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Connection Discrepancies - Unmasking Further Layers of the Digital Divide

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ABSTRACT: In assessing the integration of the Internet into society, scholars have documented that certain sectors of the population are disadvantaged by their lack of access to computer resources. The disadvantaged have traditionally included the less educated, non-whites, females, the elderly and lower income people. Scholars are now beginning to address differences in Internet experiences among Internet users, but most studies fail to account for the type of connection people use to access the Internet. The purpose of this study is to expand the level of information surrounding Internet connections. This study finds that (1) most Internet data sources fail to ask questions about types of Internet connections; (2) broadband users experience the Internet differently; and, (3) in determining who is likely to spend more time online, the type of connection is more important than other digital divide demographics such as education, race or gender. Subsequently, those engaged in the exploration of our Internet society should start controlling for how Internet users connect to the World Wide Web.

Introduction

Hargittai (2002) established a "second-level" division among Internet users which expands our initial understanding of the digital divide as existing only between Internet users and non-Internet users. She provided evidence that among established Internet users, those with greater computer and Internet skills have distinct advantages in utilizing the Internet over those with less skills. Her findings also lead to a rationalization that there are other dimensions to digital divisions.

Our research continues this discussion of differences in Internet experiences among Internet users. We explore how the value of the Internet is interceded by type of Internet connection. Whereas being connected to the Internet and having appropriate Internet skills are important in

exploring the utility of the Internet to individuals, scholars also need to begin to control for type of connection. Given its inevitable diffusion into the population, we need to better understand the social impacts of high speed Internet connectivity. This study goes beyond descriptive characteristics of high-speed users as documented in prior studies (see for instance, the 2002 Pew Internet & American Life Report *The Broadband Difference)* to document how Internet connectivity contributes to disparities in Internet use. Further, we evaluate the importance of types of Internet connections compared to other known digital divide factors.

Overview of broadband connections

The Federal Communications Commission (FCC) defines high-speed connections as "delivering transmission to the subscriber at a speed in excess of 200 kbps in at least one direction" [1]. Broadband is delivered through fiber optics, cable, telephone lines and fixed wireless technologies. Individuals can access high-speed connections through ADSL (Asymmetric Digital Subscriber Line), ISDN (Integrated Services Digital Network), cable, wireless, or satellite connections.

The report *A Nation Online: How Americans Are Expanding Their Use of the Internet* (U.S. Department of Commerce, 2002) found that 80 percent of American online users still connect through a telephone dial-up modem while 20 percent of the population has a high-speed connection. Horrigan and Rainie (2002) reported that nearly a fifth of Internet users (around 24 million Americans) are connected at high speeds. Cable modems are now the second most common way to connect to the Internet (13 percent of users) followed by Digital Subscriber Line (DSL) connections (seven percent).

A Nation Online reported that broadband adoption outpaces spread of "... other technologies such as color television, cellphones, pagers and VCRs" [2], whereas Horrigan and Rainie (2002) found the diffusion of broadband to be on par with other technologies. Regardless of the exact pace of diffusion, we expect the deployment of broadband use to spread at a rapid rate. The *UCLA Internet Report* (2001) found that broadband adoption among Internet users increased by 6.8 percent from 2000 to 2001. Statistics that include both homes and businesses reflect an even greater diffusion. "High-speed connections to the Internet increased 33% during the second half of 2001 for a total of 12.8 million lines in service" [3]. Experts predict 32 million American users will adopt broadband technology in the next four years (Grimes, 2002).

As the availability of broadband has expanded across the nation, so has the adoption of this technology. Broadband ISPs started services in urban areas, but are slowly moving to encompass all areas. Currently, high-speed Internet services are available in 97 percent of urban areas and 49 percent of rural areas (Horrigan and Rainie, 2002). The FCC reports broadband availability in 79 percent of the nation's zip codes and 98 percent of the most densely populated decile of zip codes [4]. As a result, urban users are more likely to have access and use broadband ISPs than those in rural areas (U.S. Department of Commerce, 2002).

Although initially the broadband Internet Service Providers (ISPs) were troubled by glitches (e.g., interruptions, slowdowns and disappearing providers), a current survey of cable users found three-quarters of them are extremely or very satisfied with their service (Grimes, 2002). The 2000 UCLA data (details are discussed later) reveals that 78 percent of users with high-speed connections reported being very satisfied with the speed of their connection compared to only 27 percent of dialup users.

Availability of and satisfaction with broadband services are not the only factors to consider in adoption of this technology. The cost of a broadband connection is usually twice as expensive as accessing the Internet through standard telephone connections. The expense of this technology has traditionally kept many users away. Not surprisingly, *A Nation Online* (U.S. Department of Commerce, 2002) found broadband subscribers have greater incomes than non-broadband users. Broadband adopters are also more likely to be male, have higher levels of education, and be long-term Internet users compared to dial-up users.

Motivation for investing in broadband connection is "... the convenience of Internet communication ... [a] desire to perform job-related tasks at home, their ability to download files in less time, their interest in online multi-media offerings, their desire to have an always-on connection, and their interest in freeing up a phone line for telephone calls" [5]. Horrigan and Rainie (2002) found that longevity of Internet use predicts adoption of broadband connections. After sustained use of the Internet, users are more willing to adopt the technology. This is probably due to the appreciation of the value of the Internet and the awareness that fast connections save time. Horrigan and Rainie (2002) found that home broadband use is the largest significant factor determining if a person uses the Internet.

There is scant research assessing the effects of broadband access. *A Nation Online* (U.S. Department of Commerce, 2002) reported little differences in online activity between broadband users and non-broadband users. The main difference, according to the study, was that broadband users are slightly more likely to use e-mail. The most extensive study to date is the Pew Internet & American Life report *The Broadband Difference,* where researchers Horrigan and Rainie (2002) found that broadband users, compared to dial-up users, are 41 percent more likely to go online each day and spend more time online (about 12 minutes more per day). In contrast, the UCLA Internet Report found that broadband users "at home go online 3.2 hours more per week than Internet users who connect with a telephone modem" [6]. Regardless of the data source, it appears that broadband users spend more time online than dial-up users.

Paramount is the documented fact that high-speed connections allow users to accomplish more during their time online. High-speed access users, on average, accomplish four more tasks online compared to dial-up users (seven tasks for broadband users compared to three tasks for dial-up users). Broadband users are e-mailing more, working, searching, downloading and shopping. Some high-speed users indicate that their connectivity leads to less television viewing, less shopping in stores and more reading of news online (Horrigan and Rainie, 2002). "The advent of broadband in the home transforms the Internet from a 'sometimes' tool for finding information and communicating with others to a pervasive information appliance that exponentially expands people's ability to create, download, and access information in cyberspace" [7]. Horrigan and Rainie (2002) found broadband users are more likely to create and access online content, report

they have learned more, are more informed, advanced their hobbies, shopped more, helped with job productivity and improved their health care. They also spend more time online, e-mail more frequently and perform more searches than non-broadband users.

Evaluation of existing data sets

Given Horrigan and Rainie's (2002) findings about broadband differences, we are surprised that this topic has been relatively neglected in the digital divide literature. Evidence of this neglect is found within some of the most widely used social science Internet studies. Foremost, very few Internet studies ask about types of Internet connectivity. This may partly be a result of the fact that until recently, very few people (especially home owners) had broadband access. We argue that since broadband users are becoming a significant proportion of the population, researchers need to examine the types of access Internet users are utilizing, and the implications of these different types of access. The faster the connection, the more a person can accomplish on the Internet and potentially the more value a person can gain from the Internet.

In setting out to explore the difference between broadband and dial-up Internet users, we surveyed some well-known data sources used by social science Internet researchers. We looked at the most current surveys for questions about Internet connections. Table 1 includes our examination of 11 social science data sources on Internet activities. Only four of the 10 data sets asked questions about Internet connectivity. The results of this study should demonstrate the importance of these questions being included in future studies. The four data collections that asked appropriate Internet connection questions are the "American Life: Daily Tracking Survey" (March thru June 2000) from the Pew Internet & American Life Project (Pew), 2000 General Social Survey (GSS), the March 2001 Internet Questions from the Census Population Survey (CPS), and the first and second waves of the University of California, Los-Angeles (UCLA) Internet Study.

Table 1: Examination of Internet Studies Data Sources

Data set	Type of Internet connection questions and sample size	
Current Population Survey (September 2001 Supplement)	**How do you currently access the Internet?**	**N**
	Regular "dial-up" telephone line	66,864
	DSL Line	4,564

	Cable Modem	10,177
	Somethng else	605
	No Data	61,090
EPA National Time Use Survey (1994-1995)	**None**	
General Social Survey (2000)	**At your home are you connected to the WWW through a regular telephone line connected to your computer, or through some other means?**	**N**
	Regular telephone line	302
	Other means	20
	Don't know	1
	What is this other means by which you are connected to the WWW?	**N**
	Special high-speed telephone line (ISDN) connected to your computer	6
	Cable service line connected to your computer	10
	Web TB line, connected to your television set	1
	More than one type of connection	1

	Other, not mentioned above	2
	Don't know	1
Internet Trends 1996-1999	**None**	
National Geographic Data	**None**	
NSF Family Time Use Study: Time Diaries (1998-1999)	**None**	
PEW Biennial Media Consumption Survey	**None**	
UCLA Internet Project Data (2001)	**What type of connection do you have in your home to access the Internet?**	**N**
	Telephone modem	915
	Cable modem	115
	Web TV	11
	DSL	35
	ISDN	5
	Satellite	2
	Wireless such as PDAs	
	Cell Phones	
	Other	22

	DK	25
	NA	1
	Refused	
	Combination of connections	41
University of Maryland Internet Usage Survey (Winter 1998)	**None**	
Survey of Public Participation in the Arts (1997)	**None**	

The Internet Module of the 2000 GSS includes a question about Internet connectivity (see Table 1), but only 20 individuals reported connecting to the Internet via broadband. Given the increasing adoption of broadband technology by individuals, future versions of the GSS may find dramatically different responses to this question. GSS information was not utilized in the current study due to the small number of broadband users and the lack of analytical power afforded by these values.

"The Broadband Difference" study, discussed earlier, was based on follow-up interviews of 507 broadband users, but did not include dial-up users for comparison. In addition, although the Pew and CPS data include questions about types of Internet connections, the general survey questions are insufficient for examining the importance of broadband connections. The Pew data offers mainly descriptive information about differences between users and non-users. Respondents were asked "what they did *yesterday* online," in an effort to assess an average day of Internet use. Response choices in this study were limited. Respondents could report that they (1) did an activity yesterday; (2) have done the activity, but not yesterday; or, (3) have never done the activity. These response categories do not allow researchers to quantify the exact difference in Internet activity. Someone may have attempted an activity yesterday, but we do not know how often and with what level of success they performed this activity.

The CPS 2001 measures are also weak. The CPS survey only asks if a user did the following activities (bank, trade stocks, or access information on health/government/products) sometime last year. A dial-up user may have tried the activity sometime last year and answered yes, but became discouraged with the time it took using a slow connection and ceased the activity. A dichotomous yes/no response category for a year's worth of computing is not adequate, nor

realistic given advances in technology and changes in technological skills. This type of measure will not account for the possibility that broadband users are participating in Internet activities more than non-broadband users. Thus, this type of measure does not successfully discriminate the differences between types of users and may lack discriminate validity.

As this review has illustrated, the preceding discussion of existing datasets reveals a dearth of information on differences between broadband and dial-up users. With this in mind, the current study utilizes the best existing dataset to examine differences between these users. Given prior literature, we hypothesize that there will be evidence of more Internet use among broadband users compared to dial-up users.

Methods

Data

Given the limitations of the aforementioned datasets, the UCLA Center for Communication Policy Internet Project data is used for this project. Among many data collection projects, the Center is conducting a longitudinal survey of 2,000 United States households, including Internet and non-Internet households, with the first wave of data collected for the year 2000. We used the second wave (2001) of data because it offers the best questions about Internet connections, Internet activities, and the most broadband users to compare to standard dial-up Internet users. Of the respondents who use the Internet and answered the question about types of Internet connections, 19 percent (n=215) were broadband users and 81 percent (n=942) reported using a dial-up connection to the Internet.

Measures

To determine what people are doing online, the UCLA survey asks "In a typical week, how long (in terms of hours) do you participate in the (Internet activity)." The 22 types of Internet activities are listed in Tables 2 and 3. Internet activities are measured in hours spent doing an Internet activity during a typical week. Typical digital divide measures are used including education (based on Census categories), gender, and age (continuous measure). Race is recoded into Whites (85 percent) and Non-Whites (15 percent) which includes Blacks, Asians, American Indians and others. Respondents were also asked to report how many months they have been using the Internet.

Analytical Design

Our analysis includes third order partial correlations controlling for education, Internet experience and gender, since broadband adopters are more likely to have a greater education, be long-term Internet users and male (U.S. Department of Commerce, 2002). Anderson and Tracey (2001) argue that the Internet is merely a "delivery mechanism" or a tool. They feel researchers

should study what people do online, not just if they are online or not. We agree with the importance of monitoring Internet usage and look to see how type of connectivity affects what users are doing online. We examine associations between types of connections and 22 types of Internet activities included in the UCLA survey.

Finally, we conduct regression analysis to explain total number of hours of Internet use per week. Three models are estimated: (1) standard sociodemographic factors (which are commonly used to examine digital divide issues),[8]; (2) Model 1 factors plus type of connection; and, (3) Model 2 plus Internet experience. The additive models allow us to determine whether types of connections and Internet experience help to ameliorate traditional digital divide issues or whether an even more expansive digital divide exists than has been previously detailed in the literature. The regression equation allows us to note the importance of types of Internet connections compared to other well known predictors of Internet use. All Internet activities and hours of Internet use per week are logged to adjust for skewness.

Findings

Table 2 shows the descriptive information for variables used in our analysis. The sample size includes all those that reported connecting to the Internet (n=1157) either through a dial-up modem or other type of connection. The sample includes more females (55 percent) and whites (85 percent) and 67 percent have some college education. The average age is 40. They spend an average of 11 hours on the Internet per week and on average have 43 months of Internet experience. More time is spent doing school work (mean equals 3.84 hours per week) on the Internet than any other activity. The next most popular Internet activities are e-mailing (average of 3.55 hours per week) and doing job-related work at home (average of 2.08 hours per week). Overall, the sample spends little time per week on government transactions (mean = .12 hours per week), participating in bulletin boards (.14 hours per week), paying bills (.14 hours per week) and viewing sexual content (.14 hours per week).

Table 2: Descriptive Information for 2001 UCLA Data

Variables	N	Mean	Standard Deviation	Range
Auctions	1156	.26	1.481	30
Making travel arrangements and finding travel information	1154	.42	1.587	40

Playing games	1156	.70	3.140	80
Hobbies	1156	1.12	2.796	60
Visiting sites with sexual content	1042	.14	.913	20
Doing work at home	845	2.08	6.121	90
Downloading music	1157	.59	2.388	50
Reading local, national or international news	1157	.91	2.854	80
Reading or searching for medical information	1155	.59	1.815	30
Paying bills	1045	.14	.758	14
Banking	1045	.44	1.366	20
Religious or spiritual activities	1157	.24	1.406	30
Trading or researching stocks/bonds/mutual funds	1044	.85	3.074	50
Reading or searching entertainment information	1157	.62	1.460	20
Searching for jobs or looking at classified ads	1156	.52	1.961	40
Participating in Internet chat rooms	1157	.52	2.755	40
Reading and writing e-mail or instant messages	1156	3.55	5.910	100
Participating in bulletin boards	1154	.14	.943	20
School related work	238	3.84	6.476	60
Transactions involving government services	1156	.12	.981	25
Shopping for or buying goods or services	1156	.60	1.700	32
General surfing or browsing	1153	2.23	4.551	80

Hours spent on line per week	1157	10.963	99.92	80
Type of connection	1157	1.186	.389	1
Months of Internet experience	1157	43.148	28.471	120
Education groups (1=Less than H.S./5=Advance degree)	1157	3.069	1.214	4
Race (0=Non-White/1=White)	1157	.850	.3568	1
Gender (1=Male/2=Female)	1157	1.55	.497	1
Age	1157	39.89	15.811	72

The correlation coefficient matrix (see Table 3) illustrates that significant differences exist between broadband and dial-up users in twelve out of the 22 Internet activities, when controlling for education, gender, and Internet experience. In all cases, broadband users report higher levels of each activity. Significant differences existed in measures assessing game playing, visiting sites with sexual content, doing job-related tasks at home, downloading music, paying bills, banking, trading stocks, searching for entertainment information, job searching, e-mailing, and shopping. The strongest Internet activities associated with type of Internet connection is downloading music, paying bills online, and banking. Finally, from Table 3 we see those with broadband connections are overall significantly more likely to spend longer on the Internet than those with dial-up connections.

Table 3: Third Order Partial Correlation Coefficients for Type of Connection controlling for education, Internet experience and gender. Excluded cases pairwise.

Logged computer activities (Hours spent on activity per week)	**Connection** 1=Dial-up/2=Broadband	
	Degrees of Freedom	Coefficient/Significance
Auctions	1151	.0079

Making travel arrangements and finding travel information	1149	.0552
Playing games	1151	.0820**
Hobbies	1151	.0480
Visiting sites with sexual content	1037	.0749*
Doing work at home	840	.1076**
Downloading music	1152	.1230***
Reading local, national or international news	1152	.0419
Reading or searching for medical information	1150	.0081
Paying bills	1140	.1189***
Banking	1140	.1115***
Religious or spiritual activities	1152	-.0378
Trading or researching stocks/bonds/mutual funds	1039	.1098***
Reading or searching entertainment information	1152	.0650*
Searching for jobs or looking at classified ads	1151	.0778**
Participating in Internet chat rooms	1152	.0152
Reading and writing e-mail or instant messages	1151	.0807**
Participating in bulletin boards	1149	-.0193
School related work	233	.0302
Transactions involving government services	1151	.0112
Shopping for or buying goods or services	1151	.1047***

General surfing or browsing	1148	.0444
Hours spent on line per week	1152	.1520***

*p<.05, **p<.01, ***p<.001

Table 4 shows the results from the regression analysis in which the type of connection is compared with other common digital divide demographics to determine who is more likely to use the Internet the most. The first equation shows that all demographic factors are significantly related to the logged measure of hours per week spent on the Internet; however little of the overall variance is explained by demographic factors alone. As this model and the remaining models illustrate, individuals who are younger, more educated, non-white [9], and male spend more hours on the Internet per week than to their counterparts.

The second Model adds type of connection to the equation. Consistent with the correlation findings, broadband users are significantly more likely to spend more time using the Internet than are dial-up users. Although the standardized coefficients must be interpreted with extreme caution, they suggest type of connection explains more of the variance in total hours of Internet use per week than characteristics of Internet users. Other evidence of the importance of type of connection, compared to the demographic factors, is seen by the increased level of explained variance when type of connection is added to the equation.

The third Model adds months of previous Internet experience to explain total number of hours spent on the Internet per week. This variable significantly adds to the goodness of fit for the model. Our findings are similar to other studies (e.g., Horrigan and Rainer, 2002) that found the more previous experience using the Internet, the longer a person is likely to use the Internet per week. As in the prior models, males, non-whites, and younger individuals are more likely to spend higher amounts of time using the Internet than are females, whites, and older individuals [10]. Education, however, becomes non-significant in this model.

Table 4: OLS Regression Summary for Hours of Internet Use Per Week (N=1,156)

Explanatory variables	**Model 1**			**Model 2**			**Model 3**		
	Unstandardize	**Standa**	**Standardize**	**Unstandardize**	**Standa**	**Standardize**	**Unstandardize**	**Standa**	**Standardize**

	d Regression Coefficients	rd Error	d Coefficients	d Regression Coefficients	rd Error	d Coefficients	d Regression Coefficients	rd Error	d Coefficients
Age	-.008***	(.002)	-.155	-.008***	(.002)	-.145	-.006***	(.002)	-.110
Education Census Groups (1=less than high school; 2=high school grad; 3=some college; 4=college graduate; 5=advanced/prof degree)	.099***	(.022)	.140	.093***	(.022)	.131	.031	(.023)	.044
Gender (1=Male; 2=Female)	-.193***	(.050)	-.111	-.179***	(.049)	-.103	-.140**	(.048)	-.081
Race (0= Non-White; 1= White)	-.164*	(.070)	-.068	-.167*	(.069)	-.069	-.209**	(.068)	-.086

Type of Internet connection (1=dial-up; 2=broadband)				.364***	(.063)	.165	.315***	(.062)	.142
Months of Internet experience							.007***	(.001)	.242
Constant	2.591			2.137			1.968		
R^2	.044			.071			.121		
F	13.250***			17.563***			26.458***		

*p<.05, **p<.01, ***p<.001

Discussion and conclusion

Many of the differences between broadband and dial-up Internet users seem to be related to entertainment activities such as downloading music, playing games, and searching for entertainment information. Yet, these tasks are also the most demanding on the exchange of bytes and are more successful if attempted through a broadband connection. This also explains why broadband users spend more time paying bills and banking online. The lack of significant differences between broadband and dial-up users in time spent doing the less byte intensive Internet activities may be due to the fact that broadband users are doing things much more efficiently. Future research on types of connections needs to account for users being able to do more online, and also examine whether Internet efficiency results in less time online or whether

it contributes to spending more time online (and thus the time spent online would not necessarily decrease). Unfortunately, the UCLA measures of time spent online doing an Internet activity do not allow us to evaluate what is actually accomplished online.

If the Internet becomes more crucial for conducting everyday affairs, we are likely to see the differences between broadband and dial-up users become greater. More and more services are becoming available online, and as government and other agencies increasingly expect people to "do business" online, those with slow connections will be left behind. Fixmer [11] reiterates this view: "motivated by cost savings, environmental concerns and increased productivity, governments from city halls to Congress and the White House are relocating records, services and operations to cyberspace. Eventually, anyone who is limited to dial-up access will become a second-class citizen, an issue that will never be fully resolved until we all have fiber to our home or wireless connectivity as ubiquitous as the air." Fixmer (2002) advocates that high-speed access infrastructure should be considered a public utility and not left to the determination and responsibility of private industries to provide the service. Hopefully, in the future, differences in types of access will be a non-issue. Decreasing inequality in access, type of access, and usability skills will be key issues as our society becomes more technologically advanced.

When doing research in these areas in the coming years, controlling for types of Internet connections will be an important factor that researchers must not ignore. Studies on the digital divide have mostly focused on who is online, which ignores critical layers of inequalities among those who are already online. We argue that issues of digital divide must go beyond just documenting who is online and address what people are doing online. Our findings suggest that there is a digital divide among existing Internet users. All Internet experiences are not equal. FM

Notes

1. FCC, 2002, p. 2.

2. U.S. Department of Commerce 2002, p. 37.

3. FCC, 2002, p. 1.

4. *Ibid.*, p. 2.

5. Horrigan and Rainie, 2002, p. 11.

6. UCLA Report, 2001, p. 25.

7. Horrigan and Rainie, 2002, p. 10.

8. Income is not included in the equation due to multicollinearity issues.

9. Emerging evidence suggests that non-white populations such as Hispanics and Asians are increasingly spending more time online than the general population (Morrissey, 2003; U.S. Department of Commerce, 2002).

10. We tested for interaction effects but found none between race, gender and type of connection.

11. Fixmer, 2002, p. 47.

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