

Driven to Shop?

Role of Transportation in Future Home Shopping

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This study explores some of the transportation implications emerging from electronic home shopping and on-line commerce. It suggests that travel activities and travel patterns are likely to change as electronic commerce develops and as existing stores and commercial activities adjust to future competition from on-line commerce. The study illustrates some of the complex and unanticipated interactions that are likely to take place between the growth of new communication systems and transportation. In today's retail markets, most goods are shipped to stores and people physically travel to stores to purchase goods. This tradition is likely to change with the growth of electronic home shopping, since many goods will be purchased on-line and consumers will not need to travel to shop. However, many items will require delivery to the home, and this may spur the expansion of home-delivery services. Other goods purchased on-line will require no physical distribution, and a new class of products, such as music CDs and software, is already being "shipped" electronically over broadband networks. Another impact of future electronic home shopping is the likely growth of entirely new types of retail venues, since it becomes easier to establish markets that bring together buyers and sellers who do not travel to meet, and without the movement of physical goods either. The shipping of goods takes place only after the transaction. All of these new market forms, which bring together electronically buyers, sellers, and goods, raise new issues for the study of transportation and communication interactions.

Home shopping is expected to expand rapidly over the next decade with the spread of new, interactive media. Today, catalog and telephone sales represent only about 4 percent of the retail market, but home shopping is expected to grow to about 10 percent by 2003 (1). The development of electronic home shopping raises broad concerns about communication/transportation interactions, in general, and, more specifically, issues about home delivery, household travel activity, and land use. Transportation and commerce have historically evolved together, and this paper explores many of the transport issues associated with the growth of new electronic home shopping.

Over the past 15 years, there have been many highly publicized failures of electronic home shopping (2). However, there is a renewed spate of interest due to factors like the recent growth of the Internet, improvements in the speed and quality of videographics, and confidence in the security of digital transactions.

Although new improvements in the electronic infrastructure for home shopping are taking place, there has been little recent discussion in the transportation literature of home shopping. A foundation, which precedes the current wave of popular interest, is provided by Salomon (3), Salomon and Koppelman (4), and Koppelman et al. (5).

In this paper, we explore a reciprocal relationship between home shopping and transportation. In the second section, we first set forth a definition of electronic home shopping. This definition

places emphasis on the two-way interactive, video component of the shopping exchange in order to distinguish it from other types of home shopping that are available today.

The form of shopping we do today, particularly in the United States and Europe, has been shaped by the availability of automobile travel. In the third section, we discuss how the adoption of home shopping will depend, in part, on how people use their cars and whether they view travelless shopping as an advantage. In principle, the growth of home shopping would lead to a net decline in the use of personal vehicles for shopping trips and a net increase in the number of trips undertaken by commercial (or postal) delivery services. However, this oversimplifies the issue, for people may value mobility as an end in itself, and growth in one type of shopping activity might induce growth in other shopping modes, too.

Although the transportation/communication interactions are unclear, it is expected that the development of home shopping will lead to new demand for home delivery. Home delivery is discussed in the fourth section. One of the paradoxes of home shopping is that time-busy consumers who are most likely to adopt the service may also be those who are least likely to be at home during the day. The discussion of home delivery is divided into two parts in order to identify and distinguish the growth of new electronic products.

Closely related to the development of digital distribution is a brief discussion, in the fifth section, on the emergence of new shopping markets facilitated by electronic trade. Examples of these are on-line auctions, consumer-to-consumer transactions, and hybrid physical/digital products. At this point in time, it is difficult to assess their future impact on individual or household travel activity. But, historically, new forms of transportation and communication (e.g., the railroad and telegraph) have changed the economics of distributing goods and the location of both buyers and sellers. The growth of electronic home shopping might be interpreted conservatively as a change in communication, but it can also be viewed more radically, if digital delivery networks begin to supersede physical transportation. Just as the automobile is used to facilitate shopping today, is it possible that electronic networks will facilitate different and new types of shopping exchange?

The launch for this investigation is better understood if shopping is viewed as a process, with both travel and nontravel elements. Our investigation of future electronic home shopping is enlightened by the framework of Salomon and Koppelman (4). They suggest that shopping is not a single activity, like purchasing a good. *Shopping* is a series of interrelated stages, including entry into the market, choice among shopping modes, information gathering, evaluation of information, and product selection. It has both in-store and non-store components. They indicate that shopping fulfills two main functions: it provides an economic function in which the consumer expends time and money to learn about products to reduce the risk or increase the utility of a planned purchase, and it is undertaken because of its psychological benefits.

Citing Manski and Salomon, they describe the demand for telecommunications as a "derived demand based on information that is located elsewhere." If the quality and quantity of information is deemed useful, consumers might substitute home shopping for travel trips. However, because people enjoy some types of travel, and they shop for other than economic purposes, electronic home shopping could also generate additional travel and new types of in-store shopping activity.

HOME SHOPPING: DEFINITION AND EVOLUTION

We begin with a working definition of electronic home shopping. Electronic home shopping is an inquiry or transaction for consumer goods or services that takes place through an interactive medium with video capability. The inclusion of the terms *video* and *interactive* is made to distinguish electronic home shopping from services provided today over broadcast television and through catalog/phone sales. Future electronic shopping is likely to take place over broadband communications networks, and it will be accessed through either computers, television sets, or a hybrid of both. The technology is likely to offer new features, like a greatly expanded universe of offerings, intelligent agents that can screen choices, and memory of past "shopping" searches. Electronic home shopping will usually take place outside a retail store, but it does not need to occur at home. Interactive kiosks in airports, libraries, or bus depots and computer terminals at work also provide opportunities to shop.

Home shopping can be thought of as an electronic continuum, with computers and interactive television at one end and door-to-door sales at the other. In the middle are telephone/catalog sales, which are both electronic and interactive but offer no video capability (Figure 1). The growth of electronic shopping will not necessarily supplant other types of home shopping, or reduce the demand for these older formats. In fact, they may all expand if consumer interest in shopping-related activities grows. A precedent may be observed in the recent development of the home video rental market. The latter may have helped to change movie theaters (and the composition of the audience), but it certainly has not made theaters obsolete (6).

Shopping at home, as distinct from home shopping, may have been one of the earliest forms of commerce. It preceded the traditional market, where both buyers and sellers traveled, usually on a designated date and place, to trade. The print catalog, which has existed from the 1850s, may have been the first instance in which the buyer could be geographically remote from the seller. This form of shopping was honed by Richard Sears, but its implementation depended on the telegraph and railroad (7). Home shopping received another boost in the 1920s, from the growth of home telephones. However, diffusion of the telephone coincided with the growth of car ownership, and the latter became the preferred mode for initiating shopping in the United States.

It is interesting to compare the rise of catalog and telephone sales between the United States and Great Britain. In the former, geographic distances were vast, and catalogs provided an opportunity to sell to geographically remote populations. When mobility was provided, through the car, catalog sales and telephone orders began to decline. In Great Britain, geographic distances were not as vast, and the catalog developed as a means of letting credit to poorer populations, instead of as a substitute for travel. Ordering by telephone also flourished in Great Britain because it offered home delivery to shoppers that did not have cars.

In the past 20 years, there has been tremendous speculation that electronic home shopping will grow. Although current sales (to consumers) are negligible, there are forecasts that 2003, there will be a \$4 to \$5 billion market in the United States, equivalent to about one-third of the 1992 market for mail and telephone sales (1). Some frequently cited reasons for expected growth in electronic home shopping are the convenience and time savings it would provide to consumers. Although time savings are cited based on comparisons of in-store and electronic shopping, they often overlook travel-related activity. Consumers often combine shopping trips with other activities and may gain efficiencies from bundling separate tasks.

TRAVEL BY CAR AND CURRENT FORMS OF SHOPPING

In this section, we discuss shopping trips and automobile transportation since they are intricately linked. Today, many stores in the United States, and to some extent Europe, depend on access by either automobile or mass transit. The development of out-of-town shopping centers and malls grew in conjunction with car ownership (7). To assess the future of electronic home shopping, we must consider how people use their cars for shopping trips, whether there is any evidence that people are unhappy or dissatisfied with shopping-related travel, and whether there are signs that a reduction in shopping-related trips might be channeled to different activities or generate entirely new travel behavior.

With respect to shopping-related travel, it is estimated that about 19 percent of all person trips in the United States are made for shopping (this includes mass transit), and it represents 12 percent of the annual vehicles miles traveled (VMT) (8). In 1977, they accounted for 10 percent of the motor vehicle miles in the United States (9). Shopping trips are chained with other out-of-home travel, making the estimation of miles complex. Transportation researchers have observed that actual VMT is likely to be higher because people tend to underreport trips in which they either search for information or "window-shop" and do not culminate in a purchase transaction.

The household vehicle secures the cost of shopping, for both travel time and travel expense, on the consumer. Each entry into the market generates at least four costs: the cost of the item, the cost of time to

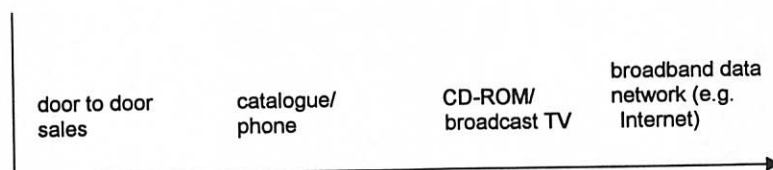


FIGURE 1 Home Shopping as an electronic continuum.

search for the item, the time to travel, and the expense of travel. Some of these costs are depicted in Figure 2, which shows a number of "activities" that are associated with a shopping visit. Shopping consists of both travel and nontravel components, and it takes place at in-store and out-of-store venues. A similar analysis of shopping activities in the United Kingdom led to the estimate that for a weekly grocery shop, the travel component is about 30 percent of the entire time spent, and the in-store component is between 50 and 60 percent (10).

The demand for electronic shopping may depend, in part, on whether consumers wish to trade off time spent in travel and time spent in the store for electronic transactions. There are at least two transportation issues, which are distinct from whether the consumer perceives electronic shopping to be an acceptable alternative for shopping in stores: one is whether electronic shopping leads to savings of time that would have otherwise been spent in travel, and the other is whether the "travel-to-shop" activity has intrinsic value.

It is difficult to estimate whether electronic home shopping will produce time savings. Although travel time is reduced, current estimates of electronic shopping time do not account for the off-setting time spent waiting for home delivery. Currently, electronic shopping takes considerable time if a complete on-line session is logged from the time that a machine is turned on and connected to a broadband network, item selection takes place, and billing and delivery specifications are made. With advances in electronic shopping technology, the speed of service will increase, but it will still remain a factor.

It is untested whether consumers desire to reduce the amount of time they travel to shop. This will vary by accessibility to stores, whether other trips are chained (combined) with shopping, and by personal characteristics, like age. External factors will also determine how shopping trips are perceived, like the ease of parking and the level of congestion. There is little research to gauge people's beliefs about the time they spend traveling, and for shopping in particular.

As Salomon and Koppelman (4) have noted, it is likely that people enjoy some aspects of routine travel. Studies indicate that people do not always prefer the most efficient route (11). There may be an underlying desire for mobility, and it is not clear that the ability to eliminate physical travel through communications will substitute for this propensity. In fact, this need might accelerate with adoption of other teleactivities, like telework. Baer (12) depicts one possible scenario for the future, in which the computerized home could become an electronic isolation chamber. Under such circumstances, home-bound populations might choose to travel, and shopping-related trips might increase in distance or frequency. Shopping serves many functions, including the need for social contact (13,14).

In U.S. retailing, there has been a movement to locate large warehouse stores and factory outlets at a great distance from urban centers, and people appear to willingly travel to them. The recreational side of these trips has not been investigated, but tour bus operators organize day trips to these shopping centers, and some families appear to make journeys that combine this distant shopping with sightseeing. An earlier study predicted the frequency of shopping at a distance from home and found it was associated with higher income and holding out-of-town charge cards (15).

As cars have made it more feasible to shop at greater distances, there has, conversely, been a growth in "convenience" stores, particularly in the United States. Chain stores, like Circle K and 7-11, provide higher prices, and a more limited stock, but presumably greater convenience, and time savings.

There is a literature in marketing on people who shop using catalogs, and it is relevant to transportation planners who seek information on shopping without travel. Catalog shopping, which represents about 4 percent of all retail sales in both the United States and the United Kingdom (16) is sometimes viewed as a precursor of electronic shopping, and it is studied for clues. There is little evidence that catalog shoppers currently choose this medium because they have reduced mobility or access to transportation. The travel substitution

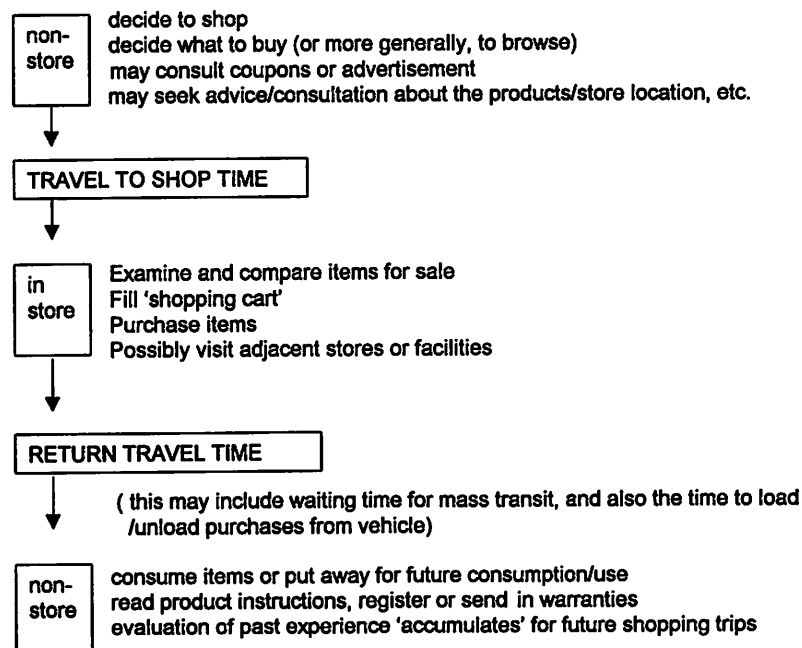


FIGURE 2 Travel and nontravel components of shopping.

theme can be found in older studies (17,18), but more recent analysis has been motivated by the search for time-busy customers. Working women do order from mail-order catalogs more frequently (19), but marital status, shopping for children's clothing, and income are stronger predictors. In qualitative research, it is found that catalog users tend to be careful shoppers, and they cite benefit from having a wider selection of merchandise choices. There is very little research that examines the shopping habits of populations that are spatially remote from market centers, but it would be interesting to observe catalog use among those who live in extreme snowbelts or on remote islands, as well as among those with physical handicaps that limit outside transportation.

The car abets shopping activities because it is used to convey goods to the home. However, this overlooks the fact that many shopping trips do not culminate in a purchase or transaction. A large portion of shopping activity involves a search for information—that search may be purposive with a specific product in mind (e.g., a new car), or the search may be more general, to learn about market trends and changes (e.g., what are the 1999 cars like?). Increasingly, product information and advice are becoming available electronically, and households with access to a broadband network can browse for information without initiating physical trips. Access to electronic information may provide different information than a physical trip but it may still prove useful to consumers. (e.g., best car prices and current advice from rating services versus “kicking the tires”). Increasingly, consumers may use information intelligence, like intelligent agents, to search product specifications and cost. The effect of this on-line information gathering on travel trips is unknown—on the one hand, it might reduce the number of window-shopping visits, but it could also lead to a net increase in travel if the awareness, selection, and variety of choices are increased. These effects could take place at the aggregate level, but may not hold for each individual.

FUTURE HOME SHOPPING AND HOME DELIVERY

Home delivery is a key component to the growth of home shopping, and it directly links the development of future home shopping to transportation concerns. On the one hand, the growth of home shopping could encourage a decrease in personal vehicle transport for shopping and an increase in demand for commercial delivery to the home. However, the demand for home delivery might increase, if home shopping expanded the frequency of all in-store shopping, since consumers might shift their shopping habits and come to expect home delivery of certain products. While door-to-door delivery may grow for some products, it will not be universal. There are a growing number of digital products, like music CDs and software, that require no physical delivery, but can be “delivered” to the home electronically. In view of these two distinct product types, we divide this discussion of home delivery into two sections. In the first section, we consider home delivery of conventional products that require physical distribution. In the second section, we examine “home delivery” for new classes of electronic goods.

Physical Delivery of Goods

Since catalog and phone sales represent less than 4 percent of all retail sales today, the home delivery industry is relatively small, and

most customers transport their packages or purchases home themselves. In a few cases, a retail store will arrange for transportation of goods after the consumer has made a face-to-face purchase. Consumers are unable or unwilling to transport the goods themselves, perhaps because they took mass transit, their vehicle is too small, or the purchase is too heavy. Bulky appliances and furniture are frequently delivered after the consumer has transacted for them. Another, less frequent form of home delivery is regular scheduled delivery of perishables, like milk. Diaper delivery is a special and interesting case of home delivery since it is a transaction of both a service and a product.

Over the past 80 years, home delivery has decreased, as consumers used their own vehicles, or mass transit, to reach stores. In Figure 3, for example, we track the decline in the home delivery of milk in Britain, over a 10-year period. The percentage of households taking home delivery declined from about 87 percent to 68 percent and continues to fall (20).

The decline in door-to-door delivery of milk is occurring for a number of different reasons, including a price gap between the milkman and supermarket, and a spiral of falling share and reductions in quality of service. Thus, the experience of this industry cannot be generalized. However, a movement back to home delivery could present a number of similar issues.

The accessibility of consumers at home to receive deliveries is an intractable problem, at least in the short run. The initial market for home shopping is believed to be busy, middle-income families because they would pay a premium for this service. Ironically, because they work more hours, they are also less available to receive home deliveries. In the United States, the absence of at-home neighbors to accept deliveries and increases in doorstep thefts are additional factors that have deterred home delivery.

Programs have been made to expedite home delivery, and some derive from improvements in telecommunications, like consumer-initiated checks of parcel location, and en route, mobile phone calls to waiting households. More radical ideas to improve home delivery propose retrofitting the exterior of homes with large, secure delivery receptacles and refrigerated cubicles (21). In fact, a commercial enterprise was recently set up to do this. A centralized post office box is another variation of home delivery. Shoppers would collect their prepacked groceries and packages at the office or from neighborhood centers or local stores. Most hybrid collection points are still likely to rely on the use of a car since shoppers need to carry their packages or bags home. Many transportation issues associated with the use of pickup centers have not been addressed; for example, the availability and ease of driving to them and securing a parking place, the time savings if other shopping or household activities

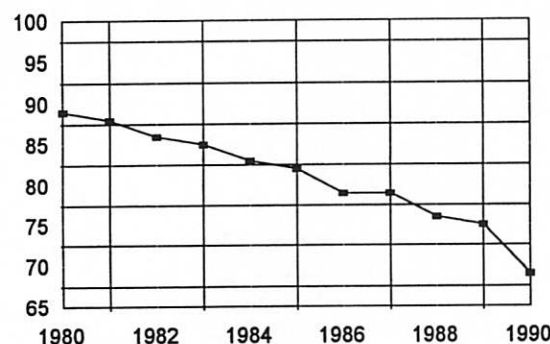


FIGURE 3 Percentage of British households with home-delivery of milk.

initiate separate trips, and the pollution generated by shorter-length vehicle trips from the home.

Delivery systems will grow in importance with expansion of electronic home shopping. Jones and Salomon (22) caution that it will generate new trips, with unknown characteristics. New transportation attracted to the home for deliveries could bring uncontrolled congestion and pollution into suburban areas.

Table 1 depicts some of the transportation-related changes that may result from increased demand for the delivery of physical products.

There is an explicit transportation cost to the growth of remote warehouse centers since they tend to be located further away from cities, and they increase the number of frequent deliveries. However, improvements in fleet logistics are being used to make these long-distance shipments more efficient. Today, many shippers have sophisticated communication systems set up with retailers to deliver store merchandise [see, for example, Hoover et al. (23)]. Similar systems are being developed for home deliveries. Shippers use information systems to consolidate loads, choose routes that minimize travel time and congestion, and coordinate intrafleet locations. For a discussion of the impact of telecommunications on the supply of transportation, see Mokhtarian (24).

Electronic Delivery of Goods

In the 1880s, Edward Bellamy, an American science fiction writer, imagined an urban infrastructure with instant home delivery. Bellamy depicted home delivery through a network of pneumatic tubes, which linked together and sped purchases from wholesalers to cities and from cities to households. Bellamy's forecast was not outlandish, since London had 67 intranets—postal offices connected by pneumatic tubes (25).

With recent advances in electronic communications, home delivery of electronic products is becoming feasible. One function, akin to Bellamy's pneumatic tubes, consists of delivering information in electronic formats, for products like CDs, newspapers, and books. Emergent products include subscriptions to software downloaded through cable to PCs, interactive on-line games (26), and printing on demand for low-volume, out-of-print books.

Very little is known about this new delivery channel, but it is expected to grow rapidly. For example, about 18 percent of all software is expected to be sold electronically to consumers over the next 18 months, and about 50 percent by the turn of the century (27). A similar trend is developing in the movie industry, in which films are

broadcast to the home over cable or satellite, instead of evoking a trip to the cinema or to a video rental store.

The travel implications of digital delivery may depend on the range and variety of products that become available on-line. By way of example, on-line travel tickets that are downloaded electronically may not change household travel behavior, unless the household currently purchases tickets in person at a travel agency or bus/air terminal. In the United States, many customers currently order this product via telephone, and it is (physically) shipped in the mail. Electronic delivery of this ticket will eliminate delivery through the mail, but it will not reduce transportation, since postal service is regularly scheduled. However, it would eliminate a travel trip if the ticket was usually sent by courier or an overnight delivery service. A future scenario for books delivered on-line, or similar products, could have larger impacts on household travel. A decision to browse for, or purchase, this product currently engenders travel outside the home (but not necessarily a separate travel trip). With on-line digital delivery, households would not have to leave home to acquire it.

Table 2 sets out some of the likely issues that emerge with the growth of new digital delivery.

GROWTH OF NEW DIGITAL MARKETS

In the previous section, we explored how home shopping will increase demand for home delivery; an important aspect of this was electronic distribution. Just as digital capability may alter established distribution channels, it may also bring far-reaching change to other established relationships. The growth of electronic commerce may affect not only individual travel behavior but, in the aggregate, how shopping markets themselves are organized. The convergence of transportation and communications may have far-reaching and unanticipated effects on shopping activity.

To put this discussion in context, Table 3 depicts how markets for commerce have evolved. Itinerant merchants, who went from village to village, helped to foster an early form of consumer-to-consumer trade. Bazaars and the open-air market trade followed, and they became the dominant form of shopping when both goods and information had to be transported on foot. Trade within stores and, much later, shopping mall commerce grew with the availability of both motorized travel and telephony. A new wave of commerce, depicted as *electronic stores*, represents commerce that may be facilitated through on-line, digital exchanges. One of the significant factors of electronic commerce is that it may encourage new consumer-to-consumer trans-

TABLE 1 Issues if There Is New Demand for Conventional Home Delivery

Site/Location	Possible Outcomes	Issues for Travel Activity
Warehouse	increase warehousing needs, reduce bulk distributions to stores	increase multiple distributions to individual households
Store	change in number of stores, hours of operation, location	household modifies frequency, length, time of both single and multipurpose shop trips
Household	availability for home delivery	household must stay at home or make provisions to travel to collection point

TABLE 2 Issues if There Is New Demand for Electronic Home Delivery

Site/Location	Possible Outcomes	Issues for Travel Activity
Warehouse	decrease warehousing needs, reduce bulk distributions to stores	decrease distributions to stores and households
Store	change in number of stores, hours of operation, location	household modifies frequency, length, time of both single and multipurpose shop trips
Household	availability for home delivery	eliminate trip taking for this specific purpose

actions, as well as more conventional transactions between businesses to consumers, and business to business.

Until recently, certain transactions were discouraged by the time associated with travel, the cost associated with travel, or both factors. For example, consumer-to-consumer sales through classified advertising involved a number of "wasteful" trips to screen choices and gather information. These trips were wasteful because they did not always culminate in a purchase, and they took time to transact. A physical trip was undertaken because the telephone was not sufficient to provide the quality or quantity of information to screen the item. Today, this type of travel can be reduced as more descriptive information is accessed by video, sound, and text over broadband networks. The availability of this information, and its low cost, may enable new markets to develop because transversing time or space becomes more "frictionless." Similarly, auctions have typically been travel intensive since (a) the buyer, (b) the seller, and (c) the goods they exchanged were transported in advance of the sale. Today, a growing number of digitally based auctions are taking place [for a prescient discussion about this, see Rayport and Sviokla (28)]. Growth of electronic, on-line markets may spur *just-in-time* delivery, analogous to the earlier development of just-in-time manufacturing, to secure arrival of components and supplies for manufacturing.

A different and separate emergent market is growing for electronic auctions that vend perishable "information" products. In a traditional (outdoor) bazaar, vendors reduced the price of produce that would spoil at the end of the day. In electronic markets, perishable items are increasingly being sold like airlines and travel, or ticket bookings for sports and concerts. These products are "perishable" because they expire in time, and electronic formats provide a new format for dis-

posing of them quickly, as their monetary value declines. Rapid information is a key ingredient of these products, since their value changes with time and the volume of sales. In the past, this type of market was small or nonexistent because the consumer had to incur many costs: initial travel, waiting time, the uncertainty of supply, and, finally, if a transaction occurred, the need to exercise the activity on the spot (e.g., a trip with standby fares).

Finally, a different market product is developing that combines properties of physical distribution markets with digital ones. It is becoming increasingly possible to provide manufactured goods, like clothing and housewares, that are made to measure. The manufacturing process is flexible so that individual product specifications and customization can be accommodated at relatively low cost. As this new market grows, the physical inventory in stores could change and consist mainly of generic samples used to guide the placement of customized orders. Or, consumers might place these orders directly on-line, from their home. In either case, a product will be generated that blends both digital and nondigital shopping activity and, ultimately, ends with physical delivery from the manufacturer to the home.

CONCLUSIONS AND RESEARCH DIRECTIONS

Over the past 150 years, changes in both transportation technologies and information technologies transformed commerce by bringing new ways to move together people, goods, and information. We may be on the brink of change as information technology performs many of the traditional functions of transportation, like moving goods over

TABLE 3 Evolution and Organization of the Marketplace

Retail Evolution	Sellers and Buyers in the Marketplace		
	Consumer to Consumer	Business to Consumer Sales	Business to Business Sales
Itinerant Merchants	✓		
Older Open Air Markets & Bazaars	✓		✓
Store-Fronts		✓	✓
Malls		✓	
Electronic Stores	✓	✓	✓

geographical distances, bringing buyers and sellers together (electronically) to form a market, and providing detailed information about goods.

Even if the change is less radical, the growth of electronic home shopping depends on the resolution of many transportation issues. Almost all growth in electronic home shopping will increase the number of trips to the home for delivery and put demand on the speed, the quality, and the reliability of third-party shippers. This presents something of a paradox since during this century, home delivery has declined and people have shown a preference for car-based shopping trips.

Although a future household may "attract" delivery vehicles, households might still choose to make the same number of outside trips, or even increase their number. Shopping provides a number of recreational and social benefits. Electronic home shopping may shift existing shopping patterns, like the hours or time when people make store visits. More available parking at stores or less traffic congestion might then encourage even more in-store visits. However, exogenous factors—like a long-term increase in the cost of travel (say, from increased petroleum prices)—might change the balance toward more in-home activity.

Research on the future of home shopping is likely to be rewarding for transportation planners since it directly spotlights many transportation and communication interactions. At the level of individual trip taking, researchers can observe whether the ability to perform transactions electronically (e.g., banking) changes travel behavior. A recent survey by Handy and Yantis (6) explores the travel-related consequences of in-home versions of shopping, banking, and movie viewing.

Assessing the impact of future electronic home shopping is difficult since the broadband network, the delivery network, and software to support it are all under construction. However, there are a few research opportunities that could be explored. With the exception of the above-cited study, most research on catalog and television shoppers has not fully explored the role played by transportation and whether there are resultant changes in household trip-taking activity. It would be particularly useful to study whether current shopping via the Internet replaces, augments, or changes certain shopping trips.

There are also a small but growing number of home-shopping services that could be examined. Research on a home grocery provider, like Peapod Interactive, could provide interesting data on travel-shopping relationships, particularly if travel-activity diaries were administered before and after the adoption of home shopping.

Table 4 depicts a number of issues for studying change at the individual or household level, and one further issue is cited at the aggregate level. First is a need to establish good baseline data about shopping-related travel. As others have noted, this is complex because shopping trips are combined with other types of travel and are multipurpose in nature. A related problem is that respondents filling out travel diaries undercount shopping trips that did not result in a purchase/transaction.

To understand whether people wish to change or adapt electronic home shopping, we also need data about the goals or purpose of shopping visits. This is closely related to the first data collection issue. Intuitively, we expect that shopping trips that are initiated for utilitarian reasons will be candidates for new electronic shopping, but this assumption needs to be examined more carefully. If a utilitarian shopping trip is combined with other enjoyable out-of-home activities, there may be little incentive. Attitudes toward both travel and shopping are also likely to be important, although there may be wide variance in shopping attitudes held between populations, and even wide variance within populations. Shopping-related attitudes are likely to be context specific, for example, someone who dislikes grocery shopping at large may still choose in-store shopping for fresh produce.

The technology to enable electronic home shopping will not develop in isolation so it may be risky to study it outside of a larger scope. The same broadband technologies that enable it will also enhance opportunities to engage in videoconferencing, telemedicine, telework, and so forth. It is more realistic to contemplate possible interactions. By way of example, future teleworkers are likely to have an option for electronic home shopping. The fact that teleworkers are at home could facilitate the growth of home delivery. On the other hand, teleworkers might use in-store shopping and other activities outside the home to recreate with others and provide a contrast to computer-centric activity.

TABLE 4 Research Needs for Electronic Home Shopping

Research Area	Data Needs	Method	Comments/Issues
Trip activity analysis	number, type, frequency, duration of both single and multi-purpose shopping trips	travel activity/diary	hard to enumerate multipurpose trip and shopping that did not result in purchase
Goals/purpose of shopping trips	classification of visits into categories: e.g., info. gathering, purchase, etc.	surveys, analyses of in-store behaviors	(as above)
Attitudes toward travel shopping and in-store visits	attitudes, opinions	opinion surveys, projective tasks	may be situational
Transport and communication interactions	aggregate data	examine trends: e.g., growth in online sales, home delivery business, postal services	over short term, may involve special (non-representative) populations

We conclude by observing that the development of home shopping is not new, but that the future growth of electronic-based versions will depend on a number of transportation outcomes. In the absence of Bellamy's pneumatic tubes that connect individual homes, we can expect that, for at least the short term, most electronic home shopping will still culminate with travel-generated delivery, and most people may still choose to take outside trips.

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