

**THE IMPACTS OF TELECOMMUNICATIONS TECHNOLOGIES
ON NONWORK TRAVEL BEHAVIOR**

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ABSTRACT

Potential new telecommunications technologies and services could have dramatic impacts on travel behavior. But the probable nature and magnitude of these impacts is uncertain. The usual assumption (or hope) is that such technologies will substitute for travel, allowing people to participate in activities at home that would have otherwise involved a trip. But telecommunications technologies may lead to other types of impacts as well, by increasing access to information and ease of communication: modification of travel, generation of additional travel, or generation of additional communication with no change in travel. This study focuses on the implications of telecommunications for nonwork travel and explores the potential substitution of in-home versions of an activity for out-of-home versions of that activity. Three specific activities were selected, and the sets of potentially substitutable versions of those activities that are currently available were examined: movies (theater vs. VCR vs. television), shopping (store vs. catalog vs. television), and banking (bank vs. ATM vs. phone vs. on-line). A household survey was implemented to characterize the use of the different versions of the three case study activities and explore the trade-offs between them. The results suggest a complicated relationship between in-home and out-of-home versions of activities. The degree to which in-home versions substitute for out-of-home versions of an activity depends on the nature of the activity and the characteristics of the individuals. In addition, the travel implications are not always clear. So far the evidence does not point to a reduction in travel.

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EXECUTIVE SUMMARY

Potential new telecommunications technologies and services, over which the business community and the press have shown great excitement, could have dramatic impacts on travel behavior. But the probable nature and magnitude of these impacts is uncertain. The usual assumption (or hope) is that such technologies will substitute for travel, allowing people to participate in activities at home that would have otherwise involved a trip. But telecommunications technologies may lead to other types of impacts as well, by increasing access to information and ease of communication. First, telecommunications may modify travel that would have occurred anyway. Second, telecommunications may generate additional travel, as a result of changes in activity participation. Third, telecommunications may simply allow for increases in total communication without any change in travel. While the impact of telecommunications on work-related travel, particularly telecommuting and teleconferencing, has been the focus of much research, the impact on non-work travel has been largely ignored by researchers so far. Yet because non-work travel is generally more flexible than work travel, with respect to choice of destination, mode, departure time, route, and frequency (including whether a trip is made or not), it is potentially more susceptible to the influence of new technologies than work travel, which is relatively fixed in the short-run.

The purpose of this study was to explore the impacts on nonwork travel of current and emerging telecommunications technologies. As an exploratory study, it is more suggestive of than conclusive about the impacts, but it begins to identify important patterns and relationships and points to areas for further research. Because of the potential complexity of the relationship between telecommunications and nonwork travel, the study focused on a more limited aspect of the overall question: the potential substitution of in-home versions of an activity, made available through telecommunications technologies (loosely defined), for out-of-home versions of the activity, requiring travel. Two other important questions are not directly addressed in this study: the potential for cross-substitution between different types of activities (such as the substitution of "net surfing" for movie watching), and the potential impact of telecommunications technologies and services designed specifically for modifying or managing travel rather than replacing it (for example, many of the ITS technologies).

Three specific activities were selected, and the sets of potentially substitutable versions of those activities that are currently available were examined:

- movie watching: theater vs. television vs. VCR
- shopping (non-grocery): store vs. catalog vs. television
- banking: bank vs. ATM vs. phone vs. on-line

These activities were chosen to represent the spectrum of nonwork activities from entertainment to personal business, with movie watching at one end, banking at the other, and shopping somewhere in the middle. By comparing the results for each of these activities, the study gives an indication of the ways in which the impacts of telecommunications will vary for different types of activities. In addition, these are activities for which in-home versions are well established and new and improved in-home versions are (or at least seem to be) imminent. Many of the current in-home versions of activities, of course, make use of basic telecommunications technologies -- TV, phone, mail -- but fiber-optic networks, two-way cable systems, and the Internet promise to change the nature of in-home versions of these activities. The study focused on currently available versions because of the uncertainty of future versions but gives some indication of what might happen when more advanced versions are available.

The research methodology involved two basic approaches: a literature search to explore overall trends in the case study activities, and a household survey to explore individual use of and choices about the case study activities -- movie watching, shopping, and banking. The literature search encompassed books, academic journals, major newspapers, popular publications, and a variety of additional sources available on-line. One of the primary goals of the search was to find data on the use of alternative versions of the case study activities and especially data on trends in their use. Although the search did not fully meet this goal, the pieces of data and the qualitative analyses uncovered paint a clear picture of the trends in the use of the available versions of each activity. But the limits of aggregate data -- even complete aggregate data -- to explore the question of substitution necessitated the development of a household survey to explore individual choices about alternative versions of the case study activities.

The household survey was developed based in part on the findings from the literature search and so as to test the hypotheses outlined in the previous section. The survey included sections on each of the case study activities as well as a section of attitudinal questions using a Likert-scale and a section of questions on individual and household characteristics. In the sections on the case study activities, several types of questions were included: availability or access to different versions of the activity, frequency of use of the different versions, factors encouraging and discouraging the use of the out-of-home version of the activity, and level of comfort in using more advanced in-home versions. For each activity, a series of questions designed to test the degree of substitution between in-home and out-of-home versions of the activities were also included. These questions asked the respondent to think about their last use of the particular version and to speculate on what they would have done if that version had not been available. Although certainly not a definitive test, these questions should give some indication of the relationship between different versions of the same activity.

The sample of 3000 households was drawn randomly from the populations of three cities -- San Jose, CA, Oklahoma City, OK, and Austin, TX. These cities were selected in order to test for the potential influence on the use of telecommunications services of high-technology culture and traffic congestion: Oklahoma City as a low-technology, low congestion city; Austin as a high-technology, low congestion city; and San Jose as a high-technology, high congestion city. The survey was administered by mail in August, 1995. The overall response rate was 16%, and varied from 13% in San Jose to 18% in Austin (where the University of Texas pulls more weight). Given the low response rate, the results of the survey are not likely to be an accurate representation of the entire population. In addition, the characteristics of the respondents differed significantly from the characteristics of the overall populations in these cities in several respects; in the analysis of the survey, these potential biases must be considered and, where possible, tested. Despite these limitations, the results should still provide insights into the probable relationships between different versions of the case study activities and the probable role of attitudes and preferences.

The results of the survey presented in the report suggest a complicated relationship between in-home versions of activities, based on telecommunications technologies, and out-of-home versions of activities, requiring physical travel. The degree to which in-home activities substitute for out-of-home activities depends on the nature of the activity and the characteristics of individuals, their attitudes and preferences. So far it appears that out-of-home versions of movie-watching, shopping, and banking offer qualities that are not currently duplicated by the in-home versions, and that these qualities are important for most individuals some of the time and for some individuals most of the time. At the same time, the results show signs that as technologies and services improve, the degree of substitution may increase. Of course, the analysis is complicated by the likelihood that the in-home versions of one activity sometimes substitute for another in-home version of the same activity -- or even of other activities, and by the possibility that the in-home version of an activity sometimes induces additional participation in the out-of-home version.

Predicting the future impact of telecommunications on nonwork travel is also complicated by the difficulty in predicting the nature of future telecommunications technologies. Often times, technologies that are most widely promised for the future prove infeasible or are replaced by the next great technology before they even have a chance. It is also difficult to predict what will happen as today's youngsters, growing up with computers and rapidly changing technologies, become tomorrow's adults. Their familiarity and comfort with telecommunications technologies may lead to an increase in the use of in-home versions of activities over time.

To understand the potential impacts of telecommunications technologies on travel, researchers must understand the choices that individuals make about using those technologies. Just because telecommunications technologies offer the potential to reduce travel does not mean they will be used to that end, and it is clear that the impacts will be much more complex than a simple reduction in travel. For the case of in-home versions of activities, which should increase in both number and quality as telecommunications technologies improve, what seems certain is that: 1. there will be changes in how different activities are accomplished, both in the home and out of the home, 2. there will be changes in what activities take place at home and what activities take place out of the home, 3. there will be changes in patterns of travel, in terms of frequency, timing, and destinations. What is not certain is whether travel will decrease as a result of these changes. So far the evidence does not point to a reduction in travel; per capita travel has been increasing, in fact, even as telecommunications technologies and services have improved in recent decades.

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CHAPTER 1. INTRODUCTION

"Wouldn't you rather be at home" -- recent Packard Bell commercial juxtaposing dark, forbidding images of the city and the people in it with the sunny image of a solitary house in a grassy field .

Traditionally, cities and towns have served as centers for entertainment, shopping, banking, and other activities. As suburban populations have grown over the twentieth century, these activities have moved to the suburbs also. Beginning as early as the 1940s, downtown stores and banks, for example, found they could serve their customers more conveniently by locating a branch in the suburbs [17]. These changes in urban form had important implications for transportation: although travel distances in many cases declined, customers increasingly reached their destinations by car rather than streetcar. Now, as congestion in the suburbs worsens and accessibility to suburban entertainment, shopping, and banking declines, efforts to provide these activities via telecommunications are increasing. The idea is to provide customers with the ultimate in convenience: the opportunity to do it at home, to substitute an in-home version of an activity for the out-of-home version of the activity [20]. This opportunity will certainly have an impact on transportation, just as the suburbanization of activities did, but the probable nature and magnitude of these impacts is still uncertain.

The relationship between telecommunications technologies and travel behavior is not straightforward. The usual assumption (or hope) is that such technologies will substitute for travel, allowing people to participate in activities at home that would have otherwise involved a trip [9]. Telecommuting, for example, is being pushed as a transportation demand management strategy, and teleconferencing, teleshopping, and telebanking are often referred to as "tele-substitutions" (e.g. [44]). A Department of Energy study on travel and telecommunications gives a long list of examples of the ways in which telecommunications may substitute for travel, including several for nonwork activities: "Interactive education, shopping, and entertainment services, and more television channels with movies on demand, that may convince more consumers to stay home rather than traveling to the mall or theater... Service transactions carried out by electronic means that require less travel" [29: v].

But telecommunications technologies may lead to other types of impacts as well, by increasing access to information and ease of communication and by changing activity patterns [38, 27, 29, 20]. First, telecommunications may generate additional travel, as a result of changes in activity participation. An on-line information service, for example, may make it easier to learn about and buy tickets for an upcoming concert. Second, telecommunications may modify travel

that would have occurred anyway. Potential modifications include increases in efficiency and thus faster speeds, as well as changes in departure time, destination, mode, and route; ITS (Intelligent Transportation System) technologies are intended to generate just such modifications. Of course, telecommunications technologies often have no impact on travel, but rather allow for increases in total communication without an increase in travel.

While the impact of telecommunications on work-related travel, particularly telecommuting and teleconferencing, has been the focus of much research (see [28] for a review of the evidence), the impact on nonwork travel has been largely ignored by researchers so far; theoretical discussions far outnumber empirical studies. Teleshopping is the one exception; the literature for this set of applications, including on-line shopping services and television shopping channels, is surprisingly extensive and still growing. But studies on the implications for transportation of other nonwork telecommunications applications are rare, and the broad interactions between in-home and out-of-home activities have not been adequately studied [20]. Part of the problem is that it is difficult to study any phenomenon that is only just underway. However, it is possible to look at the impacts of recent but already wide-spread technologies and the nature of future, more advanced technologies and begin to formally speculate about what kinds of travel impacts are most likely. The hypotheses and predictions generated by such an exercise are important to travel forecasting and transportation planning and provide a basis for further research.

The impact of telecommunications technologies on nonwork travel is particularly interesting and particularly important. Because nonwork travel is generally more flexible than work travel, with respect to choice of destination, mode, departure time, route, and frequency (including whether a trip is made or not), it is potentially more susceptible to the influence of new technologies than work travel, which is relatively fixed in the short-run. In addition, non-work travel is a growing share of total travel: home-to-work trips grew by 16% from 1969 to 1990, while shopping trips grew by 88% and other family or personal business trips grew by 137% [45]. This growth in nonwork travel has meant increasing congestion during non-peak hours and on weekends, and nonwork travel makes up an increasing share of peak-hour travel. Because of its flexibility and growth, nonwork travel presents a challenging transportation demand management problem but also a promising target of transportation demand management efforts. It may be possible, for example, to better manage nonwork travel through the implementation of specific telecommunications technologies.

The purpose of this study was to explore the impacts on nonwork travel of current and emerging telecommunications technologies. As an exploratory study, it is more suggestive of than conclusive about the impacts, but it begins to identify important patterns and relationships

and points to areas for further research. Because of the potential complexity of the relationship between telecommunications and nonwork travel, the study focused on a more limited aspect of the overall question: the potential substitution of in-home versions of an activity, made available through telecommunications technologies (loosely defined), for out-of-home versions of the activity, requiring travel. Two other important questions are not directly addressed in this study: the potential for cross-substitution between different types of activities (such as the substitution of "net surfing" for movie watching), and the potential impact of telecommunications technologies and services designed specifically for modifying or managing travel rather than replacing it (for example, many of the ITS technologies).

Three specific activities were selected, and the sets of potentially substitutable versions of those activities that are currently available were examined:

- movie watching: theater vs. television vs. VCR
- shopping (non-grocery): store vs. catalog vs. television
- banking: bank vs. ATM vs. phone vs. on-line

These activities were chosen to represent the spectrum of nonwork activities from entertainment to personal business, with movie watching at one end, banking at the other, and shopping somewhere in the middle. By comparing the results for each of these activities, the study gives an indication of the ways in which the impacts of telecommunications will vary for different types of activities. In addition, these are activities for which in-home versions are well established and new and improved in-home versions are (or at least seem to be) imminent. Many of the current in-home versions of activities, of course, make use of basic telecommunications technologies -- TV, phone, mail -- but fiber-optic networks, two-way cable systems, and the Internet promise to change the nature of in-home versions of these activities. The study focused on currently available versions because of the uncertainty of future versions but gives some indication of what might happen when more advanced versions are available.

This report is organized as follows. Section 2 describes the hypotheses in more detail, while Section 3 outlines the research methodology used. A household survey was implemented to characterize the use of the different versions of the three case study activities and explore the trade-offs between them, focusing on the potential substitution of in-home for out-of-home versions. The results of the survey, outlined in Sections 4 through 7, suggest that the likelihood of substitution depends on the nature of the activity and the attitudes and preferences of the individual. Finally, Section 8 summarizes the conclusions that can be drawn from this study as well as numerous questions that remain to be answered.

CHAPTER 2. HYPOTHESES

The total impact of telecommunications on travel will depend on whether people adopt new technologies and services and, if they do, how this changes their travel behavior, if at all. As Salomon [37] points out, researchers and writers have a tendency to see the issue of the adoption of telecommunications technologies as an issue of technology. For applications such as telecommuting, teleconferencing, and teleshopping, however, technology is only one of the factors involved. Individual decisions about telecommuting, for example, depend on the technological context but also the social/cultural, institutional, physical (spatial), and economic contexts, as well as the perceptions, attitudes, and life style "drives" of the individual. Similarly, individual decisions about teleshopping depend on system characteristics (i.e. the nature and quality of service provided by the store or the teleshopping service) but also the individual's perceptions of shopping alternatives, feelings towards shopping alternatives, and his or her personal characteristics [40]. In general, individuals "adopt new technologies and adapt their behavior so as to exploit the technology in ways suitable to their particular situation" [37]. The question of adoption is clearly complex.

The question of adoption is closely tied to the question of substitution: the adoption of a new technology generally means that the new technology at least partially replaces -- or substitutes for -- an older technology. Micro-economics textbooks define "substitutes" as "goods that make one another less valuable" [3]; if the price of one good goes down, the demand for this good will go up and the demand for the substitute good will go down. This definition suggests, first, a hypothesis about the relationship between in-home and out-of-home activities: assuming comparable quality of service, in-home versions of an activity will substitute for out-of-home version of that activity, because the in-home version saves the monetary and time costs of travel. This hypothesis leads to a second but related hypothesis about the relationship between telecommunications and travel: the use of telecommunications technologies, which enable and improve the quality of in-home versions of an activity, will substitute for travel, required for out-of-home versions of an activity.

What is probably most at issue in these hypotheses is not the predicted relationships, but the assumption: do the in-home versions provide quality of service at least comparable to that of the out-of-home versions? Does watching a movie at home on TV or the VCR equate with watching a movie at the theater? Does shopping via catalog or TV or computer equate with shopping in a store? Does banking via phone or computer equate with interacting with a teller? Clearly, the different versions of each activity are not identical -- the in-home version may provide advantages (e.g. a reduction in travel), but also disadvantages (e.g. a reduction in quality of

service), over the out-of-home version. Choosing between the in-home version and the out-of-home version is more than a decision about location; the nature of the experience will be different even if the objective content is the same [20]. This points to two important research questions: what are the perceived differences between the different versions of the activity, and how important are these differences to the individual? Even if the assumption of equivalent service does not hold in the present, it might in the future, as telecommunications technologies improve the quality of service of in-home versions of activities.

But the adoption of an in-home version does not necessarily mean that the in-home version has substituted for the out-of-home version of an activity. First, it is also possible that the in-home version of an activity might increase participation in or use of the out-of-home version of an activity. In this case, telecommunications technologies would induce additional travel. Watching movies at home might stimulate an increased interest in movies that leads to more theater-going. Learning about a product on-line might lead to a trip to the store to see it for oneself. Checking on one's account balance might lead to the discovery of a problem that leads to a trip to the bank to work it out in person with the manager. These effects will likely be subtle and difficult to detect, as individuals themselves may not be aware of them.

Second, it is possible that the in-home version of an activity does not increase participation in or use of the out-of-home version of an activity, but rather modifies it in some way. In particular, the destination or the timing of the trip may change: a shopper may discover a new store through their latest catalog, for example. For the focus of this study, the relationship between in-home and out-of-home versions of the same activity, the modification impacts are not likely to be great. In broader terms, however, modification may prove to be the most significant impact of telecommunications on nonwork travel, as more and better information becomes available in the home.

Third, it is also possible that the use of the in-home version of an activity has no impact on the use of the out-of-home version of an activity. This will be true if an individual does not make a connection between the in-home version and the out-of-home version -- for example, if renting a movie is not seen as an alternative to going to the movie theater. In this case, it is possible that the in-home version substitutes for another in-home activity [20]. For example, renting a movie might substitute for watching TV. Teleshopping might be a substitute for catalog shopping or even for TV watching. The result may be an increase in the total time, in-home or out-of-home, spent in that activity. A individual might check her account balance more frequently with phone service or with on-line service than she would if had to go to teller to so, for example. This cross-substitution of one activity for another is also difficult to detect, because individuals themselves may not be aware of it.

Clearly the impacts will vary by both the type of activity and by individual characteristics and preferences. Activities can be categorized by the type of transaction they involve: input, output, or two-way transactions. Input transactions involve the flow of information from some source to the individual. Examples include movies and bank account inquiries. Output transactions involve the flow of information from the individual to some destination. Examples include many banking transactions -- transfers, deposits, withdrawals. Two-way transactions involve the flow of information both to and from the individual. Home shopping is a good example of this: information about the product in one direction, information about an order in the other direction. However, the distinctions are not always clear, and some activities are sometimes one, sometimes another. Home shopping is also sometimes a one-way transaction, when, for example, individuals watch home-shopping channels as an alternative to other TV shows or skim through catalogs but do not buy. When choosing whether to complete transactions from home or in person, individuals implicitly trade-off the cost of a potential loss in quality of service for the cost of travel; these trade-offs are likely to vary depending on the type of transaction. Substitution of in-home for out-of-home versions of activities is most likely for input transactions because of security and confidentiality issues that may arise in output and two-way transactions, although the results will vary by the nature of the activity and may change as technologies improve.

The nature of the activity will also influence the degree of substitution between in-home versions and out-of-home versions. Two dimensions define the spectrum of nonwork activities: personal business or household maintenance aspects of activities versus social, recreational, or entertainment aspects of activities. At one end of the spectrum of nonwork activities is movie watching, which is mostly about entertainment. At the other end of the spectrum is banking, which is generally classified as "personal business" and is considered by many to be just another chore. Shopping is more difficult to classify and, for most people, involves social and recreational qualities at the same time that it serves household maintenance functions [39, 40].

In general, the substitution of in-home versions for out-of-home versions is likely to be higher for personal business activities than for entertainment activities. Because getting out of the house and going to a theater may be an important aspect of the entertainment value of watching movies in a theater, it seems unlikely that in-home versions will entirely replace the out of home version. On the other hand, it seems likely that individuals will readily choose to do their banking from home if and when they perceive the quality of the in-home version to be equal to going to a bank. However, the banking example is complicated by the range of transactions involved: individuals may be comfortable completing some transactions but not others from home. In addition, it is possible that for some individuals, going the bank is a form of recreation

or social interaction, or at least an excuse to get out of the house. The results for shopping are likely to be mixed. As with movies, getting out to the store and being around people may be an important part of the shopping experience, at least for some people. Others see shopping as a chore and will readily shop from home if given an adequate opportunity. If gender stereotypes are to be believed, women are more likely to see shopping as entertainment than are men.

Individual and household characteristics and preferences may play the biggest role in determining whether in-home versions of an activity substitute for out-of-home versions. First, attitudes about technology are an important factor. Some people are simply more comfortable with increasingly sophisticated technologies than others. Comfort with technology is likely to be correlated with age, as younger generations tend to adopt new technologies more readily than older generations. But comfort with technology is also a technological issue; as telecommunications technologies and services become more user friendly, comfort levels should increase across generations. VCRs present a classic example of this issue. When VCRs first came out, numerous articles appeared to help owners figure out how to program them; the machines have evolved over time to offer easier programming technologies such as program codes and even programming by voice. Second, attitudes about travel may also play a role: those who especially dislike driving and the hassle of parking may be more inclined to stay at home for an activity if they can. As congestion worsens and travel times deteriorate, individuals may be even more inclined to substitute in-home versions for out-of-home versions. Third, preferences about spending time at home versus spending time out of the house will also be an important factor. While the trend toward "cocooning," or spending more leisure time at home with family, is frequently mentioned in the press, some individuals still prefer to spend most of their time out of the home and most individuals prefer to spend some time out of their home. However, factors such as the perception of increasing crime may lead to an increase in the preference to stay at home.

In looking at trends in the use of the different versions of these activities, it is almost too obvious to point out that the original, out-of-home versions have not disappeared, despite the increase in the number and quality of alternatives. Televisions did not mean the end of movie theaters, nor did VCRs or movie channels; catalogs and television shopping channels have not eliminated stores; and ATMs, phone banking, and even on-line services have not led to the disappearance of bank branches. It appears that rather than going away, the original, out-of-home versions have come to serve more limited functions than they originally did, but they retain enough characteristics that are not yet matched by in-home versions that they have not yet been replaced. A hypothesis that can only be tested over time is that as telecommunications technologies and services improve, the in-home versions will provide more of the characteristics

now limited to out-of-home versions, resulting in an increase in the substitution of in-home for out-of-home versions over time. However, the following questions can be asked now to begin to understand how substitution might change in the future: what are the characteristics of out-of-home versions that aren't currently provided by in-home versions, how important are these characteristics to individuals, and how likely is it that new technologies can provide these characteristics?

CHAPTER 3. METHODOLOGY

The research methodology involved two basic approaches: a literature search to explore overall trends in the case study activities, and a household survey to explore individual use of and choices about the case study activities -- movie watching, shopping, and banking. The literature search encompassed books, academic journals, major newspapers, popular publications, and a variety of additional sources available on-line. One of the primary goals of the search was to find data on the use of alternative versions of the case study activities and especially data on trends in their use. Although the search did not fully meet this goal, the pieces of data and the qualitative analyses uncovered paint a clear picture of the trends in the use of the available versions of each activity. But the limits of aggregate data -- even complete aggregate data -- to explore the question of substitution necessitated the development of a household survey to explore individual choices about alternative versions of the case study activities.

The household survey was developed based in part on the findings from the literature search and so as to test the hypotheses outlined in the previous section. A focus group of University of Texas students helped to refine the survey instrument, which was pretested on a small sample of University of Texas employees for clarity of language and appropriateness of multiple-choice answers. The final survey included sections on each of the case study activities as well as a section of attitudinal questions using a Likert-scale and a section of questions on individual and household characteristics. In the sections on the case study activities, several types of questions were included: availability or access to different versions of the activity, frequency of use of the different versions, factors encouraging and discouraging the use of the out-of-home version of the activity, and level of comfort in using more advanced in-home versions.

For each activity, a series of questions designed to test the degree of substitution between in-home and out-of-home versions of the activities were also included. These questions asked the respondent to think about their last use of the particular version and to speculate on what they would have done if that version had not been available. Although certainly not a definitive test, these questions should give some indication of the relationship between different versions of the same activity. However, it is important to recognize that this question addresses substitution on one occasion, at one point in time. Jones and Salomon [20] describe an important temporal element of substitution and the importance of distinguishing between long-term change and one-time use of a new technology. The question included in this survey does not provide a way of evaluating this temporal dimension.

The sample was drawn randomly from the populations of three cities -- San Jose, CA, Oklahoma City, OK, and Austin, TX. These cities were selected in order to test for the potential influence on the use of telecommunications services of high-technology culture and traffic congestion: Oklahoma City as a low-technology, low congestion city; Austin as a high-technology, low congestion city; and San Jose as a high-technology, high congestion city. The random sample of 1000 individuals per city -- 3000 for the total sample -- was generated by TRW Information Services from a database developed from public records such as drivers licenses, voter registrations, and motor vehicle registrations, and from TRW's in-house credit databases. This database, which is updated every six to eight weeks, is relatively complete and accurate.

The survey was administered by mail in August, 1995. Surveys were sent out with a cover letter printed on University of Texas letterhead explaining the purpose of the survey and requesting the participation of the addressee or another adult member of the household. A business reply envelope was included with the survey. No deadline for returning the survey was specified. Four weeks after the first surveys were mailed out, a reminder postcard was sent to the entire sample; the postcard included a phone number and email address through which a new copy of the survey could be requested. A few surveys per week were still being returned as late as early November. The overall response rate was 16%, and varied from 13% in San Jose to 18% in Austin (where the University of Texas pulls more weight).

Given the low response rate, the results of the survey are not likely to be an accurate representation of the entire population. In addition, the characteristics of the respondents differed significantly from the characteristics of the overall populations in these cities in several respects (Table 3-1). First, a higher percentage of the respondents are male than is true for the general population, perhaps reflecting a link between gender and level of interest in technological issues. Second, respondents have more education and higher incomes than the general population, which suggests that respondents are more likely to have access to and experience with more advanced technologies. On the other hand, a larger portion of the respondents are over 40, which may be tied to lower levels of experience and comfort with new technologies. In the analysis of the survey, these potential biases must be considered and, where possible, tested. Despite these limitations, the results should still provide insights into the probable relationships between different versions of the case study activities and the probable role of attitudes and preferences.

TABLE 3-1. RESPONDENT CHARACTERISTICS VS. 1990 CENSUS, BY CITY

	Austin		Oklahoma City		San Jose	
	Survey	Census	Survey	Census	Survey	Census
Female	46%	50%	37%	52%	44%	49%
Male	54%	50%	63%	48%	56%	51%
Age*						
18 to 19 years	1%	6%	0%	4%	2%	4%
20 to 29 years	14%	33%	10%	23%	13%	26%
30 to 39 years	31%	26%	27%	24%	24%	27%
40 to 49 years	26%	14%	26%	17%	31%	18%
50 to 59 years	12%	8%	15%	12%	13%	11%
60 and over	16%	13%	22%	22%	17%	14%
Education*						
<high school	2%	17%	2%	22%	2%	24%
high school	28%	49%	25%	53%	28%	45%
college degree	47%	24%	55%	18%	51%	24%
grad/prof degree	23%	10%	17%	6%	19%	7%
Household Income						
less than\$20,000	10%	39%	7%	39%	4%	17%
\$20 to \$39,000	31%	32%	32%	33%	14%	25%
\$40 to \$59,000	23%	16%	29%	16%	28%	24%
\$60 or more	37%	13%	32%	12%	54%	34%
Household size	2.4	2.4	2.5	2.5	2.9	3.1
Vehicles/Household	2.0	1.5	2.1	1.6	2.5	2.0

* Percent of adults over 18 years.

CHAPTER 4. EXAMPLE 1: MOVIES

OVERVIEW

Movies are, of course, a popular form of entertainment and recreation and have been for nearly a century. A trip to the theater for a Saturday matinee or a Friday night date have long been staples of American culture. In recent decades, a number of alternative modes of movie watching have appeared to challenge the theater as the principle mode of movie watching. Television, at least at first, was more a substitute for the radio than for theater-going [10]. Although theater-going dropped off after World War II, reaching its peak in 1946, the suburban boom and the baby boom of this era had more to do with the decline than did television. Feature films were first shown on TV beginning in the mid-1950s and increasingly in the early 1960s, although until color TVs predominated most of these airings were of pre-1948 black-and-white movies. By the late 1960s, recent feature films were shown regularly on network TV, although by the early 1970s networks aired more made-for-TV movies than theater movies largely because it was cheaper for them. The advantages of watching a movie on TV rather than in a theater were obvious -- cheap and convenient -- but so were the disadvantages -- commercials, cropped pictures, single airings.

Cable TV solved some of these problems. HBO was distributed via satellite beginning in 1975, followed by Showtime and The Movie Channel in 1979. These movie channels gave viewers access to more recent movies -- although not to movies currently playing in the theater -- and more chances to catch a particular movie. Pay-per-view stations, beginning in 1985, gave viewers even greater flexibility. But video cassette recorders (VCRs) had the biggest impact on movie-watching habits: "home video would transform movie watching as nothing had since the introduction of the movie show itself" [10]. The first home versions were introduced in 1976, but were not affordable for middle-class families until the mid-1980s. By the early 1990s, however, over two-thirds of U.S. households owned one or more VCRs [30]. Video rentals offer the greatest flexibility to movie watchers yet in terms of what to watch when, and the delay between the end of the theater run and the release of the video has steadily declined.

So where does that leave theaters? Despite the increasing number of alternative modes of movie watching, theaters are still going strong, especially the multiplex theaters found at nearly every regional shopping mall. At the beginning of the 1990s, according to one observer, "the state of the movie going audience in the American theaters was healthier than it had been since the early 1950s" [10]. Movie theaters still offer qualities that watching movies at home -- whether on network TV, cable TV, or the VCR -- do not: large screens of the right dimensions, the most recent movies, and a chance to get out of the house, among others. Thus, while "pundits were

again tempted by the argument of a substitution effect... they were proven wrong during the 1980s as theatrical movie going remained a vital part of the movie exhibition scene" [10: 103].

Available data on trends in patterns of media use for the U.S. as a whole tend to support this conclusion, although the relationships between trends are not readily decipherable. The average time that Americans spend watching movies in theaters has declined 25% over the last decade or so, from 12 hours per year in 1984 to 9 hours in 1993 (Table 4-1). Time spent watching videos has increased dramatically, from 9 hours to 49 hours per year. This suggests some possible substitution of videos for theater-going, perhaps reducing time in theaters relative what it would have been without the video alternative. But the total of time in theaters and time watching videos has increased so dramatically that it suggests that videos have substituted for other forms of entertainment and recreation. If instead the analysis focuses on time spent watching TV or movies, it becomes clear that the total time has remained relatively constant, but that videos and cable TV, the watching of which has also grown dramatically, have mostly replaced free TV (Table 4-1). In other words, one in-home version may substitute for another in this case rather than for the out-of-home version. Unfortunately, the aggregate data alone are not sufficient to test this hypothesis.

TABLE 4-1. MEDIA USE: HOURS PER PERSON PER YEAR

	Free TV	Cable	Home Videos	Movie Theaters
1984	1,335	185	9	12
1985	1,320	210	15	12
1986	1,324	198	22	10
1987	1,244	241	29	11
1988	1,314	276	35	11
1989	1,280	305	39	11
1990	1,120	350	42	10
1991	1,113	402	43	9
1992	1,106	449	46	9
1993	1,079	451	49	9

Source: Communications Industry Forecast Report.

SURVEY RESULTS

The results of the household survey suggest that, at least for a large segment of the population, watching movies at home is not a substitute for theater-going, although theater-going represents a small segment of all movie watching. Respondents reported that they watch feature movies on video or TV more frequently than in movies theaters (Table 4-2): over 70% watch a feature movie on TV one to three times per month or more, while 53% watch a feature movie on video that frequently, versus only 27% in theaters. These results are not surprising; they correlate with the relative ease of each mode of movie watching. Over 95% of respondents own or have access to a VCR, so that watching a movie at home is an option for nearly the entire sample. The frequency of movie watching (both in theaters and on TV) for those that have a VCR was higher than for those that don't, suggesting that VCR access correlates with interest in watching movies. A much smaller share -- 35% -- reported that they subscribe to a cable movie channel; not surprisingly, these respondents were more likely to watch feature movies on TV more frequently than those who don't subscribe (25% of those with cable watched feature movies on TV more than once per week, versus only 7% of those without cable).

TABLE 4-2. FREQUENCY OF MOVIE WATCHING BY VERSION

	Percent of Respondents		
	Movie Theater	VCR	Television
Never	13%	9%	6%
< 1/month	59%	38%	23%
1-3 time/month	24%	37%	33%
1/week	3%	10%	17%
> 1/week	0%	6%	22%

Given the easy access to movies in the home, why do respondents continue to go to movie theaters? First, it seems clear that some are more likely to go to theaters than others. Almost two thirds of the respondents -- 63% -- indicated that they prefer to watch movies at home, but over one-third -- 36% -- indicated that they prefer to watch movies in a theater, suggesting that movie theaters still offer something to a least a segment of the population that watching movies at home does not. Those that prefer watching movies in the theater are, not surprisingly, more likely to report that they do it more frequently than those that prefer home: 46% of those that prefer the theater go to see a movie in a theater one to three times a month or

more, versus only 16% of those that prefer home (Table 4-3). Those respondents who prefer watching movies in theaters were, on average, better educated (69% with a bachelor's degree or more vs. 52%) and younger (41 years vs. 47 years) than those who prefer home (marital status was not included in the survey but might also explain preferences or at least patterns of movie watching). The differences between these groups in terms of income, gender, household size, and numbers of children at home were not statistically significant.

TABLE 4-3. FREQUENCY OF THEATER GOING BY PREFERENCE

	Percent of Category		
	All Respondents	Prefer Theater	Prefer Home
Never	13%	1%	21%
< 1/month	59%	53%	63%
1-3 time/month	24%	40%	15%
1/week	3%	6%	1%
> 1/week	0%	0%	0%
Percent of Respondents	100%	37%	63%

Second, movie theaters offer certain qualities that watching movies at home does not. Respondents were asked both about factors that encourage them to go to a movie theater and factors that discourage them from going to a movie theater (Table 4-4). Factors most strongly encouraging respondents to go to a movie theater included, in descending order of importance: "big screen" (3.71 on a 5 point scale, where 5 indicates a factor that "strongly encourages" theater going), "like to see new movies" (3.66), "better sound" (3.51), "enjoy getting out of the house" (3.33), "enjoy going out with friends" (3.13), and "comfort of theater" (3.01). These are all qualities -- perhaps with the exception of new movies, as discussed below -- that are not provided by the in-home version of movie watching. Interestingly, respondents felt less strongly about factors discouraging them from going to a movie theater, suggesting that the positive qualities of theaters draw people there, rather than the negative qualities keeping them at home. The most strongly discouraging factor was "cost of ticket" (3.81), followed by "noisy people in theater" (3.15) and "no movies you want to see" (3.11); transportation related factors -- "hard to park,"

"hard to get there," "too far away" -- did not strongly discourage theater-going, at least on average.

TABLE 4-4. FACTORS ENCOURAGING AND DISCOURAGING THEATER GOING

	Mean Score on 5-Point Scale*		
	All Respondents	Prefer Theater	Prefer Home
Factors Encouraging			
Big screen	3.71	4.27	3.38 **
Like to see new movies	3.66	4.21	3.34 **
Better sound	3.51	3.99	3.23 **
Enjoy getting out of house	3.33	3.94	2.98 **
Enjoy going out with friends	3.13	3.50	2.91 **
Comfort of theater	3.01	3.53	2.71 **
Atmosphere of theater	2.50	3.01	2.20 **
Children enjoy theater	2.30	2.16	2.37
Refreshments	1.85	1.92	1.80
Factors Discouraging			
Cost of tickets	3.81	3.65	3.91
Noisy people in theater	3.15	2.89	3.29 **
No movies want to see	3.11	3.14	3.09
Hard to park	2.57	2.47	2.64
Hard to get there	2.24	2.20	2.26
Hard to take kids/get sitter	2.24	2.20	2.27
Too far away	2.23	2.15	2.27

* 5 = factor strongly encourages or discourages.

** Difference between categories significantly different at 1% level.

On factors that encourage theater-going, significant differences were found between those that prefer theaters and those that prefer home, using a t-test of the significance of the difference between means (Table 4-4). Respondents that prefer theaters rated all but one factor as more strongly encouraging them to go to a movie theater than did those that prefer home. The one exception is "your children enjoy theater," the rating of which depends more on having children than on personal preference for theaters or home. On factors that discourage, the

differences between the two groups were not significant, with the exception of "noisy people in theater." These results suggests that those who would rather watch movies at home don't feel more negative about theaters than those that prefer theaters, rather that those who prefer theaters feel more positive about theaters than those that prefer home.

One reason people currently go to a movie theater is that the latest movies are not available on video or on TV; if one wants to see the latest movie, then watching at home is not an option. However, as technologies evolve and as the movie industry itself evolves, it is possible that one will be able to watch whatever movie one wants, including the latest movies, whenever one wants, at home (this option would, however, represent at least in part a significant deviation from long-standing movie industry practices, which take advantage of the willingness of some consumers to travel to and pay higher prices for seeing the latest movies [47]). Respondents were asked to speculate on changes in their choice of movie watching modes if they could have access at home to the movies that were currently showing in the theater. A slight majority of respondents -- 53% -- said that they would watch more movies at home and fewer in the theater, suggesting that over time, the in-home mode of movie watching might substitute for the theater mode. Still, over one third -- 36% -- said that their movie watching habits would not change, suggesting that the other positive qualities of watching movies in a theater would still prevail. Not surprisingly, those that prefer watching movies in a theater were more likely to answer that they would watch more movies at home but go to the theater the same amount (15% vs. 5%).

TRAVEL IMPLICATIONS

The implications for travel of the option of watching movies in the home rather than in the theater are not straightforward, even in the short run. Clearly the impacts depend on what version of movie watching is substituting for what other version of movie watching, if any, as well as the amount of travel associated with each version. In order to test the substitution hypothesis, respondents were asked to think about the last time they rented a movie and to speculate on what they would have done had their VCR not been working. Of those that responded to the question and remembered the last time they rented a movie (about 85% of the respondents), 64% said they would have watched something on TV and only 6% said they would have gone to a movie theater. This suggests that, at this time, for most people on most occasions, watching a movie at home is a substitute for watching TV more than it is a substitute for going to a theater.

The results are similar for the TV mode of movie watching. When asked what they would have done instead of watching a feature movie on TV if the TV had not been on at that time, only 7% said they would have rented a video and less than 1% said they would have gone to a movie theater. The vast majority -- 65% -- said that they would have watched something else on TV

instead. In other words, watching a feature movie on TV appears to be mostly a substitute for watching TV shows, rather than a substitute for either renting a movie or going to a movie theater.

It appears, then, that in-home versions of movie watching may have resulted in a net increase in travel (Table 4-5). Based on the results of the survey, it appears that video watching primarily substitutes for other TV watching. In this situation, the impact is usually an increase in travel, as a result of the necessary trips to the video rental store. In the situation where watching a movie on TV substitutes for going to a theater, the impact is certainly a savings in travel (unless another out-of-home activity replaces theater-going), but the survey results suggest that this substitution is relatively rare. The impact is less certain when renting a movie substitutes for going to a theater.

TABLE 4-5. TRAVEL IMPLICATIONS OF IN-HOME MOVIE-WATCHING

	Substituting for...	Percent of occasions*	Probable travel impact per occasion
Video rental	Theater	6%	Savings
	TV	64%	Increase
	Other	30%	?
TV feature movie	Theater	1%	Savings
	Video	7%	Savings
	Other TV	65%	No change
	Other	27%	?

* Based on what respondent would have done instead the last time they rented a movie or watched a feature movie on TV had that version not been available.

When renting a video substitutes for going to a theater, travel is still necessary -- in fact, two trips are generally necessary, one to pick up the tape and one to return it. Even so, total travel is likely to be lower for the case of renting a video, for a number of reasons. First, video rental stores are more ubiquitous, so that the average distance to a rental store is shorter than

the distance to a movie theater. At the end of the 1980s, there were approximately 25,000 movie theaters in the U.S., but 100,000 video rental outlets [10]. The 1995 Southwestern Bell Telephone directory for Greater Austin listed 19 movie theaters but 74 video rental locations (including 10 Blockbuster sites alone). The greater number of video rental locations should translate into shorter travel distances, depending on their geographic distribution.

Second, video rental stores are located so that viewers can often stop by on their way to and/or from work, so that no additional travel is generated (although the additional stopping and starting has air quality implications, even without an increase in travel distance). Third, videos can often be rented at supermarkets or other kinds of stores, so that at least in some cases an additional trip is not necessary. Fourth, video rental stores are more likely to be within walking distance of home or work, so that a car trip may not be necessary. While only 17% of respondents indicated that a movie theater was within walking distance of home, 40% indicated that a video rental store was, and while only 11% indicated that a movie theater was within walking distance of work, 15% indicated that a video rental store was. Finally, travel associated with renting movies is often more efficient on a per movie and per person basis: multiple movies can be rented in one trip to the rental store, and one person can rent movies that several people will watch.

What's difficult to determine is how these effects have changed over time and how they will change in the future. Although video rentals rarely substitute for theater-going in the present, they may have reduced the amount of theater-going over time. The aggregate data, in fact, show a slight decline in hours spent in theaters over the past decade or so. Still, the high frequency of video rentals has probably contributed to a net increase in travel associated with movie watching. Of course, movies-on-demand technology might replace video rentals altogether in the future, resulting in the elimination of the need for trips to the video rental stores and thus a savings in travel. In addition, as shown in the survey, being able to get the latest movie home would probably reduce the amount of theater going. Thus, as technologies improve in the future, the travel savings are likely to increase.

CHAPTER 5. EXAMPLE 2: SHOPPING

OVERVIEW

Shopping travel makes up a large and growing segment of all non-work travel. Data from the Nationwide Personal Transportation Survey (NPTS) show that shopping vehicle-miles-traveled increased from 7.5% to 11.5% of all vehicle travel and from 15.3% to 20.0% of all vehicle trips from 1969 to 1990 [45]. At the same time, retail space has expanded: total retail square footage grew by 39% during the 1980s, and per capita square footage in 1992 was 20% above the figure for 1986 [35]. Still, there are some signs that the nature of shopping is shifting, perhaps away from store shopping. Although sales in malls reportedly accounted for over 40% of all retail sales in 1984 [46], regional malls across the country fell on hard times in the 1990s. One recent article points to customers' concerns about personal safety in malls and raises the possibility that safety concerns are modifying shopping behavior as customers consider the alternatives: catalog shopping, home shopping channels, or on-line shopping [42].

Mail order shopping has been an alternative for over a century -- the Orvis catalog, the oldest still published, was started in 1856, the Montgomery Ward's catalog in 1872, and the Sears catalog in 1888 (the last of which was published in 1993) -- and was essential to rural residents, providing them with access to a range of goods unavailable in local communities. Catalog shopping has boomed in recent years, and it is not uncommon for households to receive a dozen or more catalogs a week; companies sent 12 billion catalogs in 1993 [5], or 46 catalogs per capita in the U.S. Several innovations over the years -- fast-mail trains, Parcel Post package delivery, credit cards, zip codes, toll-free 800 numbers -- helped to improve the quality of catalog shopping [5]. The latest twist are CD-ROM catalogs, which provide shoppers with more information than a traditional catalog but still not a direct link to merchandisers. Catalogs provide consumers with an alternative to a trip to store but may generate additional shopping as well as being a substitute for store shopping.

Catalog shopping clearly has its pros and cons. As *Consumer Reports* [5] described it:

Catalog shoppers can peruse several malls' worth of items and buy from an armchair, without driving, bumping elbows with other shoppers, or waiting in line. There's no question that American consumers find those benefits appealing... But a catalog's convenience comes at a price. You can't touch the merchandise or try it on, so you must rely on a sixth sense to determine if what you see will be what you get... An unsatisfactory order can easily cost you \$10 or \$20, not to mention time spent rewrapping and remailing.

In other words, catalog shopping does not offer a cost-free trade-off with traveling to a store.

Home shopping channels may also provide alternative to trip to store, although the products offered represent a more limited range than what can be found in catalogs (jewelry and electronic items are especially popular). Home Shopping Network, the first commercially successful shopping channel, was transmitted via satellite beginning in mid-1985. Despite its success, the financial community and cable operators and broadcasters were uncertain about the long-term potential of home shopping channels -- and were even uncertain about the function of these channels for their viewers: "If it is entertainment, will it have staying power, or is it a fad? If it is informational -- matching consumers with the best prices -- is there in fact a more efficient means? If it is advertising, will it not soon wear thin?" asked an article in *Broadcasting* in September, 1986 [4]. Still, home shopping channels have continued to generate profits and have even moved into the upscale market, with the introduction of Catalog 1 from Spiegel and Time Warner in 1994.

On-line shopping has been in the works for well over a decade. The early versions, dubbed "videotex" systems, envisioned a device that would allow for two-way interaction; a modified version of cable service was one possibility. Teleshopping would be bundled with banking services, travel services, and access to wide range of information. Computer-based services proved more viable, with CompuServe introduced in 1982 for home users, Sears' and IBM's Prodigy in 1988 (recently sold to International Wireless), and America On-line in 1989. With growing access to and use of the Internet, the number and range of on-line shopping opportunities has expanded considerably. However, it appears that shoppers have been slow to take advantage of these opportunities: despite promising numbers of browsers, "few buy" [6]. One of the problems has been a secure method of payment; customers are justifiably uncomfortable sending credit card numbers over the network, and no security system has yet proved entirely safe from bugs or hackers. A bigger problem is that "as a shop window, the [Internet] is unimpressive" [6], although faster computers make accessing pictures of products quicker and easier. Says one analyst: "Right now, however, on-line shopping is in its infancy. It offers none of the excitement or selection available in a store or a catalog. And it doesn't yet make up for this lack with convenience. It's great for some items.... But while it's easy to get on-line, finding what you need there isn't any easier than driving to the mall" [1].

Nevertheless, analysts predict rapid growth for on-line sales as technologies improve, at least for certain kinds of businesses where on-line service provides advantages over stores. One recent success story is Amazon.Com, which carries more than 1 million book titles, a selection 30 to 40 times better than the average mall bookstore [2]. The home-shopping channel industry is getting into the fray -- Home Shopping Network bought up Internet Shopping Network in 1994, QVC has been developing Q-on-line. New technologies are planned that will improve the quality

and convenience of home-shopping, but they have a lot of catching up to do: in 1993, sales totaled \$1.5 trillion in stores, \$53 billion through catalogs, \$2.5 billion through TV shopping channels, and \$200 million through on-line services [1]).

Researchers so far seem doubtful that teleshopping will replace store shopping to any large degree. Current limitations include a lack of sufficient bandwidth for efficiently delivering teleshopping services, a lack of consumer access from home, a limited range of goods and services available, lack of security for on-line payments [12]. Although many of these limitations are likely to disappear over time, others will remain. Despite some early predictions that teleshopping would mean the extinction of many types of stores (e.g. [36]), most researchers have predicted that the unique qualities of store shopping will remain important for customers. Salomon and Koppelman [39] and Koppelman, et al. [21], for example, discuss the importance of the greater quality and quantity of information available through the direct experience of shopping in a store and the importance of the recreational and psychological gratification that comes with store shopping (depending on one's attitudes and preferences). Although teleshopping may gain ground on the former factor (and there's some doubt about how much ground it can gain), it is unlikely to on the latter. Gould [11] theorizes that the adoption of electronic home shopping depends on two factors: whether electronic shopping saves time, and whether travel itself has intrinsic value. Guy [15] predicted that teleshopping would have the greatest impact on other non-store retailing opportunities, such as catalog shopping, rather than store shopping.

Manski and Salomon [22] and Salomon and Koppelman [39,40] stress that it is important to distinguish between different aspects of shopping, the acquisition of information and the purchase. A related distinction is made by Koppelman, et al. [21] between directed shopping, when the shopper intends to make a purchase (and presumably gather information first), and non-directed shopping, when the shopper may acquire information but has no intent to make a purchase. Teleshopping has the potential to facilitate the acquisition of information and may especially help comparison shoppers [40]. In this case, the result may be an increase in the total time spent acquiring information or a decrease in travel associated with acquiring information without the elimination of travel associated with the purchase of the item. Such a result may be consistent with Guy's [15] prediction, if catalogs are used as a way of acquiring information. It may also be consistent with Howard's [19] prediction that teleshopping could replace other forms of advertising. The result could be an increase in total time spent shopping (including acquiring information) and/or a decrease in shopping-related travel.

Teleshopping will have more potential for certain kinds of products than others [21]. Gould [11] notes that software, games, and books seem to be the first products to register measurable on-line sales. Products which can be distributed electronically rather than physically

and for which the multi-sensory experience of store shopping does not provide significantly more information than on-line shopping are clearly the most promising candidates. Gould [11] also describes less traditional sales transactions that may grow thanks to the Internet, including customer-to-customer sales of previously-used products (such as cars or computers) or collector items, and fire-sales transactions (such as last minute sales of available airline seats).

SURVEY RESULTS

Not surprisingly, store shopping is still the most frequent mode of shopping (for products other than groceries) among respondents: over 80% of respondents shop in a store for items other than groceries at least once a month, while over 40% shop in a store once a week or more (Table 5-1). By contrast, 65% of respondents order items from a catalog once a year or more but only 20% reported ordering from a catalog once a month or more. Clothes seem to dominate catalog purchases: 48% of respondents indicated that their most recent purchase from a catalog was clothing. Books and gift items, with 30% of respondents each, were also popular purchases (Table 5-2).

Purchases from home shopping channels are even more rare, although respondents use these channels in different ways. While 73% of respondents have access to a home shopping channel, only 21% ever watch it (29% of those who have access), and only 9% (45% of those who watch) have ever bought an item from it. The average number of purchases for those who have made purchases was only 3.6 items, with the majority indicating that they have ever purchased only one or two items. Meadows, et al. [25] and Grant, et al. [13], using the same dataset, identified three distinct segments: those who don't watch, those who watch and buy, and those who watch but don't buy. For this last segment, home shopping channels represent a form of entertainment more than an alternative mode of shopping.

Factors that strongly encouraged respondents to shop in stores included "being able to compare prices" (mean score of 4.30 on a 5 point scale, where 5 indicates a factor that "strongly encourages" store shopping), "being able to handle items" (4.28), "lots of variety and choices" (4.26), and "can do more than one thing on the same trip" (3.97) (Table 5-3). Improved technologies eventually may be able to satisfy most of these needs, but the ability to handle items will still require physical contact. Two things might happen. First, shoppers could become more comfortable buying items without physically handling them, as they become more experienced with purchasing items this way. Second, shoppers may (and already do) make use of the return option, where they order the item, then return it if it does not fit or otherwise meet their expectations; this option may increase delivery travel even further. But the potential to look

through and physically handle a large number of items is likely to remain an advantage of store shopping. Other characteristics unique to store shopping -- getting out of the house, being around people -- were not, on average, strong factors encouraging shopping at store.

TABLE 5-1. FREQUENCY OF SHOPPING BY VERSION

	Percent of Respondents
Store Shopping	
Never	2%
< 1 time/month	18%
1-3 times/month	39%
1 time/week	26%
> 1 time/week	16%
Catalog Purchase	
Never	16%
< 1 time/year	19%
1-3 times/year	45%
1 time/year	16%
> 1 time/year	4%
Watch Home Shopping Channel*	
Never	73%
< 1 time/month	18%
1-3 times/month	4%
1 time/week	3%
> 1 time/week	3%

* Percent of those with access.

Factors that strongly discouraged respondents from shopping at a store included: "too many people/too crowded" (3.71), "poor service in stores" (3.41), "don't have enough time" (3.25), and "difficulty parking" (3.17). On these factors, catalog and on-line shopping may offer an attractive alternative. Note that the factors encouraging store shopping score higher than the factors discouraging store shopping, suggesting that positive qualities draw shoppers to stores more than negative factors keep them away.

TABLE 5-2. MOST RECENT ITEMS
PURCHASED FROM CATALOG

Percent of Respondents*	
Clothes	48%
Books	31%
Gift Items	30%
Housewares	16%
Electronics	14%
Shoes	10%
Toys	7%
Jewelry	7%
Food	3%

*Adds to more than 100% because multiple items purchased at one time.

As technologies improve, particularly as on-line shopping becomes more extensive and more widely available, a decrease in store shopping is possible. However, for certain products and for certain segments of the population, such technologies are less likely to replace store shopping. In general, respondents felt more comfortable buying items from catalogs than from TV, perhaps because of the nature of current home shopping channels; for example, 72% of respondents felt comfortable buying housewares from a catalog, versus only 49% from TV (Table 5-4). But respondents were much more comfortable buying some items from catalogs -- housewares (72% of respondents), clothes (69%), and electronics (58%) -- than other items, such as shoes (34%), jewelry (32%), and food (30%). For these items, respondents may be especially concerned about fit or quality.

TABLE 5-3. FACTORS ENCOURAGING AND DISCOURAGING STORE SHOPPING

	Mean Score on 5-Point Scale*
Factors Encouraging	
Being able to compare prices	4.30
Being able to handle items	4.28
Lots of variety and choices	4.26
Can do more than one thing on same trip	3.97
Enjoy that store or shopping center	3.15
Getting out of the house	2.81
Feel like spending money	2.48
Being around people	2.15
Factors Discouraging	
Too many people/too crowded	3.71
Poor service in stores	3.41
Don't have enough time	3.25
Difficulty parking	3.17
Difficulty getting there	2.73
Hate to shop	2.69

* 5 = factor strongly encouraging or discouraging.

TABLE 5-4. COMFORT LEVELS FOR ALTERNATIVE SHOPPING

	Percent Feeling Comfortable Purchasing Item from...	
	Television	Catalog
Food	14%	30%
Clothes	31%	69%
Shoes	15%	34%
Electronics	36%	58%
Jewelry	20%	32%
Housewares	49%	72%

TRAVEL IMPLICATIONS

As for movies, the travel implications of home shopping are not straightforward. Still, the evidence points to the conclusion that home shopping has not reduced shopping travel to any significant degree, both because home shopping does not usually result in the elimination of a trip to a store and because of travel associated with the delivery of the ordered item. Another possibility, not tested here, is that even when a shopping trip is eliminated, the savings in travel distance is marginal, since shopping trips are often combined with other activities [11].

To test the degree to which catalog purchases substitute for store trips, respondents were asked to think of the last purchase they had made from a catalog and consider what they would have done had they not found that item in a catalog. Of those responding, 31.5% said that they would not have bought the item, suggesting that nearly a third of catalog purchases may be induced, i.e. that the opportunity to purchase that item from a catalog leads to a purchase that otherwise would not be made. Over 40% of respondents said they would have looked for the item on their next trip to the store, suggesting that the catalog purchase replaced a store purchase, but did not eliminate a store trip. Less than 20% said they would have made a special trip to the store for that item, suggesting that for these respondents the catalog purchase did eliminate a shopping trip. It appears, then, that a small share of catalog purchases -- on the order of 20% -- actually reduce shopping trips. Not surprisingly, when purchasers were asked to consider what they would have done had their last purchase not been available on a home shopping channel, 65% indicated that they would not have bought the item and less than 2% indicated that they would have made a special trip to the store. Clearly, respondents do not use home shopping channels as an alternative to store shopping; rather, many are probably watching purely for the enjoyment of it, such as it is [14].

Even when home shopping means the elimination of a shopping trip for the consumer, delivery of the ordered items is still required. Some researchers have argued that package delivery is more efficient than individual shopping trips (e.g.[29,41]), and delivery vehicle fleets are prime candidates for alternative fuels. However, if home shopping does not eliminate a shopping trip, then the result could be an increase in travel, as the delivery trip would be made in addition to same level of shopping travel. In some cases, two or more delivery trips are required before the item can be safely delivered, since recipients are not always home to receive it.

It is also possible that home shopping results in an increase in increase in travel by the shopper, as a result of increased information or awareness of shopping opportunities. Fifty-six percent of respondents said they have at some time made a trip to the store because of something they saw in catalog (although respondents may have interpreted "catalog" to include

advertisements rather than mail-order catalogs). In addition, 6% of respondents said they have made a trip to the store because of something they saw on a home shopping channel, suggesting that shopping channels may induce a small number of trips to the store.

CHAPTER 6. EXAMPLE 3: BANKING

OVERVIEW

Banking is a different type of non-work activity, one that is less likely to include an element of entertainment or recreation and is more likely to be seen as a necessary chore. It is increasingly easy to do banking using automated technologies -- ATMs, phone banking, on-line banking -- rather than going to the bank. ATMs were widely introduced beginning in the late 1970s and have become an integral part of personal banking. Home banking services first became available in the mid-1980s, but despite optimistic forecasts, banks found few customers for these services, largely because they were expensive and hard to use [8]. Although many analysts expected home banking services to be offered as a part of "videotex" systems, banks launched their own services for customers with home computers [24]. As one analyst says: "Home banking has long been regarded as a business with more promise than reality. Some technoides like paying their bills through home computers, but most people are quite happy with checks and ATM cards" [18].

Services are now being offered by banks as well as nonbank competitors, including telephone companies and phone and television equipment manufacturers. Microsoft tried also to take the lead in the field with its unsuccessful 1995 bid for Intuit, maker of Quicken, a popular personal finance software. Most services so far focus on transfers of funds, account information, and electronic bill payment. Of the commercial on-line services, only Prodigy currently offers electronic banking and bill paying. Banks see these services as a way to reduce operating costs and bring in new customers [8]. Several banks have established home pages on the Internet and are beginning to offer a limited number of transactions options, including inquiries about account balances and summaries of transactions; "it's unclear, however, just how many Web surfers will feel comfortable trusting their finances to an unsecured environment" [8]. Banks have recognized that "net banking won't be for everyone," and have instead focused on "internet surfers" who don't care about seeing a teller [8].

It is now possible to do most personal banking without seeing or talking to a live person; the obvious exceptions are inquiries about problems and some special transactions. It's likely that a trip to the bank is one most people would rather do without, although there may be a segment of the population, such as retired persons, who enjoy a trip to the bank as an excuse to get out of the house and interact with other people. National surveys reveal that in the early 1990s at least one-third of the adult population did not have an ATM card and that only about half actually used an ATM card [31,32,33,34]. One issue working against home-banking is trust; some people may not trust an automated system to always do what it's supposed to do. Comfort

levels may increase, though, as technologies improve and experience with automated services increase. Cash is another issue: getting cash currently requires a trip to the bank, an ATM, a store, or some other location. If cash cards or debit cards live up to their promise, however, one more obstacle to home banking will be eliminated. At this point, it appears that different modes of banking are used for different purposes -- more clearly so than for other the other case study activities.

SURVEY RESULTS

The survey asked respondents about their use of different modes of banking and what transactions they conducted last time each mode was used. One-third of respondents completed transactions with tellers 1 to 3 times per month, 22% once a week, and 29% less than once per month (Table 6-1). Only 8% complete a transaction with a teller more than once per week, and an equal share never do (this latter category may include respondents who do not have a bank account; the survey did not include a question on this issue). Not all respondents have an ATM card -- 21%, in fact, reported not having one -- and 12% that have one choose never to use it. For those who do use their ATM card, use of ATMs at the respondent's bank followed a similar pattern to teller transactions, with just over one-third using an ATM at their own bank 1 to 3 times per month; a greater percentage never use an ATM at their own bank than never use a teller (11% vs. 8%) but a greater percentage use an ATM at their own bank more than once per week than use a teller that frequently (15% vs. 8%). These results suggest that small segments of the population predominantly use one or the other, but that the majority use both ATMs and tellers to do their banking.

Respondents were most likely to use an ATM at their own bank; the frequency of use of ATMs at other locations was considerably lower (Table 6-1). Most ATM-users reported using an ATM at another bank never or less than once per month; 42% of ATM-users said that they never use an ATM at a supermarket; 48% said they never use an ATM at a free-standing site; and 71% said they never use an ATM at a gas station or other types of locations. These results suggest that respondents may be by-passing more convenient ATMs (at supermarkets, for example) in order to use an ATM at their own bank, perhaps because of the additional fees that many banks assess when their customers use ATMs other than their own or when ATM users are not their banking customers (over 80% of respondents do not pay a fee for using an ATM at their own bank, but over 75% pay a fee for using other ATMs).

Other banking options are less widely available and are used less frequently than tellers and ATMs. Telephone services offer another alternative for banking: 68% of respondents indicated that their banks provide such a service. Of those that have the service, 28% don't use

it, and nearly a third (31%) use it less than once a month. Only 13% of respondents reported that their bank offers on-line banking service; two-thirds of respondents were not sure. Of those with access to the service, 64% reported that they never use the service. Only 28% of those with access -- 13 respondents in the sample -- use the service once a month or more.

TABLE 6-1. FREQUENCY OF BANKING BY VERSION

	Percent of Respondents with Access to Service				
	Never	< 1 time/ month	1-3 times/ month	1 time/ week	> 1 time/ month
Bank Teller	8%	29%	33%	22%	8%
ATM at Own Bank	14%	18%	36%	18%	15%
ATM at Other Bank	33%	37%	22%	4%	4%
ATM at Supermarket	42%	31%	18%	4%	5%
Free-Standing ATM	48%	28%	17%	5%	3%
ATM at other location	71%	14%	9%	4%	3%
Phone Service	28%	31%	24%	11%	8%
On-line Service	64%	9%	13%	4%	11%

The types of transactions completed the last time respondents used each of the banking options suggest very different patterns of use for each option. The predominant type of transaction completed with a teller was deposits: 74% of respondents reported making a deposit on their last visit to a teller (Table 6-2). In contrast, 95% said that their most recent ATM transaction was a withdrawal. These results suggest that tellers and ATMs are being used for different purposes, perhaps because many customers are not yet comfortable with making a deposit to a machine rather than a person. The dominant use of telephone banking services is checking on account balances: 77% of phone service-users reported this transaction for their most recent use of the service. The use of this service seems to be similar to the use of telephone banking services, with 10 respondents reporting that they checked on account balances the last time they used the service and 6 reporting that they transferred money. In general, a wider range of transactions was reported than for other modes of banking, suggesting

that on-line services may prove to be more flexible than other modes (although the numbers are too small to be conclusive).

TABLE 6-2. TRANSACTIONS COMPLETED ON LAST USE OF BANKING VERSION

	Percent of Respondents Using Service*			
	Teller	ATM	Phone Service	On-Line Service
Made a deposit	74%	26%	3%	21%
Transferred money	19%	10%	29%	32%
Made a withdrawal	33%	95%	2%	16%
Cashed a check	38%	-	-	-
Checked account balances	12%	26%	77%	53%
Fixed problem/changed account	10%	-	-	-
Inquired about problem	-	-	18%	16%
Other	8%	1%	12%	17%
Can't remember last time	2%	0%	4%	14%

* Percents may add to more than 100% if multiple transactions.

Factors strongly encouraging respondents to visit the bank and complete their transaction with a teller included "can do multiple transactions" (3.55 on a scale of 5, where 5 means a factor strongly encourage banking with a teller), "get proof of a transaction", "problems solved quickly", and "transactions can't be done other ways" (Table 6-3). These are all factors that improved technologies may be able to address. Respondents were less concerned about getting to deal with a person or that it's what they're used to doing. Factors strongly discouraging visits to the bank included "long lines", "charges for using a teller", and "can do transactions more easily other ways". Respondents were less concerned about difficulties parking or the distance to the bank. For banking, unlike movie watching and shopping, the positives and negatives of the out-of-home version are rated about equal, perhaps suggesting a greater willingness to give up the out-of-home version.

Respondents feel more comfortable inquiring about balances by telephone or computer than they do about completing other transactions using these services and, not surprisingly, feel more comfortable completing transactions by telephone rather than computer (Table 6-4). Under

half of the respondents said they would be comfortable making a withdrawal (with the check mailed to them) via telephone or computer. These results suggest that, at least with current technologies, customers are willing to use telephone and on-line services for a limited range of transactions.

TABLE 6-3. FACTORS ENCOURAGING AND DISCOURAGING TELLER VISIT

	Mean Score on 5-Point Scale*
Factors Encouraging	
Can do multiple transactions	3.55
Get proof of transaction	3.47
Problems solved quickly	3.46
Transactions can't be done other ways	3.35
Get to deal with a person	2.98
It's what you're used to doing	2.82
Factors Discouraging	
Long lines	3.58
Charges for using a teller	3.10
Can do transaction more easily other ways	3.02
Hard to park	2.67
Too far away	2.63
too hard to get there	2.48

* 5 = factor strongly encouraging or discouraging.

TABLE 6-4. COMFORT LEVELS FOR ALTERNATIVE BANKING

	Percent Feeling Comfortable Completing Transaction Via...	
	Telephone	Computer
Balance inquiries	92%	76%
Transfer of funds	71%	62%
Loan payment	64%	62%
Withdrawal (check mailed)	49%	47%
Bill payment	65%	62%

TRAVEL IMPLICATIONS

The travel implications of banking alternatives -- ATMs and in-home options (telephone or in-line services) -- depends on whether the use of the alternatives substitutes for a trip to the bank. For ATM use, the travel implications depend not only on the question of substitution but also the amount of travel associated with each option. As described above, respondents appear to be using the different banking options for different purposes, suggesting limited substitution. The results of the direct questions about substitution, however, show that many more trips to the bank would be made if other banking options were not available.

Respondents were asked to think about their last ATM transaction and consider what they would have done had they not had an ATM card. Nearly half of ATM-users (48%) said that they would have made a special trip to the bank to complete the transaction and 29% said they would have cashed a check somewhere else, suggesting that the trip to the ATM in most cases replaced a trip to the bank or another location. Only 15% of respondents said they would have waited until their next trip to the bank and fewer than 10% would have completed the transaction by phone, mail, or computer. It appears that the use of ATMs is predominately a substitute for use of a teller rather than other modes of banking. This finding is easily explained by the predominant use of ATMs for withdrawals -- a type of transaction not easily or quickly accomplished by banking options other than a trip to the bank.

The travel implications then depend on whether the trip to the ATM is shorter than the trip to the bank. As noted above, respondents most frequently use an ATM at their own bank, in which case no travel is saved, since the trip is made to the same destination; the customer may find using an ATM more convenient than waiting in line for a teller, even if they still have to make the trip. Of course, ATMs also provide twenty-four hour service, in contrast to the limited hours of bank branches (although the trend in the last decade has been toward longer hours). Fewer than a quarter of the respondents use ATMs at other -- potentially closer -- locations, perhaps because of the increased fees, as noted above. Walking is more likely to be an option for trips to ATMs than trips to the bank: 35% of respondents reported having an ATM within walking distance of home, vs. only 16% for banks, and 44% of respondents reported having an ATM within walking distance of work, vs. only 22% for banks. ATMs have thus probably reduced travel to some degree, although not as much as they potentially could.

In-home versions of banking seem to serve both to reduce trips to the bank and to increase the number of transactions, especially those related to acquiring information. When asked what they would have done had the telephone service not been available the last time they used it, 46% of phone service-users said they would have made a special trip to the bank or an

ATM, while 36% said they would have waited until their next trip to the bank or ATM. Thus, it appears that a majority of these transactions substitute for a trip, thus reducing travel. However, for over one-third the transaction is induced, an additional transaction made because of the opportunity to do so.

The results for on-line service suggest less substitution. When asked what they would have done had they not had the option of using the on-line service the last time they used it, only 21% of respondents said they would have made a special trip to the bank or ATM. In contrast, 37% would have waited until their next trip to the bank and 42% would have completed the transaction by phone or mail, suggesting that on-line services are more likely to represent additional banking or substitute for other in-home modes of banking than to substitute for a trip to the bank. On-line banking may mean some savings in travel but also more total banking.

CHAPTER 7. THE ROLE OF ATTITUDES

FACTOR ANALYSIS

To test the hypothesis that attitudes play a significant role in the substitution of in-home versions of activities for out-of-home versions, the survey included a series of attitudinal questions. Respondents were asked to indicate to what degree on a 5-point Likert scale they agreed or disagreed with statements about technology, being in public places, and dealing with traffic. Factor analysis (using an oblim rotation procedure) was used to condense the responses to 20 questions into six factors (Table 7-1). Factor 1, which accounts for 19.2% of the variation, reflects attitudes about and levels of comfort with new technologies; higher scores mean more positive attitudes. Factor 2 (11.1% of the variation) reflects attitudes about congestion, traffic, and crowds; higher scores mean more negative feelings about congestion, traffic and crowds. Factor 3 (9.2% of the variation) reflects attitudes about being around and interacting with other people; higher scores mean higher preferences for socializing and interacting. Factor 4 (6.2% of the variation) reflects attitudes about spending time at home; higher scores mean stronger preferences for spending time at home. Factor 5 (5.7% of the variation) reflects feelings about time pressure; higher scores mean greater concern about time. Finally, Factor 6 (5.6% of the variation) reflects concerns about computer security; higher scores mean less concern.

Scores on these factors are in some cases significantly correlated with socio-economic characteristics (Table 7-2). The pro-technology factor, for example, is negatively correlated with age: younger respondents, not surprisingly, are more likely to feel positively about and comfortable with new technologies. Education level is positively correlated with the pro-technology factor, also an intuitive finding. Being a full-time worker is also positively correlated with this factor, while being a retired worker is negatively correlated; these correlations are probably driven by a correlation between age and work status. The positive correlation between number of children ages 0 to 4 years and the pro-technology factor may be driven by an underlying correlation between the number of young children and the age of the respondent.

The time pressure factor is significantly correlated with a number of characteristics. First, age is negatively correlated with this factor, suggesting that older respondents are less likely to feel pressed for time, driven perhaps by more limited out-of-home activities and/or by a higher portion of non-working (especially retired) respondents. Not surprisingly, time pressure is positively correlated with being a full-time worker and negatively correlated with being retired. Similarly, time pressure is positively correlated with income: higher income respondents feel more pressed for time, perhaps because they spend more time working and/or are employed in more

TABLE 7-1. ATTITUDINAL FACTOR LOADINGS

	Factor 1 Pro-Technology	Factor 2 Anti-Congestion	Factor 3 Social/Interactive
I feel comfortable using computers	0.77	0.00	-0.03
Technology makes my life easier	0.77	-0.06	0.05
Technology helps me save time	0.73	0.03	0.14
I have trouble using new technologies	-0.70	0.18	0.28
I'll spend money for the latest technologies	0.68	0.04	0.04
Technology will change society for the worse	-0.52	-0.07	-0.11
I enjoy driving, even around town	0.21	-0.77	0.09
I enjoy being in busy places	0.08	-0.53	0.32
Traffic drives me crazy	-0.02	0.51	0.02
I like to interact with other people	-0.02	-0.17	0.78
I prefer to spend my free time with friends	-0.04	0.07	0.67
I enjoy walking	0.06	-0.01	0.53
I prefer to spend my free time at home	0.05	0.04	0.13
I get bored staying at home all day	0.09	-0.13	0.31
I never have enough time to get things done	-0.02	-0.10	-0.04
I wish I had more free time	0.08	-0.01	-0.03
I worry about credit card fraud	0.10	0.14	-0.04
I worry about my privacy with computers	-0.14	-0.14	-0.01
I believe people should drive less	0.26	0.46	0.21
I really hate waiting in lines	0.19	0.32	0.07

	Factor 4 Home Body	Factor 5 Time Pressure	Factor 6 Tech. Security
I feel comfortable using computers	0.03	0.04	0.04
Technology makes my life easier	-0.07	0.15	0.03
Technology helps me save time	-0.07	0.09	0.00
I have trouble using new technologies	-0.12	0.13	0.01
I'll spend money for the latest technologies	-0.01	0.02	-0.10
Technology will change society for the worse	0.09	-0.03	-0.38
I enjoy driving, even around town	-0.05	0.08	-0.04
I enjoy being in busy places	-0.10	0.06	-0.23
Traffic drives me crazy	-0.17	0.25	-0.27
I like to interact with other people	-0.02	-0.06	-0.02
I prefer to spend my free time with friends	-0.11	0.12	0.05
I enjoy walking	0.40	-0.10	0.03
I prefer to spend my free time at home	0.64	0.21	-0.09
I get bored staying at home all day	-0.62	-0.02	-0.10
I never have enough time to get things done	0.14	0.89	0.00
I wish I had more free time	0.07	0.86	0.04
I worry about credit card fraud	-0.07	-0.06	-0.81
I worry about my privacy with computers	0.08	0.06	-0.79
I believe people should drive less	0.22	-0.06	-0.16
I really hate waiting in lines	-0.35	0.31	-0.06

time consuming occupations. Time pressure is positively correlated with the number of young children and negatively correlated with being male, suggesting that women with small children are more likely to feel pressed for time. Other factors were not significantly correlated with the socio-economic characteristics included in the survey.

TABLE 7-2. CORRELATIONS BETWEEN FACTOR SCORES AND SOCIO-DEMOGRAPHIC CHARACTERISTICS

	Factor 1 Pro- Technology	Factor 2 Anti- Congestion	Factor 3 Social/ Interactive	Factor 4 Home Body	Factor 5 Time Pressure	Factor 6 Technology Security
Age	-0.36 **	0.03	-0.11 *	0.04	-0.22 **	-0.01
Male	0.09	-0.02	-0.10 *	-0.05	-0.15 **	0.08
Income	0.08	0.02	-0.04	-0.01	0.10 *	0.06
Education	0.13 **	0.02	0.11 *	0.08	0.04	0.08
Fulltime Worker	0.20 **	-0.03	0.06	0.01	0.25 **	0.04
Retired	-0.20 **	0.06	-0.04	0.01	-0.29 **	-0.02
Fulltime Student	0.07	-0.03	0.01	-0.06	0.01	0.03
Household size	-0.01	-0.01	-0.05	-0.02	0.14 **	-0.01
#Kids 0 to 4 yrs	0.14 **	0.06	-0.03	0.03	0.17 **	0.02
#Kids 5 to 9 yrs	-0.02	0.00	-0.04	0.06	0.13 **	0.04
#Kids 10 to 14 yrs	0.00	-0.01	0.02	-0.01	0.08	0.03
#Kids 15 to 18 yrs	-0.05	-0.03	-0.04	0.02	-0.02	-0.03
#Vehicles	-0.08	0.01	-0.08	-0.03	0.02	-0.02

** Significant at the 1% level.

* Significant at the 5% level.

Although more sophisticated techniques are needed to sort out the relative importance of these factors and socio-demographic characteristics in explaining differences in the use of in-home and out-of-home versions of the case study activities, correlation coefficients begin to suggest some important relationships. The frequency of theater going, for example, is positively correlated with scores on the pro-technology, social-interactive, and time pressure factors, and negatively correlated with the home-body factor (Table 7-3). The results for the social-interactive and home-body factors are intuitive, but the results for the pro-technology and time pressure factors are not. In the latter cases, the correlations seen here may be driven by correlations with socio-demographic factors as noted above. For example, age is positively correlated with both movie frequency and the pro-technology factor. The frequency of video rentals is also positively correlated with the pro-technology and time-pressure factors. In this case, the result is more

intuitive: that respondents who feel more comfortable with technology and who have more limited time (perhaps too limited for theater going) rent movies more frequently. In fact, the frequency of theater going and video rentals are positively correlated with each other, suggesting an important distinction between frequent and infrequent movie watchers, regardless of the version of movie watching.

TABLE 7-3. CORRELATIONS BETWEEN FACTOR SCORES AND ACTIVITY FREQUENCIES

	Factor 1 Pro- Technology	Factor 2 Anti- Congestion	Factor 3 Social/ Interactive	Factor 4 Home Body	Factor 5 Time Pressure	Factor 6 Technology Security
Theater going	0.22 **	-0.03	0.19 **	-0.13 **	0.18 **	-0.08
Video rentals	0.16 **	-0.01	0.09	-0.04	0.13 **	-0.03
TV movies	0.04	-0.08	-0.05	-0.06	-0.08	0.03
Store shopping	0.11 *	-0.13 **	0.10 *	-0.10 *	0.02	0.01
Catalog shopping	0.14 **	0.01	-0.09	-0.08	0.11 *	0.01
Shopping channel	-0.01	-0.01	-0.06	0.06	0.07	-0.09
Bank teller	-0.10 *	-0.12 **	-0.01	-0.03	0.02	-0.10 *
ATM at bank	0.19 **	0.06	0.08	-0.12 *	0.08	-0.03
Phone banking	0.19 **	0.06	-0.03	-0.01	0.15 **	0.15 **

** Significant at the 1% level.

* Significant at the 5% level.

The frequency of store shopping is positively correlated with the pro-technology and social-interactive factors. The former result may be explained by the underlying correlation with age; the latter result is consistent with the hypothesis that those who like to be around other people are more likely to enjoy shopping in stores. The frequency of store shopping is negatively correlated with the anti-congestion and home-body factors: those who don't mind traffic and crowds and who aren't as inclined to spend time at home shop more frequently. The frequency of catalog shopping is also positively correlated with the pro-technology factor; in this case it is not clear that age drives the result, nor is it intuitive that feelings about technology would be linked to catalog shopping. The frequency of catalog shopping is also positively correlated with the time pressure factor, a result that makes sense on the surface: those who feel pressed for

time are likely to find ways to save time, including shopping by catalog rather than traveling to the store.

The frequency of completing transactions with a bank teller is negatively correlated with the pro-technology and technology security factors: not surprisingly, those who feel less comfortable with and less secure about technology visit a teller more frequently. For these respondents, the other banking options may not be seen as options. Frequency of bank teller visits is also negatively correlated with the anti-congestion factor: those who don't care as much about crowds, lines, and traffic visit a teller more frequently. In other words, these respondents are not deterred by some of the downsides of a teller visit. Conversely, frequencies of using an ATM (at one's own bank) and using phone banking services are positively correlated with the pro-technology factor. The frequency of using phone banking services is also positively correlated with the time pressure factor and the technology security factor, suggesting that those who use these services most frequently feel pressed for time (and may see the phone option as a way of saving time) and are not worried about security with using technology.

FREQUENCY MODELS

In order to determine the relative importance of the attitudinal factors and socio-demographic characteristics in explaining differences in the frequency of use of in-home and out-of-home versions of the case study activities, a series of logistic regression models were estimated. The dependent variable in these models was high frequency of use, with the first two frequency categories in the survey defined as low frequency. A step-wise procedure was used to determine significant predictor variables, including attitudinal factors, socio-demographic characteristics, and location (i.e. which of the three survey cities). Significant coefficients are shown in Table 7-4.

The model for predicting high frequency of theater going includes age (negative coefficient), household size (negative), number of kids 10 to 14 years old (positive), and the home body factor (negative). In other words, those respondents who go to the movie theater most frequently tend to be younger, from smaller households, have pre-teen children, and be less inclined to spend free time at home. In contrast, the model for predicting high frequency of video rentals includes age (negative coefficient), household size (positive), and the social/interactive factor (positive); those respondents who rent movies most frequently tend to be younger, from larger households, and more inclined to spend free time with friends and around other people. These results suggest that younger respondents watch movies more frequently in general and that frequent movie watchers of both types -- theater and video rental -- do so as a social activity:

to get out of the house in the case of theater goers and to be around friends and family in the case of video renters.

TABLE 7-4. LOGIT MODEL COEFFICIENTS

Independent Variables	Dependent Variable: High Frequency of...					
	Theater going	Video rentals	Store shpg	Catalog shpg	Bank teller	ATM use
Constant	2.22	1.40	1.70	0.30	-0.04	1.83
Age	-0.05	-0.05				-0.03
Household Size	-0.42	0.29		0.19	0.19	
# Kids 10-14 yrs	0.57					
Gender*			-0.33	-0.42		
Education**						
< high school				-2.11		
high school				-0.83		
technical degree				0.49		
college degree				0.22		
master's degree				0.41		
MD or law degree				0.71		
Factor 1						
Pro-Technology			0.35	0.36		0.61
Factor 2						
Anti-Congestion			0.03		-0.31	
Factor 3						
Social/Interactive		0.28				
Factor 4						
Home Body	-0.28			-0.29		
City***						
Austin					0.11	-0.46
Oklahoma City					0.56	-0.39

* Male = 1, Female = -1.

** PhD = -1 for all categories.

*** San Jose = -1 for all categories.

Not surprisingly, gender plays a role in the models for predicting both high frequency of store shopping and high frequency of catalog shopping. The model for store shopping includes gender (negative coefficient for male), the pro-technology factor (positive), and the anti-congestion factor (negative). These results suggest that those respondents who shop in stores most frequently tend to be women and not concerned about crowds and congestion -- and feel comfortable with new technologies, a finding which is more difficult to understand or explain. The model for catalog shopping includes gender (negative coefficient for male), household size (positive), education (negative coefficients for less education, positive coefficients for more education), the pro-technology factor (positive), and the home body factor (negative). In other words, respondents who shop from catalogs most frequently tend to be women, be from larger households, be better educated, feel positively about new technologies, and be less inclined to spend free time at home. The latter result is possibly explained by a desire to save time shopping in order to have more time for other out-of-home activities.

The model for predicting frequency of visits to bank tellers includes household size (positive), the anti-congestion factor (negative), and city (positive for Austin and for Oklahoma City). The latter result suggests a significant difference in the frequency of bank teller visits between cities, with Oklahoma City residents most likely to visit teller frequently and San Jose residents least likely. This finding could be driven by a number of factors: higher congestion levels in San Jose which make visiting a teller less convenient, lower levels of familiarity with technology in Oklahoma City which might make other banking options less attractive (although this should have resulted in a significant coefficient for the pro-technology factor), or differences in access to banks and availability of banking alternatives. Consistent with this result, the model for frequency of ATM use also included city, with respondents in San Jose more likely to use ATMs frequently (negative coefficients for Austin and Oklahoma City). The same explanations may apply here. What's interesting in comparing the result for banking to the results for movie watching and shopping is the relative importance of place in the case of banking, suggesting that attitudinal factors and socio-demographic characteristics play less of a role. This might support the hypothesis that substitution is more likely for banking (given adequate availability of alternatives to trips to the teller) than for the other activities which include more of an element of entertainment or pleasure.

CHAPTER 8. CONCLUSIONS

The results presented here suggest a complicated relationship between in-home versions of activities, based on telecommunications technologies, and out-of-home versions of activities, requiring physical travel. The degree to which in-home activities substitute for out-of-home activities depends on the nature of the activity and the characteristics of individuals, their attitudes and preferences. So far it appears that out-of-home versions of movie-watching, shopping, and banking offer qualities that are not currently duplicated by the in-home versions, and that these qualities are important for most individuals some of the time and for some individuals most of the time. At the same time, the results show signs that as technologies and services improve, the degree of substitution may increase. Of course, the analysis is complicated by the likelihood that the in-home versions of one activity sometimes substitute for another in-home version of the same activity -- or even of other activities, and by the possibility that the in-home version of an activity sometimes induces additional participation in the out-of-home version.

Predicting the future impact of telecommunications on nonwork travel is also complicated by the difficulty in predicting the nature of future telecommunications technologies. Often times, technologies that are most widely promised for the future prove infeasible or are replaced by the next great technology before they even have a chance. At cable television conventions in 1993, interactive TV which could provide movies on demand was the star of the show. But movies on demand proved to be more technically challenging than expected. Since then, attention has shifted to the computer-based Internet; the number of articles mentioning the Internet has grown exponentially (Figure 8-1); in 1996, the number of articles mentioning the Internet averaged more than 500 per day. Now it appears that the lines between different technologies may blur. Cable companies are currently trying to tap into the rapidly growing field with a new kind of modem that will let cable customers connect personal computers to television cable instead of telephone lines [23]. The promised difference in speed of transmission is astounding: 28,000 bits per second for phone lines vs. 10 million bits per second for cable modem. This is faster even than ISDN, which was all the rage just a few years ago. What this technology will enable: full motion video and full fidelity audio over the Internet, improving its entertainment value. Eventually, it may be difficult to differentiate between televisions and personal computers. In the meantime, the industry needs for standards for cable modem makers, and cable systems will need to be upgraded to fiber-optic networks before two-way transactions possible. Of course, by next year, an entirely new technology may be on the scene.

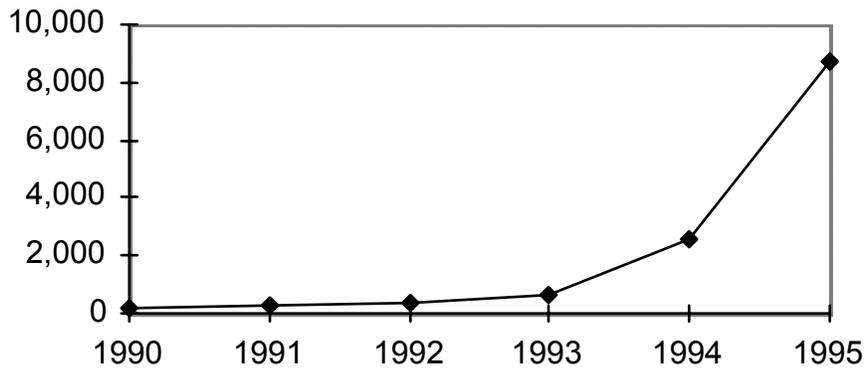


Figure 8-1. Articles Mentioning "Internet" in Nexis Database

It is also difficult to predict what will happen as today's youngsters, growing up with computers and rapidly changing technologies, become tomorrow's adults. Their familiarity and comfort with telecommunications technologies may lead to an increase in the use of in-home versions of activities over time. Technology is changing the very nature of the ways schools are educating today's kids. The U.S. Census Bureau reports that 32% of children ages 3 to 17 had access to a computer at home in 1993 and 61% used computers in school [43]; President Clinton has emphasized the need to put computers in schools and has set a goal to link every school in the nation to the Internet by the turn of the century [26]. Interactive media, one article claims, represent "a powerful combination of earlier technologies that constitutes an extraordinary advance in the capability of machines to assist the educational process" [16] -- and makes learning more like entertainment. It is unclear to what degree kids are giving up TV time for Internet time at this point. But if the complaints of parents are to be believed, they are spending more time than ever driving their kids from one activity to the next. So far, it does not appear that increased familiarity and comfort with computers and other new technologies has led to a decrease in out-of-home activities for today's kids -- but that could change, too.

Sociologist Claude Fischer [7] cautions researchers on several pitfalls in evaluating the impact of new technologies on society: avoid sweeping metaphors, don't homogenize the impacts of different technologies, don't assume linear impacts of any one technology, and avoid the impact/imprint trap (i.e. the assumption that a "a technology 'impacts' society by transferring its own properties to individuals, groups, or institutions"). He suggests two pairs of questions for

researchers: "First, why and how do people use a technology to pursue their ends? And how does using that technology lead them to alter other aspects of their lives?... Second, how does the common use of a technology alter the options and constraints for action? And how do the resulting patterns of action create further structural and cultural circumstances?" This approach focuses on the connections between technology and daily life, both the choices individuals make in their own lives and the ways in which individual choices together, over time, shape the choices available. The impacts of new technologies on society are not determined by the technologies themselves but by the choices that are made about the use of the technologies.

Thus, to understand the potential impacts of telecommunications technologies on travel, researchers must understand the choices that individuals make about using those technologies. Just because telecommunications technologies offer the potential to reduce travel does not mean they will be used to that end, and it is clear that the impacts will be much more complex than a simple reduction in travel. For the case of in-home versions of activities, which should increase in both number and quality as telecommunications technologies improve, what seems certain is that: 1. there will be changes in how different activities are accomplished, both in the home and out of the home, 2. there will be changes in what activities take place at home and what activities take place out of the home, 3. there will be changes in patterns of travel, in terms of frequency, timing, and destinations. What is not certain is whether travel will decrease as a result of these changes. So far the evidence does not point to a reduction in travel; per capita travel has been increasing, in fact, even as telecommunications technologies and services have improved in recent decades. As Fischer concluded in 1985 [7]:

Writing these words on a computer, I can hardly dismiss all the speculations about the marvels (or terrors) of the silicon-chipped society. But if we have any historical and sociological sense... we should remain skeptical about major social changes until the evidence is in.

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