The Impact of E-Commerce on Local Transportation Planning

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Introduction

New technologies often have lasting societal impacts. This has been the case with the development of the telephone, automobile, airplane, and now with the birth and rapid growth of e-commerce we are beginning to see huge impacts in areas that we never imagined. On-line education, banking, investing, bill paying, browsing, shopping, and communication are all transforming the way we communicate, the way we conduct our personal business, the way we educate ourselves, and the way we travel.

This paper takes the first step at examining the relationship between Internet use and local travel. First, an overview of Internet usage in the United States is presented using data from the 1998 Current Population Survey. Second, the relationship between daily person trip rates and Internet use is evaluated in a case study of the Boston, MA and Tulsa, Ok metropolitan areas. Data from the Nationwide Personal Transportation Survey/American Travel Survey (NPTS/ATS) pretest that was conducted in the spring of 2000 is used as a basis for analysis.

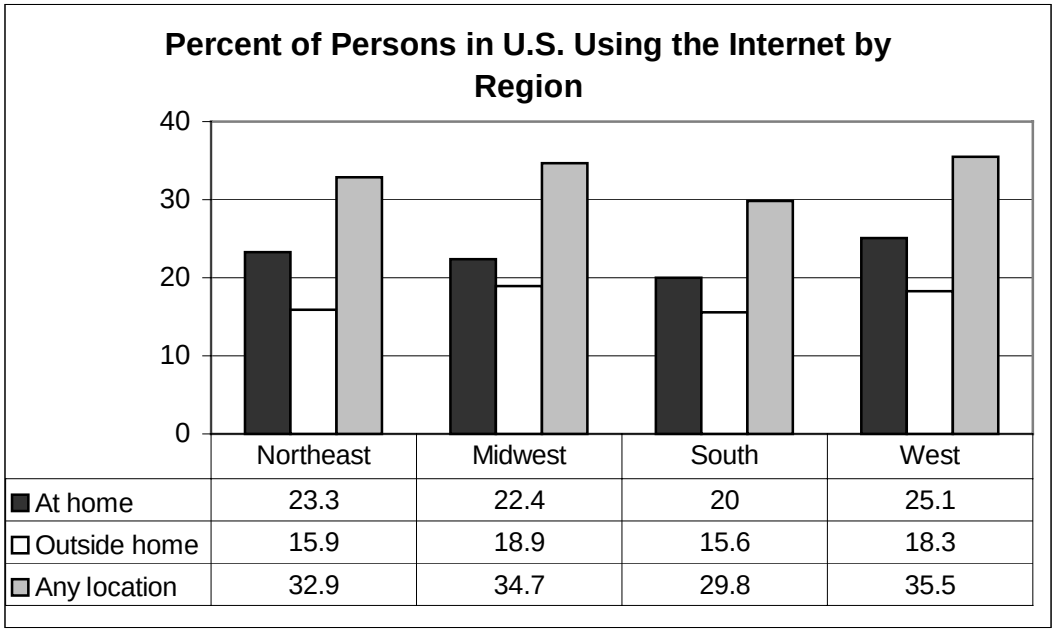
Penetration and Use among Households

Computer ownership and Internet access and use are growing rapidly throughout the United States. According to a 1999 report by the National Telecommunications and Information Administration (NTIA), over 42 percent of U.S. households have a computer in their home and approximately one-third of all Americans have Internet access from some location. In 1989, only 3.3 percent of the nation's households had a modem: by 1997, the figure had grown to 26.3 percent (NTIA 1999). In 1998, 32.7 percent of persons in the United States are using the Internet (NTIA 1999). Now in the year 2000, that number has grown to over 60 percent[1].

Variation in levels of Internet access and use, however, continue across population subgroups. The most likely Internet users are high income, white, college graduates, between the ages of 25 and 34 years old (NTIA 1990). In fact, households with incomes of $75,000 or more are more than 20 times more likely to have access to the Internet than those at the lowest income levels.

[1] Source: Cahners In-Stat Group. March 28, 2000. www.instat.com

Figure 1: Internet Use by Region



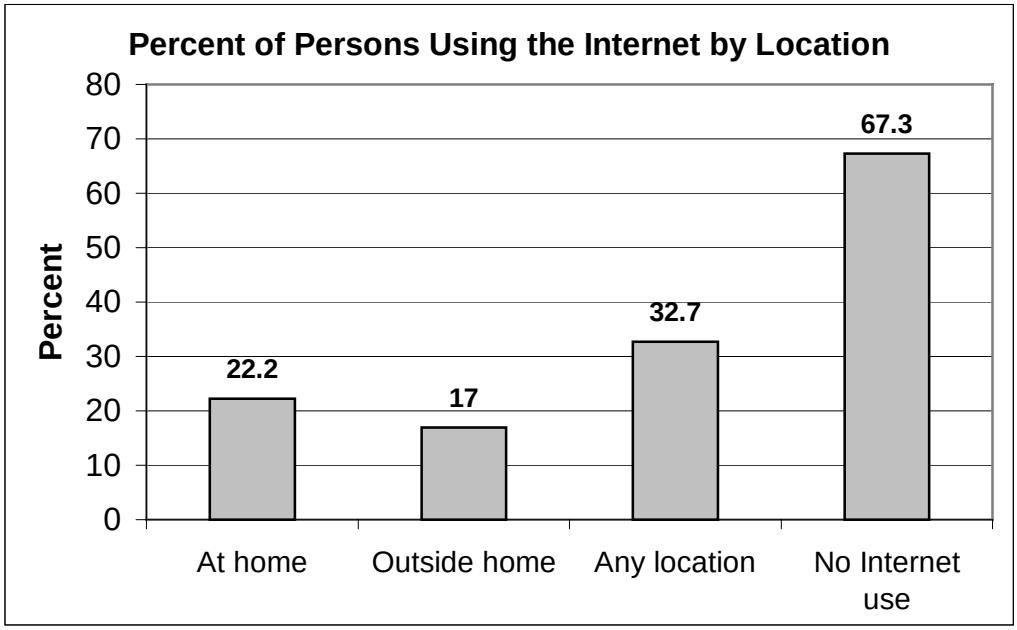
	Northeast	Midwest	South	West
At home	23.3	22.4	20	25.1
Outside home	15.9	18.9	15.6	18.3
Any location	32.9	34.7	29.8	35.5

Source: National Telecommunication and Information Administration (NTIA) and U.S. Census Bureau. U.S. Department of Commerce, using December 1998 Current Population Surveys.

There is also geographic variation in levels of Internet use. As shown in figure 1, the West and Midwest boast the highest levels of Internet use among U.S. households with 35.5 percent and 34.7 percent respectively. The South has the lowest Internet penetration in that only 20 percent of persons have Internet access in their home and just under 30 percent have access at any location which includes home, work, or another location such as school or the library. The future penetration and applications of the Internet are almost unimaginable and will impact our ability to accurately predict new consumer segments, social patterns, communication behaviors, and travel behavior over the next 10-20 years.

Internet use, however, is unique because it crosses the boundaries of geography. Persons can access the Internet to shop, research, or conduct business in any place that allows on-line access. Household and business activities that have historically generated trips can now be carried out from the privacy of the home or office. Those without Internet access at home are getting on-line at work, school, public libraries, and other locations. According to the NTIA (figure 2), almost 33 percent of persons in the U.S. have Internet access from some location while only 22 percent use the Internet from home.

Figure 2: Where People are Accessing the Internet



Source: National Telecommunication and Information Administration (NTIA) and U.S. Census Bureau. U.S. Department of Commerce, using December 1998 Current Population Surveys.

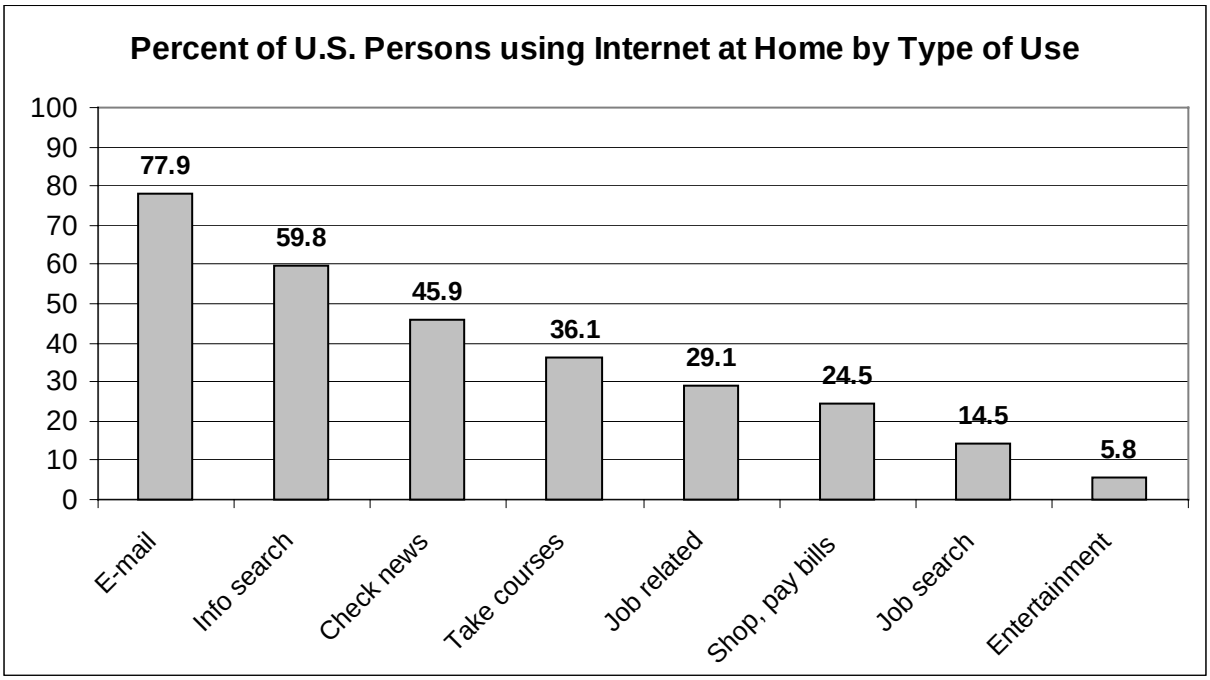
While a large majority of persons in the United States are not getting on-line (67.3 percent), we can expect rapid gains in use over the next few years. Recent data suggest that there are 64.2 million adults going online in the U.S. every month[2] indicating that adaptation of this new technology is occurring very rapidly. Beginning a discussion of Internet behavior and growth in the context of local travel behavior is the focus of this paper.

Major classifications of Internet Use

While Internet use is growing rapidly throughout the U.S., only some of the purposes of getting on-line have a potential impact on daily local travel behavior. While it is feasible that e-mails, information searches, and job searches have the potential for replacing trips or altering travel behavior, these types of activities are not the potential drivers of trip making among U.S. households. Activities, such as shopping, education, conducting personal business, and work related tasks, have the potential for significantly altering how much, why, and when people travel.

[2] Source: Mediamark Research Inc. Summarized in *Internet Facts and Figures* by Intercoast.com

Figure 3: Type of Internet Use



Source: National Telecommunication and Information Administration (NTIA) and U.S. Census Bureau. U.S. Department of Commerce, using December 1998 Current Population Surveys.

As shown in figure 3, email is the most common use of the Internet in that approximately 78 percent of on-line users in the United States are using the Internet from home for e-mail access. However, taking courses (36 percent), doing job related tasks (29 percent), and shopping or paying bills (25 percent) are also major uses of the Internet.

We can expect these numbers to continue to grow as more and more people get on-line and consumer confidence in the security of Internet transactions increases. In a recent study by Ernst & Young, the proportion of retailers selling on-line to customers has more than tripled between 1997 (12 percent) and 1998 (39 percent). The E&Y study also shows that the percentage of U.S. households that have purchased goods and services on-line rose from 7 percent in 1997 to 10 percent in 1998.

Transportation areas impacted by E-commerce

Although it may still be too early in the Internet explosion to make accurate predictions of the implications on travel that the Internet will have, we can begin to examine and identify the most likely scenarios and areas of impact. The Internet is so closely linked to travel because it affords persons with Internet access the opportunity to complete tasks and participate in activities that have historically required a trip. Activities previously mentioned such as shopping, browsing, and taking courses on-line and also newer activities such as grocery shopping, watching movies, and obtaining services such as legal advice, mortgages, and banking have the potential for changing the fundamental assumptions of travel behavior and trip generation. Not only may e-commerce change the way people travel, but the increased use of Internet shopping and home/business

delivery may also test the reliability and capacity of the system. As a result, I have characterized two areas of local travel that are potentially impacted by Internet use:

1. Change in the way that products reach the home.
2. Change in the dynamics of personal travel

Product Delivery

Business to consumer sales in 1999 was $71.4 billion and is forecasted to exceed $654 billion in 2000 (Contrino 1999). This is a huge role for transportation in moving these e-commerce goods into households. There is great concern among the private sector on the ability of the current transportation infrastructure to handle the capacity and speed demands of a virtual marketplace.

The 1999 holiday season is a realistic example of what the future of on-line commerce may look like. During the 1999 holiday season, $12.2 billion in goods and services were sold over the Internet. The United Parcel Service alone enlisted 90,000 more workers, 150,000 more trucks and two-dozen more aircraft to effectively service the additional demand that e-commerce created. On December 17th, the peak volume day for UPS, 18.7 million packages were delivered (Contrino 1999). The ability of the local and national transportation systems to accommodate this much volume is becoming an important element of transportation modeling and planning in all types of geographic areas.

Personal Travel Behavior

The second area, change in the dynamics of personal travel, is the focus of this paper. Many of the traditional forms of conducting household business and some forms of household entertainment can now be accomplished on the Internet. Tasks like shopping, banking, browsing, which traditionally have generated trips, can now be accomplished with a click of a button. In addition to the Internet, new technologies, like automated grocery orders and delivery, on-line car purchases, and on-line stamps also have an impact on how, why, and how much we travel. Although it may be premature to make any strong predictions on how travel behavior will be impacted by Internet use, we need to be aware of the potential and start researching, tracking, and planning now for future transportation needs in a next day, electronic culture.

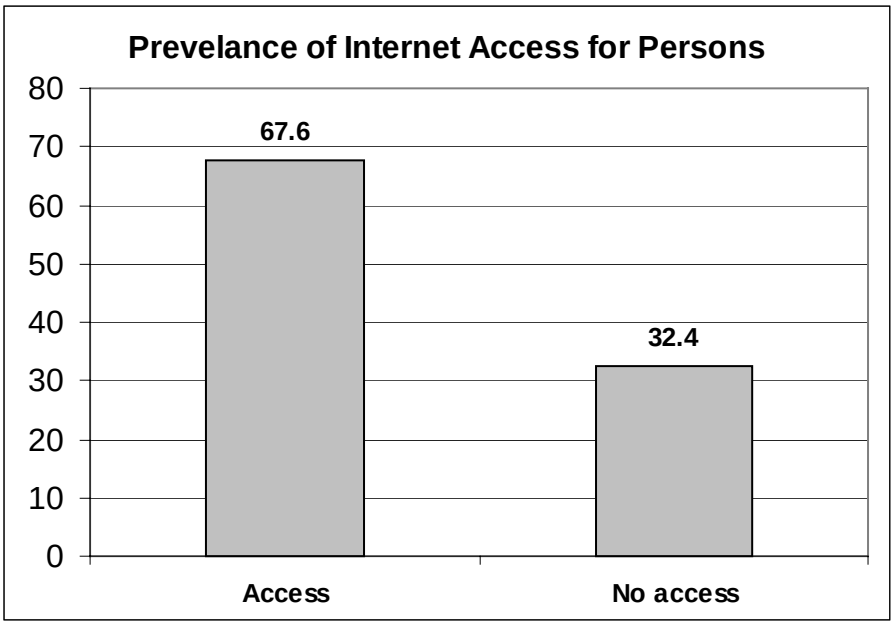
Case Study: Boston and Tulsa MSA

The first steps in examining the relationship between Internet use and daily trip making can be accomplished by including Internet use questions on national, state, and local household travel surveys. The NPTS/ATS, a national daily and long-distance household travel survey conducted by the Department of Transportation, included questions on Internet use in its spring field test[3]. The field test was conducted from February to May 2000 and collected data on travel from 2,000 households in the Tulsa, OK and Boston, MA metropolitan areas. In addition to a daily household diary, the survey also obtained information on Internet access, frequency of use, and location of use.

[3] The NPTS/ATS pretest data is not available for public use and the results are not generalizable to the U.S. population. This report is a case study and results need to be verified with representative survey data.

Figure 4 and 5 present a profile of Internet use in the Boston and Tulsa areas. Although the levels of Internet access in the Boston and Tulsa areas far exceed the 1998 Current Population Survey estimates presented earlier in this paper, they are in line with more recent national statistics which show that 38 percent of U.S. households have Internet access from their home (Nielsen 1999), and over 55 percent have access to the Internet from any location (OECD 2000).

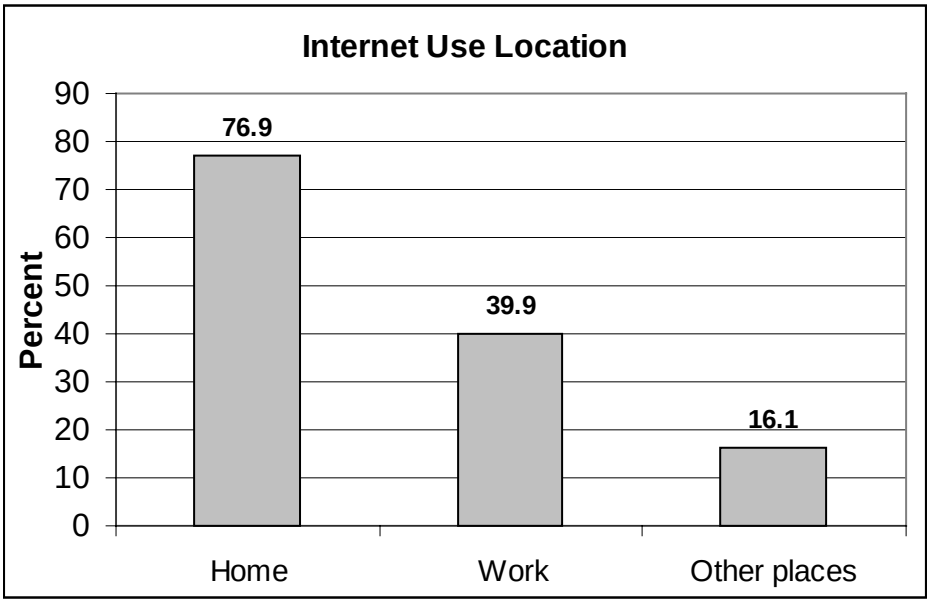
Figure 4: Levels of Internet Access in Boston and Tulsa MSA's



n= 2,178 Source: Unpublished NPTS/ATS 2000 pretest data.

As shown in figure 4, the NPTS/ATS 2000 pretest found that a majority of persons in the Boston and Tulsa metropolitan areas have access to the Internet from some location. Only 32.4 percent of residents in these areas indicated that they did not have Internet access. The following figure shows that a strong majority of persons have access in their home with only 40 percent of Internet users with access at work. Sixteen percent of Tulsa and Boston residents obtain access from some other location such as school or the public library.

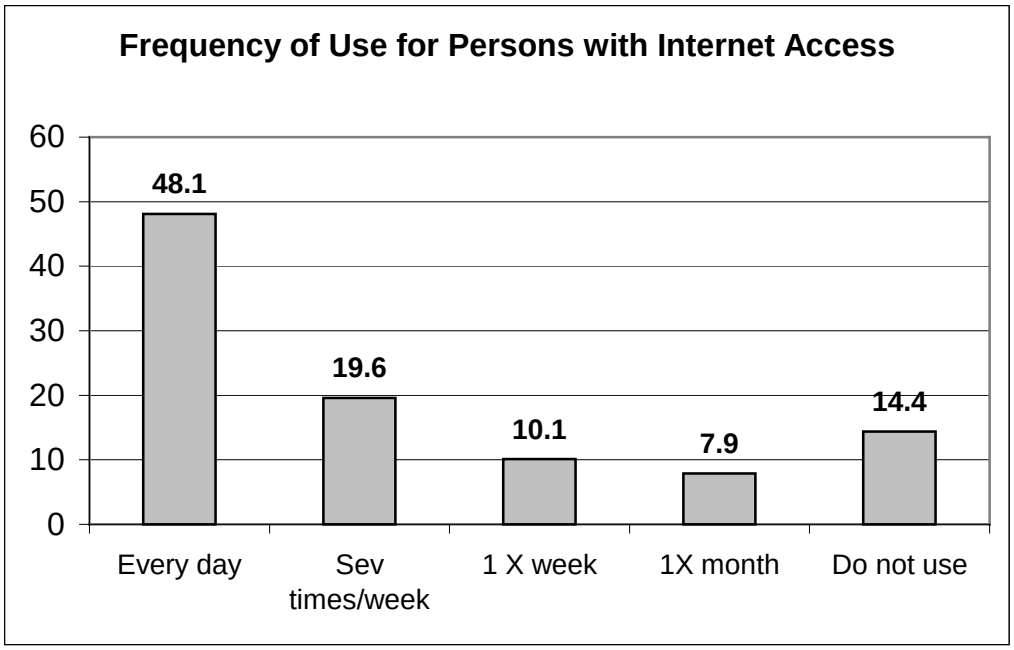
Figure 5: Location of Internet Use for Boston and Tulsa



n=1,261 Source: Unpublished NPTS/ATS 2000 pretest data.

For persons with Internet access there is no middle ground in terms of use. Over 67 percent of Internet users in the Boston and Tulsa areas access the Internet every day or several times a week while under 15 percent with Internet access never use the Internet.

Figure 6: Usage levels for Internet Users in Boston and Tulsa



n= 1,473 Source: Unpublished NPTS/ATS 2000 pretest data.

While the NPTS/ATS 2000 pretest data did not obtain information on type of Internet use, we can look again to the NTIA report that provides a national breakdown of Internet

use purposes using 1998 Current Population Survey Data. The NTIA reports that taking courses (36 percent), job related activities (29.1 percent), and shopping (25 percent) were common Internet uses for approximately one-third of persons getting on-line. Again, these types of activities have historically generated trips from home or work and the frequency of these activities within households impact household travel patterns. Other activities which were not included in the NPTS/ATS pretest or the NTIA report which have a potential impact on trip generation are banking, research, browsing, and other business conducted on-line. In the future, more specific information on the types of Internet use and the purpose distribution of daily travel will shed some light on the relationship between daily travel and Internet use in the future.

The Relationship Between Daily Travel and Internet Use

Improving our understanding of the demographics of trip makers and Internet users is an important starting point in understanding the relationship between Internet use and travel behavior. The increasing trend toward conducting typical trip generating activities on the web can impact travel in a variety of ways.

First, Internet use can have no impact on local travel in that activities conducted on-line become additional activities and do not replace or transform the existing number or types of trips generated by the household. Second, Internet use can change the types of trips made by the household, but have no impact on the number of trips the household makes overall. Here, activities such as household errands are done over the Internet but the household makes other types of trips in their place. The final scenario is that Internet use actually replaces and ultimately reduces the number of trips generated by the household. In this case, household, personal, and professional business like shopping, banking, and research are done on-line and the trips normally generated for these activities are not replaced leaving a reduced net number of trips made by the household.

Table 1 examines the demographics of Internet users and their level of use. The highest frequency Internet users are workers (38.1 percent), persons between the ages of 25-34 (44.5 percent), with household incomes between $75,000 and $99,000 (46.6 percent) and over $100,000 (57.2 percent).

The largest groups with no Internet access are nonworkers (48.1 percent), persons 65 and over, and persons with a household income under $20,000.

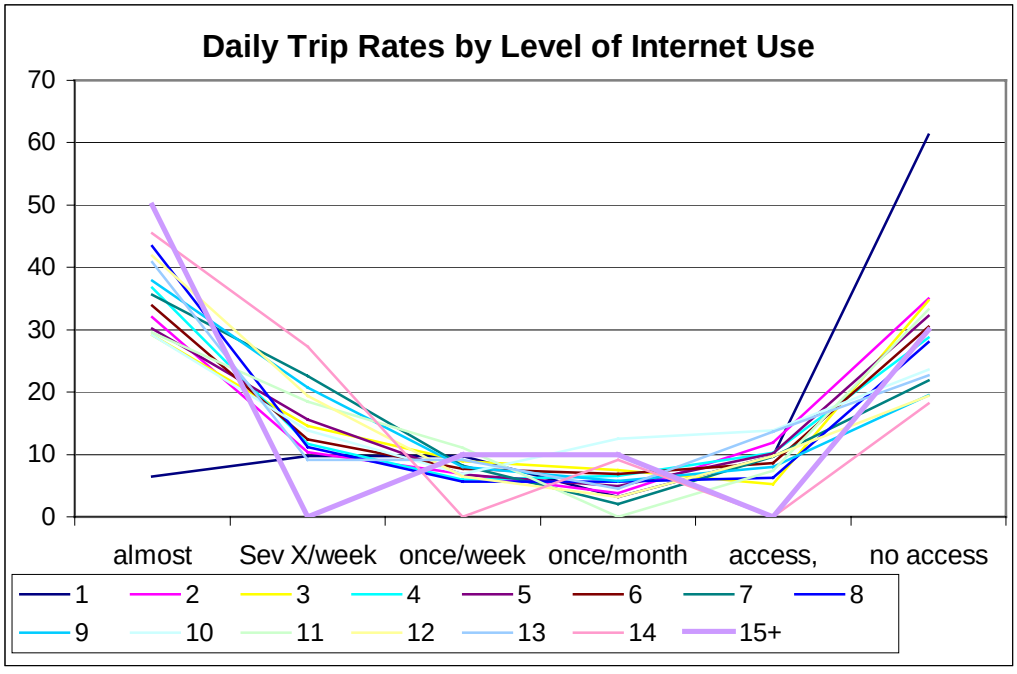
Table 1: Demographics of Internet Users in Boston and Tulsa

	Every day (percent/n)	**Several times per week**	**Once a week**	**Once a month**	**Access but no use**	**No access**
Male	38.0 (375)	12.0 (118)	5.5 (54)	5.4 (53)	9.6 (95)	29.6 (292)
Female	28.0 (333)	14.3 (170)	8.0 (95)	5.3 (63)	9.8 (117)	34.7 (413)
Worker	38.1 (584)	15.3 (234)	7.2 (111)	5.6 (86)	8.1 (124)	25.7 (395)
Nonworker	19.3 (123)	8.5 (54)	6.0 (38)	4.7 (30)	13.5 (86)	**48.1 (307)**
Age:						
15-24	**39.8 (84)**	16.1 (34)	9.5 (20)	11.4 (24)	6.2 (13)	17.1 (36)
25-34	**44.5 (158)**	18.9 (67)	10.1 (36)	5.6 (20)	6.2 (22)	14.6 (52)
35-49	**42.1 (284)**	15.1 (102)	7.6 (51)	5.8 (39)	8.2 (55)	21.2 (143)
50-64	26.6 (130)	14.3 (70)	6.3 (31)	4.1 (20)	12.1 (59)	36.6 (179)
65+	10.0 (41)	3.2 (13)	2.2 (9)	2.4 (10)	13.9 (57)	**68.2 (279)**
Income: under 20K	11.1 (32)	6.6 (19)	4.2 (12)	3.8 (11)	9.1 (26)	**65.2 (187)**
20-39K	22.1 (109)	13.0 (64)	6.1 (30)	5.9 (29)	9.7 (48)	43.2 (213)
40-69K	33.1 (179)	15.7 (85)	9.2 (50)	7.4 (40)	12.0 (65)	22.6 (122)
70-99K	**46.6 (150)**	14.9 (48)	11.1 (36)	4.3 (14)	9.0 (29)	14.0 (45)
100+	**57.2 (151)**	18.6 (49)	5.3 (14)	5.3 (14)	8.0 (21)	5.7 (15)

Source: Unpublished NPTS/ATS 2000 pretest data.

Table 1 also shows a great deal of consistency in the level of Internet use across demographic groups. Even in the groups with the lowest levels of Internet access, those who are Internet users are more likely to access the Internet every day than several times a week, once a week, or once a month. For example, over 50 percent of non-workers who use the Internet use it every day.

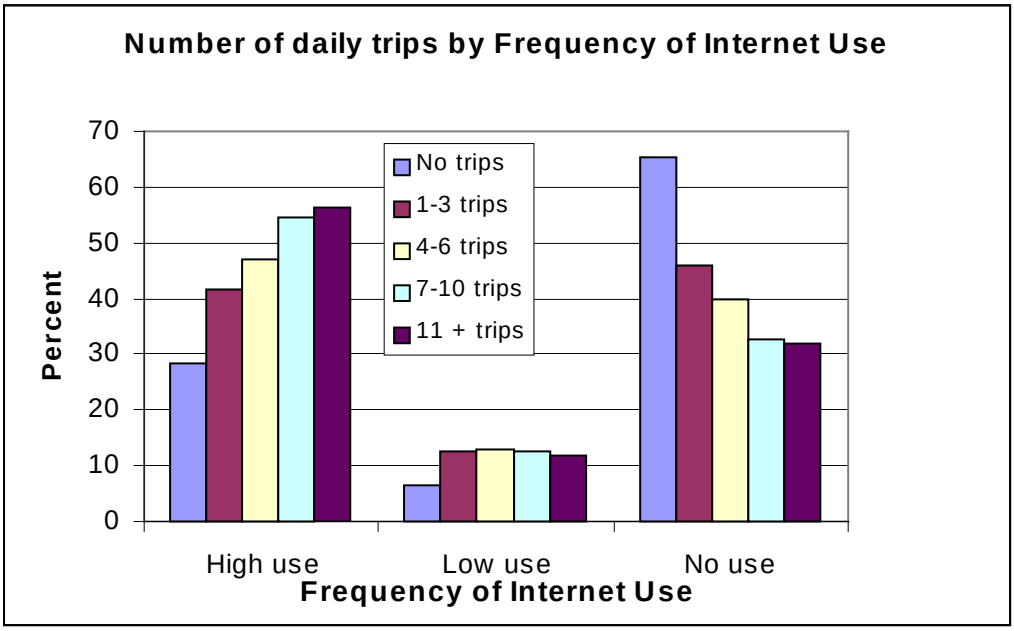
Figure 7: Reported Number of Daily Trips by Level of Internet Use



N=1,976 Source: Unpublished NPTS/ATS 2000 pretest data.

Looking at only persons who made at least one trip on travel day, Figure 7 examines the relationship between travel and Internet use. Although there is little variation in less frequent Internet use (once a week to once a month) the ends of the distribution show some large differences between infrequent and frequent travelers. Persons making only one trip on travel day were less likely to have Internet access (61 percent with no access) than the most frequent travelers (30 percent with no access). In addition, frequent travelers (with 2 or more trips on travel day) are much more likely than persons taking only one trip to use the Internet "almost every day". Under 7 percent of persons taking one trip on travel day used the Internet "almost every day" compared to 50 percent of persons who made 15 or more trips on travel day.

Figure 8: Daily Trips by Internet Usage Level



n= 2,178 Source: Unpublished NPTS/ATS 2000 pretest data.

In looking at all persons who completed the study, the relationship between travel and Internet use remains the same. The higher the level of travel, the higher the level of Internet use. Only 32 percent of persons with 11 or more trips on travel day do not have access to the Internet while over 65 percent of nontravelers do not have access.

This relationship, however, is not direct and appears to be a product of similarities in demographic characteristics as opposed to a causal relationship between these two variables. Nonetheless, it is clear that the higher the level of trip making, the higher the level of Internet use. This means that the heaviest users of the transportation system have the greatest potential for having their travel behavior impacted by Internet technology.

Conclusions

Computer ownership and Internet access in the United States are growing at a rapid pace. Current levels remain concentrated in the wealthy, white, educated population groups.

However, with over 64 million new Internet users every month, more equitable penetration in other population groups will be a reality in the near future.

There appears to be a relationship between Internet use and the level of daily travel, however, that relationship may be more a result of the similar demographics of high and low travelers and high and low Internet users. The Boston and Tulsa case study show that Internet use does not generate less trips and therefore activities conducted on-line are not reducing the total number of trips generated by an individual.

Next Steps

In order to better identify and evaluate the impact of Internet use on daily travel behavior, more information on the types of activities conducted on the Internet is needed. Examining the relationship between the level of Internet use and the number of daily trips made, like the analysis done in this paper, has value in that it allows us to track from these early stages of Internet penetration, the impact of conducting activities on the web has on the amount of travel generated by individuals and households. However, one potential impact of Internet use on travel behavior is a shifting of the trip purpose distribution with or without altering the net level of trip making generated by a household. In order to examine whether or not the trip purpose distribution is shifting for heavy Internet users, we must begin to collect data on Internet activities in our travel surveys now.

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