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Publication Date
1998

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Future Travel and Telecommunications Tradeoffs

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January 1998

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Future Travel and Telecommunications Tradeoffs

by Jane Gould, Thomas F. Golob and Patrick Barwise

ABSTRACT

Shoppers today rely upon transportation, especially the car, to reach stores. We explore characteristics of shopping related travel, in view of future home shopping. An activity analysis model is used to predict how saved travel time might be channeled by working women, and we study current travel time savings among teleworkers.

WHY DO PEOPLE DRIVE TO SHOP?
Future Travel and Telecommunications Tradeoffs

In a short article that was prescient of issues in electronic shopping, Tauber (1972) asked 'why do people shop?' He distinguished shopping from buying and consumption, and asked whether there were motivations for going to stores other than buying products. Today, with the approach of electronic shopping from home, the question 'why do people shop?' holds great relevance. Will people still choose to visit stores if they can search for goods and make secure transactions from home or work through electronic networks?

Although researchers have started to explore this issue (Alba et al., 1997; Hoffman and Novak, 1996) there has been little recent consideration of transportation aspects, although there is earlier work by Salomon and Koppelman (1988) and Koppelman, Salomon, and Proussalogou (1991). A distinguishing feature of shopping at home is that it is 'aspatial': people do not have to travel. In his investigation, Tauber did not consider the travel aspect of shopping to be a main factor, but did observe that exposure to new shopping opportunities was facilitated by having access to transportation, as well as discretionary time.

As an increasing range of shopping could be done aspatially, we need to examine what the motivations are for trips outside the home to stores, and whether driving to stores has intrinsic value, at least for some consumers, some of the time. Are there segments of the population who would prefer to travel to stores, and others who find shopping from home to be an advantage? What are the factors involved?

'Shopping trips,' as contrasted with trips to make a specific purchase, may be particularly uncertain with the development of electronic channels. Tauber (1972) noted that a shopping motive might be quite distinct from a buying motive, and that one aspect of shopping was to do with search. The growth of intelligent agents and shopping services may make it technically feasible for consumers to compare product features and prices online. Recently, there has been a tremendous growth in sites that offer pre-purchase information (e.g. for cars). Although some of this was possible before the growth of the Internet, consumers may have found the use of catalogue or telephone shopping to be cumbersome or not time effective (Barwise, 1997).

In this study we look at the relationship between shopping and travel trips, especially by car, and ask whether the travel trip has intrinsic value and/or costs for shoppers.

The plan of this paper is as follows: First we establish a baseline about shopping travel, based on recent travel statistics. We then seek, through the transportation and marketing literatures, different approaches to the question of why people travel to stores. This leads us to pose specific hypotheses about shopping-related trips which we then test using activity-based demand modeling. The final sections discuss our results and conclusions. They suggest that the behaviors associated with the adoption of electronic home shopping are complex, and that it is naïve to view home shopping as just another channel. Home

shopping will not evolve independently of other changes in work, daily routines, and leisure time use.

Recent Trends in Traveling to Shop

When shopping trips are examined from beginning to end, travel time is often a major component. Figure 1 presents a schematic of a weekly grocery shopping trip in Europe (Coopers & Lybrand, 1996). Travel represents about 30 % of this activity. The return trip home is longer since it includes time to load and unload groceries. If instead consumers were to shop for groceries online, one estimate is that it initially takes about 2 hours to set up a weekly, standing grocery order, and an average of about 40 minutes thereafter to complete a weekly shop, a reduction of over 50% (Electronic Home Services, 1997). Based on estimates that it currently takes 90 minutes to complete a weekly food shop, home shopping for groceries would offer substantial time savings even after allowing for some additional time to wait for grocery delivery and to unpack.

1.Plan Shopping Trip		10%
Non-store Based	2. Decide Where to Shop	2%
		10%
------------ TRAVEL	3. TRAVEL TO SHOP	
	4. Select Purchases	40%
Store Based	5. Pay for Purchases	10%
	6. Use Other Store Facilities	8%
------------ TRAVEL	7. RETURN HOME	**20%***
Non-store Based	8.Meal Planning	

*includes time to pack car (or go to bus stop) and unpack groceries at home
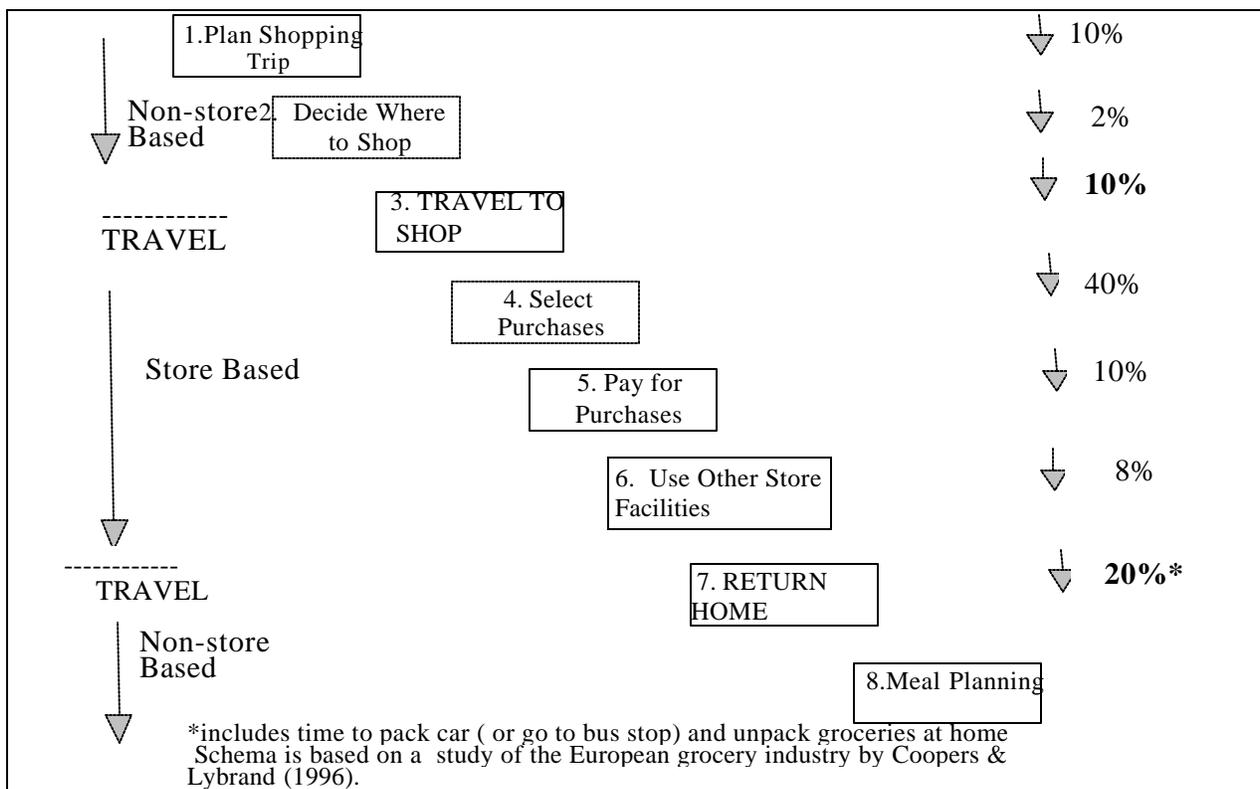Schema is based on a study of the European grocery industry by Coopers & Lybrand (1996).

Figure 1
Estimated Time and Travel/Non-Travel Activity for Weekly Grocery Shopping

Official travel statistics show that there has been a large increase in the time people spend driving to stores over the past 30 years. Although some shopping trips are made by foot,

mass transit, or bicycle, the car accounts for more than 80% of shopping trips in the USA and 74% in the UK (UK DOT, 1996; US DOT, 1994). In the UK, the number of shopping trips per person has nearly doubled since 1965, and the annual shopping mileage has nearly trebled. There are probably many interrelated reasons:

a) The increase in car ownership. In Table 1, we track only shopping trips greater than one mile in length. As people acquire cars, they drive instead of walking to stores, increasing the number of trips greater than one mile.

b) The growth in retailing centers at a distance (Table 1) has coincided with ownership of the personal automobile. These two trends have reinforced each other (Tedlow, 1996)

c) Closely   related to the growth of suburban retailing centers, has been   the emergence of combined shopping/ recreational travel. For example, a one-day family outing may now combine an out-of-town shopping trip, amusement rides at the mall, and a restaurant meal. Since the 1970s, there has been growth in warehouse stores and factory outlet stores situated outside major metropolitan areas.

Table 1
Trends in UK Shopping Trips per Person

	Shopping Trips P/ Person P/Year*	Avg. Trip Length (miles)	Annual Mileage*	Car Ownership*	Number of Purpose Built Shopping Centres (not town centre)* *	Real Consumer Expenditure per capita (£bn) constant= 1993
1965	77	3.5	268	42%	50	218.3
1975	115	3.8	440	53%	300	270.2
1985	125	4.6	577	62%	500	323.4
1995	145	5.2	747	68%	990 (1992)	405.6 (1993)

*Excludes shopping trips < 1 mile   Sources: Social Trends (1997), UK DOT (1996)
** British Council Shopping Centres (1993). Numbers are rounded up.

Trips for shopping are one of the major uses of the household vehicle. In the UK, 12% of all mileage and 20% of all car journeys are undertaken for shopping (UK DOT, 1996). Results for the US are similar - 19% of all person trips in the US are made for shopping and this represents 12% of the annual vehicles miles traveled, or VMT (US DOT, 1994).

These statistics should be interpreted with care. First, shopping trips are often combined with other types of travel, like the trip home from work (Bhat, 1997). In some travel statistics, trips taken for multiple purposes are not cross-classified. Second, many shopping trips involve multiple stops, and there is some confusion as to whether these should be categorized as separate shopping trips. Another difficulty stems from measuring the time spent in shopping activities, as respondents vary in their perception of time the accuracy of self-reporting.

Literature on Travel Related Shopping

We now review previous research on why people travel to shop. Today, consumers may have no alternative although certain product categories like insurance and travel bookings are increasingly transacted over the telephone. However, the range of products and services available online will rapidly grow. Can we identify through the literature any relevant consumer attitudes which may provide insights into the likely response to online shopping channels?

1. home delivery and the perceived costs of transport:
Shoppers have historically carried home with them the things that they bought, although home delivery achieved some popularity during the first part of this century. Opportunities to shop from home have steadily increased during this century with the adoption of the household telephone, and more recently, the fax machine and personal computer. However, since WW II, there has been a general decline in home delivery from stores. One reason is the reduced availability of consumers at home. There are fewer people home during the daytime as the number of working women increased, and the family unit size decreased. The absence of at-home neighbors to accept deliveries and increases in crime are additional factors that have deterred home delivery.

Consumers perceive that the car provides more benefits than home delivery. Since consumers initiate trips to stores, it is more efficient for them to bring back home with them the goods that they buy. They have the immediate gratification of having their purchases at hand, instead of waiting a day or more, and they avoid home delivery charges (Quelch and Takeuchi, 1981). According to McKinnon and Woodburn (1994), 'the journey between shop and home can be considered the final link in the supply chain'.

Although there is a cost to traveling to and from the stores, it is unlikely that consumers factor it into their decision making. Studies from the transportation field suggest that drivers rarely enumerate the total cost of owning and operating a car, nor do they attempt to estimate the incremental cost of a particular trip, no matter how regularly they make it (Louviere, cited by Wachs, 1991). Many consumers probably assume (wrongly) that the marginal cost of car travel is no more than the gasoline cost, and for short trips they do not even consider that.

2. The centrality of cars and car dependence:

A second reason that people drive to shop may have to do with vehicle ownership. Over the past decade, there has been growing awareness of 'car dependence' (Newman and Kenworty 1989; RAC 1995). The personal vehicle has become such a pivotal feature of daily life that we organize activities around it. For example, in the UK, the number of short trips taken by car is increasing, at the expense of trips on foot or by bicycle. It has been found that acquisition of a car encourages people to gradually change their behavior and activity patterns, and to acquire new ones that favor use of the vehicle. Owning a car is a powerful predictor that it will be used, and there is concomitant relationship between car dependence and other social changes, like the location of stores and services (RAC, 1995).

'Car dependence' turns on its head the commonsense view that the car is a mode of transport to get to a place. Instead, it suggests that having a car will, in its own right, generate travel. If this construct is extended to non-food shopping trips, people might at least prefer shopping opportunities, some of the time, that allowed them to use their car *more* (e.g., factory outlet shopping), and may not be averse to shopping trips that required unusual or variable levels of driving (e.g. yard sales, boot sales).

Tauber (1972) posited that people often go to stores because there is a recreational aspect to shopping. Here we posit that there is also a recreational aspect to driving. Although there are complaints about driving, such as parking, road rage, and congestion, many people still appear to enjoy taking their car out for a shopping trip, making this partly a recreational use. Stores foster this by providing safe and sheltered car parks, and in some upscale markets, valet parking. In the past, some other recreational activities, like the drive-in movie, developed specifically around enjoyment of car-based activities.

Although there are many opportunities today to shop without driving, consumers do not seem to non-retail shopping formats because they offer travel-less shopping. Most recent studies on catalog shoppers assume that consumers have access to cars. Other factors, like recreation, quality, and value shopping are cited in the use of catalogs or videotext (McDonald, 1993; Eastlick, 1993). A recent study found little indication that mail-order and catalog shopping was used as a substitute for travel to stores (Handy and Yantis, 1996). Shoppers who used mail-order frequented retail stores as often as non-users. Some of the products available through catalogs are "hard to find" (and easy to ship) items, such as clothing in special sizes or craft items. Sales advertising in catalogs also exposes the consumer to attractive price discounting. There is, however, one group that does seem to favor home shopping because of reduced mobility. Older people are heavily represented in home shopping services like Shoppers Express in the US (Electronic Home Services 1997) and the 'TeleSuper' project in the Netherlands (Tacken, 1990).

3. personal freedom and other psychological constructs:
Another aspect of 'why people drive to shop' may have to do with an underlying desire for mobility. People buy vehicles that exceed their utilitarian use, and although most people habitually drive the same routes, a car may provide psychological freedom. For instance, the ability to drive to a store may also introduce serendipity: as people travel, they may see

a sign announcing a sale or promotion, or come upon a new store. This introduces an element of adventure to the shopping process.

Another reason, again related to psychological motives, is that time spent in cars may be a useful 'transition.' Albertson (1977) has suggested that the journey to work by car provides a time for people to make the transition between work and home roles, and this may help to explain why some commuters do not want to give up the drive to and from work. By extension, the time spent driving to stores may abet transition into a consumer role. This may be of value to shoppers and help them organize shopping visit effectively. Online shopping does not provide this opportunity. The absence of transition time might be a particular problem for teleworkers; i.e., those who work at home, often using computers.

Although there is little empirical data about travel to stores, existing evidence does not suggest that most people find it onerous. In fact, people may blur their travel time to shop with entertainment. Evidence for this can be found in a methodological study by Kalfs (1995). She compared three methods of collecting travel diary data: paper and pencil interviews (PAPI), computer assisted self interviews (CASI), and computer assisted telephone interviews (CATI). One of the major differences between the collection methods was how respondents coded their travel time to shop. In the CATI, the purpose of a travel trip was coded as shopping, but in the CASI it was often recorded as travel time for entertainment or traveling around. That is, travel time for shopping and entertainment activities tended to blur, depending upon the data collection method.

In a different context, the value of travel can be readily seen. Holiday travel is one of the most important activities in the US and Western Europe. Vacation related travel trips have increased in the UK by a factor of four between 1965 and 1991. Among workers who get a summer vacation, 60% of them take a holiday that involves travel (Argyle 1996). This type of discretionary travel is obviously regarded by consumers as a valuable use of time and money.

Travel Behavior Models and Research Hypotheses

Consumers' outlook towards travel is likely to play a pivotal role in the development of electronic home shopping. If shoppers have access to a vehicle, available time, and a propensity to leave home/work, then driving to stores might be viewed as an acceptable, and even enjoyable aspect of shopping. However, if people are busy and/or would prefer to engage in other activities, then travel time to shop might be seen as onerous, and home shopping would provide an alternative. The latter view was articulated by Rosenberg and Hirschman (1980), who predicted customer reluctance once teleshopping developed, to drive great distances, except for high-priority shopping expeditions.

One way to explore these choices is through the use of travel behavior models. Models based on activity demand have been used to identify the relationships between travel and activities (Kitamura 1988; Lu and Pas 1997). These models predict travel, based on factors like time use, vehicle access, and competing in-home, out-of-home choices. They
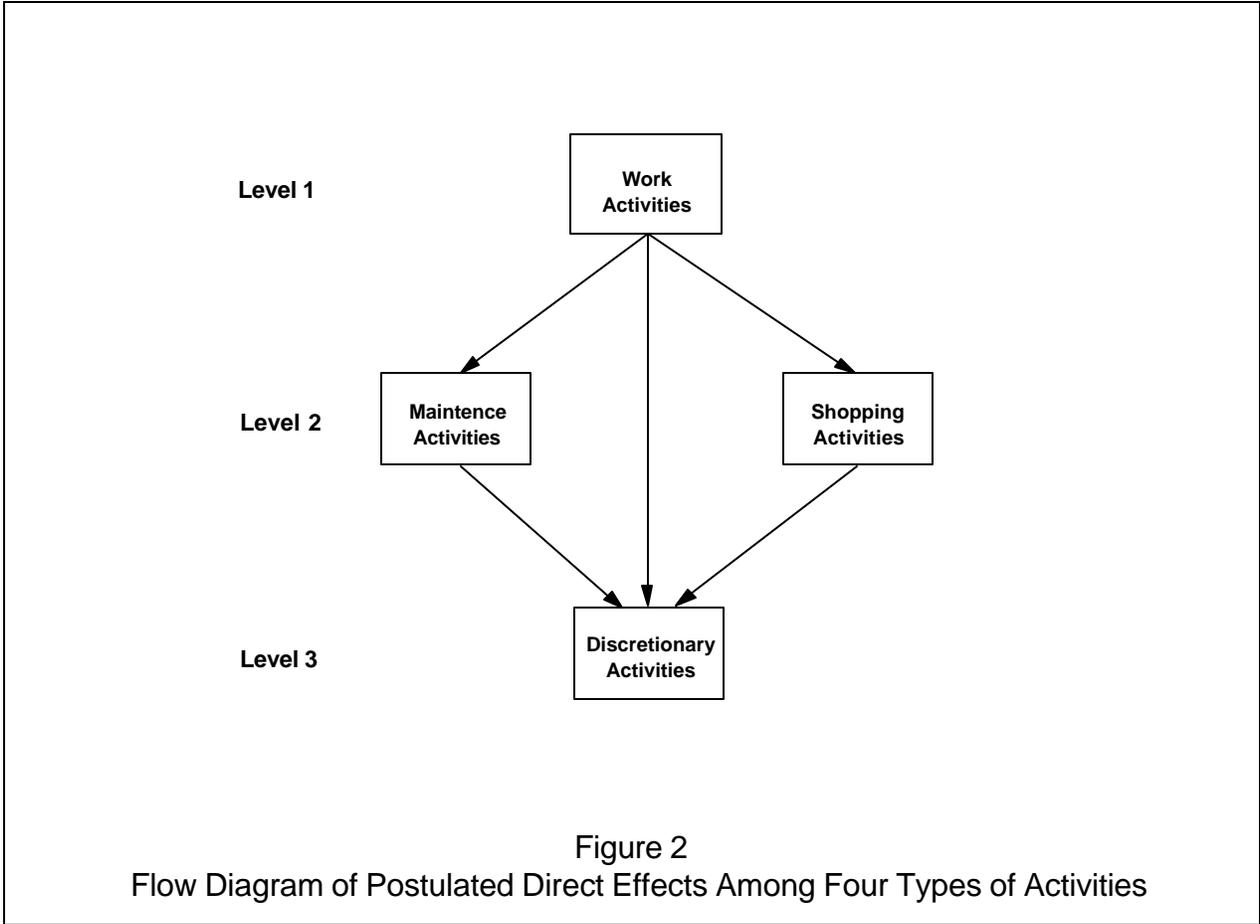
are similar to models used to study consumer time budgets (e.g., Lane and Lindquist, 1988), but they explicitly consider the role of travel. Household travel patterns have been studied using a three-way classification, based on a hierarchy of needs (Chapin 1974; Robinson 1977; Golob and McNally 1997). This hierarchy, which applies to activities both in and out of the home, is shown in Figure 2, but it is modified to draw attention to shopping activities.

(1) Level 1 is comprised of *subsistence activities*, measured by the amount of time spent travelling to and engaging in out-of-home work activities. They are at the top of the hierarchy. The more time a person devotes to subsistence activities, the less time he or she has available for all other activities.
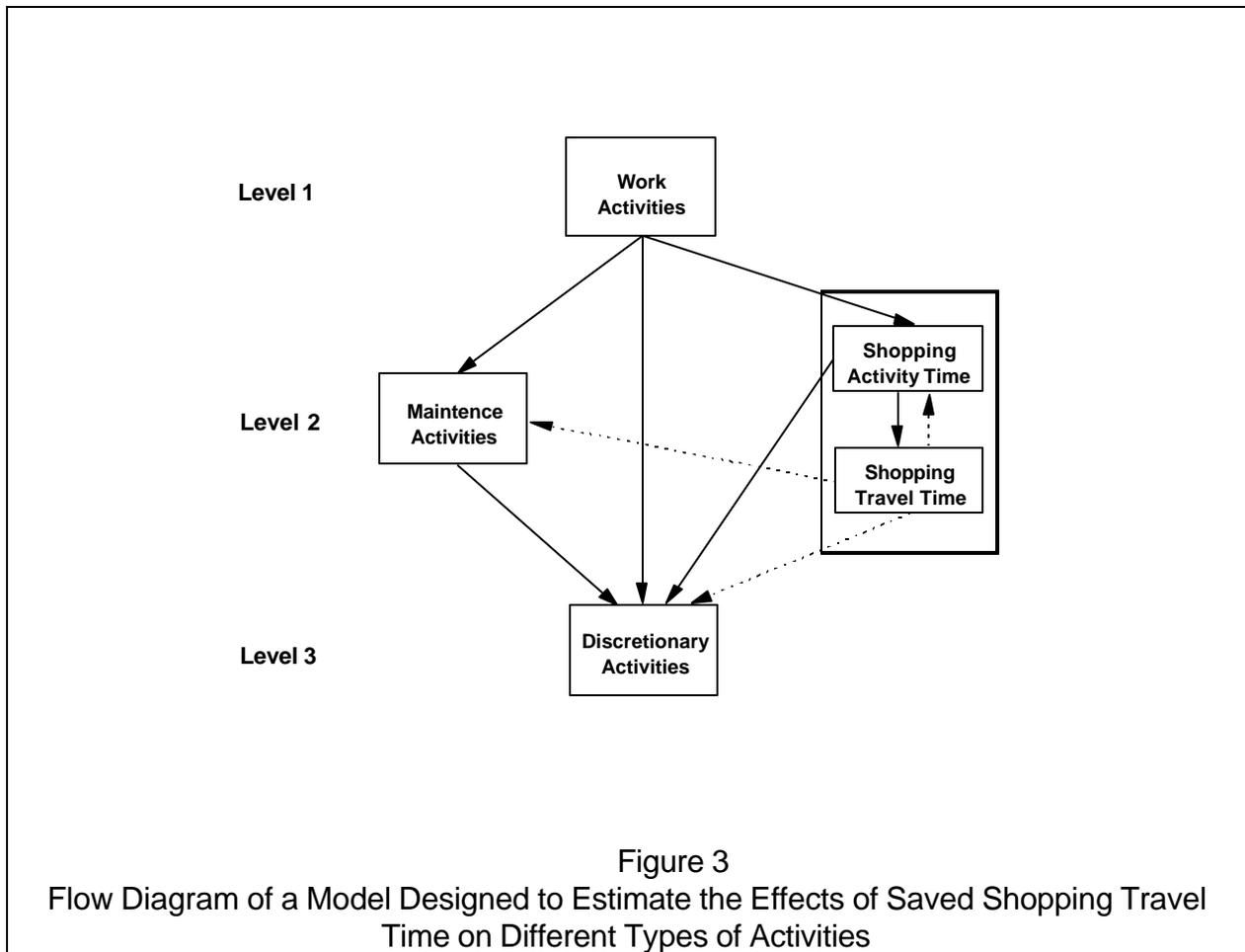
(2) Level 2 is made up of *maintenance activities*, which includes the activity time and travel for all activities that households typically need to perform on a regular basis, such as most types of shopping, eating meals, engaging in personal or professional services, medical care, taking care of household or personal obligations, picking up or dropping off passengers, school, and religious activities at non-home locations. For purposes of investigation, we will distinguish between shopping and all other maintenance activities.

(3) Finally, Level 3 is comprised of *discretionary activities*, which encompass social, recreational, and entertainment activities (such as visits to friends or relatives, engaging in cultural and civic activities, amusements, hobbies, exercising, sport, rest and relaxation, attending spectator athletic events, or making incidental or tag-along trips). As Level 3 is at the bottom of the hierarchy, discretionary activities are affected by activities at the two upper levels, and there are no direct effects originating from discretionary activities.

In most prior research using these activity models, shopping has been treated at as *maintenance activity*, and is aggregated at Level 2. However, recognizing that shopping can take place for both maintenance and discretionary reasons, and that these may overlap, our analysis treats shopping and shopping- related travel 'outside' of either category. We can then examine how shopping from home could lead to time savings that are channelled towards additional *maintenance* or *discretionary* activities, or both.

Level 1

Work
Activities

Level 2

Maintence
Activities

Shopping
Activities

Level 3

Discretionary
Activities

Figure 2
Flow Diagram of Postulated Direct Effects Among Four Types of Activities

If people did not have to travel to shop, then they would recoup the time of their round-trip travel, assuming for now that the duration of the shopping visit remained constant. In order to model the effects of the travel time savings, we expand the activity hierarchy of Figure 2 to separate out-of-home shopping activity time and shopping travel time. In Figure 3, we specify how time that is saved from shopping trips could be directed towards either *discretionary activities* (in-home or out-of-home) or towards *maintenance activities* (in-home or out-of home), or toward an increase in shopping itself. The additional three 'feedback effects' of travel time result in a structural model, depicted by the flow diagram of Figure 3, that is defined by nine direct effects: five direct effects that portray the activity hierarchy, one direct effect that represents the need to travel to conduct out-of-home shopping, and three feedback links that represent potential shopping travel time influences on activities.

Figure 3
Flow Diagram of a Model Designed to Estimate the Effects of Saved Shopping Travel Time on Different Types of Activities

The relationships postulated in Figure 3 could apply to anyone working outside the home, but Gould and Golob (1997) established that many busy working women are time-pressured. Busy working women are likely to harbor latent demand for out-of-home Level 2 and Level 3 activities; and because of this reason, they represent one segment that is likely to is likely to be an initial target for home shopping. Women, for example, currently make up about 80% of the users of the Peapod home delivery food service (Foremski, 1996).

This leads to a hypothesis that working women might favor electronic home shopping because they have an unmet demand to engage in different *maintenance* or *discretionary* activities, and they would direct saved shopping travel time to other areas. The null hypothesis is that among working women, new time savings, from travel, would not increase *maintenance* or *discretionary activities* outside the home.

Future Work/Home Relationships

Figure 2 directs our attention to the primary influence of work (*subsistence activities*). Time spent at work is a critical predictor of other travel and activities, and more work activity implies less time for shopping activities. Empirical analysis has confirmed that that retired people and homemakers without paid employment spend significantly more time shopping in stores than full and part time workers (Gould and Golob, 1997).

If people work from home more, will they then spend more time in stores, like retired people and homemakers? For some professionals the distinction between home based activities and work may blur, especially if the same technology that enables work from home enables other activities like electronic home shopping.

Early adopters of telecommuting might be studied for clues. One recent study has found that telecommuters tend to choose spatial locations closer to home (Saxena and Mokhtarian, 1997). White-collar teleworkers spend large portions of their day using computers are likely to be targeted by home shopping services since they have modems, and are also at home during the daytime to accept deliveries. However, teleworkers might shun these services if outside travel and shopping serve other psychological roles. Since we believe, like Tauber (1972), that seeking diversion outside the home is an important function of shopping, we expect that people who work at home will still seek to spend time in both travel to stores and shopping. If both the shopping activity and shopping travel are of value, then they may both increase in the future, as more people telework (provided that new, competing out-of-home activities do not capture all the resulting latent demand). We test the null hypotheses that:

a) The amount of shopping time will be the same among teleworkers and other workers.

b) The amount of travel time for shopping will be the same among teleworkers and other workers.

Methodology and Data

Sample and Data Collection

An activity and travel study with a large and representative sample was conducted for the Portland Metropolitan Area in Northwest Oregon and Southwest Washington, in 1994-95 (for a discussion of the sample see Cambridge Systematics, 1996; for a discussion of the measurement issues see Lu and Pas 1997). This is the only recent multi-day travel diary available with a spatial distribution of stores and households, similar to other large metropolitan areas in the US, and it was developed after two phases of pilot testing. A random probability sample of telephone exchanges in the area of interest was used, and the first step was to determine an eligible sample, after eliminating business and government numbers, disconnected numbers, no answers, and so forth. Among 7,090 eligible households, there was a recruitment rate of 53%, and a completion rate among them of 63%. Demographic and household characteristics of the final sample were

compared to the US Census, and are reported by NuStats (1995). The survey achieved similar distribution of households compared the 1990 Census, but there was a slight tendency for low-income households to be underrepresented because these households may have had fewer telephones, and were more reluctant to participate.

The survey was conducted in several stages. First, respondents received an advance letter about the survey, followed by a recruitment interview. Recruited households received a packet of survey materials, and later, a reminder phone call to log their activitiy diaries. Finally, a telephone survey was used to retrieve activity and travel data following the last designated travel day. The activity diaries were extensively pretested, and recorded all activities involving travel and in-home activities with a duration of at least 30 minutes, for all individuals in the household, over a 48-hour period. A full range of household and person data were also collected.

After the elimination of records with any missing travel activity data, there were 6,919 persons aged 16+ in 3,891 households. These 6,919 respondents recorded 13,838 days of observation. These days were not equally distributed across the week due to logistical problems in the interviewing and the need to over-represent work days in the sample for transportation planning reasons. Since activity participation varies by day of the week, it was necessary to weight statistics computed from the person-day sample so that all days were equally represented. The day weights, centered at unity to preserve the original sample size in statistical tests, varied from 0.82 (Thursday) to 1.30 (Sunday).

For the analysis of teleworkers, a work activity was defined if its duration was four or more hours. The sample sizes here are 5,263 days with work solely away from home, 367 days with work both at home and away, and 287 days with work solely at home. For the analysis of busy working women, we selected 1669 women who recorded at least four hours of out-of-home work activity on at least one of the diary days. This segment represents 46.7% of the 3573 women older than 15 years of age in the full data set.

Analysis

Our analysis consists of two distinct segments. First, we specify a structural equations model upon a sample of working women to investigate the potential effects of a reduction in shopping travel time on future activity. In the second part, we study teleworkers and discuss their shopping time and travel patterns.

The structural equation model tests the hypotheses of Figure 3. The relationships among the endogenous activity variables are conditioned on exogenous factors of household and person characteristics. The exogenous variables we use have been shown to be important in explaining differences among adults in their demand for these shopping, maintenance, discretionary, and work activities (Robinson 1977; Pas 1984; Golob and McNally 1997; Gould and Golob 1997; Lu and Pas, 1997). The household characteristics include income, car ownership, and household composition by age group, and personal characteristics include age and gender. In addition, since our activity diary data can be recorded on any two consecutive days in the week, we include two dummy exogenous variables, one for

Saturday and one for Sunday, to account for differences in activity patterns on weekends versus week days.

We estimate the structural equation model using maximum likelihood estimation (MLE), because the two-day activity diaries picked up well-distributed activity durations for all activity types. A particular advantage of MLE is that it is generally applied, as here, to covariances (rather than correlations), so that the estimated coefficients are in the scales of the variables, which facilitates interpretation of the results.

The second part of our analysis, about teleworkers, is descriptive. We use an analysis of variance to test the null hypotheses about activity duration and travel time across groups stratified by the amount of time spent at an away-from-home work site. Having a group that works both at home, and away from the home, gives us the chance to see whether their activity duration and travel time more resembles home-only workers, or office-only workers. We recognize that online shopping options available to teleworkers today are different than future ones, so we look primarily for evidence that today's teleworkers seek shopping and travel outside the home.

Results

Effects of Reduced Shopping Travel Time on Activity Patterns

We fitted the structural equations model for the sample of 1669 busy working women . The fit yielded a chi-square value of 12.71 with 23 degree of freedom, which indicates that the model fits extremely well and cannot be rejected at the $p = .05$ level. The estimated direct effects among the endogenous variables are shown in Figure 4. All of these direct effects have the expected sign, and all coefficients are statistically significantly at the $p = .05$ level with one exception. The single insignificant link is the feedback from shopping travel time to *discretionary activities*. This suggests that busy working women would convert saved shopping time into additional shopping and other *maintenance activities*, but not necessarily into additional *discretionary activities*.

The total effects of each variable on all other variables are listed together with their *t*-statistics in Table 2. A comparison of the total effects emanating from shopping travel time (Table 2) with the direct effects (Figure 4) shows that the conversion of saved time is dampened by the feedback loop involving shopping activity time and shopping travel time; increased shopping activities generate more shopping travel time. The net effect of saved travel time on discretionary activities actually turns out to be negative (but not significantly different from zero), because increased Level 2 activities depress discretionary activities.
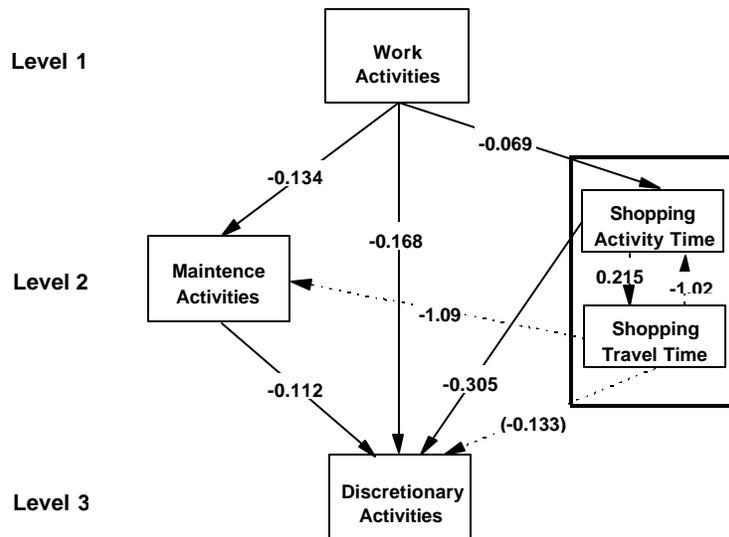
Figure 4
Estimated Direct Effects Among the Four Types of Activities and Shopping Travel Time
(one effect not significant at the *p* = .05 level shown in parentheses

We interpret these results to mean that female workers have a latent demand for all out-of-home *maintenance* activities. If more time is available, they would participate more in such activities. Work is largely responsible for repressing this demand, but our results indicate that shopping travel time is also a significant component of the time that could be converted to *maintenance* activities. Among busy working women the elimination of some shopping trips due to the substitution of in-home for out-of-home shopping should therefore lead to an increase in demand for activities that include other types of shopping.

Table 3 lists the direct exogenous effects on which the endogenous effects are conditioned, and Table 4 reports the total effects of the exogenous variables. These total effects are computed by solving the structural equations system so that the endogenous variables are functions only of the exogenous variables.

Table 2
Structural Equations Model: Total Effects of the Endogenous Variables

13

Affected Endogenous Variable (in hours)	Out-of-home subsistence activities and their travel time	Out-of-home shopping activity time	Travel time for trips to shopping activities	Other maintenance activities and their travel time	Out-of-home discretionary activities and their travel time
Out-of-home subsistence activities and their travel time					
Out-of-home shopping activity time	-0.057 (-10.7)	-0.180 (-2.66)	-0.835 (-2.86)		
Travel time for trips to shopping activities	-0.012 (-9.37)	0.177 (32.6)	-0.180 (-2.66)		
Other maintenance activities and their travel time	-0.120 (-10.5)	-0.192 (-3.80)	-0.891 (-3.39)		
Out-of-home discretionary activities and their travel time	-0.136 (-8.96)	-0.252 (-4.20)	0.247 (0.80)	-0.112 (-3.76)	

These results tend to support further the time/trade-off issues. They show that shopping activities are integrated into other routines and roles. For example, working women with a higher household income shop more, while younger women seems to be involved in different types of maintenance and discretionary activities (perhaps school or sports groups). Working women from both the highest and lowest income households travel more for shopping than do women from middle-income households, but for higher income women this is the result of more demand for shopping activity time, while lower income women must travel further per hour of shopping activity, presumably due to residential location factors.

The large coefficient between shopping activity and weekend days suggests that working women are using what free time they do have to engage in shopping activities. The model suggests that electronic shopping might serve a valuable role, based on the evidence that working women would channel their saved travel time into additional out-of-home activities because there is a latent demand to meet other needs.

Table 3: Structural Equations Model: Direct Effects of the Exogenous Variables
(z-statistics in parenthesis)

Endogenous Variable (in hours)	No. of children < 12 years	No. of children 12-16 years	Age (in years)	Age 16-25 years (dummy)	Whether person is a driver (dummy)	Household income < $20,000 (dummy)	Household income > $60,000 (dummy)	One diary day is a Saturday (dummy)	One diary day is a Sunday (dummy)
Out-of-home subsistence activities and their travel time	-0.794 (-4.42)	-0.465 (-1.97)	-.031 (2.45)	-0.748 (-1.66)	0.969 (1.74)			-3.993 (-13.6)	-3.302 (-10.7)
Out-of-home shopping activity time	-0.092 (-1.98)						0.191 (2.59)	0.507 (5.67)	0.430 (4.80)
Travel time for trips to shopping activities						0.0439 (2.19)			
Other maintenance activities and their travel time		0.328 (2.79)	-0.006 (-1.01)	1.106 (5.02)		-0.356 (-1.75)			
Out-of-home discretionary activities and their travel time	-0.344 (-3.11)		-0.019 (-2.44)	1.18 (4.26)	1.380 (4.06)			1.333 (6.97)	0.349 (1.77)

Table 4: Structural Equations Model: Total Effects of the Exogenous Variables
(z-statistics in parenthesis)

Endogenous Variable (in hours)	No. of children < 12 years	No. of children 12-16 years	Age (in years)	Age 16-25 years (dummy)	Whether person is a driver (dummy)	Household income < $20,000 (dummy)	Household income > $60,000 (dummy)	One diary day is a Saturday (dummy)	One diary day is a Sunday (dummy)
Out-of-home subsistence activities and their travel time	-0.794 (-4.42)	-0.465 (-1.98)	-0.031 (-2.45)	-0.750 (-1.66)	0.969 (1.74)			-3.994 (-13.6)	-3.302 (-10.7)
Out-of-home shopping activity time	-0.030 (-0.78)	0.027 (1.95)	0.002 (2.38)	0.043 (1.64)	-0.055 (-1.72)	-0.037 (-1.78)	0.157 (2.62)	0.643 (9.74)	0.541 (7.81)
Travel time for trips to shopping activities	-0.0065 (-0.78)	0.0057 (1.94)	0.0004 (2.37)		-0.0119 (-1.71)	0.0356 (2.16)	0.0338 (2.61)	0.1386 (8.70)	0.1164 (7.24)
Other maintenance activities and their travel time	0.113 (4.45)	0.383 (3.18)	-0.002 (-0.36)	1.196 (5.27)	-0.117 (-1.72)	-0.383 (-1.88)	-0.037 (-2.21)	0.383 (6.09)	0.314 (5.45)
Out-of-home									

discretionary activities and their travel time	-0.212 (-1.88)	0.026 (0.72)	-0.014 (-1.76)	1.161 (4.09)	1.248 (3.59)	0.051 (1.74)	-0.048 (-2.26)	1.747 (9.45)	0.688 (3.54)

Teleworkers

We found that people who worked exclusively at home on a given day allocated their time different than other workers. Results from an analysis of variance are listed in Table 5, for full time teleworkers (n=287), full time office-workers (n=5263), and a third group who mixed work at home and at the office (n=367). For teleworkers, the first null hypothesis is rejected as the groups are significantly different in terms of shopping activity duration, primarily due to the higher level of shopping activity participation for teleworkers. The second null hypothesis is also rejected as there are significant differences (at the $p = .05$ level) in terms of travel time to shopping, and the groups that work at home travel somewhat further to shop. However, this may not reflect a preference for longer trips, as the shorter travel time for out-of-home workers might also occur because full time workers can perform shopping activities on their way home from the office or during lunch time. (Among the away-from-home workers, 53% of their shopping activities were linked to the work trip, and among those who worked both at home and away, 49% of their shopping activities were linked to the work trip.)

The duration of *non-shopping maintenance* activities is significantly higher for out-of-home workers because at lunch-time they often eat out, pick up papers or packages, and so forth. The travel times for these *maintenance activities* are not significantly different across the three groups. Also, there are no significant differences in *discretionary* activities and travel; this is due to the high variances on these variables. Finally, combining *all non-work out-of-home activities and travel*, teleworkers spend, on average, more than 1.5 hours per day engaged in non-work activities outside the home, which is significantly higher than the time spent by other workers. Table 6 compares the three groups, in terms of the percentage breakdown of their non-work out-of-home activities. Relative to the other groups, teleworkers allocated only very slightly more of this time to discretionary activities (41% vs. 38%). Instead, they spent a substantially higher proportion of this time shopping and a substantially lower proportion on other *maintenance activities*.

Looking now at just non-work travel activity, we find that although they are not statistically significant, the results are in the expected direction. The telecommuters travel somewhat more across all conditions. There are several interpretations: one is that teleworkers are unable to conduct their shopping and errands in conjunction with their office lunch or the drive home from work. Therefore, when working at home they have to undertake new and separate trips. Another explanation is that the teleworkers use trips outside the home to break their isolation or seek outside contact. These data do not enable us to distinguish between these two competing ideas, but they both point in the direction of a different activity pattern for teleworkers which we might expect to become more widespread as more people work from home.

This has implications for the future location of stores, and for the choice of transportation to reach these stores. Today, the location of many stores is based upon proximity to offices and commute corridors. Since store locations are often at a distance from home, telecommuters currently have to drive to shop. If telecommuters choose shopping sites that

are close to home then they might also reach them on foot, on bicycle, or in entirely new vehicles like electric cars.

Table 5: Out-of-home Activities for Three Types of Workers (in hours)

	Group means			Test of equality of means	
	Away-from-home only	Mixed home & away	In-home only	F Statistic	probability
	N= 5263	N= 367	N= 287		
Shopping					
activity duration	0.154	0.175	0.321	18.70	0.000
travel time to activities	0.057	0.072	0.077	3.18	0.042
Other maintenance					
activity duration	0.679	0.543	0.589	3.37	0.035
travel time to activities	0.167	0.163	0.181	0.35	0.705
Discretionary					
activity duration	0.520	0.440	0.648	2.46	0.086
travel time to activities	0.101	0.086	0.120	0.92	0.401
Total non-work out-of-home activities					
activity duration	1.352	1.157	1.558	4.75	0.009
travel time to activities	0.325	0.320	0.378	1.77	0.171
Total non- work travel time	1.300	1.354	0.741	59.93	0.000

Table 6: Total Out of Home Time (Excluding Work) Spent in Different Types of Activities (%)

	Away From Home	Mixed Home and Away	Tele-commute
Shopping	11%	14	21
Maintenance	50	47	38
Discretionary	38	38	41

Discussion

In 1972 when Ed Tauber asked 'Why do People Shop?' there were few alternatives to going to the store since the range of home shopping was limited to mail-order and direct marketing. Today, home delivery shopping services are growing and electronic commerce

is burgeoning. So, it is appropriate to ask, as Tauber did, whether going to stores has an intrinsic value, beyond the selection of individual products. One of the components of the visit to the store is the shopping trip, and we are in a better position to understand the adoption of future home shopping if we examine the characteristics of this travel.

As online shopping grows, other factors will not remain static. The range of stores that are visited in-person is likely to change if consumers gain free time or expand their awareness of alternatives. The location of stores, their ambiance, the motivation for a shopping trip, and the number of impulse versus routine visits are all likely to change in response to the range and variety of products sold online and the ease and cost with which they can be acquired. Transportation and communication interactions often lead to unanticipated but far-reaching levels of change. An analogy can be found from the financial industry where the expansion of automatic teller machines has contributed to significant change in the number and location of bank branches.

One finding is that teleworkers increased non-work time spent outside the home, especially shopping, relative to other workers. The future growth of telework presents something of a paradox for electronic home shopping. On the one hand, the availability of household members for home delivery will facilitate its growth. People are more likely to be at home during the day to accept delivery of packages, and might even welcome this break in their routine. On the other hand, teleworkers may favor physical activity outside their home and diversions which provide a contrast to computer usage. Baer (1985) and Grønmo (1987) depict scenarios where social contact and interaction decrease, and the computerized home becomes an electronic isolation chamber. It should be noted however, that both of these studies preceded the rise of electronic mail. It is still a valid hypothesis, however, that home-bound workers might choose to travel, and future shopping could serve many functions, including social contact outside the home.

While teleworkers may favor shopping in stores (provided that other out-of-home alternatives do not develop), the results for working women suggest a different pattern. Working women appear to be an initial market for home shopping primarily because they have a latent demand to engage in other *maintenance activities*. Our model indicates that such women would direct saved travel towards maintenance tasks, and these probably include things like child care, financial transactions, chauffeuring others, or health appointments. In the future, more of these *maintenance activities* could be done online and electronic services might produce new time savings for working women. However, an increase in the number of *maintenance activities* could also generate demand for new products, and subsequently lead to additional shopping (e.g. more chauffeured trips leads to need for a different vehicle, which encourages new shopping). The model also identified a link which showed that if shopping travel time was reduced, more shopping activity might take place (in stores). Electronic shopping could facilitate this since the travel-intensive bits of shopping, like price and feature comparisons, could be done on-line. All of these results point to the need for future restructuring among retail centers, as the expectations and needs of electronic consumers change.

Limitations and Further Research

In this study we have used a broad definition of shopping which combines both search activities and transactions. It is likely that survey respondents tended to under-report trips that were taken for browsing, or that did not result in a transaction. With the growth of electronic home shopping it would be useful to have a finer-grained definition of shopping to see whether there is a link between online search activity, use of different electronic sources, and subsequent trips to stores.

It will be important as the definition of shopping is honed, to separate out shopping activity for different products and services. With the emergence of products that can be sold either digitally or in stores, like software and music CDs, we need to understand their trip-generating potential. We would also like to suggest that future investigation of shopping split off the search for groceries from the search for other types of items. Food shopping is less discretionary and more habitual than other types of travel for shopping. It is also an area of home shopping that is rapidly growing.

Our data are cross-sectional, with the usual limitations. In future research, our hypotheses might best be followed longitudinally- by setting up a study of people who are about to subscribe to a shopping service (e.g. Shoppers Express or Peapod) and then tracking their behavior over time. There are 'virgin' opportunities to study home shopping today that may rapidly disappear as electronic home shopping becomes more commonplace.

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