The main results of each model are central to the fourth section. The paper concludes with a discussion and a reflection on the applied models.

6.2 Theoretical framework

In this section we will discuss the three models which are central to this paper. Since attitude theory may not be familiar to non-social psychologists and is at the root of two models in this paper, we start with a discussion of this theoretical framework.

Attitude theories

In attitude theory an attitude is defined as a subjective evaluation of a behaviour, which disposes a person to behave in a certain way towards it (see Eagly & Chaiken, 1993; Gärling et al., 1998). A crucial step in the history of attitude theory has been the development of the Theory of Reasoned Action (TRA) and its successor, the Theory of Planned Behaviour (TPB) (Armitage & Conner, 2001). Both theories are based on the idea that behaviours depend jointly on motivation (intention) and ability (behavioural control) (Ajzen, 1987; 1991). However, empirically, the TRA operationalization (Fishbein & Ajzen, 1975) states that intention intermediates between behaviour and the attitude towards the behaviour. Intention depends not only on attitudes, but also on subjective norms or the perceived social pressure exerted by important others, such as parents and good friends, to perform or not to perform a behaviour.

The TPB (Ajzen, 1991) extended the TRA by including two behavioural control variables. Perceived behavioural control stands for the confidence an individual has to undertake a particular behaviour in a particular situation. This concept is different from locus of control as applied, for example, by Mokhtarian and Salomon (1997) and Stern (1998), which is a generalized expectancy that remains stable across situations and forms of action (Ajzen, 1991). Perceived behavioural control is assumed to have a direct impact on intention and behaviour (Ajzen, 1991). Actual behaviour control, which refers to the availability of requisite opportunities and resources such as time, money, and the cooperation of others, has a direct impact on behaviour. Because this construct is often difficult to measure, perceived behavioural control is in attitude theory studies usually used as a proxy for actual behavioural control (Eagly & Chaiken, 1993). It is often assumed that perceived and actual behavioural control are correlated (Gärling et al., 1998). However, little attention has been given in

empirical research to the operationalization of external factors that could act as constraints on behaviour. We return to this issue later.

In the course of time, several researchers have sought to extend the TPB by introducing new predictors of intentions and, in turn, behaviour (Triandis, 1977; Bagozzi, 1981; Verplanken et al., 1997, for example). One extension is the incorporation of habit. A habit is a learned act that becomes an automatic response to a situation and can be functional in obtaining certain goals or end-states (Verplanken et al., 1997). In other words, through their direct impact on behaviour, habits limit the implementation of an intention in behaviour, or prevent a different intention from being considered or formed (Triandis, 1977; Bagozzi, 1981; Verplanken et al., 1997). Through habits, the appreciation of a situation in which a behaviour has to take place and the search for information about alternative choices are minimized (Verplanken et al., 1997).

Another important extension to the TPB is the addition of goals. These can vary from concrete goals, such as buying clothes, to higher level ends, such as a feeling of wellbeing acquired by wearing new clothes. Goals are considered in the Extended Model of Goal-directed Behaviour (EMGB) (Perugini & Conner, 2000), an advanced alternative to the TPB. Habits are in this model also taken into account through the concept of past behaviour. The EMBG is premised on the notion that the choice of behaviours is based on utilitarian considerations (Perugini & Conner, 2000). Behaviours are assumed to be selected because of their usefulness in achieving a goal. If the behaviour is important in itself (that is to say, if it is an end in itself and not a means to an end), considerations related to pleasantness or ease could be more important in selecting a certain behaviour than utilitarian considerations. The EMGB extends the Model of Goal-directed Behaviour (MGB) by adding goal desirability (the strength of an action's end state) and goal feasibility (the ease or difficulty of reaching the end state) (Perugini & Conner, 2000).

A crucial construct in the EMGB is behavioural desire, defined by Perugini and Conner (2000, 706) as: "...the motivational state of mind wherein appraisals and reasons to act are transformed into a motivation to do so." Behavioural desire is treated as the most proximal antecedent of intention. This concept deals with motivation, which is broader than the transportation concept of "preference" that implies comparing and selecting alternatives (e.g., car versus public transport). Anticipated emotions represent positive or negative emotions in respectively achieving or not-achieving a certain goal for which the behaviours are instrumental. Anticipated emotions are believed to affect behavioural desire, together with perceived goal feasibility, goal desire, attitude, perceived behavioural control, subjective norms, and past behaviour. In the EMGB, a wider definition of intention is used, namely volition (Perugini & Conner; 2000), which constitutes a further extension of the TPB. This concept takes the engagement in plans to reach a goal into account together with the effort needed to enact the behaviour.

Characteristics of the researched models

In this paper three models are investigated through which we hope to advance the understanding of the mechanisms underlying people's choices for shopping modes. The following models will be estimated for both e-shopping and in-store shopping:

1. The *Customary Model* (CM): Various sociodemographics, land use features, ownership of technical means (e.g., car, credit card), skills (e.g., Internet experience) and personality

traits (e.g, feeling time-pressured) are applied to explain the choice for a shopping mode. A preference for one of the shopping modes could be moulded by these variables, but might also constrain the choice of shopping mode (Hägerstrand, 1970; Desbarats, 1983; Mokhtarian & Salomon, 1994). For example, monetary and time constraints could impact shopping behaviour negatively. The same factor may be either a constraint or a facilitator, depending on the negative or positive sense of its presence (Mokhtarian & Salomon, 1994). Credit card ownership would be a facilitator for online buying, whereas not owning a credit card would be a constraint. Similarly, Internet experience could be either a constraint or a facilitator for e-shopping, while shop accessibility and car ownership could act as such for in-store shopping (Van & Senior, 2000; Forsythe & Shi, 2003; Swinyard & Smith, 2003; Farag et al. 2006a). A limitation of the CM is that there is no underlying theory to guide the inclusion of variables in the model, thus leading to ad hoc explanations of behaviour. Moreover, attitude is directly linked to intention or behaviour, without recognizing the importance of intermediate motivational processes for forming intentions.

2. The *Extended Model of Goal-directed Behaviour* (EMGB): The short overview of attitude theories brings us to a simplified version of the EMGB applied in this paper for choices in shopping modes (see Figure 6.1). The EMGB has been tested for bodyweight regulation and study effort (Perugini & Conner, 2000). Compared with these goals, purchasing a product is a comparatively easy activity, one which would evoke relatively weak emotions if a purchase were (un)successful. Hence, we have left goal feasibility and anticipated emotions out of consideration in this study. Restrictions imposed by the acceptable length of our questionnaire prevented us from measuring all the constructs. A selection was therefore made of those we considered most important with respect to shopping purposes.
3. The *Hybrid Model* (HM): Attitudinal models, such as that shown in Figure 6.1, are often seen as a complete theory of behavioural choices in the sense that no other variables influence behaviour (Eagly & Chaiken, 1993). As mentioned above, actual behavioural control has been considered theoretically, but has not often been operationalized in

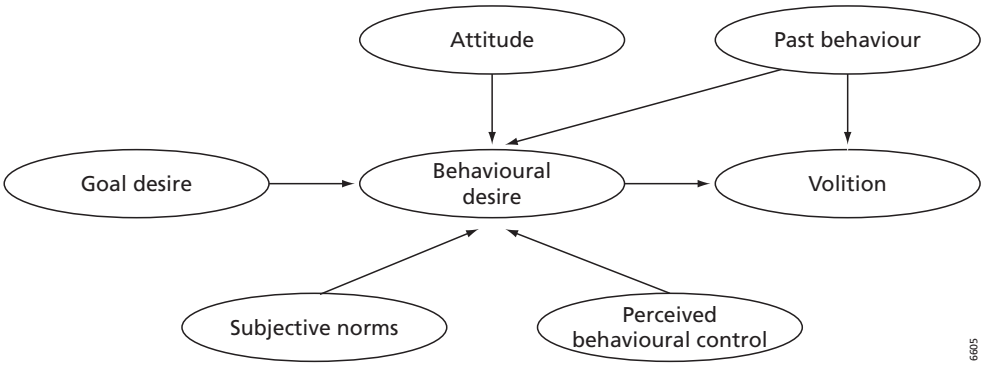


Figure 6.1 A simplified version of the Extended Model of Goal-directed Behaviour (EMGB) (Perugini & Conner, 2000)

empirical research. Thus, a conceptualization of the constraints within which intentions and behaviour occur has largely been omitted from empirical studies based on attitude theory. Constraints could, however, play an important part in an individual's choice process. These constraints are part of the CM. By integrating the EMGB and the CM, we hypothesise that external variables such as sociodemographics, land use features, ownership of technical means, skills, and personality traits have an impact on the antecedents of behavioural desire and volition such as subjective norms, perceived behavioural control, and past behaviour. Thus, the Hybrid Model can be viewed as an expansion of the simplified EMGB.

Product characteristics play an important part in the decision to buy a product online or in-store (Chang et al., 2005). Search goods (books, music, for example) are more suited to buying online than experience goods (clothing, furniture, for example). Mixing product categories in e-shopping behaviour research is likely to give inconsistent results (Cao & Mokhtarian, 2005). We therefore focuse on one type of product, namely search goods (books, CDs, videos, DVDs, computer software).

6.3 Methodology

Research design

A questionnaire, consisting of questions about daily and non-daily in-store shopping behaviour, Internet use, e-shopping behaviour, attitudes towards e-shopping and in-store shopping, and sociodemographic data, was designed. The research area consists of four municipalities (one urban, three suburban) located in the centre of the Netherlands; they were selected on the basis of their urbanization and shop-availability levels (measured as the total amount of floor space for non-daily goods, expressed in square metres (Locatus, 2003)). (For further details on the research area, see Farag et al. (2006a)).

The data collection took place in two stages. For the first stage, 8000 households were drawn randomly using the municipalities' population administration; the households were sent a selection questionnaire asking whether they would like to participate in the main questionnaire and if so, how: online or with paper-and-pencil. Nearly a quarter (24 percent) of the households returned the selection questionnaire; of these, 80 percent were willing to participate in the main questionnaire (1566 respondents). Of the respondents willing to participate, 77 percent were Internet users and therefore belonged to our research population (1210 respondents). An Internet user was defined as a person using the Internet for work or private reasons. In the second stage, the 1210 respondents received the main questionnaire. Reminders were sent by post mail and by e-mail to the participants. Respondents could win three main prizes of respectively 200, 150, and 100 Euros, and twelve minor prizes of each 25 Euros. In total, 826 people completed both a shopping questionnaire and a travel diary, which means that 68 percent of the individuals who had agreed to participate in the main survey actually did so. Of these respondents, 44 percent participated online.

The questionnaire contained a section that asked about the desire to buy a specific product within the forthcoming month. Half the sample received a questionnaire with a section on buying clothes and shoes, while the other half received a questionnaire with a section on buying media products (books, CDs, videos, DVDs, computer software). This section of

the questionnaire was divided in two: one half contained questions about buying a product online and the other half about buying it in-store. Half the 826 respondents reported having a desire to purchase either media products or clothes and shoes in the forthcoming month. Of these respondents, 245 had filled in the section about media products. The analyses in this paper are restricted to the media products, because the majority of products bought online are media products; comparison with buying these products in-store is therefore easier (TNS, 2002).

Method of analysis

Structural Equation Modeling (SEM) is a common method of analysis in applications of attitude theory (Perugini & Conner, 2000; Shim et al. 2001; Hansen et al. 2004, for example). In SEM, a variable can at the same time be both an outcome variable and an explanatory variable. Moreover, SEM distinguishes between direct, indirect, and total effects (Jöreskog & Sörbom, 2001). A total effect consists of a direct and one or more indirect effects. An SEM analysis consists of two parts: a measurement model and a structural model. In the measurement model, latent variables are measured by their indicators (observed variables). In the structural model, relationships between the latent and/or observed variables are modelled. The structural model captures the regression effects of exogenous (independent) variables on endogenous (dependent) variables, and the regression effects of endogenous variables on each other.

Covariance analysis was used to estimate the coefficients in an SEM model. A model covariance matrix was fitted on a sample covariance matrix while iteratively minimizing the differences between the model-implied and observed values. Maximum likelihood was used as the method of estimation. In addition to a covariance matrix, an asymptotic covariance matrix was calculated as input for the analysis. In this way, standard errors and chi-squares were corrected for non-normality (Jöreskog, 2001). A disadvantage of constructing an asymptotic covariance matrix is that a listwise deletion procedure is applied, which resulted in many missing cases (19 percent). Therefore, we imputed values for missing items using the technique of Expectation Maximization (EM), which substitutes values for missing data through a maximum likelihood estimation procedure (Olinsky et al., 2003). This approach performs well with small sample sizes (Olinsky et al., 2003). A recursive structural equation model with latent variables was estimated using LISREL software version 8.54 (Jöreskog & Sörbom, 2001).

There are several goodness-of-fit measures that can be used to assess the outcome of an SEM analysis. Frequently-used measures include (Golob, 2003): the root mean square error of approximation (RMSEA), which is based on chi-square values and measures the discrepancy between observed and predicted values per degree of freedom (a good model has an RMSEA value of less than 0.05); the comparative fit index (CFI), which compares the proposed model with a baseline model with no restrictions (a good model should exhibit a value greater than 0.90); and goodness-of-fit measures, which compare the sample and model-implied variance-covariance matrices, such as the standardized root mean square residual (SRMR) (a value less than 0.05 is considered a good fit) and the adjusted goodness-of-fit index (AGFI) (the greater the value, the better the fit). Another goodness of fit measure is the Satorra-Bentler chi-square, which takes non-normality into account by using an asymptotic covariance matrix (Jöreskog, 2001). Squared multiple correlations (R^2) give

insight into the proportion of explained variance of the dependent variables included in the model.

It has to be kept in mind that a direct comparison of goodness-of-fit indicators between these models is very difficult due to the varying sizes of the covariance matrices that are estimated (the sizes of these matrices differ because different numbers of variables are considered in each model). Hence, it is not possible to assess formally which model explains shopping behaviour best in statistical terms. It is, nonetheless, possible to compare the insights that each model gives in terms of the explanations offered for individuals' intentions to shop online and in-store. In other words, it becomes clear why certain variables affect shopping behaviour and via which causal mechanisms this influence occurs. Within each of the three models, it is possible to compare the goodness of fit indicators for e-shopping and in-store shopping.

Operationalization of variables

The operationalization of the variables and their frequency distribution prior to the imputation of values for missing items are shown in Table 6.1. Internet connection speed and the frequency of non-daily (e.g., clothes, books) shopping trips per month were also analyzed, but excluded from the final models since they did not have statistically significant impacts on any of the psychological constructs of the EMGB. We have used the same question wording for measuring the various psychological constructs as Perugini & Conner (2000) have applied. The difference between the external variable Internet experience and the psychological construct past behaviour needs to be noted. The former refers to the number of years one has been using the Internet and the frequency of Internet use, while the latter refers to the number of times one has bought a media product online (or in-store) during the past year. Attitudes were operationalized as affective attitudes: that is, attitudes which express an individual's (dis)liking (Moktharian & Salomon, 1994). Perugini and Conner (2000) also included cognitive attitudes ('facts' as viewed by the individual as useful or effective, for example) in the EMGB. Initially, attitudes were operationalized containing both affective and cognitive items. However, the e-shopping model performed considerably better when the cognitive attitudes were left out, while the model fit of the in-store shopping model did not change appreciably. We therefore consider only affective attitudes in the current paper. It seems that affective attitudes are more important than cognitive attitudes for e-shopping.

Several shop accessibility measures were developed using Flowmap version 7 (Van der Zwan et al., 2003). Regular proximity counts were used that measure the number of stores selling books, CDs/videos/DVDs, and computer software that a respondent could reach from the place of residence (defined in 4-digit postal code zones) either on foot or by bicycle within fifteen or twenty minutes respectively.

6.4 Results

In this section, the estimation results for the following three models are presented for both e-shopping and in-store shopping: the Customary Model (CM), the simplified Extended Model of Goal-directed Behaviour (EMGB), and the Hybrid Model (HM) (Table 6.2). In the

CM, attitude has a direct effect on volition, which is similar to the way attitudes are often incorporated in transport studies, where attitudes are assumed to affect revealed behaviour directly (see, for example, Schwanen & Mokhtarian, 2005). No significant effect from attitude on volition occurs, which is as expected, since its effect should be mediated via behavioural desire according to attitude theory (see Figure 6.1). External variables also affect the volition to shop. This is the case for both e-shopping and in-store shopping, indicating that it is important to account for constraints in models explaining shopping behaviour. In the e-shopping model, the strongest relationship is that people with a lot of Internet experience have a stronger volition to buy a media product online within the next month. Having a credit card also positively affects the volition to buy a media product online. These findings show the importance of having certain resources for online buying. Further, we see that the more media stores one can reach from home by bicycle within twenty minutes, the weaker is the volition to buy a media product online. This result seems to hint at substitution between e-shopping and in-store shopping: when stores are relatively difficult to reach, the volition to buy online becomes stronger. Similar results have been found with regard to actual online buying behaviour: online buyers of CDs tend to live in areas with low shop accessibility for music stores (Farag et al., 2006b). A negative effect of shop accessibility was also found on online searching behaviour for all types of product (Farag et al., 2006a). Another result which seems to support the notion of substitution between shopping modes is that frequent online buyers have a relatively weak volition to buy a media product in-store. It seems that the more online buying experience people have, the less inclined they are to buy media products in-store. The advantages of buying these types of product online probably outweigh the advantages of buying them in-store.

Finally, people who own one or two cars also have a relatively weak volition to buy a media product in-store. Earlier research has found that owners of one or two cars make fewer shopping trips than people who do not own a car (Van & Senior, 2000; Farag et al., 2006a). A possible explanation for the findings here may be that car owners tend to live in the suburbs and would have to make more effort to reach a shopping centre, which in the Netherlands is often located in the central areas (CBDs) of towns and cities (Locatus, 2003). They might be more comfort-oriented and attach more value to efficiency compared to persons without a car, which could lead to fewer shopping trips. The model fit is reasonably good of the models for e-shopping (AGFI=0.950, CFI=0.993) and in-store shopping (AGFI=0.969, CFI=0.895).

In our simplified version of the EMGB for e-shopping and in-store shopping attitude indirectly affects behaviour (or volition, as in our case) via desire. Overall, the EMGB performs reasonably well when applied to shopping behaviour. In both the e-shopping and in-store shopping models, behavioural desire has a statistically significant positive impact on volition, which is also the strongest effect of all the specified relationships. This finding indicates that the people who have a greater wish to buy media products in the forthcoming month are more willing to do so either online or in-store. However, contrary to our expectations, in neither of the models does attitude have a statistically significant effect on behavioural desire. It seems that other psychological constructs are more capable of explaining the volition to shop within the next month. One may have in general positive attitudes towards shopping, but planning to do so within the next month may connote a particular need that might not fit the circumstance; even for those who have positive

Table 6.1 Operationalization and frequency distribution of variables (OL=online shopping, IS=in-store shopping)

Variables	N		%	Mean		SD	
EMGB constructs	**OL**	**IS**		**OL**	**IS**	**OL**	**IS**
Goal desire							
My desire to buy media products within the forthcoming month is:							
1=very weak, 7=very strong	240	240		5.01	5.01	1.39	1.39
Attitude							
I think that to buy media products online* within the forthcoming month would be for me:							
1= unpleasant, 7=pleasant	240	239		3.76	4.44	1.81	2.08
1= unenjoyable, 7= enjoyable	240	236		3.67	4.35	1.71	2.04
1= unattractive, 7=attractive	239	237		2.98	4.11	1.93	2.21
Subjective norms							
People who are important to me think I should buy media products online within the forthcoming month							
1= strongly disagree, 7=strongly agree	243	240		2.03	3.01	1.54	1.91
Perceived behavioural control							
For me buying media products online within the forthcoming month would be:							
1= very difficult, 7= very easy	244	239		5.07	6.09	1.92	1.36
I am confident that I could buy media products online within the forthcoming month if I wanted to							
1= strongly disagree, 7=strongly agree	244	240		5.58	5.93	2.01	1.88
Behavioural desire							
My desire to buy media products online within the forthcoming month is:							
1=very weak, 7=very strong	244	239		2.86	4.93	1.84	1.62
I want to buy media products online within the forthcoming month							
1= false, 7=true	243	239		2.72	4.89	1.96	1.78
Volition							
I will invest time in order to buy media products online within the forthcoming month							
1= very unlikely, 7= very likely	241	237		2.72	4.92	1.98	1.80
I intend to buy media products online within the forthcoming month							
1= strongly disagree, 7=strongly agree	243	237		2.78	5.03	1.95	1.73
Past behaviour							
How many times did you buy media products online during last year?							
Number of times during last year (continuous)	238	238		2.05	11.38	2.96	7.94

Variables		N		%	Mean		SD	
External variables		**OL**	**IS**		**OL**	**IS**	**OL**	**IS**
Frequency of Internet use for work and/or private reasons								
	Less than once a week	26		11				
	At least once a week	63		25				
	At least once a day	157		64				
Number of years using Internet for work/private reasons (continuous)		242			5.33		2.71	
Frequency online buying for private use in the past year (continuous)		241			2.78		3.95	
Time-pressured ("I do not have enough time for myself")								
1=completely disagree, 7= completely agree		245			4.37		1.76	
Shop accessibility (number of media stores one can reach from home)								
	On foot within 15 minutes	242			3.76		9.94	
	By bicycle within 20 minutes	242			27.01		24.30	
Gender	% Female	246		61				
Age (continuous)		246			39.67		11.75	
Income (net household income per month)								
	Low (< 1700 Euros)	69		29				
	Medium (1700 – 3100 Euros)	89		37				
	High (> 3100 Euros)	82		34				
Household car ownership	No car	56		23				
	1 car	132		54				
	>=2 cars	56		23				
Credit card ownership	% Credit card owner	246		70				

* = 'Online' was replaced by 'in-store' for the questions about in-store shopping.

Table 6.2 Standardized coefficients of direct and total effects for the Customary Model, simplified EMGB, and Hybrid Model (significance at least $p < 0.05$, unless indicated otherwise)*

	Customary Model		Simplified EMGB				Hybrid Model			
	Online	In-store	Online		In-store		Online		In-store	
Measurement model										
Attitude										
Pleasant to buy media pr.	0.989	0.973	1.002		0.974		0.972		0.973	
Enjoyable to buy media pr.	0.824	0.973	0.814		0.971		0.839		0.972	
Attractive to buy media pr.	0.487	0.882	0.480		0.883		0.495		0.883	
Perceived behav. control										
Easy buying media pr.			0.993		0.732		0.916		0.497	
Confident buying media pr.			0.417		0.622		0.440		0.577	
Behavioural desire										
Desire to buy media pr.			0.923		0.892		0.918		0.885	
Want to buy media pr.			0.934		0.884		0.929		0.866	
Volition										
Invest time to buy media pr.	0.834	1.142	0.904		0.880		0.897		0.861	
Intend to buy media pr.	0.944	0.656	0.871		0.851		0.862		0.828	
Internet experience										
Years using Internet	0.579						0.527		0.515	
Frequency Internet use	0.775						0.714		0.889	
Structural model	**VO[a]**	**VO[a]**	**BD[b]**	**VO[a]**	**BD[b]**	**VO[a]**	**BD[b]**	**VO[a]**	**BD[b]**	**VO[a]**
EMGB constructs										
Goal desire			0.092[d]		0.463		0.093[d]		0.569	
			0.092[d]	*0.101[d]*	*0.463*	*0.448*	*0.093[d]*	*0.103[d]*	*0.569*	*0.567*
Attitude	0.060[d]	-0.043[d]	0.023[d]		0.054[d]		-0.012[d]		-0.003[d]	
	0.060[d]	*-0.043[d]*	*0.023[d]*	*0.025[d]*	*0.054[d]*	*0.052[d]*	*-0.012[d]*	*-0.013[d]*	*-0.003[d]*	*-0.003[d]*
Subjective norms			0.214		-0.008[d]		0.229		0.023[d]	
			0.214	*0.236*	*-0.008[d]*	*-0.008[d]*	*0.229*	*0.253*	*0.023[d]*	*0.023[d]*

	Customary Model		Simplified EMGB				Hybrid Model									
	Online	In-store	Online		In-store		Online					In-store				
Structural model	**VO**[a]	**VO**[a]	**BD**[b]	**VO**[a]	**BD**[b]	**VO**[a]	**BD**[b]	**VO**[a]				**BD**[b]			**VO**[a]	
Perceived behav. control			0.234		0.522		0.295					0.707[c]				
			0.234	*0.259*	*0.522*	*0.505*	*0.295*	*0.326*				*0.707*[c]			*0.704*	
Behavioural desire				1.104		0.968		1.106							0.997	
				1.104		*0.968*		*1.106*							*0.997*	
Past behaviour			0.611	-0.104[d]	-0.009[d]	0.107	0.604	-0.109[c]				0.093[c]			0.114	
			0.611	*0.571*	*-0.009*[d]	*0.009*[d]	*0.604*	*0.559*				*0.093*[c]			*0.207*	
	VO[a]	**VO**[a]	**BD**[b]	**VO**[a]	**BD**[b]	**VO**[a]	**BD**[b]	**VO**[a]	**SN**[f]	**PBC**[g]	**PB**[h]	**BD**[b]	**VO**[a]	**AT**[e]	**SN**[f]	**PBC**[g]	**PB**[h]
External variables																	
Internet experience	0.466									1.072	0.587			-0.384			
	0.466						*0.670*	*0.677*		*1.072*	*0.587*	*0.001*[d]	*0.001*[d]				
Frequency online buying		-0.237														-0.436[c]	
		-0.237										*-0.308*	*-0.307*			*-0.436*[c]	
Time-pressure										-0.282							
							-0.083[c]	*-0.092*		*-0.282*							
Shop acces. 15 min. walking															-0.127		0.135[c]
															-0.127		*0.135*[c]
Shop acces. 20 min. cycling	-0.218								-0.137	-0.162[c]	-0.210						
	-0.218						*-0.206*	*-0.205*	*-0.137*	*-0.162*[c]	*-0.210*						
Female										0.327					0.152	0.411[c]	
							0.096	*0.107*		*0.327*		*0.294*	*0.293*		*0.152*	*0.411*[c]	
Age															0.184		
												0.004[d]	*0.004*[d]		*0.184*		
Income										-0.392	-0.257						
							-0.271	*-0.271*		*-0.392*	*-0.257*						
Car ownership		-0.220[c]								0.275							-0.189
		-0.220[c]					*0.081*	*0.090*		*0.275*		*-0.018*[d]	*-0.039*[c]				*-0.189*

Table 6.2 continued

	Customary Model		Simplified EMGB				Hybrid Model											
	Online	In-store	Online		In-store		Online					In-store						
	VO[a]	VO[a]	BD[b]	VO[a]	BD[b]	VO[a]	BD[b]	VO[a]	SN[f]	PBC[g]	PB[h]	BD[b]	VO[a]	AT[e]	SN[f]	PBC[g]	PB[h]
Credit card ownership	0.238										0.290							
	0.238						*0.175*	*0.162*[c]			*0.290*							
Goodness of fit indicators																		
R^2 (reduced form)	0.385	0.115	0.725	0.710	0.575	0.632	0.448	0.445	0.019	0.739	0.476	0.459	0.466	0.148	0.076	0.425	0.066	
Degrees of freedom	19	10	40		40				125					124				
Satorra-Bentler χ^2	10.912	8.988	43.797		63.247				52.370					86.176				
p-value Satorra-Bentler χ^2	0.927	0.533	0.314		0.011				1.000					0.996				
SRMR	0.029	0.059	0.046		0.050				0.063					0.095				
RMSEA	0.000	0.000	0.020		0.049				0.000					0.000				
CFI	0.993	0.969	0.976		0.940				0.924					0.885				
AGFI	0.950	0.895	0.876		0.791				0.794					0.752				

Total effects are in italic; a VO= Volition; b BD= Behavioural Desire; c significant at $p < 0.10$; d not significant; e Attitude; f Subjective Norms; g Perceived Behavioural Control; h Past Behaviour

attitudes. The volition to shop online is better explained than the volition to shop in-store, which results in a better fit of the e-shopping model (RMSEA=0.020, AGFI=0.876) than that of the in-store shopping model (RMSEA=0.049, AGFI=0.791), which has a significant Satorra-Bentler chi-square at p=0.011 (Table 2).

In the e-shopping model, past behaviour does not have a significant direct effect on volition, but it does have the strongest (positive) effect on behavioural desire (Table 6.2). It seems that experience with buying media products online in the past influences the wish to do so again in the forthcoming month. No significant effect of goal desire on behavioural desire was found. This seems to imply that the strength of an action's end state, namely owning a media product, does not affect the desire to buy a media product online. Perhaps people see in-store shopping as an alternative to e-shopping in ultimately acquiring a media product, an interpretation that is supported by the results for the in-store shopping model presented below. Hence, their behavioural desire to buy a media product online is not affected by their goal desire to possess this type of product. Significant positive effects were found of perceived behavioural control and subjective norms on behavioural desire. The more control one perceives to buy a media product online, the greater the desire to do so. Additionally, the desire to buy a media product online in the forthcoming month becomes greater for an individual whose immediate circle includes people who strongly encourage online buying. This finding suggests that perceived social pressure could ultimately have an effect on the decision to shop online. Concerning the total effects, we can conclude that past behaviour, perceived behavioural control, and subjective norms have a significant total effect on the volition to buy a media product online via behavioural desire (Table 6.2).

In the in-store shopping model, past behaviour has no significant total effect on either volition or behavioural desire (Table 6.2). So, in contrast with the case of online buying, past experience of buying media products in-store does not have a total effect on the desire or volition to do so in the forthcoming month. However, goal desire for buying a media product in general has a significant positive effect on behavioural desire: the stronger the wish to buy a media product, the stronger the wish to buy it in-store. Here, the inclusion of goal-related factors in the explanation of volition seems to be important. This might be so, because in-store shopping is for many people still the most important way to obtain products. This might suggest that people are prepared to take the effort to shop in-store if they have a strong desire for obtaining a media product. Additionally, buying media products online might more often reflect impulse purchases, which could explain why no statistically significant effect of goal desire was found on the volition to buy media products online. Perceived behavioural control has the strongest (positive) effect on the volition to shop in-store. The wish to buy media products in-store in the forthcoming month appears to depend on how easy a shopping trip is perceived to be. Although it has a significant positive direct effect on volition, past behaviour does not have a significant total effect on volition. This is owing to a negative, though not statistically significant effect from past behaviour on behavioural desire. Nevertheless, via behavioural desire, goal desire and perceived behavioural control have a significant total effect on the volition to buy media products in-store.

When the effect of external variables, such as sociodemographics, on the volition to shop became apparent in the CM, the question that arose was via which psychological constructs did these effects occur. In other words, which determinants of behavioural desire in the EMGB are affected by external variables? The Hybrid Model answers this question and

illustrates the importance of adding external variables to the EMGB (Table 6.2). Although they have an SRMR greater than 0.05, both the e-shopping model (RMSEA=0.000, Satorra-Bentler chi-square not significantly different from zero) and the in-store shopping model (RMSEA=0.000, Satorra-Bentler chi-square not significantly different from zero) perform reasonably well. The e-shopping model performs slightly better (AGFI=0.794, CFI=0.924) than the in-store shopping model (AGFI=0.752, CFI=0.885). In contrast with the simplified EMGB, here the in-store shopping model shows a significant positive effect, both direct and total, from past behaviour on behavioural desire and volition. This suggests that people who have bought media products in-store in the past have a stronger volition to buy such products in-store in the forthcoming month. Both shopping modes are thus affected by previous shopping behaviour. Concerning the relationships between the constructs of the EMGB, the e-shopping model in the HM is similar to the e-shopping model estimated in the simplified EMGB. However, past behaviour has now a statistically significant negative direct effect on volition: the more media products one has bought online in the past, the weaker the volition is to do so again in the near future. This counterintuitive result might indicate that media products bought online belong to the less frequently purchased type of consumer goods. Hence, some time needs to pass before one forms the volition to buy such products online again. Alternatively, this result could also mean that media products bought online are often impulse purchases.

In the e-shopping model, several external variables affect subjective norms, perceived behavioural control, and past behaviour. All the significant direct effects reported below are also significant total effects on behavioural desire and volition. The subjective norms are affected negatively by shop accessibility: the more media stores one can reach within twenty minutes from home by bicycle, the less encouraging significant others are with respect to buying media products online. It seems that the perceived social pressure to buy online decreases when there are more shops available in the vicinity of the home. This result may possibly be derived from a more individualistic lifestyle of urban residents who are less liable to social pressure concerning the purchase of consumer goods such as media products. People who perceive that they have a lot of control over buying media products online tend to be: women, experienced Internet users, and car owners. It is well known that Internet experience affects actual online buying behaviour positively (Swinyard & Smith, 2003; Forsythe & Shi, 2003, for example). Most online buyers tend to be male (Swinyard & Smith, 2003). There is no straightforward explanation for the relationship between owning a car and online buying. Perhaps people who own a car are comfort-oriented and perceive online buying as a comfortable method of acquiring goods. Additionally, car owners could be more control-oriented in general (since owning a car gives one a lot of control over the time and place of one's travel), and hence more likely to feel in control of online buying. People who perceive that they have little control over buying media products online tend to be people who feel time-pressured, have a high income, and have several media stores within twenty minutes from their home cycling. It seems that people who feel time-pressured perceive online buying as difficult (and possibly time-consuming) rather than lifting possible time-constraints. It is difficult to find a simple reason for the result that people on a high income tend to perceive online buying as complicated. Certainly, the actual online buying behaviour of higher income groups does not reflect this relationship, since people with a high income buy more often online (Forsythe & Shi, 2003). This finding demonstrates that there might

be a gap between how people perceive certain phenomena and how they actually behave. A further explanation for these findings is that people on a higher income tend to have a higher value of time, and hence could be more irritated with any time-consuming complications of online shopping that may arise. It seems that people find it more difficult to go to the trouble of buying media products online if they can access more media stores within twenty minutes by bicycle and presumably can obtain such products more easily: no waiting time for delivery is required; the product is usually obtained immediately. Hence, online shopping could be perceived as more difficult when stores are relatively near home. It thus seems that e-shopping and in-store shopping can act as substitutes for each other.

With respect to past behaviour, it was found that people who have often bought media products online in the past tend to be experienced Internet users, credit card owners, people who have relatively few media stores within twenty minutes cycling from home, and people with a relatively low income. Perhaps the latter group of people use the Internet to find cheap products and so buy online more often than higher income groups. The effect of shop accessibility on online buying behaviour in the past suggests a tradeoff between e-shopping and in-store shopping. Earlier research has found similar results (Farag et al., 2006b). In conclusion, Internet experience has the strongest (positive) effect on the volition to buy online via perceived behavioural control and past behaviour.

Perceived behavioural control and past behaviour are also affected by external variables in the in-store shopping model. With regard to perceived behavioural control, we found that frequent online buyers perceive that they have less control over buying media products in-store. Their positive experience with online buying appears to make them reluctant to undertake a shopping trip for media products. Hence, they could perceive in-store shopping to be more difficult than e-shopping. Again, this finding points in the direction of a tradeoff between e-shopping and in-store shopping as far as media products are concerned. In the e-shopping model, it was found that women perceive online buying as easy. Similarly, they also find in-store shopping simple to carry out. This result matches previous findings in a study of revealed behaviour which indicated that women tend to make more shopping trips than men (Farag et al., 2006a). Thus, women feel that they have control over their shopping, whether it is online or in-store. With respect to past behaviour, in order to purchase media products, car owners have made fewer shopping trips than people who do not own a car. Previous studies of actual shopping behaviour have shown that car owners tend to make fewer shopping trips than people who do not own a car (Van and Senior, 2000, for example). All of the external variables discussed above also have significant total effects on behavioural desire and volition, with the exception of car ownership. This variable does not have a statistically significant total effect on desire, but it does have a significant total effect on volition. Thus, the negative effect of online buying and car ownership on the volition to shop in-store in the Customary Model reflects the direct effects of these variables on perceived behavioural control and past behaviour. The number of trips made in the past to purchase media products was also affected by shop accessibility: the more media stores one can reach from home within fifteen minutes on foot, the more shopping trips one makes. Comparable findings have been reported in studies of revealed shopping behaviour (Van & Senior, 2000; Farag et al., 2006a). Comparing the strength of the effects, it becomes clear that the negative effect of car ownership on past behaviour is stronger than the positive effect of shop accessibility (Table 6.2). This finding suggests that people owning one or two

cars bought fewer media products in-store in the past. Online buying experience has the strongest (negative) effect on the volition to buy in-store via perceived behavioural control. This result supports the notion of a tradeoff between e-shopping and in-store shopping for media products.

Attitude and subjective norms do not have a significant effect on behavioural desire, but they are significantly affected by external variables. Because the impacts of attitude and subjective norms on behavioural desire are not significant, the total effects of these external variables on behavioural desire and volition are also not significant. Experienced Internet users tend to have a negative attitude about in-store shopping. This finding matches the result discussed earlier that frequent online buyers perceive in-store shopping to be difficult. It seems that both Internet experience and online buying experience negatively affect the opinion about in-store shopping and the perceived ability to do so. Age has the strongest effect on subjective norms: older people tend to experience more social pressure to buy media products in-store than younger people. Women also tend to feel that important people in their immediate circle encourage in-store shopping. The more media stores there are available within fifteen minutes' walking distance from home, the less social pressure one feels to buy media products in-store. This finding seems to be at odds with the earlier finding in the e-shopping model, stating that if there are many stores in the vicinity, important others encourage online buying less. Apparently, having many media stores available does not lead to a feeling that one should buy media products in-store. Again, this result could perhaps be explained by urban residents having a relatively individualistic personality and by being less sensitive to social pressure concerning the purchase of consumer goods such as media products.

Summarizing, the simplified EMGB provides more insight than the Customary Model in which attitude and external variables (such as sociodemographics) are directly related to volition. The Hybrid Model which expands the simplified EMGB with external variables provides further insights into the determinants of the constructs in the EMGB. It can thus be concluded that an individual's context and resources are important in explaining shopping volition and, ultimately, shopping behaviour. It has been shown that, in such a modified version of the EMGB, Internet experience has the strongest (positive) effect on the volition to buy online, while online buying experience has the strongest (negative) effect on the volition to buy in-store. These external variables affect the volition to shop online and in-store via perceived behavioural control and past behaviour.

6.5 Conclusion

In this paper we have addressed the issue of the relevance of three different types of models for understanding behavioural choices in shopping modes for search goods. These models were (1) a Customary Model (CM) which includes various sociodemographics and land use features, ownership of technical means, skills and personality traits, (2) a simplified version of the Extended Model of Goal-directed Behaviour (EMGB) (Perugini & Conner, 2000), and (3) an Hybrid Model (HM), which is an integration of the EMGB and the CM.

The findings show that the simplified EMGB (in which the effect of attitude on volition is mediated by behavioural desire) provides more insight than the Customary Model in which

attitude is directly related to volition. The EMGB performs reasonably well when applied to shopping behaviour. Although no significant effects of attitude on behavioural desire were found, other psychological constructs had statistically significant impacts. The effects of past behaviour, perceived behavioural control, and subjective norms on volition to shop online were statistically significant, while the volition to shop in-store was influenced by goal desire and perceived behavioural control.

The simplified EMGB was better in explaining e-shopping than in-store shopping. An important assumption of the EMGB is that behaviours are selected because of their usefulness in achieving a goal. Shopping could, however, be important in itself rather than a means to an end. Instead of utilitarian considerations, recreational motives could lead people to choose between e-shopping or in-store shopping. The fact that the EMGB performed better for e-shopping than for in-store shopping might mean that e-shopping is more often the result of utilitarian considerations than is in-store shopping. An important aspect of recreational shopping is the opportunity that shopping in-store provides to see and feel products.

Estimating the Hybrid Model, in which external variables were added to the simplified EMGB, proved to be rewarding for both the e-shop and in-store shopping model. In the former model, experienced Internet users perceive having more control over buying media products online in the forthcoming month and they have also done so frequently in the past. Credit card owners have also often bought media products online in the past. People who have media stores within twenty minutes' cycling distance from their home have a weaker volition to buy media products online, because they have done so infrequently in the past, they perceive having less control over buying, and because they experience social pressure from important others who do not encourage buying online when stores are relatively near the home.

External variables also proved to be statistically significant in the in-store shopping model. Individuals who do not own a car and people with many media stores within fifteen minutes' walking distance from home frequently bought media products in-store in the past. Also, women and older people tend to experience a social pressure to buy media products in-store. Frequent online buyers tend to perceive having less control over making a shopping trip to buy media products within the forthcoming month. Thus, on the one hand, a high shop accessibility negatively affects the volition to buy online, while on the other hand a lot of online buying experience negatively affects the volition to shop in-store. This finding suggests that e-shopping and in-store shopping interact with each other. At least for media products, substitution between e-shopping and in-store shopping is likely to occur.

Our modified version of the EMGB has been helpful in understanding the causal mechanisms via which shopping behaviour could occur. It seems worthwhile to appply a stricter definition of attitude: a subjective evaluation of a behaviour, which disposes a person to behave in a certain way towards it (see Eagly & Chaiken, 1993; Gärling et al., 1998). Consequently, attitudes can be analytically distinguished from other psychological constructs. In studies of individual choice behaviour it could be rewarding to let behavioural desire mediate the effect of attitude on volition and behaviour. Such an application could be useful not only for future studies of shopping behaviour, but also of other types of personal travel behaviour, for example, mode choice or destination choice. Additionally, the Hybrid Model has provided more insight into how external variables affect the volition

to shop online or in-store. For example, it has become clear that shop accessibility affects e-shopping via past behaviour, perceived behavioural control, and subjective norms. In general, transportation studies might benefit from an application of attitude theory that also conceptualizes constraints in order to achieve a better understanding of the relationships between personal or land use characteristics and personal travel behaviour. Consequently, instead of including variables *ad hoc*, as is often the case, clearer analytical distinctions can be made. The way that relationships between attitudes and behaviour are currently modelled could be improved by applying a theoretical framework such as attitude theory that also takes individuals' context, resources, and constraints into account.

Acknowledgements

The authors wish to express their gratitude for the helpful comments from Dr. Marco Perugini (Department of Psychology, University of Essex) and Dr. Jan Faber (Department of Innovation and Environmental Sciences, Utrecht University).

References

Ajzen I, 1987, "Attitudes, traits and actions: dispositional prediction of behavior in personality and social psychology" *Advances in Experimental Social Psychology* **20** 1-63

Ajzen I, 1991, "The theory of planned behavior" *Organizational Behavior and Human Decision Processes* **50** 179-211

Armitage J C, Conner M, 2001, "Efficacy of the theory of planned behavior: A meta-analytic review" *British Journal of Social Psychology* **40** 471-499

Bagozzi R P, 1981, "Attitudes, intentions, and behavior: a test of some key hypotheses" *Journal of Personality and Social Psychology* **41** 607-627

Bagozzi R P, Baumgartner H, Youjae Y, 1992, "State versus action orientation and the theory of reasoned action: an application to coupon usage" *Journal of Consumer Research* **18** 505-518

Cao X, Mokhtarian P L, 2005, "The intended and actual adoption of online purchasing: a brief review of recent literature", ITS, Department of Civil and Environmental Engineering, UC Davis, http://www.its.ucdavis.edu/publications/2005/UCD-ITS-RR-05-26.pdf

Chang M K, Cheung W, Lai V S, 2005, "Literature derived reference models for the adoption of online shopping" *Information & Management* **42** 543-559

Couclelis H, 2004, "Pizza over the Internet: E-commerce, the fragmentation of activity and the tyranny of the region" *Entrepreneurship & Regional Development* **16** 41-54

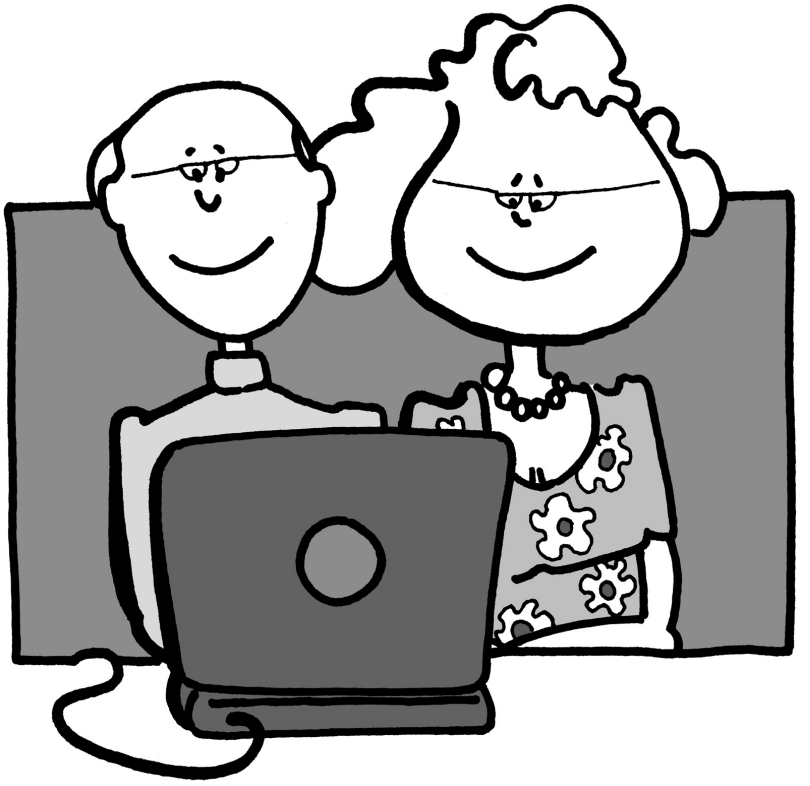
Desbarats J, 1983, "Spatial choice and constraints on behavior" *Annals of the Association of American Geographers* **73** 340 -357

Eagly A H, Chaiken S, 1993, *The Psychology of Attitudes* (Harcourt Brace Jovanovich, Orlando, FL)

Farag S, Schwanen T, Dijst M, 2006a, "Shopping online and/or in-store? A structural equation model of the relationships between e-shopping and in-store shopping", forthcoming in *Transportation Research A*

Farag S, Weltevreden J, Van Rietbergen T, Dijst M, Van Oort F, 2006b, "E-shopping in the Netherlands: Does Geography Matter?" *Environment and Planning B* **33** 59-74
Festinger L, 1957, *A Theory of Cognitive Dissonance* (Stanford University Press, Stanford, CA)
Fishbein M, Ajzen I, 1975, *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research* (Addison-Wesley, Reading)
Forsythe S, Shi B, 2003, "Consumer patronage and risk perceptions in Internet shopping" *Journal of Business Research* **56** 867-875
Fujii S, Gärling T, 2003, "Application of attitude theory for improved predictive accuracy of stated preference methods in travel demand analysis" *Transportation Research A* **37** 389-402
Gärling T, Gillholm R, Gärling A, 1998, "Reintroducing attitude theory in travel behavior research" *Transportation* **25** 129-146
Golob T F, Horowitz A D, Wachs M, 1979, "Attitude-behaviour relationships in travel-demand modelling" in *Behavioural Travel Modelling* Eds D A Hensher, P R Stopher (Croom Helm, London) pp 739-757
Golob T F, 2001, "Joint models of attitudes and behavior in evaluation of the San Diego I-15 congestion pricing project" *Transportation Research A* **35** 495-514
Golob T F, 2003, "Structural equation modeling for travel behaviour research" *Transportation Research B* **37** 1-25
Hägerstrand T, 1970, "What about people in regional science?" *Papers in Regional Science* **24** 7-21
Hansen T, Jensen J M, Solgaard H S, 2004, "Predicting online grocery buying intention: A comparison of the theory of reasoned action and the theory of planned behaviour" *International Journal of Information Management* **24** 539-550
Jöreskog K G, 2001, "Analysis of ordinal variables 2: Cross-sectional data", http://www.ssicentral.com/lisrel/ord2.pdf
Jöreskog K G, Sörbom D, 2001, *LISREL 8: User's Reference Guide* (Scientific Software International, Lincolnwood)
Koppelman F S, Pas E I, 1980, "Travel-choice behavior: Models of perceptions, feelings, preference, and choice" *Transportation Research Record* **765** 26-33
Kraus S J, 1995, "Attitudes and the prediction of behaviour: A meta-analysis of the empirical literature" *Personality and Social Psychology Bulletin* **21** 58-75
Locatus, 2003, *Retail Guide 2003* (Locatus, Woerden) (in Dutch)
Louviere J J, Hensher D A, Swait J D, 2000, *Stated Choice Methods: Analysis and Application* (Cambridge University Press, Cambridge)
Mokhtarian P L, Salomon I, 1994, "Modeling the choice to telecommute: Setting the context" *Environment and Planning A* **26** 749-766
Mokhtarian P L, Salomon I, 1997, "Modeling the desire to telecommute: the importance of attitudinal factors in behavioral models" *Transportation Research A* **31** 35-50
Mokhtarian P L, 2004, "A conceptual analysis of the transportation impacts of B2C e-commerce" *Transportation* **31** 257-284
Olinsky A, Chen S, Harlow L, 2003, "The comparative efficacy of imputation methods for missing data in structural equation modeling" *European Journal of Operational Research* **151** 53-79

Perugini M, Conner M, 2000, "Predicting and understanding behavioral volitions: the interplay between goals and behaviors" *European Journal of Social Psychology* **30** 705-731
Reibstein D J, Lovelock C H, Dobson R P, 1980, "The direction of causality between perceptions, affect, and behavior: An application to travel behavior" *Journal of Consumer Research* **6** 370-376
Shim S, Eastlick M A, 1998, "The hierarchical influence of personal values on mall shopping attitude and behavior" *Journal of Retailing* **74** 139-160
Shim S, Eastlick M A, Lotz S L, Warrington P, 2001, "An online prepurchase intentions model: The role of intention to search" *Journal of Retailing* **77** 397-416
Schwanen T, Mokhtarian P L, 2005, "What if you live in the wrong neighbourhood? The impact of residential neighbourhood dissonance on distance travelled" *Transportation Research D* **10** 127-151
Stern E, 1998, "Travel choice in congestions: Modeling and research needs" in *Theoretical Foundations of Travel Choice Modeling* Eds T Gärling, T Laitila, K Westin (Pergamon, Oxford) pp 173-199
Swinyard W R, Smith S M, 2003, "Why people (don't) shop online: A lifestyle study of the Internet consumer" *Psychology & Marketing* **20** 567-597
TNS Interactive, 2002, "Global e-Commerce Report 2002", http://www.tnsofres.com/ger2002/
Triandis H C, 1977, *Interpersonal Behavior* (Brooks/Cole, Monterey, CA)
Van U P, Senior M, 2000, "The contribution of mixed land uses to sustainable travel in cities" in *Achieving Sustainable Urban Form*. Eds K Williams, E Burton, M Jenks (E & F N Spon, London/New York) pp 139-148
Van der Zwan J, Van der Wel R, Ritsema van Eck J, De Jong T, Floor H, 2003, *Manual Flowmap, Version 7* (Faculty of Geosciences, Utrecht University, Utrecht)
Verplanken B, Aarts H, Van Knippenberg A, 1997, "Habit, information acquisition, and the process of making travel mode choices" *European Journal of Social Psychology* **27** 539-560



7 Conclusions

7.1 Introduction

E-shopping (searching and/or buying products via the Internet) has grown rapidly in recent years. This new way of shopping could affect individuals' in-store shopping behaviour and, in the long term, the location of shops. At present, very little is known about the potential relationships between e-shopping and in-store shopping. Moreover, online searching has not received much attention in scientific studies as yet, although searching for product information is an important activity in the shopping process. Most studies about the adoption of e-shopping use sociodemographics, Internet behaviour, and attitudes as explanatory factors (Chang et al., 2005). Land-use variables, such as residential environment and shop accessibility, are almost entirely lacking in explanations of online shopping. This oversight is remarkable, since one would intuitively expect land-use characteristics such as the number of shops near an individual's home to play a part in the adoption of e-shopping. The few empirical studies that have investigated the relationships between e-shopping and in-store shopping are mostly of a descriptive nature and do not distinguish between shopping travel for groceries (daily goods) and non-daily goods such as clothing and books. Such a distinction is necessary, since the types of relationships between e-shopping and in-store shopping for various products might differ. We have focused on non-daily goods, since products of this type are most frequently bought online (AC Nielsen, 2005).

The aim of this research was to provide insight into consumers' adoption of online searching and buying and the implications this adoption might have for their in-store shopping behaviour. To achieve this aim, the following research question was formulated:

To what extent are in-store shopping behaviour, sociodemographics, Internet behaviour, land-use features, and shopping attitudes associated with the adoption of online searching and buying of products by consumers?

Our definition of online searching is limited to directed searching, during which a person actively seeks information about a commercial product or service. This activity can range from browsing online to acquire some initial ideas to visiting specific websites in order to compare products, prices, or shop characteristics. Online buying is defined as a transaction that is *established* online; a product does not necessarily have to be *paid for* online, however, to qualify as an online purchase.

In this concluding chapter an overview is given of the main results. Policy recommendations and directions for future research are provided in the last section. It has to be kept in mind that different datasets and methods of analysis have been used in the successive chapters. In Chapters 2 and 3, a national e-commerce dataset collected by a Dutch Internet research agency was used. Chapter 4 draws on Dutch data gathered within the city of Utrecht and US data obtained in and around Minneapolis. Data gathered in Utrecht and three suburban municipalities (Nieuwegein, Culemborg, and Lopik) form the basis of

Chapters 5 and 6. In these last two chapters, Structural Equation Modeling (SEM) has been used as a method of analysis; in all the other chapters, single-equation regression methods have been applied.

7.2 Summary and discussion of the results

The outcomes of the various chapters are discussed below per type of explanatory factor (in-store shopping, sociodemographics, Internet behaviour, land-use features, and shopping attitudes) for online searching and online buying respectively.

In-store shopping behaviour

In the literature, there is a debate about how ICT-use and personal travel behaviour relate to each other. Four types of interactions are commonly distinguished; they are specified in one direction of causality (Mokhtarian, 2002): 1) *substitution* (e-shopping replaces a shopping trip); 2) *generation* (e-shopping generates a shopping trip that otherwise would not have been made); 3) *modification* (e-shopping alters a shopping trip, in mode or timing, for example); 4) *neutrality* (e-shopping and in-store shopping do not affect each other).

We have found evidence that e-shopping and in-store shopping are related to each other after diverse factors have been taken into account (Chapters 4 and 5). Overall, the results indicate relationships of generation or complementarity when shopping frequency is studied. Frequent online searchers tend to make more shopping trips, and frequent in-store shoppers tend to buy more frequently online (Chapter 5). These findings support the notion of a hybrid form of shopping in which online and in-store shopping are combined. Different acts of the shopping process (information gathering, evaluation, purchase, for example) are being carried out via various channels, also referred to as *multi-channel* shopping (Ward & Morganosky, 2002). It is interesting to note that the same combination of e-shopping and in-store shopping is popular in USA and the Netherlands, namely to search online and to buy in-store (Chapter 4). It seems that the converse – searching in-store and buying online – is not often done as yet (this result is based on Dutch data). Our results show further that in both USA and the Netherlands 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 places. This situation might change in the future, however, as discussed below. Another indicator of generation or complementarity is our finding that people with a positive attitude towards in-store shopping buy more often online than people who are less positive about in-store shopping (Chapter 5). A substitution of shopping trips for e-shopping would therefore seem unlikely to occur for people who like in-store shopping and buy online at the same time.

Nevertheless, it seems that e-shopping also modifies or substitutes for in-store shopping, when the duration of the shopping activity is investigated. People who shop frequently have a shorter shopping activity duration whether they do so online or in-store (Chapters 4 and 5). That statement does not necessarily imply, however, that the *total* time spent on in-store shopping during a given time period is also shorter. The shorter duration per trip may be offset by more frequent trips, so that in the end frequent online searchers may still spend an equal amount of time (or even more) than those who search online only infrequently or

not at all. In general, a higher shopping frequency could cause a shorter shopping activity duration, regardless of e-shopping. However, if people acquire product information online prior to their store visit, they might need to spend less time in a store, thus leading to a shorter shopping duration.

Our findings further show that the more often one has bought products online in the past, the weaker the intention to buy a media product (books, CDs, videos, DVDs, computer software, and so forth) in-store within the coming month (Chapter 6). Thus, we have found potential substitution effects concerning the duration of the shopping activity and for media products. These effects could vary per product type, which illustrates the difficulties in assessing the net outcome of interactions between e-shopping and in-store shopping. Regarding home shopping experience (ordering products via a catalogue, by telephone, and so forth), the findings show that this type of experience positively affects e-shopping. People who are familiar with buying at a distance are more likely to buy online and do so more often than people without any home shopping experience.

The direction of causality between e-shopping and in-store shopping is hard to determine. The results in Chapter 5 show that frequent in-store shoppers tend to buy more often online, but in Chapter 4 we report that we also found the converse: frequent online buyers tend to make more shopping trips. E-shopping and in-store shopping probably mutually influence each other. Additionally, these diverse outcomes could be ascribed to the various datasets that have been used and the different methods of analysis. In Chapter 4, we have specified the direction of the relationship between e-shopping and prior in-store shopping (using multivariate regression analysis), whereas in Chapter 5 the strength of the relationships between e-shopping and in-store shopping could be compared in both directions (using SEM) and was decided upon afterwards. Additionally, varying operationalizations, methods of measurement, and question wording have been used in the different datasets; this variation could also have attributed to the diverse outcomes.

Since we do not know how people travelled before they started e-shopping, the 'generation or substitution' question that has become important in the transportation literature on the relationships between ICT-use and mobility (Golob & Regan, 2001; Mokhtarian, 200, for example) is difficult to answer. Rather than trying to come up with an answer, it is better to recognize 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.

Other concerns could also hinder a proper assessment of the relationships between online and in-store shopping. Although precise knowledge is lacking about people's shopping and travel behaviour prior to e-shopping, 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 & 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. 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 (Gould, 1998; Mokhtarian, 2002). Also, home shopping (ordering products via a catalogue, by telephone, and so forth) might be replaced by e-shopping rather than shopping trips. Finally, the type of product bought online is closely related to shopping motive and varies between individuals and within an individual over time. Even within one product type, for example books, it is hard to make predictions, because differences in lifestyle could cause one person to buy books online and another person to buy them in-store. Moreover, the same person could choose to buy scientific literature online, but fiction in-store.

Sociodemographics

In line with previous empirical studies, we have found that sociodemographics affect e-shopping. Their impact differs between online searching, the likelihood of having ever bought a product online, and the frequency of online buying. With regard to online searching, the results show that males and highly-educated people are not only more likely to have ever searched online, but that they also search online more frequently than females and poorly educated people. We found that sociodemographics affect the likelihood of having ever bought online to a greater extent than they affect the frequency of online buying (see Chapter 3 and 4). This finding seems to suggest that, once people are familiar with online buying, their sociodemographic characteristics are less important in determining the frequency with which they buy online. Males and young people (up to the age of 35) are more likely to have ever bought online, but they do not buy more often online than females or older people do. A comparison with Internet users in USA (Chapter 4) shows that higher-income groups are more likely to buy online in both countries, regardless of the differences in sociocultural and urban contexts.

We find different outcomes depending not only on what precisely is being accounted for, but also on the datasets and methods used. For example, the data used contain different respondents and vary in the operationalization of various factors. As mentioned above, in the research reported in Chapters 3 and 4, multivariate regression analysis was applied, while in the work described in Chapter 5 Structural Equation Modeling (SEM) was used. Employing SEM enables a distinction to be drawn between direct, indirect, and total effects. A total effect consists of one direct and one or more indirect effects. The results reported in Chapter 5 show that sociodemographics do influence the frequency of online buying, contrary to the findings reported in Chapters 3 and 4. Men, highly-educated people, and young people shop more often online, because they tend to have more Internet experience and a more positive attitude towards e-shopping. Thus, sociodemographics have no direct influence on the frequency of either online searching or online buying, but there are indirect and therefore total effects via other factors such as Internet behaviour and shopping attitudes. The individual decision context (which takes account of individual as well as social and spatial characteristics) may be particularly important for e-shopping, as described above. It should be noted that, in the analysis reported in Chapter 5, people who had never bought online were also included, while only the people who had bought at least once online were included in Chapters 3 and 4. In general terms, across the various chapters the direction of the effects of sociodemographic variables is consistent with our expectations and earlier findings from the literature.

Looking at specific products that are purchased online, we found in Chapter 3 that women are more likely than men to buy clothing online and less likely than men to buy CDs/videos/DVDs online. No gender differences were found concerning the purchase of travel tickets online. Highly-educated people are more likely to buy travel tickets online and less likely to buy clothing online. Credit card owners are in general more likely to buy online (particularly travel tickets) and do so more often than people who do not own a credit card. It has to be kept in mind that, in the Netherlands, credit card use is not as common as in other European countries or in USA (see Chapter 1). Therefore, the direction of causality between owning a credit card and shopping online is not entirely clear: people could have bought a credit card in order to be able to buy online, or vice versa. Nonetheless, we expect the effect from credit card on online buying to be the stronger of the two, because credit cards can be used for many types of purchases (for example, paying in a restaurant) and not only for online shopping.

Internet experience

Internet experience is a very important explanatory factor for e-shopping. In all chapters, the effects of variables such as the number of years of experience in using the Internet and the frequency of Internet use are positive and statistically significant: experienced Internet users are more likely to search and buy online and do so more often than inexperienced Internet users. This finding holds not only for Dutch Internet users, but for Internet users in USA as well (Chapter 4). People with a fast Internet connection at home search and buy online more often than people with slower Internet connections. Again, the direction of causality is not completely straightforward: people might choose a fast Internet connection in order to be able to shop online more comfortably, or the converse. However, we expect a fast Internet connection to affect e-shopping, since an Internet connection can be regarded as a facilitator for e-shopping (and as a constraint in the case of a slow or malfunctioning Internet connection). This view is supported by the analysis results (in Chapter 5) that showed stronger effects when the relationship was specified as such compared with the converse.

Land use features

Concerning the impact of land-use features on e-shopping, the following two hypotheses have been researched (Chapter 3). The first is that e-shopping is a predominantly urban phenomenon, because innovations follow a conventional pattern from large to small settlements (innovation diffusion hypothesis) (Hägerstrand, 1967). The second is that people are more likely to adopt e-shopping when their accessibility to physical shops is relatively limited (efficiency hypothesis). Although urbanization level and shop accessibility are closely related to each other, they are not entirely the same. One could argue that there is a certain type of people living in urban areas who are more likely to innovate (Rogers, 1983). Thus, the effects of urbanization level on e-shopping could reflect the composition of the population living in those urban areas, despite our controlling for sociodemographics and attitudes in the analyses. In comparison, shop accessibility could be regarded as measuring urban form more accurately, since it focuses on the spatiotemporal dimension of the distribution of stores. This factor might therefore capture any possible effects of the built environment on e-shopping better than urbanization level. It has to be noted that, when only one of these

land-use indicators is incorporated in an analysis and an effect on e-shopping is found, this might also contain some of the effect of the other indicator. For example, if only shop accessibility has been included in the analysis and it has a statistically significant effect on e-shopping, urbanization level might also have attributed to that effect, and vice versa.

That having been said, our results are generally consistent with the innovation-diffusion hypothesis and we find mixed results for the efficiency hypothesis. The impact of land-use variables on e-shopping can be considered at three different levels: 1) the neighbourhood level (within the city of Utrecht) (Chapter 4); 2) the regional level of residential environments (the urban area of Utrecht versus the suburban areas of Nieuwegein, Culemborg, and Lopik) (Chapters 5 and 6); 3) the national level (the heavily-urbanized western part of the Netherlands versus the rest of the Netherlands) (Chapters 1 and 3). People living in a strongly urbanized area have a greater likelihood of searching and buying online and do so more frequently than people living in other residential environments. Chapter 5 shows that urban residents shop more often online, because they have a faster Internet connection. Although Internet access in less urbanized areas might have improved since our data collection (which took place in late 2003), particularly given the recent increase in subscriptions to broadband Internet (see Chapter 1), this finding might indicate an uneven spatial distribution of ICT networks, where cities dominate their development and use (Graham & Marvin, 1996). Whether our findings are consistent with the innovation-diffusion hypothesis also depends on the type of product. Respondents living in very strongly urbanized areas are more likely to buy airline tickets online, whereas respondents living in moderately and weakly urbanized areas are more likely to buy clothing and music online, respectively.

The different shop accessibility measures (for example, the number of stores one can reach by car, bicycle, or on foot for different time thresholds, ranging from ten to thirty minutes), the differences in the variables that are being explained (for example, the likelihood of buying online versus the frequency of online buying), and the datasets that have been used may be responsible for the mixed results we found concerning the impact of shop accessibility on e-shopping. Also, urbanization level and shop accessibility were not always included in an analysis simultaneously. They were both included at the same time In Chapters 3 (buying music online) and 5 (online searching and buying in general). The results show a direct negative effect of shop accessibility on online searching: the more shops people can reach for non-daily goods (for example, clothing, books) within ten minutes by bicycle from their homes, the less often they search for products online. Also, CDs, videos, and DVDs were bought less often online when respondents could reach more music stores within thirty minutes by car from their homes. The findings in Chapter 5 illustrate that people who can reach more stores within ten minutes by bicycle buy online more often, which is not what we expected. This effect occurs indirectly via in-store shopping: people who have high shop accessibility shop more often in-store and people who often shop in-store also often buy online.

Results from analyses where urbanization level and shop accessibility were not included simultaneously are as follows. People with high shop accessibility buy less often online than people who can reach fewer shops from their homes within thirty minutes by car (Chapter 3). However, the shorter the travel time (as subjectively assessed by the respondents) to stores for non-daily goods, the more likely people are to buy products online (Chapter 4). Chapter 6 shows that the more shops one can reach by bicycle within twenty minutes, the

weaker the intention to buy media products online within the coming month. Overall, these mixed results for the efficiency hypothesis lead us to believe that the relationship between shop accessibility and e-shopping is predominantly a negative one: the more shops one can reach from home, the less often one shops online. 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. If we assume that people living in non-urban areas would have lower shop accessibility than urban residents, it could be the case that, once people in non-urban areas have bought online, they do so more frequently than urban residents. This remark is based on Chapter 3, where the likelihood of buying online was separately analysed from the frequency of online buying (including only respondents who had bought online at least once).

Shopping attitudes

Shopping attitudes also play an important part in e-shopping. People with a positive attitude towards e-shopping search and buy more often online than people with a less positive attitude (Chapter 5). Respondents in the USA who indicated that it is important for them to see and feel a product before buying it are less likely to buy online and also buy less often online than people who find these factors less important.

We found mixed results concerning the relationship between time-pressure and e-shopping, depending on whether we considered intention or revealed behaviour. Time-pressured individuals seem to perceive buying media products online as a difficult task (Chapter 6), and this perception reduces their intention to buy such products online within the coming month. This finding questions the extent to which e-shopping is done out of time-saving reasons for this product type. Perhaps time-pressured people do not want to spend their precious free time comparing media products at all and prefer to purchase a media product directly in a brick-and-mortar store, because they find that easier. The opportunity to acquire products cheaply might also be a more important reason for online shopping than time-saving reasons are, at least in the case of media products. However, regarding revealed behaviour, our results show that time-pressured people often shop from home (for example, via a catalogue) and often chain their shopping trips (Chapter 5), both of which are positively related to online buying. Thus, in general, time-pressured people shop more often online, although they perceive buying media products online as difficult and therefore have a weaker intention to buy such products online within the coming month. It has to be noted that time-pressure has been measured subjectively here: that is, how respondents experience time-pressure. Those operationalizations that measured time-pressure objectively (number of hours of paid work, number of children, for example) did not yield any statistically significant results.

Many studies include attitudes on an *ad hoc* basis when explaining e-shopping and do not take into account a person's individual decision context. A comprehensive theoretical framework is therefore needed that includes explanatory factors relating to individual, social, and spatial characteristics. We have tried to provide such a framework in Chapter 6, where individuals' intentions to buy a media product (books, CDs, videos, DVDs, computer software) online and in-store within the coming month were studied by estimating three models that explain these intentions differently: (1) a Customary Model, which directly links attitude and external variables (sociodemographics, for example) to intention; (2)

a simplified version of the Extended Model of Goal-directed Behaviour (EMGB) (Perugini & Conner, 2000), which links attitude to intention via behavioural desire; (3) a Hybrid Model, which integrates the two former models. Contrary to our expectations, attitudes did not have a statistically significant effect on the intention to buy media products online. An attitude has been strictly defined here as *a subjective evaluation of a behaviour, which disposes a person to behave in a certain way towards it* (Gärling et al., 1998). However, applying the EMGB showed that past behaviour (a proxy for habit), perceived behavioural control (the confidence an individual has to undertake a particular behaviour in a particular situation), and subjective norms (the perceived social pressure exerted by important others, such as parents and good friends, to perform or not to perform a behaviour) all have a statistically significant impact on the intention to buy media products online within the coming month. The more often one has bought media products online in the past, the more confident one is of being able to buy online, and the more positive important others in one's surroundings are about online buying, the stronger is one's intention to buy media products online within the coming month. Thus, not only are factors that relate to the individual (past behaviour and perceived behavioural control) important for e-shopping, but also factors that relate to other people (that is, subjective norms). Social conventions seem to influence the decision to shop online or in-store.

Constraints such as Internet experience and shop accessibility could, however, limit people's intentions and hence behaviour (Hägerstrand, 1970; Mokhtarian & Salomon, 1994). The Hybrid Model, in which the EMGB is extended with some external variables, was therefore estimated. This model provided more insight into the reasons why external variables, such as shop accessibility, affect the intention to buy media products online and in-store. We found that people who can reach many shops from home within twenty minutes by bicycle have a weaker intention to buy a media product online within the coming month. This result can be explained by the fact that these individuals tend to have little experience with online buying in general and that they tend to perceive it as difficult. Also, important people in their surroundings do not encourage online buying.

Drawing on concepts such as perceived behavioural control and subjective norms is helpful for understanding the context in which individuals make their decisions. These concepts apply to a specific situation (buying a media product within the coming month, for example) and are therefore operationalized on a detailed level. Our findings from the Hybrid Model illustrate the importance of applying psychological concepts that are operationalized on such a specific level and simultaneously taking into account constraints (shop accessibility, for example). These psychological concepts clarify why constraints such as land-use features affect individuals' intentions and behaviour. Such a precise operationalization might be more effective in expressing the social and time-space context in which decisions are taken compared with the common practice in many transportation studies where peoples' individual decision context is hardly considered, or if it is, only in a general way by looking at sociodemographics and general land-use characteristics. Consumers' choice opportunities have extended over the past few years and are likely to continue to do so. In this respect, it is important to understand how people make choices among the options they have, given their individual characteristics, and their social and spatial context.

7.3 Looking into the future

This thesis concludes with a look into the future regarding developments in e-shopping and in-store shopping, as well as their consequences for consumers and retailers. Implications for policy and future research are also discussed.

Future developments in shopping

The future of online shopping in the Netherlands looks bright: although e-shopping currently accounts for only a small percentage of total turnover in the purchase of consumer goods, its growth figures are impressive and likely to continue to be so (see Chapter 1). Furthermore, a whole new generation of individuals is growing up with the Internet, which is a significant development since Internet experience is an important predictor of e-shopping. People are getting accustomed to e-shopping and it is certainly no longer predominantly an activity of early adopters. Additionally, technology is likely to keep evolving, thus enabling wireless Internet and secure online payment. The availability of broadband Internet has already stimulated online purchases (Thuiswinkel.org, 2005). On the basis of our results, we believe that in the future individuals will increasingly use a hybrid form of online shopping and in-store shopping. The advantages of both shopping modes can be combined in this way.

E-shopping might affect 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. Travel agencies are already experiencing difficult times to survive the popularity of the online booking of travel. However, stores could change their function in order to compete with e-shopping. For example, computer stores might primarily become showrooms and pickup points, mainly displaying the computers that are sold online and serving as a collection point for items ordered online or as an after-sales service point for computers that have broken down. This strategy would take into consideration a multi-channel way of shopping in which consumers combined various shopping modes. Another survival strategy for stores is to change their location from expensive inner-city streets to shopping areas outside the city centre where the costs of running a store are lower.

A further professionalization of e-shopping in payment, delivery, and after-sales service could increase its popularity, which in turn could affect peoples' motives for in-store shopping. 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. In this value lies the strength of in-store shopping as a leisure activity, as a means to socialize, see and feel products in-person, and discover new environments (Urry, 2004).

Interactions between e-shopping and in-store shopping depend not only on developments in e-shopping, but also on the future developments of in-store shopping. It is therefore important to know what trends can be discerned in physical retailing. The following three developments are likely to occur in the Netherlands (Evers et al., 2005): 1) an enlargement of stores; 2) a shift towards building stores in peripheral areas; 3) an increase in the importance of the recreational function of stores. The restrictive national retail planning policy against building at the fringes of cities in order to prevent urban sprawl has recently been brought to an end (Evers, 2002). Currently, walking and cycling are important modes of transport

for shopping trips, largely as a result of this former spatial planning policy (Schwanen et al., 2004).

A relocation of stores might, however, affect personal travel behaviour: longer distances are likely to be travelled and an increase in car use is expected (Evers et al., 2005). E-shopping will probably reinforce rather than slow down these developments. If mega stores were developed, they would probably be advertised online. People might be induced to travel longer distances by faster modes (car and train, for example) in order to be entertained (Evers et al., 2005). Under such circumstances, consumers might want to combine e-shopping and in-store shopping. Although we have currently found no evidence that new stores are being discovered through online shopping, this situation might change in the future. Overall, our results indicate that e-shopping and in-store shopping complement or generate each other. Consequently, we expect that e-shopping might stimulate visits to mega stores located in peripheral areas and the converse: that visiting mega stores might stimulate e-shopping.

The rise of mega stores at city edges could bring about fierce competition between shopping areas in attracting consumers. If such competition were to lead to more attractive city centres, the substitution of in-store shopping for e-shopping might be implausible, since people who consider city centres to be attractive are less likely to replace their shopping trips (Weltevreden & Van Rietbergen, 2006). However, these developments might afflict less attractive and relatively small shopping centres such as city district centres in large cities and the inner city centres of medium sized cities (TNO Inro, 2002). Small shopping centres would face competition from both mega stores and web stores.

Although we did not investigate C2C-commerce (Consumer-to-Consumer e-commerce) explicitly, we expect it to become even more popular than it is now, because one can obtain all sorts of products cheaply and easily (without a credit card). Currently, the C2C-web site Marktplaats.nl holds the fourth position in the top 5 of most frequently visited web sites by Dutch Internet users (Marktplaats.nl, 2005). More than six million individuals per month visit this website, which has in total 2.6 million advertisements placed by consumers and 85,000 new advertisements each day. An increase in the popularity of C2C-commerce could cause an enlargement of people's action spaces, since via the Internet they get to know other people who can buy or sell a product. They will probably visit each other in order to complete the transaction and hand over the product. More travel is expected to occur as a result of this type of e-commerce since the transaction takes place between people who have either to deliver or pick up the product. A change in mode choice could occur as well if these individuals travel longer distances. The new places that will be visited are likely to be residential areas rather than shopping areas, since most products offered on C2C-web sites are kept at individuals' homes.

Policy implications

Policy makers have to be aware of the potential environmental effects of e-shopping. Overall, more rather than less travel is likely to occur, caused by both consumers and retailers; more travel leads to more pollution. E-shopping is unlikely to function as a means of reducing travel. As mentioned above, consumers might shift towards more car use if they enlarged their action spaces by visiting stores that were advertised online. By ensuring that new shopping malls in peripheral areas are relatively easy to reach by public transport, the forecast increase in car use might be reduced. Another issue that needs to be noted is that

an increase in air travel could occur, since travel tickets are a popular item to buy online: this segment already accounts for nearly half the total turnover in online consumer spending. Cheap online offers could stimulate air travel, which would result in larger distances covered and more pollution. There are various opportunities to participate in tree-planting programs when travelling by air so as to contribute to a healthy environment: the 'Trees for Travel' program is an example (GreenBiz.com, 2005). Up till now, such contributions are voluntary, but it might become necessary to make them obligatory. It could also be useful to devise regulations concerning the efficiency of the delivery of products ordered online to prevent pollution. 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 & Lanzendorf, 2004). Policy makers could perhaps develop environment-friendly legislation for solving the logistic problems that many web stores contend with.

Because of their repetitive character and their potential impact on personal travel behaviour, online grocery shopping has attracted the attention of policy makers (Ministry of Financial Affairs, 2000, for example). Online grocery shopping is unlikely to become widespread In the near future, because of the dense network of grocery supermarkets in the Netherlands. Moreover, fresh grocery products are typical experience goods (see Chapter 1) that need to be seen and felt, which is not possible when shopping for groceries online. Also, the need to be present for the delivery of the items (or to make arrangements for that) could impede a swift popularity of online grocery shopping, together with the extra costs that are currently required for delivery (Gould, 1998). Nevertheless, in the long term, an ageing population could lead to an increase in the popularity of online grocery shopping, because of the mobility constraints the elderly often experience – provided they have sufficient Internet experience. As long as physical stores for daily goods, such as groceries, stay relatively easily accessible for most people, we believe that government policy is not needed for e-shopping. If policy makers should wish to regulate the commercial activities that are carried out online, they will have to identify the diverse consumer groups in society, since e-shopping can be done for very different motives, just as people's reasons for in-store shopping vary.

In the long term, however, shop accessibility problems concerning certain products could arise for people who are unfamiliar with e-shopping. As indicated above, determining which types of product will be affected is difficult. Nevertheless, it is known that older, poorly educated, and less affluent groups often have very little Internet experience and are therefore likely to be affected most by the potential closure of certain stores. Moreover, these people would not be able to benefit from the advantages that e-shopping might provide, such as buying products cheaply on C2C websites such as eBay. The government might therefore consider taking on the responsibility of giving people without Internet experience the opportunity to acquire it in order to prevent a digital divide in society. Not only can shopping be done nowadays online, but also many other activities that are more important than shopping for the way individuals function in society. For example, the labour market and social security systems are increasingly accessed via the Internet.

Future research

Two main suggestions for future research can be proposed. The first suggestion is to develop a comprehensive theoretical framework that is capable of explaining hybrid forms

of e-shopping and in-store shopping, taking into account individuals' social and time-space contexts. Second, many concepts need to be defined in a better way, since the outcomes of empirical studies also depend on matters of measurement. Both suggestions are further discussed below.

Only when we begin to understand people's motives for online and in-store shopping can the interactions between e-shopping and in-store shopping be accurately assessed. A theoretical framework concerning people's motives for shopping online and in-store needs to be further developed, taking into account hybrid combinations of both shopping modes as well as people' individual decision context. Using the detailed operationalizations of various psychological concepts from attitude theory has proven to be a fruitful approach, especially when individuals' constraints, such as shop accessibility and Internet experience, are also taken into account. The Hybrid Model we used can, however, be extended both theoretically and empirically.

As its name implies, the EMGB (Extended Model of Goal-directed Behaviour) provides a utilitarian explanation of behaviour (Perugini & Conner, 2000). When applied to shopping, this means that people choose the shopping mode that best helps them reach their goals. However, if the shopping activity is important in itself (that is to say, if it is an end in itself and not a means to an end), considerations related to enjoyment or ease could be more important in selecting a shopping mode than utilitarian considerations. An extension of the Hybrid Model should therefore leave room for explaining shopping activities that are important in themselves. More insight could thereby be gained into the extent to which e-shopping is more task-oriented and in-store shopping more leisure-oriented. Such shopping motives will probably vary among people and within people. Moreover, incorporating the change of goals into a comprehensive theoretical framework would resemble more closely the day-to-day reality in which goals are continually being adjusted. Additionally, such a framework should also be capable of explaining impulse purchases.

More insight into the relationships between e-shopping and in-store shopping could also be provided by an activity-based approach, since that would relate the shopping activity to other activities people carry out on a certain day (Ettema & Timmermans, 1997; Srinivasan & Bhat, 2005). In such an approach, individuals' complete activity schedule over a day or a longer period of time is analysed, taking into account interactions with household members regarding their activity- and travel patterns. Thus, insight is gained into where activities are conducted, when, for how long, why, with whom, and what mode of transport is used. Not only out-of-home activities, but also in-home activities are studied. This approach offers the opportunity to estimate, for example, how much time e-shopping takes, which is as yet unknown. The time-saving effects of buying a book or music online might be smaller than buying groceries online; there might be time-saving effects, although they would be difficult to measure. An activity-based approach could provide further insights regarding this issue, since the shopping activity is not considered in isolation. Furthermore, such an approach offers opportunities to explain shopping as a household activity, since interpersonal linkages between individuals are taken into account. At the same time, a distinction needs to be drawn between the various shopping acts (evaluation, selection, and so forth) when studying in-store shopping behaviour, in order to understand how these different activities relate to online searching and online buying. Such an approach might be helpful in assessing the direction of causality of the relationships between e-shopping and in-store shopping. It

might also provide more insight into the fragmentation of the shopping activity (that is, the possibility to shop at any time, at any place) and in combinations that are made of online and in-store shopping.

A few suggestions can be made for the refinement of some concepts. The type of relationship that is found between e-shopping and in-store shopping depends on many factors, one of which is the travel aspect under study. For example, different results were obtained for in-store shopping frequency and in-store shopping activity. Future research should therefore investigate how other aspects of in-store shopping (such as mode choice, distance, timing, and destination) relate to e-shopping, since this could reveal new insights. 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. We have found indications that media products might be substituted by e-shopping, but it is still unclear how other product types could be affected. Furthermore, some products are more leisure-oriented (books, for example), while others are more task-oriented (groceries, for example), which could be related to individuals' shopping motives and choice of shopping modes (online and/or in-store). Thus, future studies could pay more attention to distinguishing different product types.

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. Thus, future research should seek to differentiate between certain social groups that could have different shopping motives. Additionally, a distinction needs to be drawn between C2C- and B2C-commerce when studying e-shopping, since the travel impacts of C2C-commerce could be greater than B2C-commerce, as has been indicated above. Also, attention needs to be paid to different combinations of in-store and online shopping in order to assess the extent to which e-shopping generates trips to new activity places.

In order to gain more insight into the effect of land-use features on e-shopping, more refined and behaviourally-sound accessibility measures should be used that pay attention to the individual time-budget and space-time constraints, thereby enhancing our insight into personal accessibility. Researchers should therefore seek to include space-time accessibility measures in their analyses (Dijst & Kwan, 2005). Additionally, further research needs to be carried out in other countries where e-shopping is often done and that differ from the Netherlands in urbanization pattern.

Future studies face the challenge to further unravel the adoption of online shopping and its relationships with in-store shopping. 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, individuals might adapt new technologies in unforeseen ways, thereby creating whole new types of activity- and travel-patterns. In the long term, this might also apply to e-shopping.

References

AC Nielsen, 2005, "Global Online Shopping Habits. AC Nielsen Global Online Survey October 2005" http://www2.acnielsen.com/press/documents/ACNielsen_OnlineShopping_GlobalSummary

Casas J, Zmud J, Bricka S, 2001, "Impact of shopping via Internet on travel for shopping purposes", paper presented at the 80th Annual Meeting of the Transportation Research Board, Washington D.C.

Corpuz G, Peachman J, 2003, "Measuring the impacts of Internet usage on travel behaviour in the Sydney Household Travel survey", paper presented at the 26th AustralasianTransport Research Forum, Wellington, New Zealand

Dijst M, Kwan M-P, 2005, "Accessibility and quality of life: time-geographic perspectives", in *Social Dimensions of SustainableTransport: Transatlantic Perspectives* Eds K Donaghy, S Poppelreuter, G Rudinger (Ashgate, Aldershot, Hants) pp 109-126

Ettema D F, Timmermans H J P, 1997, "Theories and models of activity patterns", in *Activity-Based Approaches to Travel Analysis* Eds D F Ettema, H J P Timmermans (Pergamon, Oxford) pp 1-36

Evers D, 2002, "The rise (and fall?) of national retail planning" *Tijdschrift voor Economische en Sociale Geografie* **93** 107 – 113

Evers D, Van Hoorn A, Van Oort F, 2005, *Shopping in Megaland* (in Dutch) (NAI/RPB, Rotterdam/Den Haag)

Gärling T, Gillholm R, Gärling A, 1998, "Reintroducing attitude theory in travel behavior research" *Transportation* **25** 129-146

Golob T F, Regan A C, 2001, "Impacts of information technology on personal travel and commercial vehicle operations: research challenges and opportunities" *Transportation Research C* **9** 87-121

Gould J, 1998, "Driven to shop? Role of transportation in future home shopping" *Transportation Research Record* number 1617 149-156

Graham S, Marvin S, 1996 *Telecommunications and the City: Electronic Spaces, Urban Places* (Routledge, London)

GreenBiz.com, 2005, http://www.greenbiz.com/reference/organizations_record.cfm?LinkAdvID=10768

Hägerstrand T, 1967 *Innovation Diffusion as a Spatial Process* (University of Chicago Press, Chicago, IL)

Hägerstrand T, 1970, "What about people in regional science?" *Papers in Regional Science* **24** 7-21

Marktplaats.nl, 2005,
http://www.marktplaats.nl/index.php3?url=http%3A//verkopen.marktplaats.nl/about_us.php

Ministry of Financial Affairs, 2000, *Three Future scenarios for the Netherlands in 2030* (Ministerie van Economische Zaken, Den Haag)

Mokhtarian P L, Salomon I, 1994, "Modeling the choice to telecommute: Setting the context" *Environment and Planning A* **26** 749-766

Mokhtarian P L, 2002, "Telecommunications and travel: the case for complementarity" *Journal of Industrial Ecology* **6** 43-57

Murphy A J, 2003, "(Re)solving space and time: fulfilment issues in online grocery retailing" *Environment and Planning A* **35** 1173-1200
Perugini M, Conner M, 2000, "Predicting and understanding behavioral volitions: the interplay between goals and behaviors" *European Journal of Social Psychology* **30** 705-731
Schwanen T, Dijst M, Dieleman F M, 2004, "Policies for urban form and their impact on travel: the Netherlands experience" *Urban Studies* **41** 579-603
Thuiswinkel.org, 2005, "Home shopping in the Netherlands", http://www.thuiswinkel.org
TNO Inro, 2002, *Towards an Environmental Navigator ICT, Land Use, and Mobility* (in Dutch) (AVV, Rotterdam)
Urry J, 2004, "Connections" *Environment & Planning D* **20** 27-37
Srinivasan S, Bhat C R, 2005, "Modeling household interactions in daily in-home and out-of-home maintenance activity participation" *Transportation* **32** 523-544
Visser E, Lanzendorf M, 2004, "Mobility and accessibility effects of B2C e-commerce: a literature review" *Journal of Economic and Social Geography* **95** 189-205
Ward M R, Morganosky M, 2002, "Consumer acquisition of product information and subsequent purchase channel decisions" in *Advances in applied microeconomics: The economics of the Internet and E-Commerce*. Ed M R Baye (Elsevier Science, Amsterdam) pp 231-255
Weltevreden J, Van Rietbergen T, 2006, "City centre shopping in the Internet era: the case of the Netherlands", paper submitted for publication, copy available from weltevreden@rpb.nl

Curriculum Vitae

Sendy Farag was born on 28 November 1975 in Hilversum, the Netherlands. She completed her Masters Degree in Sociology at the Faculty of Social Sciences, Utrecht University, after five years of study in 1998. For one year she studied Arabic Language and Culture at the Faculty of Arts, Leiden University, and finished with a propaedeutic diploma. Subsequently, she worked for two years (1999-2001) as a researcher at the Research Centre for Education and the Labour Market (ROA), Faculty of Economics and Business Administration, Maastricht University. For four years (2002-2005) she has been a PhD student at the Faculty of Geosciences, Utrecht University. Currently, she is working as a research fellow at the Centre for Transport and Society, Faculty of the Built Environment, University of the West of England, Bristol (UK). Her main project deals with assessing barriers to the use of traveller information services.