Correlates of the Digital Divide:
Individual, Household and Spatial Variation

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What is the Digital Divide?

The "digital divide," a concept propounded by political advocates such as the African-American leader Jessie Jackson refers to systematic differences in computer and Internet use: between developed and less-developed countries, between people of different socioeconomic statuses (education, income, occupation, wealth), between people at different stages in the life-course, between men and women, and between different local areas and regions.

Although the concept has been widely used by politicians, the existence of the digital divide has had solid empirical backup (such as Andrew Reddick and associates' own reports to the Office of Learning Technologies). Moreover, the digital divide is not just an academic's debating game. There is a large and growing importance to the public of having access to computers and the Internet. Hence, the existence, size and shape of the divide has significant policy implications and substantial learning/training challenges.

The "digital divide" refers to the substantial differences between groups in computerization:

- The ability to obtain access to computers and the Internet – at work, at home, in public spaces, and through friends.

- The ability to make skilled and effective use of these computers and the Internet – at work, at home, in public spaces, and through friends.

As a first-order cut, the digital divide can be divided into:

1. Differences between *developed* and *less-developed* countries in computer and internet access.

2. Differences between *adults and children* in all countries, with children having better access to education and less resistance to adopting new technologies.

3. Differences between *types of people* within developed and less-developed countries in computer and internet access.

4. Differences between *types of areas* within a country: such as regions, rural-urban, or neighbourhoods within a metropolitan area.

Although we recognize the importance of the divide between developed and less-developed countries (and within less-developed countries), *we focus here on differences between types of adults and areas in North American developed countries, Canada and the United States.* We treat computer use and Internet use as synonymous. As stand-alone, isolated personal computers become less

common, computer use and Internet use have become commingled, so much so that many people use a personal computer primarily for Internet use. Hence, we discuss both computer use and Internet use interchangeably in this report.

A Possible Spatial Component: Is There a "Double Digital Divide"

The literature that we have reviewed about the digital divide in North America focuses on differences between people, such as socioeconomic and gender differences. To some extent, these are joined with discussions about household differences, such as family wealth. Yet except for a few cursory discussions of rural-urban differences, scant attention has been paid to spatial variations in the digital divide.

Yet disadvantaged Canadians living in disadvantaged areas may be doubly divided because they have less access to institutional supports and informal mentoring.

This report pays special attention to examining the extent to which the digital divide has substantial spatial variation in Canada. This means that different cities -- and different neighbourhoods within cities -- vary significantly in computer ownership, computer use, and computer skills. Not only do poorer people have less access to effective computer use, poorer people in poorer areas are particularly ill-equipped because they do not have as much formal training and informal mentors available to provide computer skills. We use statistical simulation to provide some information about what population characteristics of cities are associated with high (or low) rates of Internet use.

This is the Double Digital Divide, segregated by area as well as by individual socioeconomic status. Documenting this divide should provide guidelines to government as to how to target learning, training and mentoring activities. In which cities and neighbourhoods are they most needed? At what target groups should they be aimed?

Research (by ourselves and others) show that there is less access according to:

Gender

Women have less access

Age and Generation

Older people have less access

Socioeconomic Status

Those who are have lower income, less wealth, less education, and are *not* in white-collar jobs have less access

Ethnicity and Language

Non-English speaking people have less access

Rural-Urban

Those in rural areas have less access.

Locale

The digital divide has substantial geographical variation in Canada and the United States. Different cities -- and different neighbourhoods within cities -- vary significantly in computer ownership, computer use, and computer skills. Not only do poorer people have less access to effective computer use, poorer people in poorer areas are particularly ill-equipped because they do not have as much formal training and informal mentors available to provide computer skills. Similar phenomena suggest why rural Canadians are not utilizing computing resources to the same extent as urban Canadians. ***This is the Double Digital Divide, with unequal access to computer use affected by geographical locale as well as by personal characteristics, such as socioeconomic status.***

The Hands-On, Therefore Spatial, Nature of the Digital Divide

Access to Computers, Training and Mentoring: Training for computer use takes many forms: books (such as *Windows98 for Dummies),* formal education in schools and commercial or adult education training programs. Informal mentoring by community members is as important as formal training because:

(a) People trust their friends for acquiring information.

(b) Informal ties best provide the continuing reliable sources of assistance necessary for ongoing computer use.

(c) Almost all computer learning has an interpersonal component, as people rely on their friends to know which hardware to buy, which software to use, and how to deal with inevitable problems, from crashing to spamming.

Because much schooling, training and mentoring tends to take place near a person's home, the spatial distribution of learning, training and mentoring resources are important. The spatial availability of educational and training programs is important as is the proximity of people with the skills and desire to mentor others in computer use. Yet it is quite probable that the availability of computer training and mentoring is spatially uneven, with poorer areas having fewer educational/training programs that are well-equipped and staffed, and poorer areas having a lower percentage of the population equipped with computers and computer skills that could be used for mentoring their fellow computer members.

Access to the High-Speed Internet: There is another spatial component, independent of computer access and skills. With the growing complexity of internet use – especially on the web – broadband services (such as cable-modem and telephone-based DSL) are increasingly important for taking advantage of the web. This is so not only for consumption and information-seeking on the web, but for work. Without broadband service, it is almost impossible to effectively access or exchange large documents, such as papers, spreadsheets, drawings, etc.

The 30 times difference in speed between 1 Mb/second cable/DSL and 33Kb/second dial-up telephone modem is the difference that makes many jobs accomplishable. Large organizations now, and many others in the future, will have even faster access (Wellman 2000). Moreover, there is more opportunity for substantial speed increases with cable or DSL technology than there is with dial-up telephone access. Yet cable and DSL are far from universally distributed, and the uneven distribution is socioeconomically linked. Cable and telephone companies wish to recoup their capital investments as quickly as possible. They do so by turning first to high-socioeconomic local areas for installing central office and subscriber equipment. Between areas of equivalent socioeconomic status, cable and telecommunication companies will first invest in those that are centrally located. It is much more expensive to install the necessary equipment in more physically-isolated areas, such as smaller cities and towns.

In short, where people live and work matter because of their:

(a) Access to communication facilities
(b) Access to the tacit knowledge that informal mentors provide in showing:
    1. How to buy and use hardware and software.
    2. How to deal with problems with hardware and software.
    3. How to upgrade skills in using hardware and software.
(c) Access to the structured knowledge that institutions (such as schools, learning centres) provide in showing:
    1. How to use hardware and software.
    2. How to deal with problems with hardware and software.
    3. How to upgrade skills in using hardware and software.

Policy Implications

Because of the double digital divide, socioeconomically unequal access to computer learning and training is compounded by the lack of educational and mentoring resources in the very areas where people with the greatest needs are concentrated. Identification of the relevant characteristics associated with low computer use -- will help the Office of Learning Technologies (OLT) at Human Resources Development Canada (HRDC) to develop policies aimed at locating learning, training and mentoring resources in the areas where they would be of most benefit.

Not only can specific areas be identified using our approach, but knowledge of the characteristics associated with low computer use in an area should enable the OLT to develop a monitoring system to identify areas of need on a continuing basis. In this report we:

1. Identify the characteristics of under-served cities and neighbourhoods in Canada with both low individual and low area access to computing and the Internet. Such localities require extensive formal facilities and extensive support for informal mentors. These also have a great need for public access facilities, such as in libraries.

2. Compare these Canadian characteristics with cities and neighbourhoods in the United States.

3. Use multivariate analysis to identify where the true digital divides are in Canada, with respect to socioeconomic status, locality, etc.

4. Provide a method to identify ready-to-be-served cities and neighbourhoods which, despite low socioeconomic status, have relatively high numbers of computer and Internet users. Such localities require identification of such users and training them to be mentors. This analogue of “barefoot doctors” -- using informal resources to spread information widely -- also requires a network of formal supports for these mentors.

5. Provide information and a method to identify cost-effective leverage points for Human Resources Development Canada in general (and OLT in particular) to develop training centres and supports for informal mentoring.

We believe that this is the first analysis of the Internet that:

1. Looks at the effects of neighbourhood contexts.

2. Individual/household effects analyzed jointly with neighbourhood effects.

3. Does a predictive simulation of the impact of individual, household and neighbourhood effects on Internet use, overall and at home.

The Current State of Knowledge about Computer and Internet Use

Internet Experience

U.S Newcomers to the Internet spend less time online, engage in fewer online activities, and are less likely to buy products via the Web than those users who have more experience using the Internet. Time and experience make online veterans feel more attached to the Internet (Spooner & Rainie 2000) and result in them using the Internet for longer periods of time per week.

A national random sample conducted in December 1999 of 4,113 Americans in 2,689 households shows that the average hours of Internet use and number of activities increases by years of access (Nie & Erbring 2000). Those Web users with less than two years of access logged 6 activities and 4 hours of online use per week, considerably less than users with 2 to 3 years of experience (7 activities and 5 hours online per week), and those who had been Internet users for 4 to 5 years (8 activities and 6 hours of Internet use per week). Experienced Web users with more than 5 years experience spent an average of 8 hours online and engaged in 9 different activities on the Internet per week.

Another survey (Lebo 2000) conducted in May 2000 of 2,096 American households indicates similar findings that hours spent online is correlated with experience using the Internet. Newbies, or those with less than one year of experience spent approximately 6 hours a week online compared to those with Internet experience of 4 years or more who spent 16 hours online a week.

The Gartner Group, a consulting company that analyzed surveys from 40,000 American households in February 2000, found that the longer Web users of any socioeconomic group have had access to the Internet, the more likely they are to use it for e-commerce. Across all socioeconomic groups, over half (51%) of those who have been on the Internet for three years or longer have purchased goods or services online within the previous quarter (Smolenski 2000). In contrast, those with a year or less logged on to the Internet were about half as likely (24%) to have purchased something online in the same time period. Eighty percent of American respondents who have been online for 2 to 4 years have purchased goods online, compared to just over a quarter (26%) of those with one year or less online experience (Lebo 2000).

These findings suggest that spending much time online has important implications for social and personal activities. The *Internet and Society* report, conducted in December 1999 and surveying 4,113 respondents, finds that the more time people spend using the Internet, the more they lose contact with their social environment (Nie & Erbring 2000). Four percent of respondents who used the Internet for less than an hour a week reported less time with family and friends. This rate increases to 15% for those who spend more than 10 hours a week online. Traditional media also competes with the Internet for users' time as

27% and 13% of Internet users spending less than an hour online per week reported less time watching TV and reading the newspapers, respectively. Users who spent more than 10 hours online per week reported less time watching TV (65%) and less time reading newspapers (39%).

Canada: Canadian data paints a similar picture with over one quarter of Internet users saying they spend less time watching TV, while 15% spend less time reading books, magazine and newspapers (Dryburgh 2001). This data collected from the Canadian General Social Survey of 25,090 respondents between January and December 2000 also shows that working for pay was not displaced by time spent using the Internet. In fact, 91% of respondents reported that being on the Internet had no effect on the time spent working for pay, while 7% said time spent in work for pay had increased with using the Internet, and only 2% said it had decreased because of their preference to spend time online. Students experienced a slight displacement of time spent on school work as 7% of students said their school work time had decreased because they preferred to spend time on the Internet. However, 82% reported no change in time spent on school work and 11% said they actually spent more time on school work after having been introduced to the Internet.

Content-Related Barriers

Mass access to computers and the Internet will not fully bridge the digital divide as user obstacles related to content will persist. Primary barriers to skillfully using Internet technology are related to content issues, such as lack of local information, language barriers, lack of cultural diversity, and literacy barriers.

U.S.: Lack of local information for Internet users is partly due to the development of the Internet in which large commercial companies are encouraged to develop prepackaged information rather than enable community web-sites to tailor-make their own content (Lazarus 2000). Wendy Lazarus, founder of the Children's Partnership says, "We found a strong desire among people for practical, local information about their neighborhoods that seems to fly in the face of the way the Internet is moving in terms of national portals like Yahoo, Netscape and Excite" (quoted in Taglang 2000, p. 1). A study sponsored by the FleetBoston Financial Foundation and conducted by the University of Massachusetts Poll questioned 1,600 residents of low-to-moderate income (less than $40,000 of household income per year) neighborhoods in Northeastern United States (Spitzer 2001). It found that only 3% of survey residents living in low-to-moderate income neighborhoods said that they use the Internet to find out what was going on in their communities. This indicates that low- and moderate-income communities underutilized the Internet, perhaps in part because they did not find useful online community content. Michelle Courton Brown, president of the FleetBoston Financial Foundation explains, "Content on the Internet appears to be significantly underdeveloped as a useful source of information about the

community – for example information on jobs, affordable housing, neighborhood issues, day care, and school programs (pg. 2)."

Although an estimated 87% of Internet documents are in English, at least 32 million Americans do not employ English as their primary language (Lazarus 2000). These Americans do not enjoy the benefits of the Internet as they may not be able to access translation programs, they may have difficulties navigating the Internet and search engines, or they may not find information relevant to their community in the United States as content in their native language is developed in another country.

Literacy barriers pose major obstacles for people interested in become connected to the Internet. Online text-based content has historically been developed for an audience that reads at an average or advanced literacy level as these individuals typically are highly educated and have discretionary money to spend on e-commerce (Lazarus 2000). However, up to 44 million American adults, or 22% of the adult population, do not have the writing and reading skills necessary for functioning in everyday life. Although recent developments include streaming audiovisual content that could be of potential benefit to those who do not have basic literacy skills – less-educated, lower-income individuals – they are still probably not likely to be able to afford the broadband connections required for streaming media (Carvin 2000).

Moving beyond the notion of basic literacy, Andrew Carvin outlines how issues of functional, technological, information, and adaptive literacy remain important to bridging the technology gap (Carvin 2000). Functional literacy implies whether one is able to put their reading and writing skills to daily use in activities such as filling out forms or reading traffic signs. He cites the U.S. Department of Education finding that nearly one in four adults is functionally illiterate.

Another form of literacy, technological, is measured by one's ability to use common IT tools effectively, including hardware, software, and Internet applications. In contrast, information literacy is the ability to judge the quality of content to determine the reliability, bias, timeliness, and context of information. The last type of literacy required by computer users is adaptive, which implies that an individual is able to develop new skills as one uses the computer more regularly. This includes whether one can apply previous IT knowledge to new situations or if one is able to learn new applications.

The Children's Partnership study provides useful initiatives to assist underserved Americans who face internet-content barriers. It concludes that underserved connected adults are looking for practical information focusing on local community, information at a basic literacy level, content for non-English speakers, and cultural information (Lazarus 2000). Local information would include local job listings, local low-cost housing listings, and the advertising of

community events. Online space to explore cultural interests is also important, as is health information that is relevant to particular racial and ethnic groups. Both adults and children desire mentors to help develop their Web skills and to assist them in finding sites and activities during their initial time spent online. On an optimistic note, the FleetBoston study indicates that 80% of low-to-moderate income inner-city adults who had little or no familiarity with the Internet reported they would be eager to learn Internet skills (Spitzer 2001).

Cost, Interest and Need Barriers

U.S.: In August 2000, the Current Population Survey of approximately 48,000 U.S. households indicated that the reasons for not having access to the Internet at home were primarily due to households that "don't want it" (31%), followed by "cost, too expensive" (17%) and "can use elsewhere" (10%) (NTIA 2000). Rounding out the top five reasons for disconnected households were "not enough time" (9%) and "computer not capable" (7%). Cost remains a barrier for non-user low-income households. One third of households earning less than $15,000 annually cited cost as the main reason for remaining disconnected. Over one-quarter (27%) of these households cited "don't want it" as another barrier to online connection. In contrast, households in the highest income bracket of $75,000 and over reported the opposite citing "don't want it" (31%) over cost (9%). Youngest householders (under 25 years of age) were more likely to report that Internet connectivity is too expensive (26%) than they "don't want it" (19%). Seniors (55 years and older) were more likely to cite "don't want it" (40%) than cost (15%) as a barrier to Internet home-use. Likewise, all major race/ethnic groups reported "don't want it" as more relevant than the cost factor; for Whites (32% vs. 16%), Asian Americans and Pacific Islanders (30% vs. 13%), Blacks (31% vs. 18%) and Hispanics (26% vs. 24%). Similar findings are shown for individuals with different levels of education attainment: households with college degrees (29% vs. 12%), some college (28% vs. 20%), a high-school diploma (33% vs. 17%), and some high school (37% vs. 20%). Thus, low-income and youngest households deem cost the major barrier to online connection at home, while other groups report "don't want it" over the cost associated with connectivity.

A smaller study conducted on 2,096 U.S. households via telephone in mid to late Spring 2000 presents differing findings to the *Falling Through the Net* report. Households were most likely to cite "no computer or terminal available" (38%) as the principal reason for their status as non-users (Lebo 2000). One-third of respondents cited "not interested" and 19% reported "I don't know how to use it" as reasons for remaining unconnected. Smaller numbers of users (9%) deemed Internet connections as "too expensive" and thus the reason why they remained unconnected. Over half (59%) of non-users reported they were not likely at all to become Internet users in the next year compared to 27% of non-users who cited they were somewhat likely and 15% of non-users who were very likely to be online in the coming year (Lebo 2000). Those individuals most likely to remain

disconnected are older non-users as approximately 45 percent (44%) of those who cited they were not likely to access the Internet in the next year were older than 56 years old. Over one third (34%) of non-users 36-55 years old and 22% of those 12-35 year old non-users stated they were unlikely to access Internet services.

Similar findings by Lenhart indicate that 57% of non-users are not interested in getting online (Lenhart 2000). Of these non-users, the Pew Internet report suggests that 32% of them without Internet access now say they "definitely will not" get Internet access in the future. This accounts for approximately 31 million Americans. The remaining 25% of non-users who are not interested in being connected report they "probably will not" venture online in the upcoming year. Older Americans seem the most unlikely to want Internet connections as 74% of those non-users over 50 years of age do not plan to get Internet access. Meanwhile 65% of those younger than 50 years of age intend on getting connected to the Internet. The study conducted between March and August 2000 interviewed 2,503 American citizens.

Another national telephone survey was conducted by Market Facts, Inc. for AARP, a leading organization serving the needs and interests of people 45 years and older in the U.S. The survey interviewed 1,002 computer users age 45 and older and was designed to gauge computer use and proficiency amongst mid-life and older individuals. Findings indicate that more than half of the sample (54%) saw themselves as "experienced" users, whereas 38% reported they were "novices" and only 8% described themselves as "experts" (De Pallo 2000). Those users who self-identified as novices were more often age 65 or older and had lower education levels than either experienced or expert users. More generally users age 65 and older, less affluent users, and less educated users were less confident and less proficient than those who were younger, more affluent, and more educated.

Canada: Canadian non-users, responding to the General Social Survey, identified cost as the greatest barrier that keeps them from using the Internet (Dryburgh 2000). Non-users cited lack of access to computers or the Internet as a second obstacle to getting online. Forty-two percent of respondents in the lowest income category with less than $20,000 household income reported cost as a barrier to use, compared with 35% of those who earned $20,000 to $29,999. In contrast, non-users earning more than $50,000 annual income cited not having enough time as a major barrier to Internet use. Of the non-users interested in using the Internet in the future, young non-users age 15 to 24 were far more interested (49% were interested) than non-users 65 to 74 years old (8% were interested) in becoming connected. The survey conducted by Statistics Canada collected data from 25,090 respondents over a 12-month period from January to December 2000.

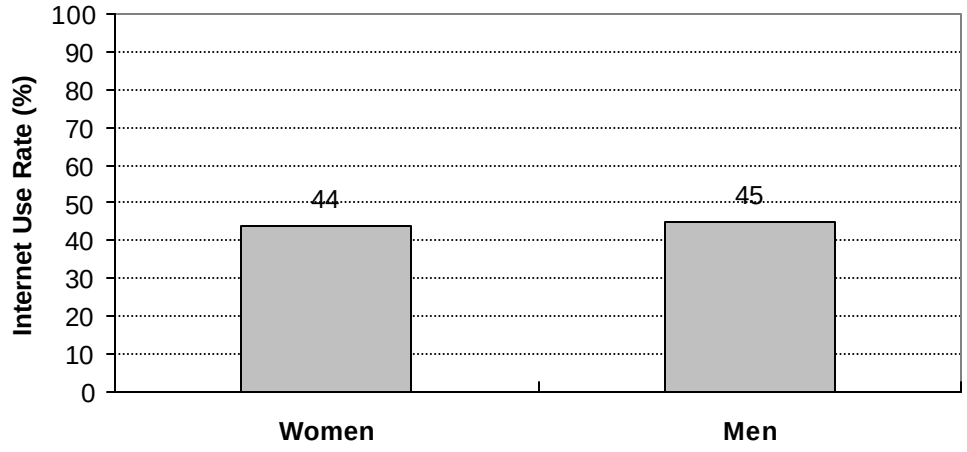
Using a 1997-1998 study, the *Information Highway and the Canadian Communications Household*, Andrew Reddick created a typology of non-users.

Type One non-users are those who recognize some value in the Internet in meeting some of their needs but who face cost/affordability obstacles in gaining access to the Internet (Reddick 2000). These individuals, "near users", are primarily younger Canadians (age 44 and younger). Public access sites can have a significant role in meeting the needs of this group of non-users. In contrast, Type Two non-users face both cost and interest barriers as they see little or no personal or social benefit and value of Internet service. This group is most helped by technical skills training, content development relevant to their social needs and the availability of public access sites. Lastly Type Three non-users are likely to derive little personal benefit from access as they lack the social skills or resources to benefit from Internet access. Seniors (55 years and older) dominate in this group of non-users.

Gender

U.S.: Research by the U.S. Department of Commerce found that the gender divide has been decreasing, and indeed may have disappeared from some perspectives. In December 1998, 34% of American men and 31% of American women were using the Internet. As indicated by *Figure 1, b*y August 2000 45% of men and 44% of women were Internet users (NTIA 2000). The Gartner Research Group used US Census data for February 2000 and found that males had a slight lead with Internet usage levels of 67% compared to females (62%) (Smolenski 2000).

Figure 1: Internet Use By Gender, U.S., 2000

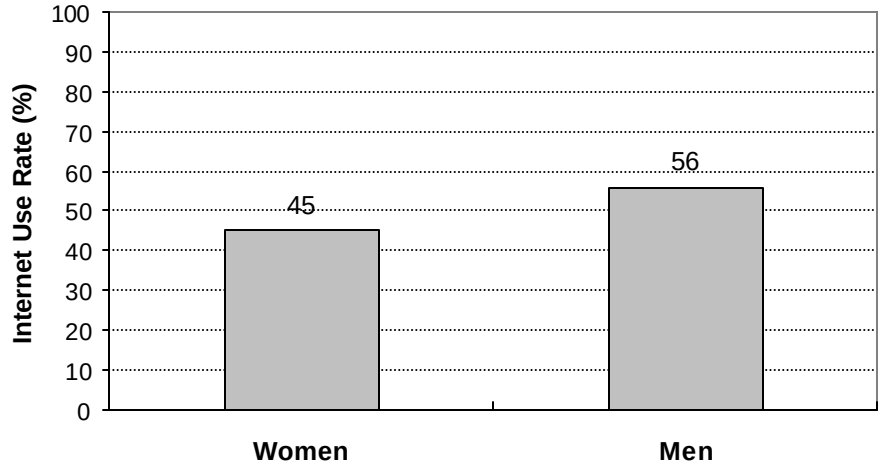


Source: U.S. Department of Commerce (NTIA 2000)

Canada: Similar to Americans, Canadians also saw the split between male and female users decrease significantly. One study found that female Internet users at home accounted for 51% of the Canadian online population in October 1999, as compared to 49% being male users (PricewaterhouseCoopers 2000).

However, another slightly earlier study (Reddick 2000) found that in July 1999 56% of men accessed the Internet in the past three months opposed to 45% of women (see *Figure 2*). It also found that the rate of growth of Internet use among women was almost twice as large as among men. From June 1998 to July 1999 the growth rate for male and female online users was 24% and 45% respectively (Reddick 2000). The difference in findings between the two Canadian surveys is largely in part due to how Internet use by gender is measured.

Figure 2: Internet Use By Gender, Canada, 1999



Source: Reddick 2000

The Internet is becoming more attractive to women and this is shown by their increasing Internet adoption rate. However, gender differences in Internet use remain. We caution that simple percentages of Internet use can provide misleading information about the extent to which men and women actually use the Internet. Canadian women tend to be largely light users whereas Canadian men tend to be moderate and heavy users (Reddick 2000). The 2000 Canadian General Social Survey shows that the proportion of men (68%) citing personal interest as the reason for first using the Internet is slightly higher than women (64%) (Dryburgh 2001). School-related needs for first using the Internet were more likely to be cited by women than men (16% versus 12% respectively) and nearly 19% of both men and women first used the Internet for work-related needs.

In the United States as well, men tend to spend more time online (Witte, et al., 2000), and hence at any given moment, there are probably more men online than women. Moreover, gender differences in how the Internet is used persist. The general trend is one in which American men choose to spend a higher percentage of their time online on commerce (purchasing, banking, auctions), while women spend a slightly higher percentage of their time for school

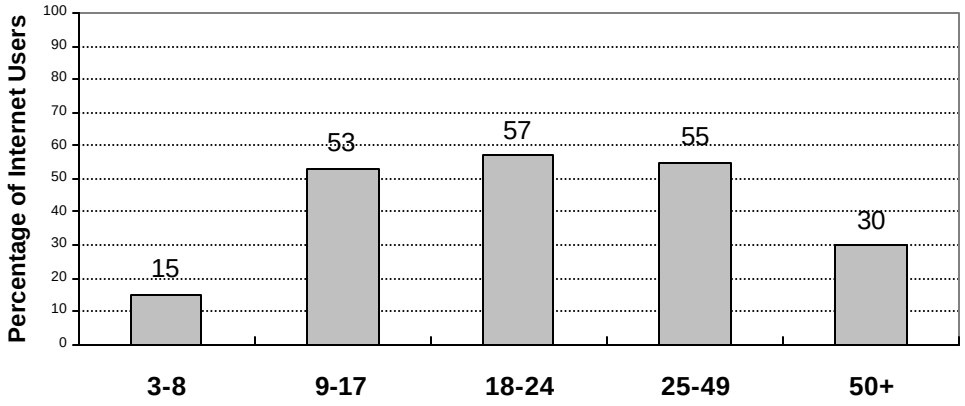
homework or their jobs (Lebo 2000). Both men and women in the U.S. spend an equal amount of time on entertainment.

Age and the Life Course

U.S.: A Consumers Federation of America report surveying 1,900 respondents found that of the 47% who did not have access to the Internet at home, those most likely to be "disconnected" were older individuals (Cooper 2000). However, this finding provides little insight into the correlation between Internet use and age. Significant factors such as household income, labour force participation, and interest in the Internet play important roles in age variation and Internet use.

Falling Through the Net (NTIA 2000) uses five age categories to group Net users by important periods in their lives – children (age 3-8), youth (age 9-17), college/early work force (age 18-24), work force (age 25-49), and late work force/retirement (age 50+). As shown in *Figure 3*, only children (15%) and the retired (30%) were below the national average of 44% in August 2000. Over half of the youth (53%), college/early work force (57%), and work force (55%) respondents are Internet users (NTIA 2000). Household income is a significant factor in Internet use among children age 3 to 8 years. Young children living in households with income less than $15,000 have an Internet use rate of 5%. This compares with the use rate of 22% among those households with children and with incomes greater than $75,000.

Figure 3: Percentage of Internet Users
By Age Group, U.S., 2000



Source: U.S. Department of Commerce (NTIA 2000)

Income is less important to college and early work force Internet users age 18 to 24 years. Individuals at all household income levels in 2000 have Internet use rates close to or above the Internet use rate (44%) for the population as a whole:

less than $15,000 (42%), $15,000 to $24,999 (44%), $25,000 to $34,999 (52%), $35,000 to $49,999 (60%), $50,000 to $74,999 (67%) and $75,000 and above (78%).

Although older Americans are less likely to be connected to the Internet than their younger counterparts, they are just as likely to recognize the importance of computer technology for the future. That is not to say that they want or need computers for themselves but they clearly acknowledge that computers are needed for their children and grandchildren to succeed (Smolenski 2000). Half of all the respondents, 40,000 household heads, in the Gartner Group study aged 18-34 say that a home computer is essential for a child to succeed in school (Smolenski 2000). This is 9 percentage points behind those 35-54 (59%) and 8 points behind those 55 years or older (58%). At the same time, however, findings from the *Who's Not Online* 2000 study indicate that the "gray gap" – aging baby boomers and senior citizens – are the most resistant to the Internet (Lenhart 2000). They do not see the benefits that the Internet can bring them personally and do not believe they are missing out on anything by not being online. By contrast, a substantial majority (65%) of those under 30 years of age who are not currently online say they plan to get access, though the cost of going online still poses a barrier to them.

Americans of varying ages differ more in their actual use of technological innovations may differ relatively insignificantly in their attitudes towards technology. A survey of computer users age 45+ finds differences in computer use by age. The *AARP National Survey on Consumer Preparedness and E-Commerce* reports that the most often used computer application by those 45 years of age or older is word processing, used by 81% of those surveyed (DePallo 2000). The same age cohort with a lower socio-economic status make use of far fewer applications than those with higher incomes and education. The Internet offers 'older elders' in nursing homes an opportunity to become reconnected with family and friends and to feel appreciated. Seniors in these environments often suffer loneliness, helplessness, boredom and cognitive decline (Plotnikoff 2000). Significant barriers for the frail elderly to get online include cultural resistance, lack of access to training and technology that is not user-friendly. David Lansdale teaches basic Net navigation to 200 seniors and says of interface problems, "If they go to Yahoo, it's just overwhelming to look at (quoted in Plotnikoff 2000, p. 1)."

Although children use the Internet extensively (data not reported here), by no means is the Internet dominated by young people. In fact, between the ages of 12 and 35, the average weekly Internet connect time increases with age. Children age 12 to 15 spend an average of 5.6 hours online per week, far less than those age 16 to 18 (7.6), 19 to 24 (9.7), and 25 to 35 (11.3) years of age (Lebo 2000). The use of the Internet at work largely explains this steady increase in time online. Likewise, the *Falling Through the Net* data on Internet use rates by age indicates this trend. There is an increase in Internet use in the various

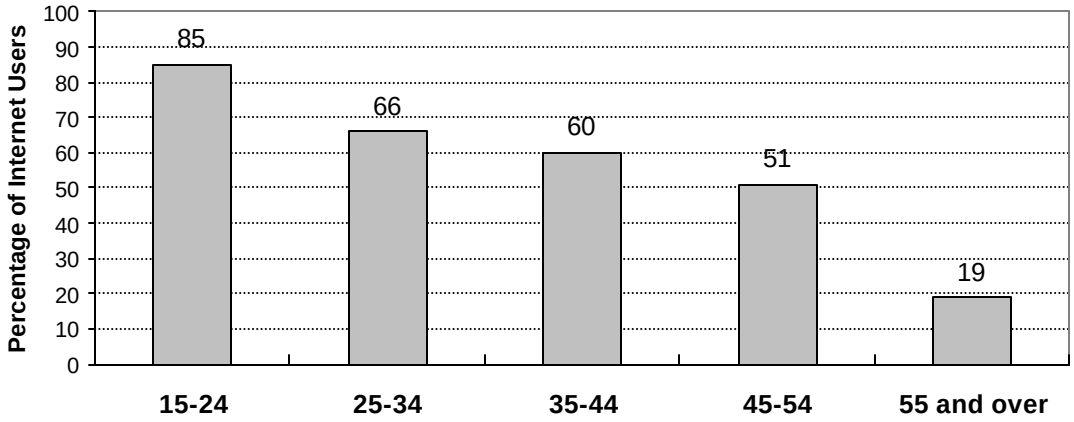
age cohorts under 24 years of age. The most substantial difference in Internet use rates occurs between children age 3 to 8 (15%) and youth age 9 to 17 (53%) (NTIA 2000). More than half of the young adults age 18 to 24 (56.8%) used the Internet in August 2000.

The data call into question the common supposition that young users populate the online environment in greater numbers than adults. However, adults and younger people often access the Internet for different reasons. The Children's Partnership's survey shows that young people often view the Internet differently than do adults. Where young users tend to see the Internet as an entertainment medium that facilitates self-expression, adults tend to view the Internet as an information source (Lazarus 2000). Adults want Web sites with practical content that is delivered in a simple, text-based presentation. Young users, on the other hand, prefer Web sites that have fast-moving imagery and that offer games and downloadable plug-ins, music, video, and pictures. Interactive content is also important to these youth because it allows them to chat with others online. As researchers at Carnegie Mellon University found in their HomeNet Project, many teenagers would hurry home after school to have email conversations with the friends that had just seen in person. One sixteen year old describes the perceived importance of the Internet: "I really want to move to Antarctica. I'd want my cat and Internet access and I'd be happy (quoted in Lewin 2001, p. 3)."

Canada: Similar to the American findings that indicate decreased Internet use with age, younger Canadians under the age of 25 (72%) have the highest Internet use rates in 1999 (Reddick 2000). There is a steady decrease for those age 25 to 44 (57%), 44 to 64 (47%), and 65 years or older (17%). Despite having the lowest Internet use rate, Canadians over the age of 65 have had the greatest rise from June 1998 to July 1999, with an impressive 143% increase in one year.

Statistics Canada reports a smaller number of older Canadians accessing the Internet in 1997: 6% of households headed by seniors used the Internet compared to 7% in 1998 and 10% the following year (Dickinson & Ellison 2000). In 1999, more than half the Canadian households with heads aged less than 54 used the Internet, but this drops to less than one-third where the head is aged 55 to 64, and only one-tenth for households headed by a senior (65 and over). A more recent Statistics Canada study indicates a nine percentage point increase in the number of connected households headed by someone 55 years or older (19%) in 2000 (Statistics Canada 2001). *Figure 4* shows that seniors still lag significantly behind individuals aged 15 to 24 (85%), 25 to 34 (66%), 35 to 44 (60%) and 45 to 54 (51%).

Figure 4: Percentage of Internet Users by Age Group, Canada, 2000
(Age 15 and Over)



Source: General Social Survey, Cycle 14 (Statistics Canada 2001)

Household Characteristics:

An important aspect of the digital divide is the correlation between household type and computer and Internet access. The characteristics of a household can include household size, the presence or absence of children, and whether there are one or two parents living in the household.

Household Size: Those households with Internet use are larger than those which do not use the Internet (Cooper 2000). Those households who do not have any Internet service or do not own a home computer or cellphone have a mean household size of 2.1. Those who are "potentially connected" – owning a computer or cellphone but without Internet service – have larger households (2.5). The "partially connected" (2.7) who have basic Internet service and the "fully connected" (2.8) who have a commercial Internet Service Provider have the largest households.

Household Type: Also related to household Internet access is whether there is one or two parents living in the household. Internet access rates increase by nearly double for dual-parent households (61%) compared to male-headed households with children less than 18 years of age (36%), and for female-headed households with children less than 18 years of age (30%) (NTIA 2000). Those households which cite particularly low Internet access rates are female-headed households in central cities (23%) and male-headed households in rural areas (30%).

Computer ownership is high for most families earning $75,000 or more (93% for dual-parent families, 84% for male-headed households 82% for female-headed households, 83% for households without children, and 77% for non-family households). However, computer ownership dips dramatically for all household types in the lowest income bracket (NTIA 2000). The only exception is for married couples earning incomes below $15,000 who children: One-third (33%) of these families own computers. As computers are becoming more affordable, they are viewed by families as a valuable purchase for their children.

Number of Children: Consistent with the previous discussion, households with children are significantly more likely to own a computer and to have Internet access. Beyond the lowest income group, one study found that the differences in access between households with children and those without are considerable (20 percentage points or more) for most income groups (Cooper 2000). The *Falling Through the Net* study reports that households with two parents and children have much higher rates of Internet access than other family types (NTIA 2000). Married couples without children are far less likely to have Internet access (43.2%) than married couples with children under 18 (61%). In contrast, "non-family households" comprised of single or unmarried people are the least likely to have Internet access (at 28%). The African-American online population has a similar demographic feature in that about 53% of online blacks have a child under the age of 18 living at home compared to 42% of online whites who are parents (Spooner & Rainie 2000). The study asserts that African-American families recognize the importance of the Internet as an investment in the future. The Gartner Group study finds that black Americans are almost identical to white Americans in seeing a home computer as advantageous to school children and to career success (Smolenski 2000).

The presence of children in the home, however, does not have similar effects for men and women in two-parent households (Lebo 2000). On the one hand, women in these households with children have more access to the Internet (70%) than women in households without children (57%). On the other hand, the presence of children has little or no influence on the likelihood that men will have differing levels of Internet access.

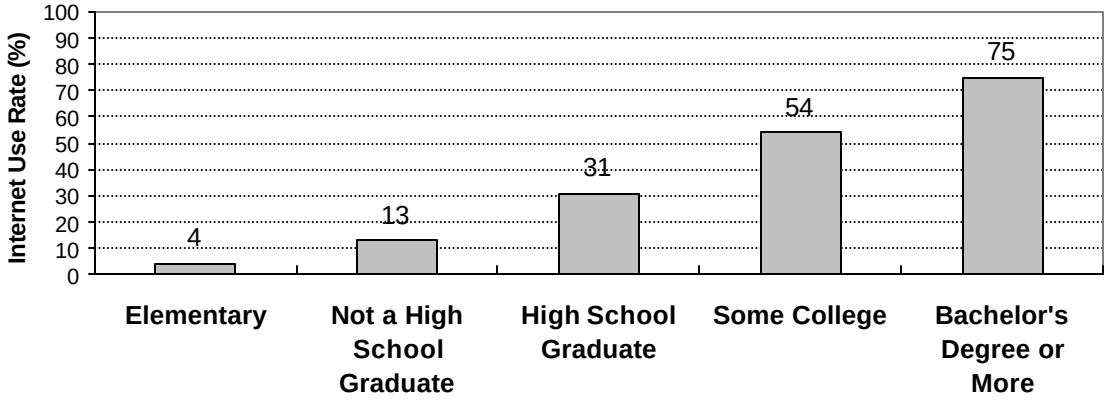
Canada: Canadian households follow similar trends to the United States with respect to accessing the Internet. The highest proportion of all family groups wired to the Internet (59%) in 1999 are single-family households with unmarried children under 18 (Dickinson & Ellison 2000). Access is lower for single-family households without children: only 39% have Internet access. Although it can be argued that households with children have a higher rate of Internet use due to access at school, this alone does not account for the varying penetration rates. Instead, we find that home-use among single-family households also varies substantially. Households with children have access rates of 41% while 28% of households without children access the Internet.

The *Plugging In* study argues that the importance of recognizing that the presence of children in the household may not necessarily imply differing home penetration rates. Differences may be related more to other household characteristics than to the presence of children. The study asserts one example in which "Internet use is lower in older age groups, and the older age groups contain a larger share of the families without children than the younger age groups (Dickinson & Ellison 2000)."

Education

U.S. Highly educated individuals have correspondingly high levels of Internet use. The *Falling Through the Net* report found the following results: adults with no more than an elementary school education lagged nearly 71 percentage points behind people with a bachelors degree or higher (NTIA 2000). Those individuals with the lowest educational attainment had an Internet use rate of 4% in August 2000, trailing behind those who did not graduate high school (13%). Nearly a third (31%) of high school graduates and more than half of those (54%) with some college education had surfed the Internet. In contrast, three-quarters (75%) of college graduates were online (*Figure 5*). Results comparing internet access by education level and race indicate that 27% of online African-Americans have a college or graduate degree compared to 38% of their online White counterparts. Online Blacks who have some college experience (37%) had a seven point advantage over online Whites (30%). Both online Blacks and Whites who possess high school degrees access the Internet in similar proportions (28%).

Figure 5: Internet Use Rates by Educational Attainment, U.S., 2000
(Age 25 and Older)



Source: U.S. Department of Commerce (NTIA 2000)

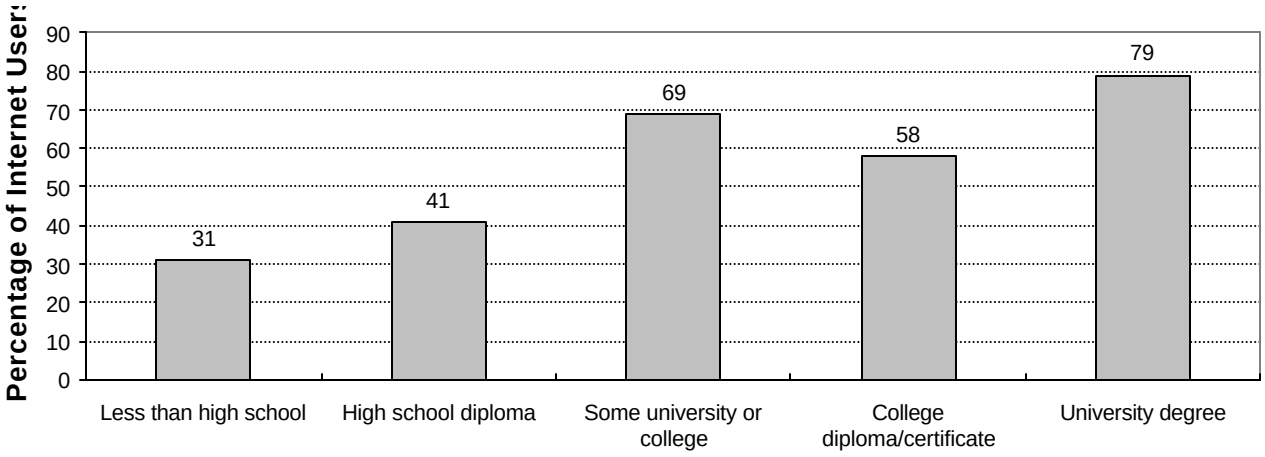
Over two thousand (2,096) American adult household heads were interviewed in the *Surveying the Digital Future* study in 2000. Those who had less than a high

school diploma had Internet access rates of 31%, 22 percentage points less than high school graduates (53%) (Lebo 2000). Both college graduates and those with advanced degrees had significantly higher rates at 86%, while those with some college education hovered in between with access rates of 70%.

Canada As for Americans, for Canadians, increased education levels indicate higher rates of Internet use. Over a third (37%) of those with a high-school diploma or less, over half (51%) of college graduates, and 70% of university graduates had used the Internet by July 1999 (Reddick 2000). Similarly, the Statistics Canada report found lower rates of Internet access for household heads who did not complete high school (16%) and who had a high school or college qualification (44%) (Dickinson & Ellison 2000). Internet access rates of 70% were found for households where the head had a university degree. Between 1998 and 1999 all education categories experienced an increase in the proportion of households using the internet. However, these gains were largest for households in the lowest education category.

The most recent Statistics Canada report presents General Social Survey data collected during January to December 2000 from 25,090 people. It indicates the continued trend of higher Internet use rates by those age 15 and over with increased education levels (*Figure 6*). Thirty-one percent of those with less than a high school diploma were Internet users in 2000, while those with a high school diploma (41%) were 10 percentage points more likely to be accessing the Internet (Statistics Canada 2001). Individuals with some university or college education had slightly higher access rates (69%) compared to those who had a college diploma or certificate (58%). Clearly, those with a university degree were most likely to be connected to the Internet (79%).

Figure 6: Internet Use Rates by Educational Attainment, Canada, 2000
(Age 15 and Older)



Source: General Social Survey, Cycle 14 (Statistics Canada 2001)

Labour Force

U.S.: For those American users age 25 to 49 years, labour force participation is an important component of Internet use in August 2000. People are more likely to be Internet users if they are in the labour force (58%), as compared to those not in the labour force (39%). Labour force participation is even more significant for users age 50 and older than for those in the "work force" category. Individuals age 50 and older who are in the labour force (46%) are nearly three times as likely to be Internet users than their age cohort who is not in the labour force (16%).

For African-Americans and Hispanic-Americans aged 25 to 49 years, labour force participation is not a significant motivation for Internet use. African-Americans (40%) and Hispanic-Americans (30%) in the labour force, as well as African-Americans (19%) and Hispanic-Americans (17%) not in the labour force fall below the national average of all age groups of 44%.

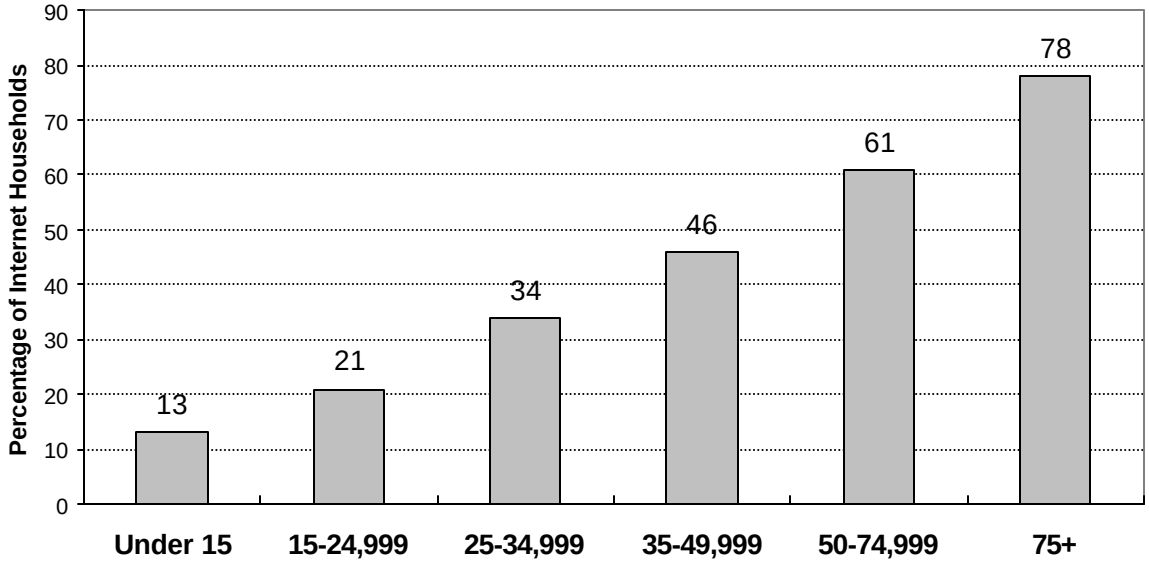
Income

U.S.: Low income still represents a substantial barrier to Internet access as Internet use remains greater among higher income households. However, those at the low end of the economic scale are becoming regular Web users relatively rapidly.

Yet Internet use rates remain correlated with income. The *Falling through the Net* data show that in the lowest income quartile, U.S. households with less than US$15,000 in income had a 13% Internet access rate in 2000, a rise from 7% in 1998 (NTIA 2000). At the $15,000-$24,999 income levels, 21% of households had Internet access. The Internet use rate increased 93% from 1998 (11%) to 2000 (21%). By comparison the rates for households with incomes between $25,000 and $34,999 stood at 19% in 1998 and 34% in 2000. Since 1998 this income group has experienced a 78% increase in household internet use. (All U.S. income figures in this report are in U.S. dollars.)

Households with incomes beyond $35,000 had a 17 percentage point gain from 1998 to 2000 (NTIA 2000). The Internet use rate for households with income between $35,000 and $49,999 was 29% in 1998, compared with 46% in 2000 (*Figure 7*). Less than half the households with incomes between $50,000 and $74,999 accessed the Internet in 1998 (44%), while in 2000 61% of these households were online. Households in the highest income bracket with annual income of $75,000 or more climbed from a 61% Internet penetration rate to 78% in 2000.

Figure 7: Percentage Internet Households by Income ($000s), U.S., 2000



Source: U.S. Department of Commerce (NTIA 2000).

A similar positive correlation between household income and online usage levels was found in the *Digital Divide and American Society* report (Smolenski 2000). Having surveyed 40,000 American households in February 2000, the report indicates a steady increase in online access among households earning less than $10,000 (32%), $10,000-$14,999 (35%), $15,000-$19,999 (42%), $20,000-$24,999 (45%), $25,000-$34,999 (56%), $35,000-$49,999 (66%), $50,000-$74,999 (75%), and $75,000 and more (83%) (Smolenski 2000). In

1998, households in the highest income bracket were more than four times as likely as those earning less than $10,000 to use the Internet. By 2000, that gap had narrowed so that the highest income groups had online usage levels about 2½ times those of the lowest groups.

A further indication that the barriers to Internet access are weakening is the strong growth of Web users in the moderate-income groups. Between February 2000 and 2001, the number of home Web users with annual incomes of less than $25,000 a year rose 46% from 4.3 million to 6.3 million users (Fass 2001). The largest segment of the online population, those earning $50,000-$74,999, had the second-highest rate of increase, up 42% to 30.4 million users in February 2001. The Nielsen/NetRatings survey also found that those in the $25,000 to $49,999 groups had the third highest rate of increase, rising 40% to 26.4 million Internet users.

One approach to measuring the digital divide focuses on the nature of connectedness to Internet networks instead of focusing only on Internet usage. Four categories of actual and potential connection to the Internet were developed in the Consumer Federation of America and Consumers Union report. The data, collected in June 2000, consisted of a national mail survey of 1,900 respondents. Again the data indicates a correlation between household income and connectivity status. The mean income of "disconnected" respondents who did not have any Internet service and did not have a computer or cell phone was $25,500 (Cooper 2000). Those "potentially connected" had a mean income of $34,300 and had no Internet service but did own a computer at home or have a cellular phone. The "partially connected" earned more ($39,600) and had basic Internet or e-mail service at home. In contrast, the "fully connected" in the population had a mean income of $45,200 and reported having a commercial Internet Service Provider or high-speed Internet access at home.

There are different types of use at different income levels. Media Metrix, a market research firm, completed a survey of 55,000 Internet users in June 2000 and found that lower-income Web users spent 4 hours more online per month (13 hours) than higher-income users who logged in at nine hours of online surfing (Auchard 2000). A Nielsen/NetRatings study in August 2000, based on data from a panel of 57,000 at-home computer users, also found that people with lower incomes spend more time surfing the Web at home than more affluent individuals (Grenier 2000). Part of the reason for this is that people with higher incomes and more education tend to have increased access to the Internet at work compared to blue-collar employees, who typically have lower income and less education. After the initial period of getting online, lower socioeconomic groups find enough services and content to keep them logged on. Popular websites among lower-income, high-Internet-use individuals include the instant-message service ICQ.com, WalMart.com and the entertainment sites Emazing.com, Wotch.com, and SendingFun.com. Higher-income, lower-online-use surfers. in August 2000 preferred investor websites such as Schwab.com, TheStreet.com and

CNBC.com, and information and sports sites like the Boston Globe's Boston.com and MajorLeagueBaseball.com.

Evidence from the *Falling Through the Net* report indicates that both income and education are independently associated with Internet access. For example, home Internet access rates for households with some schooling beyond high school but not a college degree was 76% in the over $75,000 income group (NTIA 2000). For households with the same educational background but earning under $15,000 their access rate was only 26%, fifty percentage points behind households in the highest income bracket. This inequity also holds true within income groups. The average Internet penetration rate for households earning $75,000 or more is 78% but it ranges from a high of 82% for users with a college degree or more to a low of 51% for Internet users with less than a high school education (NTIA 2000). At the other end of the income spectrum, those households with an income between $15,000 and $34,999 had an average access rate of 28%, with 46% of college graduates and only 11% of users with less than a high school diploma having online access.

Canada: Canadian data makes the same point: There are differences in why people first choose to go online. Lower-income Canadian users are more likely to use the Internet for leisure purposes, compared to higher-income users who are more interested in education as a main reason for home Internet use (Reddick 2000). A significant amount of users with lower levels of education cite the Internet as a means to improve their education and skill levels. However, as users gain greater online experience there tends to be a diversity of content use which are not easily categorized.

Internet use remains greater among higher income households in both Canada and America. Cost and affordability of computer technology thus remain obstacles to getting online. Indeed, *The Dual Digital Divide* found cost and affordability to be the most important obstacles (Reddick 2000). They are important criteria for at least two-thirds of those in the lower- and upper-middle, and upper income segments, and for just over half of those who are lower-income.

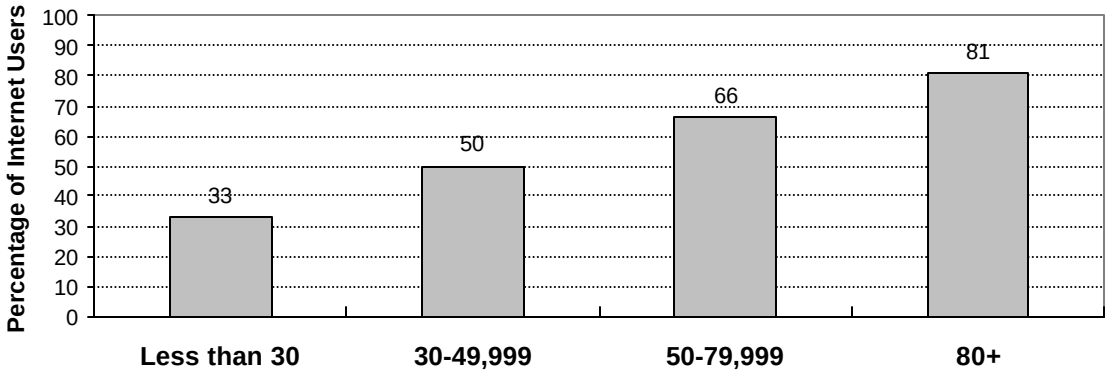
Canadian findings from 1997, based on a survey of 3,522 households, are similar to U.S. findings. The great majority of lower-income households (83%) had no Internet service from home while 80% of those in lower-middle income households were not connected (Reddick 2000). Less than one in three (27%) upper-middle income households were likely to have home Internet, as compared to almost half (46%) of upper-income households.

Plugging In (Dickinson & Ellison 2000), a report surveying 36,241 Canadian households in 1999 saw an increase in Internet use at all levels of household income. Those households in the top income quartile (the 25% of households with the highest incomes) experienced a 71% Internet use rate in 1999 compared

to 19% of households in the bottom income quartile (Dickinson & Ellison 2000). Nearly half (48%) the households in the third quartile and thirty percent in the second quartile used the Internet from the home or other locations.

Approximately 25,000 Canadian households were interviewed between January and December 2000 for the General Social Survey Cycle 14 study. This Statistics Canada report shows a positive correlation between household income and Internet use. One-third (33%) of Canadian households with an annual income of $30,000 or less were Internet users, as compared with one-half (50%) of all households with an income of $30,000-$49,999, and two-thirds (66%) of all households in the $50,000-$79,999 income range (Statistics Canada 2001). Up to 81% of households in the top income bracket of $80,000 or more used the Internet (*Figure 8*).

Figure 8: Percentage Internet Users by Income ($000s), Canada, 2000
(Age 15 and Over)



Source: General Social Survey, Cycle 14 (Statistics Canada 2001)

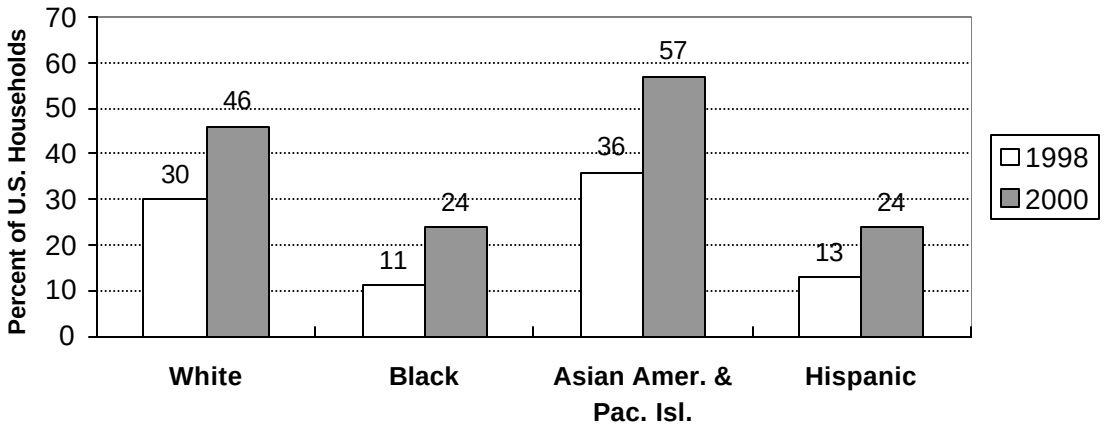
Race and Ethnicity

As more people from non-majority ethnic populations become Internet users, there is substantial opportunity for Internet Service Providers and Web portals to attract these consumers with in-language, in-culture messages, and specialized content. Robert Rosenberg, president of Insight Research explains that when "ethnic sites go beyond in-language translations and move in the direction of cultural interest to address the special communities they serve, they have the potential to induce a loyalty not usually associated with more generic Web sites (quoted in Pastore 2001, p.1)."

U.S.: Between 1998 and 2000 Asian Americans and Pacific Islanders saw their home Internet access rates grow by a dramatic 21 percentage points, from

36% to 57% (NTIA 2000). White households (46%) had the second highest rate of access in 2000, with Black and Hispanic households trailing behind with 24% Internet penetration rates for both groups. However, as shown in *Figure 9*, Internet uptake by Black and Hispanic households has been strong with gains of 13 and 11 percentage points respectively.

Figure 9: Percent of U.S. Households with Internet Access By Race/Hispanic Origin, 1998 and 2000



Source: U.S. Department of Commerce (NTIA 2000).

African-Americans and Hispanic-Americans - U.S.: Access Worldwide Communications surveyed approximately 3,500 users of several major ethnic Web sites in 2000 to explore the relationship between ethnic and cultural factors and Internet use (Pastore 2001). Of all the ethnic groups surveyed, African-American users are the least likely to believe that the Internet removes racial barriers and creates new social opportunities. Compared to the general market, African-American respondents are nearly three times, and Hispanic-American respondents five times as likely to mention negative perceptions of the Internet.

For the African-American online community, women now represent 61% of Internet newcomers (Spooner & Rainie 2000). African-American men who accessed the Internet for the first time accounted for 750,000 surfers whereas approximately 1.2 million African-American women surfed the Internet during the same time. Among Internet users who have been connected to the Internet for more than a year, Black women make up 56% of the African-American online population (Spooner & Rainie 2000). However, white women (50%) still have significantly higher Internet use rates than Asian American/Pacific Islander (46%), African-American (31%) and Hispanic-American (25%) women (NTIA 2000). For each race/ethnic group there were similar Internet use rates amongst men and women except for the Asian American/Pacific Islanders. In this group men had a 6.6 percentage point lead over women with an Internet use rate of 53% compared to 46%.

Among African-Americans, there are gender differences in what is accessed on the Internet. African-American men are more likely than African-American women to have sought sports and financial information and purchased products online (Spooner & Rainie 2000). Forty-three percent of African-American men have purchased something online, as compared to just 29% of American women. Yet African-American women are more likely to use the Internet to seek health and job information. African-American women are also twice as likely to have sought religious and spiritual information on the Internet than African-American men.

African-Americans online tend to be younger than their online white counterparts. In 2000, almost 56% of online African-Americans were under the age of 34 whereas 40% of online whites were in that age bracket (Spooner & Rainie 2000). Among online whites 46% are aged 35-55 and 14% are over 55.This contrasts with online African-Americans aged 35-55 (38%) and those over 55 (5%).

Hispanic-Americans - U.S.: A key finding is that Hispanic-Americans are more likely than the general population to use the medium as a source of news, especially international news (Pastore 2001a). New users, both African-American and Hispanic-American, are less likely to use the Internet to look for financial or technological information. However, the longer these users have been online, the more likely that they have engaged in e-commerce.

One study suggests that Hispanic and Asian-Americans will see their Internet access rates grow several times faster than the rest of the population over the next five years. This is a reasonable supposition, because plateau effects are less apt to be present among groups with low percentages of users. In particular, Hispanic-Americans have seen significant increases in their use of household Internet. A Cheskin Research study shows that Hispanic-American household Internet access has risen from 42% in the first quarter of 2000 to nearly 47% in the fourth quarter (Pastore 2000b). “Perceived expense” and “lack of information” remain the greatest barriers to computer ownership among Hispanic-Americans.

Asian (Chinese) - Americans - U.S.: A study commissioned by SINA.com interviewed 1,005 citizens of Chinese descent living in the United States and Canada. According to this study Chinese-American households have a 60% Internet connection rate at home, and that the majority of these users have a university degree and an average income of $69,000 (Pastore 2001d). The majority of United States (73%) and Canadian (63%) Chinese Internet users visit Chinese-language web sites. Additionally, close to one-quarter of Chinese Internet users in both the US and Canada conduct online banking.

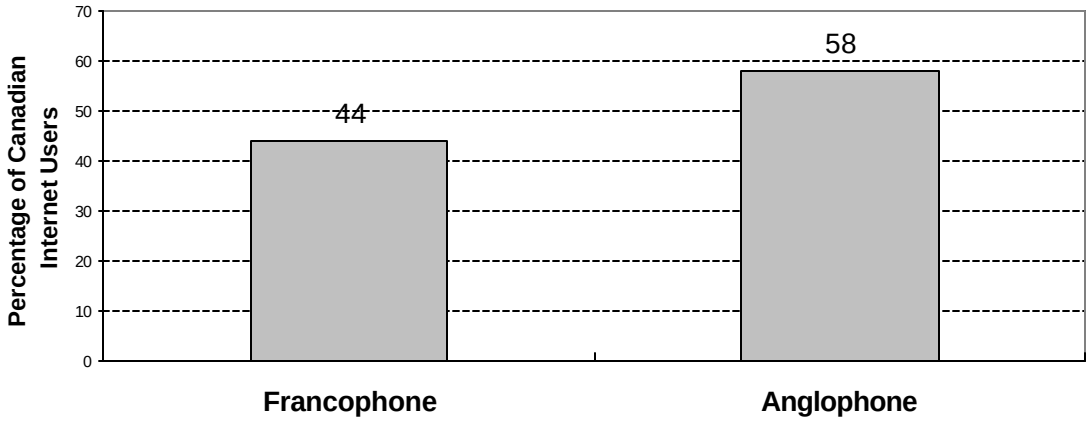
***Native-Americans - U.S.*:** We have not found usable data about Native-American Internet use. The *Falling Through the Net* report does not include separate data on American Indians, Aleuts, and Eskimos (AIAE) because the sampled population from that group is too small for credible results.

Language

Francophones and Anglophones - Canada: Results from a Media Metrix Canada study of 6,856 Canadians, 1,430 of them French-speaking, undertaken between May and October 2000 show a 22% jump in the number of English-speakers online, from 7.8 million in May to 9.5 million in October (Mulroney 2000). Francophones, with a slight increase of 2% between the two periods, accounted for 2.8 million users in October, up from 2.7 million in May. Where French-speaking surfers frequented government, news, education and business-related sites, anglophone users spent most of their time viewing health, auction and travel sites. English-speaking Internet users spent an average of 762 minutes per month online whereas francophones spent an average of 624 minutes. The difference in online time may be partly due to the difficulties of accessing high-speed connections in Quebec. Broadband connection is correlated with length of time online as faster connection speeds allow for more sites to be visited and increased satisfaction with the visits. Additionally, Website choices for French speakers are still limited as much of the information on the Web remains in English.

The 2000 General Social Survey (Dryburgh 2000) reports that 44% of francophones in Canada use the Internet compared with 58% of anglophones (*Figure 10*). Of those francophones who have accessed the Internet in the last 12 months, 20% report they view Websites in French and 93% say they access Internet sites in English. Given these data, it is not surprising that francophones report being less satisfied than anglophones in the amount of Internet content in their official language of choice. Compared to 99% of anglophones who think there is sufficient amount of Internet content in their official language of choice, only 62% of francophones feel the same way.

Figure 10: Percentage of Internet Users by Language, Canada, 2000



Source: General Social Survey, Cycle 14 (Statistics Canada 2001)

Location and Bandwidth

Greater bandwidth delivers more services and better services, more quickly. Yet current technology means that the two primary means of delivering greater bandwidth – (wired) broadband and wireless – are closely linked to location. Urban areas are better served than rural, and not all urban areas are well served.

The rollout of broadband services to households has focussed primarily on the speed of broadband connections. Jamal Le Blanc of the Digital Divide Network argues that this focus creates two compounding dilemmas that lead to an inappropriate choice in the selection of Internet services (2000). First, people tend to discern whether broadband is "fast enough" based upon previous experiences with the medium. Although clearly dial-up may be slower than the connections that they might experience at work, dial-up can still be evaluated as 'fast enough' given the higher price of ADSL or cable modem line, and the availability of other means of access. Second, the focus on speed obscures the relevance of broadband connections in carrying more digital information. The true potential of broadband is not the speed of information delivery but that it allows richer, flexible, more meaningful information to be communicated. Le Blanc sees digital information – as text, sound or video – as "more than information perceived, it is raw material received (pg. 2)." Broadband delivers information that can be reconfigured and reused infinitely without degradation.

Broadband - USA: Democratizing online media is more than a case of simply bridging a digital *textual* divide. It will mean sweeping changes to broadband infrastructure and mass adoption of high-speed services that allow for rich and

more meaningful information to be communicated (Wellman 2000). Broadband, featuring wider bandwidth and faster transmission speeds, includes asymmetric digital subscriber line (DSL), cable modem, and integrated services digital network (ISDN). DSL and cable-modems offer download speeds ranging from 4.6 to 11.4 times faster than dial-up connections (Potter 2001) which allow consumers to access, among other things, streaming media.

Access to streaming media – such as movies, video and radio -- has been an important reason for people to switch to high-speed Web services. But as T.S. Kelly, director of Internet media strategies at NetRatings warns, "Improvements in quality, ease-of-use, and accessibility must continue if streaming consumption is to become as commonplace as broadcast or cable television (quoted in Pastore 2001, p 1)." Higher downstream data speeds also enable people to receive video services such as video-on-demand and video-conferencing. The adoption of broadband is slated to have a significant impact on e-commerce revenue in the future. According to the Gartner Group, by 2005 consumers will spend twenty times more on the Internet when using a high-speed broadband connection than they do with traditional analog dial-up modems (Haines 2000).

With the current economic downturn in North America, some people are finding themselves without broadband service. Internet Service Providers either go bankrupt or scale back their plans and abandon the less profitable areas (Borland 2001). Even customers in smaller, relatively wealthy, remote areas such as Aspen, Colorado – as well as other high-wealth rural areas where urban expatriates are clustered – are having their broadband dreams put on hold. Some companies that have bought a host of smaller ISPs have concluded that some of their operations are simply not sustainable.

Broadband has substantial continuing costs. Diffusion of continuing information services throughout a population (such as broadband) lags significantly from the diffusion of information goods such as radio, television and VCRs as there is generally a one-time investment in the latter products. The lag is especially significant when the services require a deployment of infrastructure. With information services, ranging from telephone services to dial-up Internet connections and broadband capabilities, consumers must purchase hardware as well as monthly services. Poorer households have a harder time maintaining monthly Internet services and middle-income families might choose a lower dial-up connection for home services if they enjoy high-speed access at work or at school. Using data from the U.S. government's Current Population Survey, the Employment Policy Foundation found that while over two-thirds (68%) of dial-up access plans cost less than $20 a month, the majority (60%) of broadband subscribers pay more than $20 per month (Potter 2000). In the United States, subscribers to ADSL services (similar to High Speed Sympatico in Canada) pay, on average, US$23.83 a month, while those with cable-modem access (similar to @Home) pay, on average, $29.45 a month. Both technologies have marketing price-points at $20 and $40 per month.

Two current spatial limitations of ADSL and cable-modems are their reach and puny upstream bandwidth. Currently customers of ADSL need to be within 3.3 miles of a central telephone office to get service as data is sent over standard phone lines. One initiative undertaken by SBC Communications, "Project Pronto", aims to install multiple-neighborhood broadband "gateways" using high-capacity fiber cables to connect them to existing central offices (Wired News Report 2000). The gateways shorten the distance copper lines must travel to connect residential homes. In most cases Project Pronto is stringing fiber to within a mile or so of each home. This promises to transform 80% of SBC Communications' 61.2 million access lines into ADSL-capable lines by 2002, as compared to the 50% of these lines that are currently ASDL compatible. Another benefit is that customers will receive a minimum downstream data speed of 1.5 megabits per second, a sizable difference compared to the current connection speed of 384 Kbps available to its consumers. Project Pronto poses obstacles for other ISPs wanting to offer service comparable to the incumbent phone company. Competing service providers will have to engage in the non cost-effective option of stringing its own fiber to each neighborhood of 500 to 1000 homes to reach the clean copper needed to offer ADSL services. Another option is for the ISPs to be reduced to selling the phone company's service, or letting the phone company carry its traffic (Oram 2001). Ultimately the equipment needed to connect to the phone company or cable company system is extremely expensive.

The Federal Communications Commission's report on subscriptions to high-speed services shows that broadband use in the U.S. saw an increase between 1999 and 2000. High-speed lines connecting homes and small businesses to the Internet increased by 57% during the first half of 2000, to a total of 4.3 million lines in service from 2.8 million at the end of 1999 (FCC 2000). As of August 2000, 11% of online households, about 4% of all U.S. households, had broadband-speed access (NTIA 2000). The *Falling Through the Net* survey shows that the remaining 89% of online households (37% of all U.S. households) connect to the Internet by regular dial-up phone service, as wireless connections are just starting to be an option.

A U.S. General Accounting Office study finds that in 2000, the majority of broadband households use cable modems (51%) or DSL (34%) compared to wireless and satellite (5%) connections and other telephone-based technologies such as ISDN (11%) which is slower than broadband but quicker than dial-up. Narrowband subscribers, those connected to a low-speed, low-capacity communication method such as dial-up telephones, account for 88% of Internet users, as compared with the 12% subscribed to broadband services (GAO 2000). These broadband and dial-up use rates mirror the figures noted in the *Falling Through the Net* study. Over half (52%) of the survey respondents report that broadband service is available to them but only a small portion of them actually use the broadband service.

The demographic characteristics of broadband preference include age, location, region and income. The youngest households, those with respondents 25 years and younger, favor DSL (50%) over cable modems (43%), while other age groups prefer cable modems over DSL.

In all fifty states subscribers to high-speed service were reported and in about 70% of the nation's zip codes, compared to 59% at the end of 1999 (FCC 2000). High-speed subscribers were also reported to be present in 96% of the most densely populated zip codes and in 40% of zip codes with the lowest population density. Additionally, the number of sparsely populated zip codes with high-speed subscribers increased by 69% during the first half of 2000, compared to an increase of 4% for the most densely populated zip codes (FCC 2000). There was also an increase of 18% during the first half of 2000 for high-speed lines (or wireless channels) delivered over fiber, satellite, fixed wireless, and wireline technologies other than ADSL.

Broadband use in central cities (12%) is higher than in rural areas (7%), and higher in the West (13%) than in the South (11%) (NTIA 2000). As well, broadband service is more available in wealthy and large metropolitan areas (GAO 2000). ADSL and cable-modem services are available in local areas with an average median household income approximately 28% higher than areas where neither service was available (GAO 2000). Additionally, poverty rates are lower in areas offering broadband services (10%) than in local areas where neither services are available (15%). These locational differences are in part a result of consumer choice and in part a result of the decisions made by ISPs about where to provide broadband services.

For the most part broadband use increases as household income increases, no doubt because broadband is appreciably more expensive than regular dial-up Internet services. Only 8% of online households with family income of less than $15,000 in 2000 had broadband access compared to 14% of those in the most affluent online households with income of $75,000 and greater (NTIA 2000). Broadband subscribers are more likely than their dial-up counterparts to have a household income of at least $75,000 (GAO 2000).

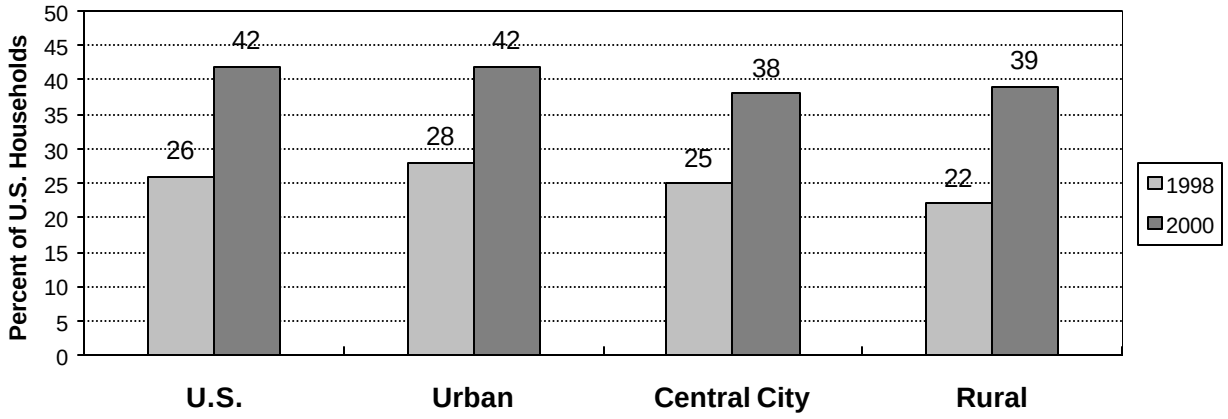
There is concern (Smolenski 2000) that broadband may cause a third digital divide in the future due to the difference between socioeconomic groups in adoption rates. Interestingly enough, however, households in the lowest income bracket (under $5,000) yield high broadband access rates (10%). One explanation for this is the presence of students who prefer higher transmission speeds for school or who value faster access as a priority. At present, a United States General Accounting Office study, *Characteristics and Choices of Internet Users*, concludes that there is little difference in the demographic characteristics of broadband and dial-up subscribers besides income and location differentials (GAO 2000).

Broadband - Canada: Non-proprietary Canadian data detailing broadband access rates are limited. A PricewaterhouseCoopers survey in 1999 of 229 online Canadian households indicates that the majority (66%) of households accessing the Internet at home used telephone dial-up connections (PricewaterhouseCoopers 2000).

Community Type: Urban vs. Rural

U.S.: Although urban areas in the U.S. continue to have the largest Internet use rate in 2000 with 42% of households having Internet access, rural areas have narrowed the digital divide (NTIA 2000). Nearly 40 percent (39%) of rural households and 38% of households in central cities have Internet access (*Figure 11*). Of rural households, Black households have historically had the lowest Internet connection rates but between 1998 and 2000 Black households increased their access rates from 7% to 20%. Rural households at all income levels have seen a growth in their Internet access indicating that rural households approximate the access rates of households across the nation.

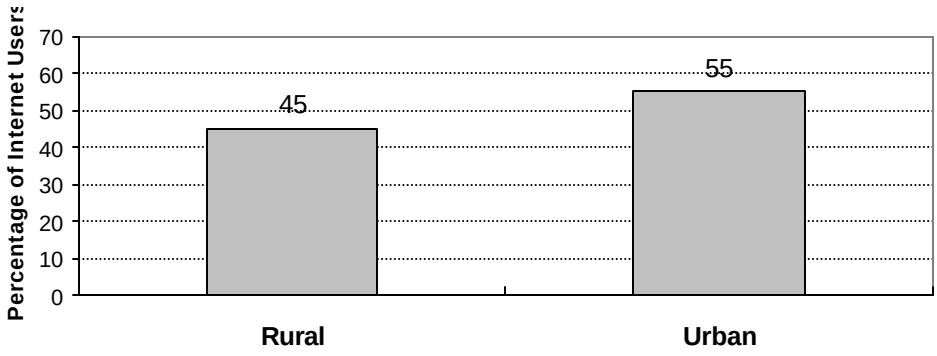
Figure 11: Percent of U.S. Households with Internet Access by U.S., Rural, Urban and Central Cities, 1998 and 2000



Source: U.S. Department of Commerce (NTIA 2000)

Canada: Rural Canadians are clearly closing the digital divide with their urban counterparts. Between 1998 and 1999 rural Canadians had a 46% growth rate compared to a 35% growth rate for urban Canadians (Reddick 2000). Over half (54%) of the individuals residing in urban and 41% of rural Canadians had used the Internet in the three months preceding the study. The General Social Survey (Statistics Canada 2001) conducted between January and December 2000 on 25,090 people found similar results with 55% of urban individuals and 45% of rural individuals using the Internet in the past 12 months (*Figure 12*). When considering whether people accessed the Internet from home, the figures show smaller access rates; 44% of urban users aged 15 or over and 35% of rural users had used an Internet connection at home in the past 12 months.

Figure 12: Percentage of Internet Users
by Urban/Rural, Canada, 2000
(Age 15 and Over)



Source: General Social Survey, Cycle 14 (Statistics Canada 2000).

Regional Characteristics - Canada

Provinces: Between 1999 and 2000 Canada's overall Internet use rate grew from 42% (Dickinson & Ellison 2000) to over half (53%) of the population having Internet access (Dryburgh 2001). The following information is based upon two national surveys, the Home Internet Use Survey (HIUS) conducted in 1999 on 36,241 Canadian households and the General Social Survey (GSS) completed between January and December 2000 which had a sample size of 25,090 Canadian respondents.

For four years in a row Alberta and British Columbia have remained the most connected provinces with Internet use rates of 35% and 34% in 1997, 45% and 42% in 1998, 51% and 48% in 1999, and 60% and 61% in 2000, respectively (Dickinson & Ellison 2000; Dryburgh 2001). Among the other provinces, Internet use in 2000 was substantially lower in Newfoundland and New Brunswick (44%), Québec and Manitoba (46%), and Prince Edward Island (48%), as indicated in Table 1 (Dryburgh 2001). Both the Yukon and Northwest Territories were excluded from the questionnaires on Internet use.

Although Québec had the lowest Internet penetration rate of all the provinces in 1997 (20%), 1998 (26%) and 1999 (33%) (Dickinson & Ellison 2000), it rivaled British Columbia for the largest percentage increase (both 13 percentage points) in 2000. As a result Québec no longer has the lowest penetration rate in 2000 as Newfoundland trailed behind at 44%.

Table 1
Internet Use Rates by Province, Canada

Province	1997*	1998*	1999*	2000
Canada	**29%**	**36%**	**42%**	**53%**
Newfoundland	27	29	35	44
Prince Edward Island	26	35	41	48
Nova Scotia	32	38	41	52
New Brunswick	29	31	38	45
Quebec	20	26	33	46
Ontario	33	39	45	55
Manitoba	29	34	38	46
Saskatchewan	27	34	40	50
Alberta	35	45	51	60
British Columbia	34	42	48	61

* Source: Home Internet Use Survey (Dickinson & Ellison 2000)
Source: General Social Survey (Dryburgh 2001)

Metropolitan Areas: Almost two-thirds (63%) of all households live in Census Metropolitan Areas (CMAs), of which more than half (56%) of these households live in the largest fifteen CMAs (Household Internet Use Survey, Dickinson & Ellison 2000). Households (36%) residing in other areas during 1999 had lower Internet use rates compared with households in these fifteen CMAs that had a Internet use rate of 46%. Thus, households in metropolitan areas (CMA) are more likely to be connected than those in smaller cities or in rural areas.

Within the top 15 CMAs there is considerable variability in Internet use rates, with Ottawa (63%) and Calgary (67%) on the high end and Winnipeg (49%) and Quebec City (47%) on the low end in 2000 (Dryburgh 2001). Table 2 shows that all of the largest 15 CMAs experienced an increase in Internet use between 1998 and 2000. For the most part Internet use rates at work fell and school use rates rose. The HIUS report concludes that the driving force behind the increase in overall penetration rates was the increase in home use (Dickinson & Ellison 2000).

Table 2
Internet Use Rates by Census Metropolitan Areas, Canada

Census Metropolitan Areas	1997*	1998*	1999*	2000
Canada	**29%**	**36%**	**42%**	**53%**
Halifax	39	50	52	65
Quebec City	24	29	34	47
Montreal	24	32	39	51
Ottawa-Hull	--	--	57	63
Toronto	38	42	49	56
Hamilton	30	41	43	56
Winnipeg	33	38	42	49
Calgary	41	53	60	67
Edmonton	36	44	49	60
Vancouver	36	46	50	63
Victoria	40	49	56	64

* Source: Home Internet Use Survey (Dickinson & Ellison 2000)
Source: General Social Survey (Dryburgh 2001)

Location of Access

Differences in Internet use depend upon whether one has discretionary access to the Internet outside of the domestic sphere or if one spends leisure time online at home. The use of the Internet at home implies that an individual typically has more opportunity to use the technology and for longer periods of time than if he or she uses it only at a school, library, or community center (NTIA 2000). Smolenski asserts that unequal opportunities are created for those who use public Internet access sites compared to those who have access at work or at home, precisely because the latter group have had the Internet become integrated into their daily lives (Smolenski 2000). Evidence from Canadian home-use households show that these households are more likely to use the Internet for a diversity of online services, use the Internet more often, and for a longer period than households who access the Internet from other locations (Dickinson and Ellison 2000).

U.S.: In August 2000, one quarter of the U.S. population accessed the Internet only from home which was an increase from 16% in December 1998 (NTIA 2000). Those users who used the Internet from both home and outside the home grew from 7% to 11%, whereas the access rate of those who solely used the Internet from outside the home declined from 11% to 9%. Possible places of access outside the home included work (12%), school (4%), "someone else's computer" (3%), public libraries (2%) and "other school" (2%). Evidence indicates that demographic groups access the Internet from different locations. Of the African-American respondents, 10% used the Internet only from locations outside their home whereas 9% of Internet users nationwide used the Internet only from outside their homes (NTIA 2000).

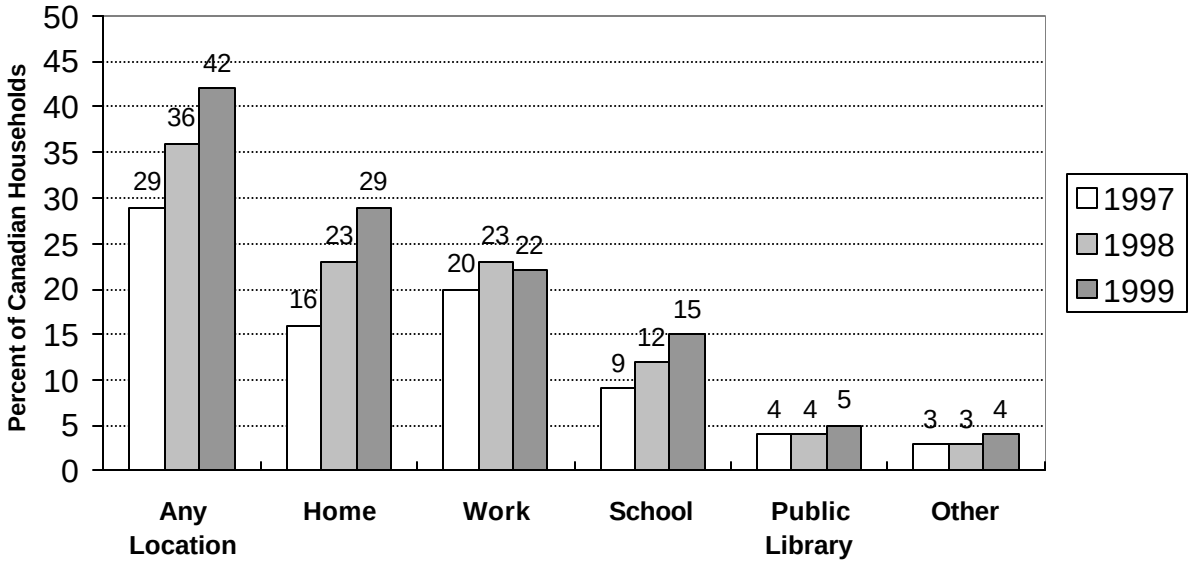
Access to the Internet at work increased with household income. For example, only 2% of individuals whose household income in August 2000 were less than $15,000 reported accessing the Internet at work. A steady increase in household income saw higher online work rates. Four percent of individuals with household incomes between $15,000 and $24,999, 8% individuals with household incomes between $25,000 to $34,999, 17% of individuals with households income between $35,000 to $74,000 and 30% of individuals with households incomes greater than $75,000 reported accessing the Internet from work.

At the same time however, recent trends indicate that blue-collar workers are adopting home Internet access faster than any other occupational group. According to Neilsen/NetRatings, the home Internet access rates for labourers and factory operators have grown 52% with 9.5 million blue-collar workers accessing the Web in March 2001 (Pastore 2001e). The second fastest growing group, homemakers, rose 49% and accounted for 2.5 million Americans. Both Internet users in the service field (2.9 million individuals) and workers in sales (5.6 million individuals) saw a 37% rise in their Internet access rates. Rounding out the top five occupational groups to access the Internet at home were workers in the clerical and administrative fields who rose 31% and accounted for 5.5 million Americans.

Canada: Canadian households were far more likely to have Internet access at home than their European counterparts. Findings from a 1999 study that surveyed 345 Canadian households show that 43% of these households accessed the Internet at home compared to U.S. households (43%) and European households (17%) (PricewaterhouseCoopers 2000). However, the report also shows that Canadian households spent an average of 4 hours online a week, one hour less than the American respondents. The *Plugging In* study, completed by 36,241 Canadian households in 1999, indicates that more than two-thirds (67%) of home-use households spent at least ten hours per month accessing the Internet from home, while almost half (47%) spent at least twenty four hours (Dickinson and Ellison 2000).

Strong increase in home use amongst Canadians accounts for the overall rise in connectedness. As indicated in *Figure 13* home use of the Internet rose substantially from 16% to 29% between 1997 and 1999 (Dickinson and Ellison 2000). Less significant growth is shown for access from school (9% in 1997 and 15% in 1999), from a public library (4% in 1997 and 5% in 1999), and from 'other' locations (3% in 1997 and 4% in 1999). Internet use rates from work rose between 1997 (20%) and 1998 (23%) but dropped in 1999 (22%) so that slightly more than one in five households accessed the Internet from work.

Figure 13: Internet Use Rates by Location of Use, Canada



Source: Household Internet Use Survey (Dickinson & Ellison 2000)

Summary of Current State of Knowledge

Internet Experience: Newcomers to the Internet spend less time online, engage in fewer online activities, and are less likely to buy products via the Web than those users who have more experience using the Internet.

Content Related Barriers: Primary barriers to skillfully using Internet technology are related to content issues, such as lack of local information, language barriers, lack of cultural diversity, and literacy barriers.

Underserved connected adults are looking for practical information focusing on local community, information at a basic literacy level, content for non-English speakers, and cultural information.

Interest and need barriers also exist when those who do not use the Internet perceive little or no personal or social benefit and value of Internet service. Seniors and women dominate this group of non-users.

Cost, Interest and Need Barriers: Cost remains a barrier for non-user low-income households.

Gender: The gendered digital divide has largely disappeared with respect to access to the Internet. However, the divide continues with respect to the extensiveness and intensiveness of use. Men continue to be moderate to heavy users while women spend less time online.

Age and Life Course: Seniors are less likely to be connected to the Internet than their younger counterparts. The "gray gap" – aging baby boomers and senior citizens – are the least likely life-course group to use the Internet.

Household Size: Larger households are more likely to be "fully connected" and be subscribed to basic Internet service than smaller households.

Household Type: Dual-parent households are twice as likely to have Internet access than single-parent households, either male or female-headed. This fits with our findings (below) that Canadian Internet use is related to individual, rather than to household, characteristics.

Number of Children: Households with children are more likely to own a computer and have Internet access than households without children.

The presence of children in the home does not have similar effects for men and women in two-parent households. Women's Internet use is affected by the number of children in the household, but the presence of children has little influence on men's Internet use.

***Education*:** Higher levels of education correspond with higher levels of Internet use.

Labour Force: Internet use rises with labour force participation. This is especially the case for seniors in the work force who are nearly three times as likely to be Internet users than other seniors who are not employed.

Income: Low income still represents a substantial barrier to Internet access as Internet use remains greatest amongst higher income households.

***Race and Ethnicity*:** In the U.S., slightly more than half of Asian-American and Pacific Islander households use the Internet, while slightly less than half of White households use it. By contrast, only about one-quarter of Hispanic-American and African-American households use the Internet.

Language: In Canada, anglophones are more likely to use the Internet in 2000 than francophones. Francophones report being less satisfied than anglophones in the amount of Internet content in their official language of choice.

***Location and Bandwidth*:** The availability of broadband in urban areas has meant that broadband Internet services have been adopted at higher rates in urban areas compared to rural locations. Satellite Internet technology offers rural and remote communities one possibility for broadband service, albeit a costly alternative. Broadband use also increases with household income.

Rural – Urban: The urban vs. rural digital divide has narrowed, although a slightly higher percentage of urban households continue to use the Internet. The urban-rural gap is greater in Canada than in the United States where it has almost disappeared.

Regional Characteristics: Alberta and British Columbia are the most connected provinces in Canada while Newfoundland, New Brunswick**,** Quebec and Manitoba have the lowest Internet use rates.

Households in census metropolitan areas (CMAs) are more likely to use the Internet than non-CMA households, i.e., those in smaller cities or rural areas.

Location of Use: Home-use Internet users are more likely to use the Internet for a diversity of online services, use the Internet more often, and for longer periods of time than households who access the Internet from other locations.

The Canadian Digital Divide

Data and Methods

Our analysis is drawn from two data sets. The *first data set* is the Household Internet Use Survey conducted by the Special Survey Division of Statistics Canada in November 1999 for Science, Innovation Information Division at Statistics Canada. Its purpose was to measure the internet use of Canadian households. The survey contains valuable information about the frequency and the locations of, and the reasons for using the Internet. We obtained special permission from Statistics Canada to integrate the released data with census tract location appended to each household.

The *second data set* is the 1996 census 2B profile that contains detailed information on *"census tract"* characteristics. The census tract is a proxy for "neighbourhood". A census tract is defined as a geostatistical area within a major metropolitan area. It has an average population of 4,000. The boundaries of a census tract are defined by Statistics Canada (1999) according to a few major principles, including:

(1) They lie along easily recognized physical features, such as a major street division or river.
(2) The minimum population size is 2,500 and the maximum is 8,000.
(3) The social background of residents living in the tract are relatively homogenous.

To accomplish some of our analysis, we merged the two data sets together to understand how neighbourhood characteristics are related to household Internet use. We have also been constrained in our multilevel analysis of the relationship of household and neighbourhood characteristics with Internet use. In this multilevel analysis, we only included households living in the 15 census metropolitan areas; the largest clusterings of population in Canada. This is because Statistics Canada only defines the census tract in census metropolitan areas or census agglomerations, and the census tract information associated with each household in the Household Internet Use Survey only included the 15 largest census metropolitan areas.

Internet use is the major phenomenon that we seek to understand. We used two variables to capture different aspects of Internet use, each of which has substantial implications.

1. ***The Internet use of the household in a typical month,*** based on the question that asks if anyone in the household uses the Internet ***from any location*** in a typical month.

This variable measures the general Internet use of the household. Any household member can use the Internet in different locations, such as school, library, at work, or even an Internet café. This variable indicates the widespread use of the Internet by the Canadian population.

2. Internet use of a household in a typical month <u>at home</u>.

This variable focuses on Internet use at home because having such access to the Internet can be convenient for all household members. They can spend time on the Internet without worrying about the closing time of a building or office. Furthermore, socialization usually takes place within the family. Children learn about computers and Internet knowledge at an early age and home use facilitates the intergenerational transfer of knowledge.

In our analysis, we want to identify how the social characteristics of the household head (the only person about which such information were available), the household characteristics, and the neighbourhood qualities affect Internet use. We include **<u>five variables to capture the social characteristics of the household head,</u>** regretting as we do that if information was not collected about other household members, adult or child.

Gender is coded such that male is 1 and female is 0.

For *marital status*, a married household head is coded as 1. Other types of marital status, such as single, widow, divorced, or separated, are coded as 0.

We also include the *employment status* of the household head. Those who are employed are coded 1, and otherwise are 0.

Age is categorized into four groups: 34 or under, 35-54, 55-64, 65 and above.

The *educational level* of the household head is represented by three categories: some high school or less, high school or some college, and at least a university degree.

<u>Household characteristics include five variables:</u>

We included three dummy variables to indicate whether any household member is:

Under 18 years old

Enrolled in school

Whether the household's residential location is *urban*.

Dummy variables code as “0" if the phenomenon is not present and “1" if the phenomenon is present. For example, a household with one or more people under the age of 18 is coded as “0".

We also included a set of variables to measure the size of the household, categorized as 1 person only, 2 persons, and 3 or more persons.

We categorized household income into three groups: below $40,000, $40,000-$59,999, and $60,000 and above.

Neighbourhood characteristics are represented by six variables:

Average household income in the neighbourhood.

Proportion of immigrants who arrived in 1996 or later.

Proportion of individuals not knowing English or French.

Proportion of immigrants.

Proportion of individuals who have *completed university education.*

Proportion of *visible minorities*.

These selected variables are not intended to be exhaustive. Given the limited information about the immigration and race of the households in the Household Internet Use Survey, and given that some studies in the U.S. have documented differential rates of Internet use among immigrant and racial groups, these neighbourhood variables help to study the effect of immigration at the neighbourhood level.

Our analysis of the Canadian data proceeds in three parts.

1. We provide descriptive statistics of Internet use in the 15 major census metropolitan areas and the household characteristics of those who use the Internet.

2. We analyze how the background of the household head, household characteristics, and neighbourhood qualities are related to Internet use.

3. We provide a simulation set that is based on the results of the second analysis and the published information about each city to predict Internet use.

Descriptive Statistics

Spatial Variation in Household Internet Use: Table 3 reports the percentage of Internet use in a typical month among households in the 15 largest census metropolitan areas. The findings provide several pertinent results.

1. There are considerable variations in household Internet use among these cities. The rates range from low Internet use rates in Calgary (59%), London (59%) and Montreal (61%) to high rates in Hamilton (77%) and Toronto (73%).

2. Variations also are found within regions. For example, the highest percentage of Internet use in Ontario metropolitan areas is 77% in Hamilton and the lowest is 61% in Windsor. A large variation also can be found among metropolitan areas in the Western provinces. The difference between the highest and lowest percentage of Internet use among metropolitan areas in the west is about 12%.

3. High percentages of household Internet use are not necessarily associated with large cities. For example, the metropolitan areas with the highest percentage of Internet use are Hamilton (77%), Toronto (73%), and Victoria (71%). The rates in the three largest cities in Canada are 73% in Toronto, 61% in Montreal, and 67% in Vancouver.

***Social Characteristics of Household Heads*:** Table 4 shows the percentage of Internet use in a typical month in households with different social characteristics.

Consistent with other studies, *households with household heads who have higher levels of education have higher levels of Internet use.* For example, in households whose heads have less than high school education, only 62% use the Internet in a typical month, compared to 69% of those households whose heads have completed university.

The results also show that households with heads between the *age of 35 and 64* are more likely to use the Internet in a typical month. This suggests that these households are more likely to have school-age children which requires the use of computers.

Households with *employed household heads* have almost double the rate of Internet use in comparison to households with unemployed heads. This finding reflects the limited resources of unemployed households or market selection results, i.e. those who have limited use of computers or Internet are less likely to be employed.

One sizeable difference is that households with *male household heads* have about twice the percentage of Internet use as households with female heads.

The limited economic resources of female headed households coupled with gender differences in fostering Internet use in the household may contribute to this difference.

***Social Characteristics of Households*:** Table 4 also displays the Internet use in a typical month of households with different characteristics.

Surprisingly*, households with the lowest of income (i.e., below $30,000) have a higher percentage of Internet use than households in higher income categories.* This probably relates to the fact that most of these household heads are single, younger in age, and have been in the labor market for a short period of time and have recently been students. Thus, many members of these households have characteristics of people who are relatively comfortable using the Internet. Although currently low-income, many may not be permanently low-income.

Households of *married couples* have a higher percentage of Internet use than common-law households. The difference reflects the fact that households of married couples are more likely to have children who are more likely to use the Internet. This interpretation is further reinforced by the higher percentage of Internet use for households with college or university students, with children under 18, and a household size of more than 2 persons.

Households in *urban areas* have a higher percentage of Internet use than those in rural areas.

In summary the data show substantial variations in Internet use according to the social characteristics of household heads and other household characteristics. However, our analysis also suggests that these variations may be caused by the combined effects of individual and household characteristics. To clearly delineate the effects of household head and household characteristics, we present the results of multivariate analysis in the following section. Multivariate analysis helps us to understand the specific characteristics of Internet use while controlling for all possible factors.

Multivariate Analysis of Overall Internet Use

In this section, we present a set of analyses that compare the effects on Internet use of the social characteristics of (a) household heads and (b) the social characteristics of the households themselves. We look first at overall Internet use, wherever it occurs – in the household, at work, at school, in public facilities, etc.

We use probit and logistic regression analyses because they are well suited for situations like this one where the dependent variables are binary variables (i.e. the outcome is either "using internet" or "not using internet"). The regression

analyses help us understand the relative importance of the effects of independent variables to the dependent variable. The coefficients associated with the independent variables tell us how each of them is related to the dependent variable.

To understand the results, we need to pay attention to a few things:

1. *We are only interested in coefficients that are statistically significant.* They are the coefficients with asterisks.

2. *We should look at the sign associated with the variable.* A variable with a negative sign indicates that the variable is negatively related to the dependent variable. For example, if income is negatively associated with the dependent variable, the internet use, this result means that households with higher income are less likely to use internet.

3. *We should compare the relative strength of the coefficients associated with independent variables.* A larger value suggests that the variable is more important in predicting the dependent variable. For example, we found that the coefficient of income is larger than that of age, meaning that the effect of income on internet use is stronger than the effect of age.

Characteristics of Household Heads and Households: Table 5 reports the probit regression analysis of the demographic background of household heads and household characteristics on Internet use in a typical month.

The first three columns show the results for models of Internet use in households in both urban and rural areas.

Column 1: A *full model* that includes *both household head and household characteristics.*

Column 2: A partial model that only contains *household head* characteristics.

Column 3: A partial model that only contains *household characteristics*.

Taken together, the three models provide valuable information about patterns of household Internet use. In our discussion for this report, *we focus on the full model.* The results of the other two models are reported for reference.

Both the social characteristics of household heads and the characteristics of the households they head are related to Internet use.

Multivariate analysis shows that even after other variables are controlled, *households with heads who are male, employed, age 34 or under, and with at least high school education are more likely to use the Internet.* Among all these

characteristics, *age and education play the more important role* in determining Internet use.

Looking at households – and not just household heads – *households without children under 18, with a larger family size, with members who are students, and higher income levels are more likely to use the Internet in a typical month.* The seemingly contradictory findings of households without children under 18 and with members who are in university or college imply that households with children who are in university and above 18 years old are more likely to use Internet than households with children in elementary or high school who are still under 18.

Urban-Rural: Households in urban areas are more likely to use the Internet than rural households. It is therefore important to delineate the urban and rural differences in the effects of the social characteristics of household heads and household characteristics on Internet use.

Results in column 4 of Table 5 show the model of household Internet use in urban areas, while column 7 gives the results for rural households. There are considerable *similarities* in the way that some social characteristics of households head affect Internet use in urban and rural households. Households with heads who are *employed, younger, and have a higher level of education* are more likely to use the Internet *regardless of residential location.*

There are some *differences*, though. *Gender and marital status are related to urban and rural households in unique ways:*

1. In *urban households*, the likelihood of Internet use is *higher for those with household heads who are male.* This likelihood does not relate to marital status in urban households.

2. In *rural households*, those with *married household heads* are more likely to use the Internet, but the gender of the head has no effect.

When we look at the characteristics of the households themselves – as distinct from the heads – we find that the likelihood of Internet use for urban and rural households is related to all of the household characteristics we analyze. Both the *presence of children under 18 and the presence of students* in the household are related to Internet use in urban and rural households in similar ways. Although the presence of children and the presence of students are correlated, they are not identical, and our multivariate analysis shows that both are related to Internet use. The data show that households are more likely to use the Internet when they *do not contain children under 18 but they do contain students*.

At the household level of analysis, there is one reversal of effect between urban and rural households. Urban households with more than 3 persons and the highest level of income are less likely to use the Internet, while rural households with the same characteristics are more likely to do so. This suggests that urban households larger in size with higher incomes may have more alternatives for social activities other than Internet use.

We go one step further to understand the patterns of Internet use in urban areas by studying the effect of neighbourhoods (as indicated by census tracts). Table 9 shows how the social characteristics of household heads, household characteristics, and neighbourhood characteristics affect Internet use. Even when statistically controlling for the effects of neighbourhood characteristics, the results show that the social characteristics of *both* household heads and household characteristics significantly affect Internet use.

In addition, neighbourhood characteristics play an important role in determining household Internet use in urban areas. Both the *proportion of recent immigrants* who arrived in the country in 1996 or after and the *proportion of residents with university degrees* are strongly related to Internet use. Neighbourhoods with higher proportions of recent immigrants obviously contain higher proportions of households and household heads who are recent immigrants. Unfortunately, the data set does not include information about the immigration status on the household heads and households, so we cannot evaluate this supposition more precisely with these data, nor can we tell if the country from which people immigrated makes a difference.

In summary, the results for overall Internet use – not only within the home – show that most social characteristics of household heads and household characteristics affect the Internet use of urban and rural households in similar fashion. The results also show that the likelihood of Internet use among urban households may be related to various neighbourhood characteristics. However, there is no compelling evidence of a double digital divide: neighbourhood characteristics affecting Internet use over and above the effects of households and household heads.

Multivariate Analysis of Internet Use in the Household

To further understand the patterns of Internet use, we focus on Internet use at home (Table 6). It is here that the effects of household and neighbourhood characteristics should be most evident. The set of analyses in this section is similar to the previous tables.

Analyses that includes both urban and rural households shows that *the social characteristics of household heads are related to Internet use at home whereas most household characteristics are not.* Households with household heads who are *male, married, employed, younger, and with less education* are

more likely to use the Internet at home. The observation that men are less likely to use the Internet at home suggests that men are more likely to use the Internet only at work or school than at home. The finding that household heads who are older are less likely to use the Internet at home suggests that they may have access to the Internet at work but that they do not use it at home as much as younger household heads.

Among household characteristics, a household that is *small and does not include students* is more likely to use the Internet at home. This finding suggests that the need to support a larger family with members in school, may limit their financial resources available to purchase computers for home. Thus high student use is disproportionately use at school or work, mitigating the mentoring/spillover effect that high student use might have on the use of the Internet by other household members.

Urban-Rural: *Rural households* are more likely to use the Internet at home. Members of urban households can access Internet at different times and places, which in turn reduces their Internet use at home. However, home may be the most convenient place for rural households to access the Internet since resources in rural areas are dispersed and not many places have the Internet access. This relatively high use of the Internet at home in rural areas is for the data being analyzed here that was collected in 1999. Yet connectivity and the Internet are changing rapidly. We believe that data collected in 2001 might well show *lower* home Internet use in rural areas because it is urban areas that are disproportionately receiving higher-speed broadband connections, both cable (e.g., *@home)* and telephone based ADSL (e.g., *High Speed Sympatico*™). In the future, higher-speed wireless communication may be cost effective communication media for low-density rural areas that are far from major metropolitan areas.

Our separate analyses for urban and rural households further confirms that the social characteristics of individuals (household heads) play a more important role in determining Internet use than do the social characteristics of households. For urban and rural households, most of the social characteristics of household heads are significantly related to Internet use. However, most household characteristics, even household income, are not.

Table 8 shows the results of Internet use at home in *urban areas.* It takes into account the social characteristics of household heads, households, and neighbourhoods. Most social characteristics for home Internet use are similar to those of overall Internet use.

However, all household characteristics, except for the presence of students, become insignificant once neighbourhood characteristics are taken into consideration. In other words, most of the significant effects of household characteristics on Internet use at home in the previous analysis are spurious,

once they are placed in the context of a larger set of variables. Among all neighbourhood characteristics, the proportion of immigrants is strongly related to Internet use at home. These results, similar to the previous analysis, suggest a possible effect of recent immigration on the Internet use at home.

In short, the results show that the likelihood of Internet use at home is affected by the social characteristics of household heads and neighbourhood characteristics, especially the proportion of immigrants in the neighbourhood. Almost no household characteristics relate to the Internet use at home once neighbourhood characteristics are taken into consideration.

To summarize, our research shows that the likelihood of Internet use at home is affected by two sets of factors:

1. ***Social characteristics of household heads.*** Gender, marital status, employment, age between 35 and 45, and educational level all are related to Internet use at home. All of these characteristics are about equally important except that age 35-45 is less important. In other words, socioeconomic status, gender and marital status have substantial relationships to Internet use.

2. ***Neighbourhood characteristics***, especially the proportion of immigrants in a census tract. However, other manifestations of the double digital divide do not appear, such as variables measuring the socioeconomic or life-course characteristics of census tracts.

Just as important, the likelihood of Internet use at home is ***not*** affected by a third set of factors:

3. Virtually ***no household characteristics*** are related to an individual's Internet use at home once neighbourhood characteristics are taken into account.

In other words, in addition to improving the social and demographic characteristics of household heads, implementing specific programs targeting neighbourhoods with higher proportion of immigrants may help facilitate Internet use at home.

Three cautions are appropriate:

1. The immigration variables at the neighbourhood level (as supplied by Statistics Canada) are extraordinarily heterogeneous, encompassing immigrants from developed countries with a high rate of literacy and computer skill as well as immigrants from less developed countries. Effective program development calls for analysis with data that more specifically identify which neighbourhoods with what types of immigrants have low and high rates of Internet use at home.

2. The individual level data provided by Statistics Canada are confined to information about household heads. They should be used with greater caution for developing policy with regard to the Internet use of other adult members of the household.

3. Statistics Canada measurements of Internet use and neighbourhood characteristics are quite basic. Moreover, they do not provide data for those not heads of household. This suggests that further research is needed to understand the double digital divide.

Types of Internet Use

To this point, we have analyzed only the extent to which people use the Internet, overall and at home. Yet as noted in the introduction to this report, analysis of Internet use should take into account the kinds of activities people do online. Hence we have studied various he types of activities for which the Internet is used at home (Table 7). We analyze 13 types of activities, representing diverse activities from email to banking. By studying these activities, we are able to obtain a relatively comprehensive picture of the Internet use of these households.

Our results show diverse and different effects of various factors on types of Internet use. In general, the social characteristics of household heads are more closely related to Internet use than are the characteristics of households or neighbourhoods. Although general patterns of Internet use hold, there are some interesting variations in the kinds of households and household heads that are more or less likely to use different aspects of the Internet:

***Email*:**

Households with heads between the age of 55 and 64 with some high school or less education are more likely to use email at home.

***Banking*:**

Households with heads who are female, older than age 34, with some high school or less, and a household income between $39,999-59,999 are more likely to use Internet banking at home.

***Buying Goods*:**

Households with heads who are female, not married, 34 years old or younger, without university education, with household income between $39,999 and 59,999, living in neighbourhoods with higher proportion of recent immigrants who arrived in 1996 or later, lower proportions of immigrant populations, and higher proportions of visible minorities are more likely to buy goods at home through the Internet.

Health Information:

Households with heads who are male, not married, age 65 or above, with education of some high school or less, a household size not more than 2 persons, with students and in a neighbourhood with a high proportion of immigrants who arrived in 1996 or later are more likely to obtain health information at home through the Internet. This suggests that policies to encourage senior citizens to use the Internet emphasize its utility for obtaining health information from governments.

Education:

Households with heads who are married, with children under 18, smaller household size, and living in neighbourhoods with higher average income and higher proportions of immigrants are more likely to obtain information about education through the Internet at home. This suggests that policies to encourage immigrants and families with children emphasize the use of the Internet for educational and learning purposes.

***Government Information*:**

Households with heads who are employed, age 65 or above, and some high school or less are more likely to obtain government information through the Internet at home. This suggests that policies to encourage senior citizens to use the Internet emphasize its utility for obtaining information and service from governments.

***Other Information*:**

Households with heads who are female, married, age 65 or above, and some high school or less, living in neighbourhoods with lower proportions of immigrants, higher proportions of individuals who have completed university education, and higher proportions of visible minorities are more likely to obtain other information through the Internet at home.

***Browsing*:**

Households with heads who are married, older with a smaller household size, in neighbourhoods with lower average income, lower proportions of recent immigrants who arrived in 1996 or later, and higher proportions of individuals who completed university education are more likely to browse the Internet at home.

***Games*:**

Households with heads who are married, between ages 55 and 64, with some high school or less, with children under 18, smaller household size, in neighbourhoods with higher proportions of individuals who have completed university education are more likely to play game through the Internet at home.

***Chat*:**

Households with heads who are married, age 55 or older, with higher educational levels, with children under 18 years old, smaller household size, with students, in neighbourhoods with higher proportions of individuals who completed university education are more likely to chat on line.

***Music*:**

Households with heads who are female, married, age 35 or older, with university degree, children under 18, larger household size, with children, living in neighbourhoods with lower proportions of recent immigrants who arrived in 1996 or later are more likely to use Internet for music related activities. This documents the widely discussed affinity of children – and households with children – for music downloading services (such as *Napster).*

***Radio*:**

Households with heads who are female, married, age 65 or older, with no students, are more likely to listen to the radio through the Internet. As the Internet develops specialized radio tastes catering to communities of interest, it may well appeal to historically underserved groups, such as senior citizens.

***Other Types of Web Sites*:**

Households with heads who are female, age 35 or older, with some high school or less, lower household income, in neighbourhoods with higher income, higher proportions of individuals not knowing English or French, lower proportions of immigrants, and higher proportions of visible minorities are more likely to visit other types of web sites at home.

Simulations

In this section, we report about a series of simulations that we ran in order to estimate the probability of Internet use in various metropolitan areas (Table 10). The simulation is important because it shows the probability of Internet use controlling for some factors, while allowing some factors to vary. It shows the relative importance of various factors on Internet use in different metropolitan areas.

In this set of simulations, we use the set of coefficients reported in Table 8 to estimate the probability of Internet use in different metropolitan areas. To make the simulations feasible, we set the simulation to represent the more likely characteristics of household heads: that the household heads are male, married, employed, with the presence of children under 18, and members who are students. Other factors, including age and education level of household head, household size, household income, and all neighbourhood characteristics vary according to the average of the metropolitan area. In other words, *the simulations*

show the effects of these factors, most of which can be improved by local governments, on the probability of Internet use.

The simulation results suggest that the probability of internet use is lowest in Toronto and highest in Vancouver. The probability between the two metropolitan areas is .09. In other words, the probability of internet use in an average household in Toronto is about one-third lower than in Vancouver. Based on the predicted probability of internet use, the difference is related to the difference in age and education levels of the household heads, the household size, household income, and neighborhood characteristics in the two metropolitan areas (see Table 10).

To narrow such a gap, our analysis suggests that internet use programs should target neighborhoods with higher concentration of immigrants. This is an important area where the government can directly make a difference in facilitating internet use at home. By contrast, government's tend to have less immediate influence over other factors that can affect the use of Internet, such as educational achievement and household income.

Table 3
Percentage of Internet Users in Households, 15 Largest Cities

	Internet Use in a Typical Month	
	No	Yes
Atlantic Provinces		
Halifax	37%	63%
Quebec		
Montreal	39%	61%
Quebec	38%	62%
Ontario		
Hamilton	23%	77%
Kitchener-Waterloo	33%	67%
London	41%	59%
Ottawa	35%	65%
St. Catherines - Niagara	35%	65%
Toronto	27%	73%
Windsor	39%	61%
Western Provinces		
Calgary	41%	59%
Edmonton	37%	63%
Vancouver	33%	67%
Victoria	29%	71%
Winnipeg	31%	69%

Table 4

Percent Using Internet by Household Social Characteristics

	Internet Use in a Typical Month	
	No	**Yes**
Household Head's Characteristics		
Education		
Less than high school	38%	62%
High school or some college	35%	65%
University Degree	31%	69%
Age		
Less than 35	39%	61%
35-54	33%	67%
55-64	32%	68%
65 and above	36%	64%
Employed	35%	65%
Male	34%	66%
Household Characteristics		
Income		
Below $30,000	28%	72%
$30,000-$59,999	35%	65%
$60,000 and above	33%	67%
Marital Status		
Married	34%	66%
Common-Law	40%	60%
Other	33%	67%
Presence of College/University Student	26%	74%
Family with Children Under 18	33%	67%
Household Size		
1 person	37%	63%
2 persons	37%	63%
More than 2 persons	32%	68%
Urban	34%	66%
N	**3176**	**6093**

Table 5
Coefficients from Probit Regressions Predicting Frequency of Internet Use in a Typical Month

	All			Urban			Rural		
	All	**Head**	**House**	**All**	**Head**	**House**	**All**	**Head**	**House**
Intercept	-2.027***	-0.195***	-1.911***	-1.964***	-0.140**	-1.924***	-2.157***	-0.327**	-1.555***
Household Head's Characteristics									
Male	0.072**	-0.049***		0.108***	0.007		-0.087	-0.235***	
Married	0.010	0.435***		-0.018	0.415***		0.112**	0.563***	
Employed	0.313***	0.293***		0.347***	0.309***		0.238***	0.255***	
Age									
34 and under (o.c.)									
35-54	-0.032*	-0.033*		-0.080***	-0.084***		0.155***	0.154***	
55-64	-0.359***	-0.554***		-0.390***	-0.565***		-0.206***	-0.478***	
65 and above	-0.818***	-1.117***		-0.845***	-1.150***		-0.655***	-0.991***	
Education									
Some High School or Less (o.c.)									
High School or Some College	0.584***	0.617***		0.575***	0.597***		0.601***	0.606***	
University Degree	1.317***	1.358***		1.304***	1.320***		1.351***	1.340***	
Household Characteristics									
Any Member Under 18	-0.091***		-0.424***	-0.032		-0.354***	-2.157***		-0.614***
Household Size									
1 Person (o.c.)									
2 Persons	0.387***		0.357***	0.397***		0.360***	0.384***		0.379***
3 or more Persons	0.641***		0.642***	0.660***		0.663***	0.597***		0.608***
Presence of Student	0.701***		0.906***	0.733***		0.944***	0.550***		0.739***
Income									
Below $39,999 (o.c.)									
$39,999-59,999	-0.052**		-0.006	0.379***		-0.046**	0.028		0.093**
$60,000-99,999	0.403***		0.692***	-0.085***		0.663***	0.482***		0.789***
Urban	0.145***		0.287***						
N	**35523**	**35523**	**35867**	**26278**	**26278**	**26562**	**9245**	**9245**	**9305**

***p<.001 **p<.05 *p<.10 o.c. = omitted category for dummy variable comparison

Table 6
Coefficients from Logistic Regressions Predicting Frequency of Internet Use At Home in a Typical Month

	All			Urban			Rural		
	All	Head	House	All	Head	House	All	Head	House
Intercept	-0.072	-0.398***	-0.317**	-0.259	-0.557***	-0.435**	0.407	0.360	-0.355
Household Head's Characteristics									
Male	-0.393***	-0.320***		-0.339**	-0.270**		-0.738**	-0.644**	
Married	0.320***	0.347***		0.333***	0.370***		0.265*	0.260*	
Employed	0.403***	0.230**		0.380***	0.192**		0.483**	0.318	
Age									
34 and under (o.c.)									
35-54	-0.295***	-0.319***		-0.238***	-0.258***		-0.590***	-0.646***	
55-64	-0.380***	-0.290***		-0.257**	-0.184**		-0.932***	-0.774***	
65 and above	-0.150	0.017		-0.011	0.160		-0.829**	-0.637**	
Education									
Some High School or Less (o.c.)									
High School or Some College	-0.170**	-0.178**		-0.128	-0.130		-0.284**	-0.254*	
University Degree	-0.360***	-0.365***		-0.317***	-0.310***		-0.504**	-0.445**	
Household Characteristics									
Any Member Under 18	0.014		-0.049	-0.005		-0.045	0.101		-0.075
Household Size									
1 Person (o.c.)									
2 Persons	-0.118		0.040	-0.150		0.010	0.063		0.220
3 or more Persons	-0.338**		-0.171*	-0.355**		-0.180*	-0.252		-0.078
Presence of Student	-0.419***		-0.415***	-0.428***		-0.434***	-0.311**		-0.321**
Income									
Below $39,999 (o.c.)									
$39,999-59,999	-0.012		0.010	0.026		0.056	-0.134		-0.142
$60,000-99,999	-0.001		-0.010	-0.002		-0.006	-0.023		-0.037
Urban	-0.092*		-0.117**						
N	**9077**	**9077**	**9269**	**7287**	**7287**	**7443**	**1790**	**1790**	**1826**

***p<.001 **p<.05 *p<.10 o.c. = omitted category for dummy variable comparison

Table 7
Results from Logistic Regressions Predicting Types of Internet Use at Home

	Email	Banking	Buy Goods	Health Info	Education	Gov't Info
Intercept	-1.481**	1.936***	2.137***	-0.520*	0.428	0.421
Household Head's Characteristics						
Male	0.395	-0.823***	-0.678***	0.329**	-0.132	-0.170
Married	-0.351	-0.078	0.310**	-0.293**	0.490***	0.006
Employed	-0.271	-0.147	-0.160	0.174	0.024	0.220**
Age						
34 and under (o.c.)						
35-54	0.206	0.385***	0.202*	0.007	-0.112	-0.011
55-64	0.436*	0.712***	0.319*	-0.046	0.141	0.201
65 and above	0.239	0.998***	0.622**	0.069**	0.343	0.414**
Education						
Some High School or Less (o.c.)						
High School or Some College	-0.539**	-0.800***	-0.180	-0.318**	0.012	-0.227*
University Degree	-1.017***	-0.860***	-0.419**	-0.305**	-0.133	-0.538***
Household Characteristics						
Any Member Under 18	-0.311	0.141	-0.114	0.158	0.433***	0.038
Household Size						
1 Person (o.c.)						
2 Persons	0.091	-0.051	-0.054	-0.244*	-0.331*	-0.181
3 or more Persons	0.423	0.273	0.079	-0.072	-0.890***	0.158
Presence of Student	-0.274	0.140	0.078	0.316***	-1.566***	-0.047
Income						
Below $39,999 (o.c.)						
$39,999-59,999	0.233	0.209**	0.307**	0.111	0.093	0.097
$60,000-99,999	0.139	0.001	0.016	-0.104	0.136	0.001
Tract Characteristics						
Average Income (in '000s)	-0.004	-0.008	0.005	0.004	0.018**	0.003
Proportion immigrated since 1996	0.311	-0.489	0.865*	0.197**	-0.670	-0.500
Proportion with no English or French	2.908	-2.537	0.703	6.211	-1.753	-0.919
Proportion Immigrant	-1.422	0.316	-1.739**	-0.125	1.501**	-0.667
Proportion with University Degree	-0.230	0.292	-0.744	-0.280	-0.722	0.111
Proportion Visible Minority	0.081	0.392	1.114*	0.237	-0.512	0.611
N	**3708**	**3708**	**3708**	**3708**	**3708**	**3708**

*****p<.001 **p<.05 *p<.10** o.c. = omitted category for dummy variable comparison

Table 7 - continued

	Other Info	Browse	Games	Chat	Music	Radio	Other Sites
Intercept	-1.248**	-0.966**	-0.551*	0.873**	0.948**	1.721***	0.414
Household Head's Characteristics							
Male	-0.508**	-0.259	-0.062	0.013	-0.448***	-0.441**	-0.277**
Married	0.335*	0.412**	0.337**	0.753***	0.736***	0.309**	0.160
Employed	0.115	-0.063	0.174	0.184	0.133	0.052	-0.105
Age							
34 and under (o.c.)							
35-54	0.052	-0.259**	-0.053	-0.059	0.169*	-0.007	0.190**
55-64	0.207	0.712***	0.274**	0.346**	0.446**	0.210	0.303**
65 and above	0.809***	0.741**	0.195	0.724**	1.048***	0.406*	0.602**
Education							
Some High School or Less (o.c.)							
High School or Some College	-0.382**	0.030	0.339**	0.331**	0.080	0.056	-0.314**
University Degree	-0.780***	0.271	0.755***	0.557***	0.280*	0.087	-0.440**
Household Characteristics							
Any Member Under 18	0.134	-0.151	0.458***	0.260**	0.269**	-0.001	0.102
Household Size							
1 Person (o.c.)							
2 Persons	-0.304	-0.526**	-0.443**	-0.580***	-0.587***	-0.065	0.081
3 or more Persons	-0.079	-0.703***	-0.804***	-1.059***	0.926***	-0.317	0.137
Presence of Student	-0.177	0.097	-0.017	-0.184*	-0.468***	-0.183*	0.027
Income							
Below $39,999 (o.c.)							
$39,999-59,999	0.044	-0.044	-0.050	-0.159	-0.010	-0.133	0.272**
$60,000-99,999	-0.103	-0.156	-0.088	-0.139	0.034	0.094	0.169*
Tract Characteristics							
Average Income (in '000s)	-0.015	-0.020**	-0.007	-0.010	0.002	0.009	0.013*
Proportion immigrated since 1996	-0.321	-0.905*	-0.173	-0.844*	-0.734*	-0.073	-0.168
Proportion with no English or Frenc	2.658	-3.897	-1.202	-0.582	1.343	0.182	4.465*
Proportion Immigrant	-1.265*	-1.347	0.254	-0.806	0.227	-0.765	-2.174**
Proportion with University Degree	1.807**	2.996***	1.076**	1.599**	0.053	0.092	0.046
Proportion Visible Minority	1.508**	0.659	-0.180	-0.196	-0.751	-0.242	1.513**
N	**3708**	**3708**	**3708**	**3708**	**3708**	**3708**	**3708**

*****p<.001 **p<.05 *p<.10** o.c. = omitted category for dummy variable comparison

Table 8
Results from Logistic Regressions Predicting Internet Use At Home with Tract Variables

	All	Head	House
Intercept	-0.324	-0.265	-0.427
Household Head's Characteristics			
Male	-0.386**	-0.319**	
Married	0.375**	0.221**	
Employed	0.496***	0.521***	
Age			
34 and under (o.c.)			
35-54	-0.151*	-0.167*	
55-64	-0.159	-0.091	
65 and above	0.161	0.315*	
Education			
Some High School or Less (o.c.)			
High School or Some College	-0.239*	-0.242*	
University Degree	-0.443**	-0.435**	
Household Characteristics			
Any Member Under 18			0.103
Household Size			
1 Person (o.c.)			
2 Persons	-0.094		0.060
3 or more Persons	-0.159		0.019
Presence of Student	-0.343***		-0.359***
Income			
Below $39,999 (o.c.)			
$39,999-59,999	0.009		0.023
$60,000-99,999	-0.055		-0.057
Tract Characteristics			
Average Income (in '000s)	-0.002	-0.003	0.000
Proportion immigrated since 1996	0.187	0.233	0.170
Proportion with no English or French	3.782	3.733	3.433
Proportion Immigrant	-1.947***	-1.866***	-1.903***
Proportion with University Degree	0.089	0.086	-0.365
Proportion Visible Minority	0.362	0.209	0.404
N	**3708**	**3708**	**3772**

***p<.001 **p<.05 *p<.10 o.c. = omitted category for dummy variable comparison

Table 9
Results from Probit Regressions Predicting Internet Use with Tract Variables (CMAs only)

	All	Head	House
Intercept	-1.372***	0.440***	-1.523***
Household Head's Characteristics			
Male	0.130**	0.051	
Married	-0.024	0.371***	
Employed	0.321***	0.290***	
Age			
34 and under (o.c.)			
35-54	-0.100**	-0.126***	
55-64	-0.451***	-0.574***	
65 and above	-0.951***	-1.220***	
Education			
Some High School or Less (o.c.)			
High School or Some College	0.511***	0.523***	
University Degree	1.104***	1.109***	
Household Characteristics			
Any Member Under 18	0.031		-0.315***
Household Size			
1 Person (o.c.)			
2 Persons	0.390***		0.370***
3 or more Persons	0.645***		0.667***
Presence of Student	0.719***		0.896***
Income			
Below $39,999 (o.c.)			
$39,999-59,999	-0.134***		-0.106***
$60,000-99,999	0.354***		0.572***
Tract Characteristics			
Average Income	-0.002	-0.006**	-0.002
Proportion immigrated since 1996	0.348**	0.464**	0.138
Proportion with no English or French	0.966	0.746	1.182
Proportion Immigrant	0.152	0.245	0.356*
Proportion with University Degree	-1.540***	-1.394***	-2.223***
Proportion Visible Minority	-0.226	-0.560**	-0.338*
N	**11547**	**11547**	**11641**

***p<.001 **p<.05 *p<.10 o.c. = omitted category for dummy variable comparison

Table 10
Predicted and Actual Probabilities of Households Using Internet at Home by Census Metropolitan Areas

	Predicted	1999 data
Montreal	0.31	0.26
Ottawa	0.31	0.44
Toronto	0.27	0.35
Hamilton	0.31	0.32
Winnipeg	0.29	0.28
Calgary	0.31	0.41
Edmonton	0.34	0.34
Vancouver	0.36	0.38

Source (1999 data): Home Internet Use Survey (Dickinson & Ellison 2000)

The American Digital Divide

We include analysis of similar American data to provide a benchmark to compare patterns of Internet use by various groups in Canada. We expect that certain variables will follow certain patterns, for example it is likely that Internet use is higher among people with more income and more education in both countries. However, due to the unique patterns of suburbanization of American cities as well as the fact that American inner cities have more areas of disrepair than their Canadian counterparts there may be some significant differences.

Data and Methods

The Data Set: We obtained data about Internet access from the August 2000 Internet and Computer Use Supplement. This is a supplement to the Current Population Survey, conducted by the U.S. Bureau of the Census, the governmental analogue to Statistics Canada.

The Current Population Survey is a labour force survey conducted monthly with about 48,000 households in the United States. The Internet and Computer Use Supplement contained questions about household access to the Internet as well as about individual access and use of the Internet. By contrast to the Canadian surveying of the household head, the American survey chose one respondent in each household, not necessarily the household head. This respondent, who had to be at least 15 years of age and who had to have knowledge about the Internet was asked to give proxy answers for other members of the household. Hence, there is somewhat greater likelihood that women and relatively young people provide information in the U.S. survey as compared to the Canadian survey.

A total of 134,986 individuals were contacted. Of these, there were a total of 94,984 cases available for analysis. These cases represent adult civilians 15 and over. An additional 312 cases were excluded since these were adults in the armed forces. Finally 26,449 children (under 15) were also excluded.

The Variables: The data set contained many variables. We recoded the original American variable categories to make these variables (and our analysis) comparable with the data on Canadian Internet use.

***Sex*:**

Male and female: Did not require any re-coding.

***Age*:**

We re-coded age (in years) into six categories: 15-20, 21-29, 30-39, 40,49, 50,59 and 60 and over.

***Marital Status*:**

We coded respondents as being in one of three categories: married, never married, or other. The married category was created by combining two categories: married –spouse present and married-spouse absent. The never married category did not need recoding. The "other" category comprises those who are divorced, separated or widowed .

***Education*:**

We constructed a four- category education variable: less than high school, high school graduate, some college and university.

***Labour Force Participation*:**

This variable originally had seven categories: employed-at work, employed-absent, unemployed-on layoff, unemployed-looking, not in labour force-retire, not in labour force-disabled, not in labour force-other. We recoded these the seven categories of this variable into a three-category variable: employed, unemployed and not in the labour force.

***Family Income*:**

To make the income variable comparable to the categories in our Canadian data set we re-coded the original fourteen American income categories into five categories: less than US$30,000, $30,000-49,999, $50,000-59,999, $60,000-74,999 and $75,000 and over.

Race and Ethnicity:

Race/ethnicity consists of five categories recoded from an interaction of a race and an ethnicity variable: Non-Hispanic White, Non-Hispanic Black, Asian, Hispanic and Other. The "Other" category consists of American Indian, Aleut, Eskimo [sic], and Asian and Pacific Islander.

***City Type*:**

We constructed a variable indicating three types of geographic location: central city, suburbs and rural areas. We created this variable measuring the type of city from two variables, one indicating living in the central city of a metropolitan area, and one indicating living outside of a metropolitan area (i.e., rural).

***Year of Immigration*:**

This variable has five categories: born in the United States, immigrated before 1970, immigrated between 1970 and 1979, immigrated between 1980 and 1989, immigrated between 1990 and 2000.

***Internet Use*:**

A two-category variable that we coded 1 as no and 2 as yes. Respondents were asked the following question " Has anyone in this household ever used the Internet from home?". We constructed this variable by taking the total number of

responses from four questions in the survey. This was necessary since people were asked one of these four questions depending on their answers to prior questions determined by a skip pattern.

Weighting to Make a Representative Sample

All variables in the second part of Table 11 are weighted by the variable "PSSWGT". This weighting variable controls for: states; origin sex, age, race and sex. Use of the weighting makes the resulting statistics more accurately reflect U.S. population characteristics. We provide the frequencies for all the variable using and not using the weight variable. The discussion of tables only discusses the weighted table. However the results are similar with or without weighting.

American Internet Use and the Digital Divides

Table 11 presents the frequencies of Internet Use in the United States. Each variable is presented for the overall sample. We then inquire into Internet use in the central city, Internet use in the suburbs and Internet use in rural areas.

Gender: Men are more likely to have used the Internet than women regardless of geographic location. For all types of cities, 51% of men and 48% of women had used the Internet. The rates of Internet use in the central cities and rural areas were lower, though the gender gap remains. In the central city less than half of men and women had used the Internet, 46% of men and 42% of women. The rates of Internet use were somewhat lower in rural areas where only 42% of men and 40% of women had used the Internet. By contrast, the suburbs had the highest rate of Internet use. Almost 57% of men and 54% of women in the suburbs had used the Internet.

Age*:* People aged 60 and over have the lowest rates of Internet use, regardless of geographic location (26%). The highest rates of Internet use are by those in aged 40-49 (59%), followed by those aged 15-20 (57%) and 30-39 (57%) . Anomalously, those in the 21-29 category have slightly lower rates of Internet use (52%): Their rates of Internet use are similar to the rates of those who are in the 50-59 age group(52%). One other anomalous geographical difference is that those in the 15-20 age group in rural areas have higher (53%) rates of Internet use than those in that age group who are in the central city (46%).

Marital Status: In all geographical types (city, rural, suburb), married people have the highest rates of Internet use (55%). Almost 50% of those who are never married have used the Internet. These two categories contrast strongly with those in the "other" category (divorced, separated and widowed): Only 32% of those in this other category have used the Internet. In terms of geographic location there is a similar split between the central city, suburbs and rural areas as there is for gender.

Regardless of marital status, the rates of Internet use in the suburbs are highest, followed by the central city, and then the rural areas. The rates of Internet use among those who are divorced, separated or widowed in rural areas are very low at 23%.

Education*:* Internet use increases markedly with education. In all types of geographical areas, only 28% of those with less than a high school use the Internet. Those who have graduated from high school have a 39% Internet use rate, those with some college have a 58% Internet use rate, and those with a university education have a 72% Internet use rate.

Comparing Internet use by education in the central city, suburbs and rural areas shows that the pattern of higher Internet use in the suburbs exists regardless of the level of education. Suburban residents with less than a high school education have a 34% Internet use rate. With some high school, the suburbanite Internet use rate is 44%, rising to 75% for suburbanites with university degrees.

In the central cities, 50% of those with high school or less use the Internet. While a similar 52% of those urbanites with some college use the Internet. However those with University degrees who reside in the central city have very similar rates to those in the suburbs (71% urban as compared to 75% suburban).

In the rural areas the rates of Internet use (69%) are lower for those with University education than for those with university who live in the central city (71%). However, those with less than high school who live in rural areas have higher Internet use (25%) rate than those who live in the central cities (22%).

Labour Force: Employed people have the highest rates of Internet use (57%), followed by the unemployed (44%). Those who are not in the labour force have the lowest rates of Internet use (35%).

For all types of labour force participation, Internet use rates are highest in the suburbs and lowest in rural areas. In the suburbs, even those who are unemployed have over 50% Internet use.

Internet use rates are lower in the central city than in the suburbs. Of those who are employed and living in the central city, 52% have used the Internet. Those who are unemployed and living in the central city have lower rates of Internet use (34%) than the average for not in the labour force (31%).

In the rural areas, regardless of employment status, the rates of Internet use are all under 50%. Those who are employed and living in rural areas and those who are not in the labour force and living in rural areas each have lower rates than their central city counterparts (53% unemployed, 31% not in labor force).

There are interaction effects for Internet use between where people live and the nature of their employment. Those who are not in the labour force and who live in the suburbs (42%) have higher Internet use rates than unemployed people in the central cities (34%) or in rural areas (37%). However, those suburbanites not in the labour force (42%) use the Internet less than their employed (62%) and unemployed counterparts (54%).

Family Income: Internet use increases with family income. Those with income of $75,000 and over have extremely high rates of Internet use (81%), as compared with the low rates of Internet use for those who have income below $30,000 (24%).

Those with high family income living in the suburbs have the highest rate of Internet use of any category we measured (83%). It also appears that living in the suburbs is associated with higher rates of Internet for those in the lower income categories. Even those who have incomes between $30,000-$49,999 who live in the suburbs have over 50% Internet use rates which is not the case for either their central city or rural counterparts.

In the central cities those in the highest income category ($75,000+) have a 79% Internet use rate. Those who earn between $50,000-$59,000 who live in the central city use the Internet at a rate of 59%. Those who earn under $50,000 and who live in the central city have less than 50% rates of Internet use. The Internet use rates for those with very low incomes (< $30,000) that live in the central city are very low at 23%.

In the rural areas, those in the highest income category have similar rates of Internet use to their counterparts in the central cities. With the exception of those in the $60,000-$74,999 category, the Internet use rates by income for both the central city and suburbs are almost identical. For those in the $60,000-$74,999 category, the rates of Internet use are a quite similar 71% in the rural areas and 69% in the central cities.

Race and Ethnicity: There are marked ethnic differences in Internet use. Asian-Americans have the highest rate of Internet use at 63%, followed by whites who have a 55% Internet use. Much lower are "others" (American Indian, Aleut, Eskimo and Asian and Pacific Islander) with a 36% Internet use rate, African-Americans with a 30% Internet use rate, and Hispanics with the lowest Internet use rate of 28%.

In the suburbs only Hispanic-Americans (32%) and African-Americans (38%) have rates of Internet use below 50%. The "other" category in the suburbs has a 53% Internet use, which is much higher than the "other" Internet use rate in the central city (36%) or in the rural areas (25%).

In rural areas, regardless of race, the rates of Internet use are all below 50%. African-Americans in rural areas have the lowest rate of Internet use at 20% of any category of measurement that we have studied for this report. Thus this rate is lower than low income alone in rural areas (22%) (see income discussion above). This suggests that low-income rural African-Americans have even lower rates of Internet use.

City, Suburb and Rural Area*:* A major finding is that regardless of the social characteristics of individuals, there is a clear geographical distribution to Internet use. Internet use is highest in the suburbs, followed by the central cities and lowest in rural areas. The suburbs have a 55% rate of Internet use, the central city has a 44% Internet use rate, and the rural areas have a 42% Internet use rate.

Year of Immigration: People born in the United States have the highest levels of Internet use. The rates of Internet use are lowest among the most recent immigrant group, those who immigrated between 1990 and 2000. These findings may differ from the characteristics of recent immigrants to Canada. This is because many of the recent immigrants to Canada are selected based upon the point system and therefore are likely to have many of the other characteristics related to higher Internet use such as education and income.

Summary of Findings

1. ***Central Cities and Rural Areas*** have substantially lower rates of Internet use. The low rate of Internet use in rural areas may have to do with access in terms of phone lines etc. These causes of lower Internet use in the central cities may be slightly different.

2. ***Gender***: Although men have higher rates of Internet use than women do, the differences appear much more marginal than the differences in terms of other categories. Of course, men and women may use the Internet differently but at this point we do not have data about this.

3. ***Race and Ethnicity***: African-Americans, Hispanic-Americans and "Others" have much lower rates of Internet use than do Asian-Americans or White-Americans. This is likely correlated with other factors such as the fact that Asian-Americans and White-Americans also have higher incomes than these groups on average.

Table 11
Frequency of Internet Use in the United States, 2000 Current Population Survey

	All Cities Internet Use		Central City Internet Use		Suburbs Internet Use		Rural Areas Internet Use	
	No	Yes	No	Yes	No	Yes	No	Yes
Sex								
Male	48.67	51.33	52.87	47.13	43.25	56.75	54.99	45.01
Female	51.53	48.47	56.27	43.73	46.11	53.89	57.26	42.74
Marital Status								
Married	44.67	55.33	47.51	52.49	39.84	60.16	51.28	48.72
Never	49.53	50.47	55.27	44.73	43.74	56.26	54.02	45.98
Other	68.32	31.68	70.06	29.94	63.33	36.67	74.96	25.04
Education								
Less than high school	70.62	29.38	77.41	22.59	65.05	34.95	72.71	27.29
High school graduate	60.11	39.89	65.37	34.63	55.32	44.68	64.01	35.99
Some college	41.78	58.22	46.54	53.46	37.29	62.71	46.39	53.61
University	27.20	72.80	28.71	71.29	25.15	74.85	31.07	68.93
Race								
Non-Hispanic White	45.13	54.87	42.82	57.18	40.85	59.15	53.30	46.70
Non-Hispanic Black	70.56	29.44	74.28	25.72	61.86	38.14	79.77	20.23
Asian	39.57	60.43	42.73	57.27	34.41	65.59	54.01	45.99
Hispanic	71.55	28.45	73.89	26.11	68.40	31.60	76.84	23.16
Other	67.70	32.30	64.71	35.29	48.67	51.33	74.15	25.85
Year of Immigration								
Born in U.S.	48.87	51.13	52.42	47.58	43.11	56.89	55.89	44.11
Before 1970	59.03	40.97	67.65	32.35	53.77	46.23	60.07	39.93
1970-1979	54.65	45.35	58.57	41.43	51.04	48.96	58.87	41.13
1980-1989	57.61	42.39	61.32	38.68	53.69	46.31	60.52	39.48
1990-Present	62.29	37.71	61.93	38.07	61.34	38.66	70.33	29.67
Labor Force Participation								
Employed	42.42	57.58	46.29	53.71	37.79	62.21	47.90	52.10
Unemployed	54.10	45.90	63.53	36.47	45.10	54.90	59.32	40.68
Not in labor force	64.64	35.36	68.68	31.32	58.82	41.18	70.95	29.05
Family Income								
Less than $30,000	75.22	24.78	77.07	22.93	73.30	26.70	75.95	24.05
$30,000-49,999	49.76	50.24	51.49	48.51	48.67	51.33	50.11	49.89
$50,000-59,999	38.20	61.80	40.10	59.90	37.07	62.93	38.93	61.07
$60,000-74,999	28.62	71.38	30.07	69.93	28.64	71.36	27.45	72.55
$75,000 and over	18.22	81.78	19.87	80.13	16.94	83.06	21.49	78.51
City Type								
Central city	54.68	45.32						
Suburban	44.75	55.25						
Rural	56.18	43.82						
Age								
15-20	41.02	58.98	51.35	48.65	34.72	65.28	43.86	56.14
21-29	47.87	52.13	50.16	49.84	42.90	57.10	55.15	44.85
30-39	42.71	57.29	47.26	52.74	37.99	62.01	47.95	52.05
40-49	40.44	59.56	47.58	52.42	34.82	65.18	45.33	54.67
50-59	47.45	52.55	52.08	47.92	41.90	58.10	53.70	46.30
60 and over	74.15	25.85	76.67	23.33	69.88	30.12	78.96	21.04

Table 11 - Continued

	All Cities Weighted Internet Use		Central City Weighted Internet Use		Suburbs Weighted Internet Use		Rural Areas Weighted Internet Use	
	No	Yes	No	Yes	No	Yes	No	Yes
Sex Male	48.87	51.13	53.83	46.17	43.32	56.68	57.26	42.74
Female	51.88	48.12	57.23	42.77	46.30	53.70	59.62	40.38
Marital Status								
Married	44.77	55.23	48.44	51.56	39.81	60.19	53.57	46.43
Never	50.23	49.77	56.56	43.44	44.30	55.70	56.27	43.73
Other	68.31	31.69	70.14	29.86	63.32	36.68	77.30	22.70
Education								
Less than high school	71.50	28.50	78.22	21.78	65.62	34.38	75.01	24.99
High school graduate	60.53	39.47	66.05	33.95	55.49	44.51	66.05	33.95
Some college	41.47	58.53	47.31	52.69	37.19	62.81	46.81	53.19
University	27.04	72.96	28.89	71.11	25.22	74.78	31.45	68.55
Race								
Non-Hispanic White	44.64	55.36	42.78	57.13	40.46	59.54	55.14	44.86
Non-Hispanic Black	70.27	29.73	74.52	25.48	61.76	38.24	80.42	19.58
Asian	37.39	62.61	40.68	59.32	33.29	66.71	50.67	49.33
Hispanic	71.66	28.34	74.57	25.43	67.91	32.09	79.71	20.29
Other	63.76	36.24	68.03	31.97	46.21	53.79	75.01	24.99
Year of Immigration								
Born in U.S.	49.05	50.95	53.43	46.57	43.24	56.76	58.18	41.82
Before 1970	58.95	41.05	68.77	31.23	52.77	47.23	62.30	37.70
1970-1979	54.59	45.41	58.63	41.37	50.77	49.23	63.30	36.70
1980-1989	57.69	42.31	61.59	38.41	53.62	46.38	63.48	36.52
1990-Present	62.06	37.94	62.30	37.70	60.66	39.34	72.80	27.20
Labor Force Participation								
Employed	42.92	57.08	47.48	52.52	38.27	61.73	50.15	49.85
Unemployed	55.67	44.33	65.99	34.01	46.05	53.95	63.12	36.88
Not in labor force	64.41	35.59	69.07	30.93	58.45	41.55	72.51	27.49
Family Income								
Less than $30,000	75.73	24.27	77.43	22.57	73.23	26.77	77.78	22.22
$30,000-49,999	50.93	49.07	52.39	47.61	49.28	50.72	52.92	47.08
$50,000-59,999	38.68	61.32	40.59	59.41	37.44	62.56	40.15	59.85
$60,000-74,999	29.54	70.46	31.05	68.95	29.18	70.82	29.12	70.88
$75,000 and over	18.16	81.84	20.99	79.01	16.75	83.25	21.71	78.29
City Type								
Central city	55.61	44.39						
Suburban	44.86	55.14						
Rural	58.49	41.51						
Age								
15-20	42.60	57.40	53.63	46.37	35.98	64.02	46.56	53.44
21-29	48.29	51.71	51.52	48.48	43.31	56.69	57.05	42.95
30-39	43.19	56.81	48.14	51.86	38.26	61.74	50.62	49.38
40-49	41.32	58.68	48.83	51.17	35.77	64.23	48.12	51.88
50-59	48.05	51.95	53.76	46.24	42.27	57.73	56.43	43.57
60 and over	73.90	26.10	77.33	22.67	69.36	30.64	80.08	19.92

Taking Stock; Moving Forward

Summary

1. Newcomers ("newbies") to the Internet use it less than those with experience.

2. Those who have computers at home use the Internet more, and in more ways, than those who only access them elsewhere.

3. There are content barriers as well as cost barriers to Internet use: matters of language, cultural diversity, literacy, and local orientation.

4. These findings suggest that measures to lessen the digital divide will be multi-step:

   a. Fostering access to computers and the Internet.
   b. Fostering home use of computers and the Internet.
   c. Developing experience with using computers and the Internet.

5. The correlates of high (and low) Internet use are very similar in Canada and the United States. This suggests that the findings of better-financed American studies should be taken seriously in thinking about the Canadian experience.

6. Although women have historically used the Internet less than men, this gender gap is decreasing rapidly.

7. Although older Canadians and Americans have historically used the Internet less than younger adults, this age gap is decreasing as the more experienced population gets older, and as adult children instruct their parents.

8. Married households use the Internet more than unmarried households. This may be a function of the greater number of adults likely to reside in married households.

9. Households with children use the Internet more. This may be a function of two phenomena: (a) Parents buying computers so that their children can learn. (b) Children teaching their parents.

10. People with lower socioeconomic status use the Internet less. This is true for a number of aspects of low socioeconomic status: little education, low income, not in the labour force.

11. Race, ethnicity and language are all associated with rates of Internet use. In the United States, Hispanic-Americans and African-Americans use the Internet much less than White-Americans and Asian-Americans. In Canada, Francophones use the Internet less than Anglophones. In both countries, immigrants use the Internet less

than non-immigrants. This was measured for individuals in the United States and for areas with high proportions of immigrants in Canada.

12.People living in rural areas use the Internet less than those in urban areas. Suburban areas have the highest rate of Internet use.

13. High-bandwidth Internet access, both DSL and cable modem, are disproportionately going into urban and suburban areas. This will increase the rural-urban digital divide.

14. Most of the variables explaining Internet use are those that describe individuals, especially their socioeconomic status and age. The household characteristics that are important have to do with household size and the presence of children. The most important neighbourhood characteristic is the proportion of immigrants and rural-urban-suburban location.

The Digital Divide: The Next Generation

The Employment Policy Foundation provides an optimistic view that, with time, the digital divide based on income will all but disappear. The Foundation forecasts that 95% household computer penetration will occur between 2003 and 2007 for upper-income households and between 2005 and 2009 for the lowest-income households (Potter 2001: 2). Furthermore, by 2003 there will be no difference in Internet access by household income when 95% of households with computers will have some form of Internet access.

Other optimistic evidence are the trends that indicate a continued plunge in the cost of personal computers and a growing adoption of new low-cost Web access devices such as Web TVs, handheld PCs, and other Internet devices that can retail for as little as $99 (Auchard 2000: 2). The GlobalPC, priced at $300 and offering word processing, money management, Internet access and email, is marketed to families earning $27,000 a year; typically PC owners have household incomes of $47,000 (Lieberman 2000: 1). Computer have-nots remain a market for cheaper computer technology but as Preston Moore, coordinator of the Digital Divide Working Group at the First Unitarian Church of Oakland, Calif., warns, “The tough issues here are not the hardware or the software. The tough issues are the brick-by-brick building of connections between people at a very individual level, which is a painstakingly slow process of learning what differences a computer and Internet access can make in a person’s life (Hafner 2000: 2).”

It is time to rethink the digital divide, and move from worrying about sheer access to worrying about skilled access and high-bandwidth connectivity. The digital divide is usually documented by simple measures of computer ownership or Internet use. The evidence suggests that two other classes of phenomena are important:

1. Knowledge and skill in using a range of computer programs and Internet services.

2. Access to high-speed bandwidth that will provide a wider range of always-available Internet services.

Although relative affluence plays an important part in the digital divide, the evidence that we provide shows that it results from more than differences in wealth or income. If all Canadians were immediately given a state-of-the-art computer and software suite, the divide would be minimized but persist substantially. This is because much of the divide results from differences in current skills needed to use computer software and, to a secondary extent, to maintain computers. Thus the constantly declining real price of computers does not mean the end of the effective digital divide.

Although computer usage has persistently become easier, this does not mean that computers will soon become as easy to use as VCRs, vacuum cleaners, or automobiles. (To be sure, such products all have computer chips inside them, but that is a different matter as their operation is transparent to users.) As basic computer use becomes somewhat easier, the reach and scope of computerization is greatly increasing. More things are being done on computers daily, be it shopping, banking, analyzing one's health, listening to music, or checking sports scores (Wellman 2001). Cellphones, widely used in all socioeconomic groups, are fast becoming wireless internet appliances (Katz 1999) Such use takes a basic repertoire of skills in computerization as well as the ability to learn skills specifically needed for using particular products.

Thus computer experience is much more complex than mere Internet access. To address the digital divide effectively, the issues should be specified in more detail:

1. Ownership of a computer.

2. Access to a computer, not necessarily ownership, such as use at work, at school, at a library.

3. Possession of basic computer use skills, such as keyboarding, file copying, printing, managing folders, creating icons, coping with crashes.

4. Possession of basic computer maintenance skills, such as shopping wisely, attaching peripherals, understanding hardware problems.

5. Ability to use the basic components of widely-used computer programs, such as word processing, scanning photos, drawing, checkbook, anti-virus, spreadsheets and databases.

6. Ability to use the more advanced components of the above computer programs.

7. Ability to use more complex computer programs, such as software, financial management, investment advice and management, project management, CAD/CAM, web design, maintenance utilities.

8. Ability to do basic Internet use, such as sending and receiving emails, going to known web-sites, online shopping, downloading upgrades, and simple searching for specific items.

9. Ability to do more complex Internet use, such as sending and receiving attachments, doing Boolean searches in multiple search engines, customizing websites, creating one's own website, and protecting privacy.

10. Cognitive ability to evaluate the validity of information on the web and to recognize spam and scams.

11. Access to broadband (i.e., high-speed and capacity) Internet service providers.

12. Ability to engage successfully in Internet communities.

The Hands-On Nature of the Digital Divide

Sheer ownership of a computer and a free internet account will ameliorate and not solve the digital divide. Learning skills and receiving training on how to use them is necessary. But where will such training come from? One source is training books. It is a skills gap that has led *Windows 98 for Dummies* to become the best-selling computer book of all time (more than 4 million copies sold according to Amazon.com July 14, 2000): even though Windows 98 now is substantially easier to use than its predecessors. Indeed, Amazon reports 683 book titles with the word "Dummies" in the title (although not all pertain to computing: Investing for Dummies is currently the second most popular book in the series.)

It is training, not only reading books, that teaches people to use computers effectively. Although books such as *Windows 98 for Dummies* are not expensive ($28.98 at Chapters.ca), they are principally used as a back-up reference "security blanket" rather than as a primary learning tool. Training for computer use takes many forms: formal education in schools, commercial or adult education training programs, informal mentoring by community members. As much schooling, training and mentoring tends to take place near a person's home, the spatial availability of educational and training programs is important as is the proximity of people with the skills and desire to mentor others in computer use.

Yet it is quite probable that the availability of computer training and mentoring is spatial uneven, with poorer areas having fewer educational/training programs that are well-equipped and staffed, and poorer areas having a lower percentage of the population equipped with computers and computer skills that could be used for

mentoring their fellow computer members. This is the ***double digital divide***: the socioeconomically unequal access to computer learning and training is compounded by the lack of educational and mentoring resources in the very areas where people with the greatest needs are concentrated.

Ownership and access to a computer and the Internet will be a serious but decreasing problem over this decade, as the real cost of purchasing a computer, software, and Internet access continues its steady decline. This reasoning follows the detailed investigation of telephone use in the United States which found that poverty was rarely a barrier to having a telephone account. Indeed, many of those who avoided telephone accounts purchased premium pay-television services. Rather than not being able to afford a telephone account, those of low socioeconomic status who did not choose to have telephones did so to avoid unwanted callers or unwanted acquaintances who would have demanded (unreimbursed) use of such telephones. Moreover, historical experience shows major initial demand for telephone use was in rural areas, as both men and women sought information and to lessen isolation.

The serious continuing problem will be in acquiring and using the skills to make effective use of a computer and the Internet. This suggests that the digital divide concerns in this decade will be pre-eminently ones of learning, training and mentoring.

High Bandwidth for Canada?

High bandwidth is moving from being a luxury to being a necessity. High-bandwidth systems such as ADSL (High Speed Sympatico) or cable-modem (@Home) at least ten times faster than dial-up telephone-modem systems. This not lets information flow through the system more quickly, it affords possibilities for a wider range of information. Graphics-intensive websites, downloaded music, and real-time video become feasible as bandwidth goes up. Moreover, the always-on nature of high-bandwidth systems means that the Internet can be accessed whenever desired, without fuss, and there are no contentions between telephone users and Internet users (Hampton and Wellman 1999).

The Strategis Group predicts that by 2005 there will be a broadband market throughout North America of 36 million subscribers, surpassing dial-up access (Pastore 2001c). Competition between broadband and dial-up services may result in a dramatic drop in the costs of both types of service, thus allowing increased access for a greater portion of the population (Smolenski 2000). However, this price drop was made during the time of Internet euphoria. It seems unlikely when considering the necessary infrastructure required for mass broadband adoption.

Yet the double digital divide substantial affects access to high-bandwidth services. If trends continue, broadband access will be provided in predominantly wealthy areas to those who can afford the monthly costs of high-speed service. It will

remain a market-driven service contingent upon consumer adoption and costly investment in infrastructure. Jamal Le Blanc, of the Digital Divide Network, calls upon the public sector, with some assistance from industry and government, "to provide the demonstration models that will change the perception of broadband from being 'fast enough' for Internet browsing to being 'critical' for the health of our public information infrastructure (2000, p. 4)." Former Federal Communications Commission chairman, William Kennard, acknowledges that broadband implementation is an outgrowth of natural market phenomena and that it is introduced first to areas which service providers deem profitable (quoted in Irwin 2000, p. 3). At the same time, Kennard supports Clinton government policy that ensures equal access regardless of income or population density. He cites telephone service, which is available in almost all markets, as the model which broadband implementation should follow.

However, Michael Powell, the new chair of the Federal Communications Commission in the George W. Bush administration, is less supportive of broadband. He wonders why the average consumer needs what he calls a "Mercedes" service (quoted in Labaton 2001).

One alternative to ADSL and cable-modem lies in wireless delivery of high-speed Internet access, either via cellphone-like towers or via satellite. Starband recently launched a two-way, satellite-delivered Internet service that targets the nearly 50 million American homes that are not subscribed to broadband access either because of a lack of broadband cable service or they are too remote for ADSL connections (Goodman 2000). The satellite service requires no telephone connection, no terrestrial Internet account, has always-on access, and is available in any location that enjoys a clear view of the satellite (from advertisement). Starband Communications originally supplied new satellite dishes to 120 locations on Navajo, Hopi, and Havaupai reservations throughout Arizona, New Mexico, and Utah. The pilot project allowed for remote communities to access the Internet without the tremendous costs associated with landline connections. As such, satellite service forgoes the expenses associated with long-distance phone service to remote areas and is more reliable than phone service that can be intermittent.

However, while wireless is effective in certain geographic areas, it is hampered by obstructions and weather in others (Oram 2001). Satellite Internet services will continue to be more expensive than ADSL and cable-modems, but Internet from the sky may be rural dwellers' best and only hope for broadband service (Borland 2001).

These developments will promote both interpersonal communication (by email and Instant Messanger) and web services. Much of this will be commercially driven. By expanding upon e-commerce and making it portable, "m-commerce" or mobile commerce, promises a source of substantial revenue for online businesses. Ovum predicts that by 2005 m-commerce revenues will exceed $200 billion in diverse products and services such as banking, ticket sales, online retailing, and media downloading (Myers & Dyke 2000).

Given the new state of mind in Washington and the continuing Canadian commitment to the Internet, fostering high-bandwidth services, both wired and wireless, may be areas in which Canadians can move to the forefront of initiatives.

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