Who is going online? Results from the National Capital FreeNet

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Abstract

The National Capital FreeNet (NCF) in Ottawa, Canada is one of the largest and most successful community online services in the world. A sample of 1073 National Capital FreeNet (NCF) users were surveyed about their demographic characteristics, their access methods, and their levels of satisfaction. The results indicate that NCF users are not a specialized group in the community, but are comparable to the local regional population in age, education, and income. NCF users most often connect from home using modems, often using equipment and telephone lines purchased specifically for this service. NCF users connect to the system regularly, and usage of the system was not strongly related to demographic factors. NCF users are very satisfied with the system and satisfaction and donations were not strongly related to demographic factors or use of the system. These results suggest that this community network has a broad appeal and that current and future online services may have significant widespread impacts on individuals and society.

Introduction

There has been a lot of interest in the last few years in developing an "information highway" in North America. Futurists and politicians see the development of an electronic infrastructure as an important national goal, much like the development of railroads and transportation systems in a previous century. The information highway is supposed to enhance communications, commerce, and lead to the development of a modern information economy and a sophisticated electronically literate society. It is supposed to help people communicate, work, and live better (see, for example, Bell Canada, 1995; Industry Canada, 1994; NTIA, 1993).

It is not clear, however, who will use the information highway, how they will be connected, and whether they will find anything of value once they are connected. A careful examination of whom might use the information highway, for what services, and with what impact on their lives is required. This research begins to examine these questions.

An early form of the information highway already exists today as a collection of interconnected networks and services. Although it is neither as fancy nor as fast as the highway proposed for the future, this "information country road" still provides a variety of services. Commercial online services such as CompuServe and America Online provide many of the electronic services that are supposed to be offered in the future. You can do electronic banking and shopping, communicate with millions of other people, and download programs for entertainment and business. In addition, the Internet is a worldwide electronic network that is accessible to perhaps 50 million people (Quarterman, 1997), and its services include electronic mail and news, information access and publishing, library searches, and electronic commerce. Perhaps an examination of today's systems can help us understand the likely users and services of tomorrow.

Some have argued, however, that the current online services are not appropriate comparisons for the coming information highway. These arguments are based on claims that the Internet and the commercial online services are too expensive and too technical, limiting their use to a small, specialized subset of the population. The information highway is supposed to have broader

Who is going online? Results from the NCF
Andrew S. Patrick and Alex Black

Internet Research: Electronic Networking Applications and Policy
Volume 7 · Number 4 · 1997 · 305–319

appeal, be more affordable, and easier to use than the existing services (Anderson *et al.*, 1995).

Perhaps the least expensive and easiest to use of the current services are "FreeNets." FreeNets are non-profit community online systems that provide information highway services such as mail, discussion groups, and information services (Beamish, 1995; Schuler, 1994). They are organized around a donation model where, much like public television, the funding comes from individual donations, corporate sponsorship, and government grants. Users of FreeNets either do not have to pay any fees or the fees are minimal. Instead, the users are asked for donations and encouraged to volunteer their time to develop and run the systems. The users also often have a direct say in the management and organization of the service.

The National Capital FreeNet (NCF) in Ottawa, Canada is one of the largest and most successful examples of these systems. The mission statement of the NCF describes the project and its goals:

The National Capital FreeNet is a free, computer-based information sharing network. It links the people and organizations of this region, provides useful information, and enables an open exchange of ideas with the world. Community involvement makes FreeNet an important and accessible meeting place, and prepares people for full participation in a rapidly changing communications environment.

The NCF was launched in February of 1992. By the fall of 1994, it had grown to 29,000 registered users, with approximately 12,000 members using the service each week. More than 200 organizations had joined the NCF and published information on the system. Users of the system enjoy such services as electronic mail, local and international (Usenet) discussion groups, library search and information retrieval services, and connections to other systems on the Internet. Users access the service using computers and modems from home or work, or via "Telnet" connections across the Internet. The NCF also supports approximately ten public access terminals in local libraries and community centres so users can access the system even if they do not have computer equipment of their own.

The NCF does not require any personal information, other than an address, when members register for an account. Thus, the operators of the NCF know little about their users. The current research used a survey of NCF users to gather information about the characteristics of the users, how they connect to the system, and their satisfaction with the service. If the NCF is a good model for the future information highway, then the participation in the system should be widespread in the community. Users should have a broad range of ages, occupations, education, and income levels. On the other hand, the NCF might be used by a special subset of the population that has narrow characteristics.

To address this issue properly it is necessary to research comparison groups. The Statistics Canada Census data from 1991 (Statistics Canada, 1992) was used to provide comparison data from the local regional population. There has also been research conducted on a similar FreeNet system in Cleveland, Ohio (Anderson, 1992), and comparisons will be made to users of that system. Amsterdam also has a FreeNet system called the "Digital City" and a recent report (Schalken and Tops, 1994) provides some useful comparison data. Finally, Pitkow and Recker (1994) reported a survey of users of the Internet World Wide Web (WWW) service, and it will be used as a comparison.

The present paper also examines how NCF users access to the system and how much they use the system. If use of the system is widespread in the community, than one might expect that users often connect from home using modems, rather than being restricted to business users using Internet connections. In addition, the importance and impact can be measured by how much the system is used. Finally, users were asked about their satisfaction and donation history, and these are related to the demographic and connection characteristics.

Method

Materials

A survey was prepared using an iterative empirical approach. First, questions were developed to address the areas of interest for the current research. A review of previous research on similar systems (e.g. Anderson, 1992) was then conducted and questions were added and revised based on those findings. Draft versions of the survey were then sent to colleagues with an interest in this form of research, and to NCF volunteers with knowledge of the user population.

Who is going online? Results from the NCF

Andrew S. Patrick and Alex Black

Internet Research: Electronic Networking Applications and Policy

Volume 7 · Number 4 · 1997 · 305–319

The survey was then pre-tested in the laboratory where subjects could be observed and questioned about their responses. The survey was also pre-tested online by the volunteers to assure that all the questions were clear and that all the responses would be meaningful.

Two versions of the survey were used for this study. One version was written in HTML, a mark-up language used for the World Wide Web (WWW) on the Internet. This survey was used with the Lynx software so that users could complete the survey online using a form-filling interface (see Figure 1 for an example). When each survey was completed, the results were transferred automatically to a computer in our laboratory for processing. The second version of the survey was in plain text, and this was sent to subjects via e-mail on request. Subjects could complete the survey using a text editor and return the survey via e-mail.

All responses to the survey were stored in an anonymous fashion as soon as they were received. All identifying information that was collected automatically by the WWW software or the e-mail system was encrypted before the data were stored. It was possible for subjects to complete the survey more than once, but the identifying information was always en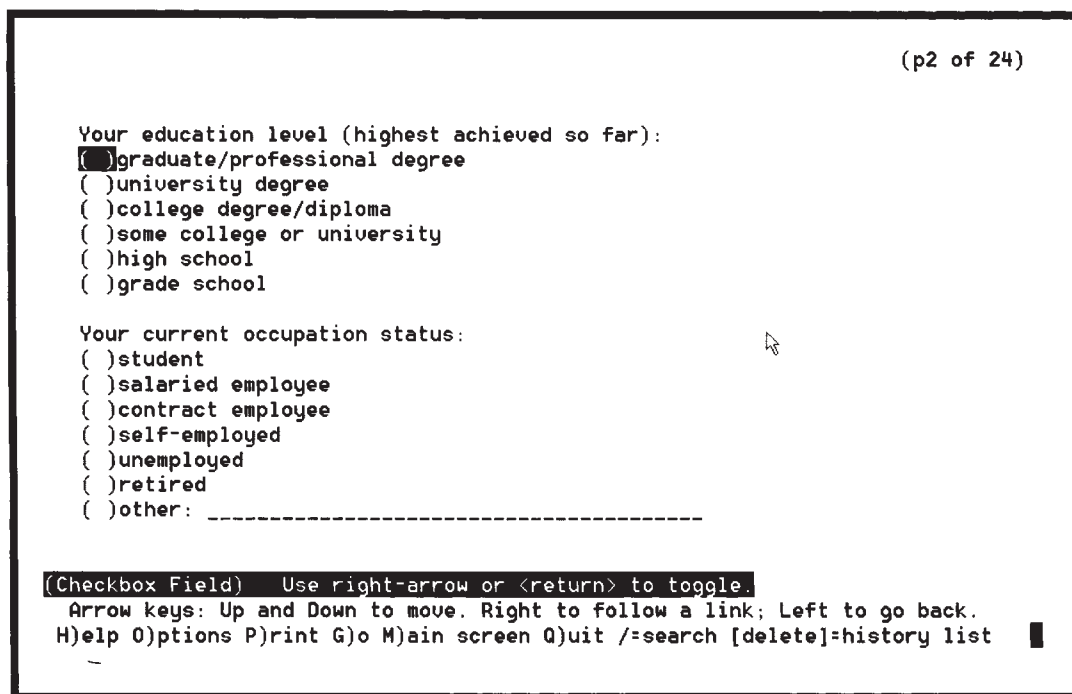crypted the same way and time-stamped, and only the most recent complete response from each subject was included in the analysis.

Subjects

The survey was made available to all NCF users on a self-selection basis. The survey was accessible from the main menu of the system and notices inviting users to complete the survey were sent to the most active discussion groups on the system (e.g. computer games, men's issues, youths) and posted in the announcements areas. Responses were collected over an 85-day period during September-December 1994.

In addition, a method of "random encouragement" was used where a sample of 3,138 user IDs was prepared from those active users who had not yet completed the survey. Each of these users was sent a personal invitation via e-mail to complete the survey. This encouragement method was an attempt to reduce any sampling bias produced if only a self-selection procedure had been used. Although users who were encouraged still had to choose to complete the survey once they received their invitation and that decision could be biased by their backgrounds, interests, or concerns, because the group was randomly chosen from the list of active users it may be more representative of the population.

Figure 1 A sample screen from the Lynx interface to the survey

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                                                                (p2 of 24)


      Your education level (highest achieved so far):
      [■]graduate/professional degree
      ( )university degree
      ( )college degree/diploma
      ( )some college or university
      ( )high school
      ( )grade school

      Your current occupation status:
      ( )student
      ( )salaried employee
      ( )contract employee
      ( )self-employed
      ( )unemployed
      ( )retired
      ( )other: _____


   (Checkbox Field)   Use right-arrow or <return> to toggle.
    Arrow keys: Up and Down to move. Right to follow a link; Left to go back.
  H)elp O)ptions P)rint G)o M)ain screen Q)uit /=search [delete]=history list   ▌
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Who is going online? Results from the NCF
Andrew S. Patrick and Alex Black

Internet Research: Electronic Networking Applications and Policy
Volume 7 · Number 4 · 1997 · 305–319

Response rate

After removal of duplicates, 1,073 survey responses were available for analysis (51 via the e-mail system and the remainder via the WWW interface). This sample is approximately 4 percent of the total number of NCF registered users at the time of the study. However, not all the NCF users are active at any one time, and this sample size is approximately 9 percent of the estimated 12,000 users who were active on the system during each week of the period of the survey.

This sample size compares favorably with previous studies. Schalken and Tops (1994) used a sample of 1,197 Digital City users, and this represented 9 percent of the total population of 13,000 users. Anderson (1992) used a much smaller sample of 320 Cleveland Free-Net users, representing only 1 percent of the population of 30,000 for that system. Finally, Pitkow and Recker (1995) collected a sample of 3,522 WWW users for their study, and the population of Internet users with access to the WWW was approximately 14 million (MIDS, 1995).

A sample of this size allows us to be confident about the results. As long as the sample is representative of the population we can estimate, with 95 percent confidence, the worst sampling error for the data to be approximately plus or minus 3 percent (Babbie, 1973).

Levels of experience in the sample

One method of measuring the success of the sampling is to examine the amount of experience users had with the system. Subjects were asked "How long have you been using the NCF (months)," and the distribution of responses can be seen in Figure 2. On average, users had 11.2 months of experience with the system (N = 1,046, SD = 7.29), and there was a broad range of experience from a few months to more than two years. This suggests that both new and veteran NCF users completed the survey. It is interesting to note that 13 subjects claimed to have used the NCF for more than 35 months, even though the system had not been officially operating for that long. This may reflect members who were involved in the initial development and setup of the system in the year before the launch, or it may be spurious data.

Figure 2 Distribution of experience with the NCF

Results and discussion

Members' location

In order to determine how many of the users were from the local area, the survey asked: "Do you live in the National Capital area (Eastern Ontario or Western Quebec)?" A total of 1,050 respondents answered this question and 85.3 percent indicated they did live in the local region. In contrast, Anderson (1992) reported that only 24 percent of the users she surveyed came from the local Cleveland region. In Amsterdam, only 45 percent of the users surveyed came from the local region. These results suggest that the NCF is unique because its membership is primarily from the local region. It also indicates that comparisons with census data from the local region will be appropriate.

Gender

A question about their gender was answered by 1,052 users and 81.8 percent of the respondents were male (18.2 percent female). The census data for the local region show that only 49 percent of the population are male. This suggests that females are under-represented on the NCF, and might indicate that NCF users are a special subset of the community.

It is important, however, to compare these results with those of other systems. The study of Cleveland Free-Net users reported 83 percent males (Anderson, 1992), the Digital City data showed 91 percent males (Schalken and Tops, 1994), and a 1994 survey of WWW users showed 90 percent males (Pitkow and Recker,

Who is going online? Results from the NCF

Andrew S. Patrick and Alex Black

Internet Research: Electronic Networking Applications and Policy

Volume 7 · Number 4 · 1997 · 305–319

1995). Thus, when compared to other online systems the NCF is more gender-balanced. So there may be gender inequality in the NCF, but it is not as extreme as other online systems.
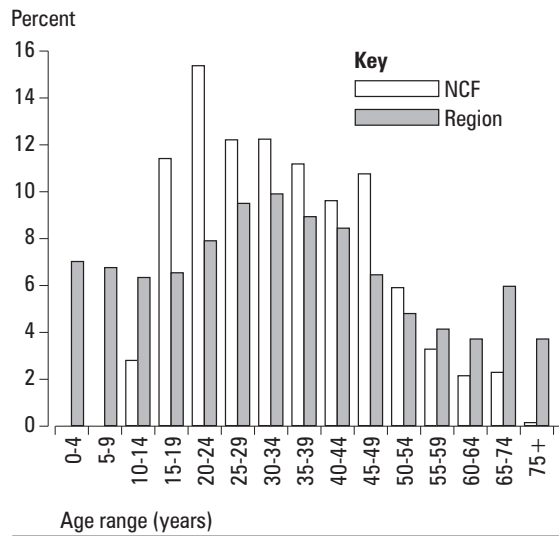
Quarterman and Carl-Mitchell (1995) recently reported some interesting results on gender inequality on the Internet. For their study they surveyed organizations connected to the Internet and asked: "For network users who can send electronic mail from inside to outside your domain, please give percentages for the following genders: male, female." Their survey of 1,468 organizations indicated that 64 percent of users with e-mail connections to the Internet were male. These results suggest that when it comes to access to the Internet (at least for electronic mail), there is more gender equality. It is important to note the difference between access to a service and use of the service. These results from organizations connected to the Internet suggest that more women may have access to the Internet than actually use it.

Age

The average age of respondents to the NCF survey was 34.3 years (N = 1,053, SD = 13.70). The distribution of ages is summarized in Figure 3, where the percentage of people falling in each age range is illustrated for the NCF users and the regional population. It is clear that there is a broad range of ages in the NCF sample from teens to senior citizens.

A comparison with the results from the census of the local region indicates that the NCF under-represents people in the extremely low and high age ranges (less than 15 and greater than 65). There also appears to be an over-representation of the young and middle age ranges, particularly in the 15-19 and 20-24 categories. It is important to note the nature of these graphs, however. Each bar represents the percentage of people in an age category and the percentages must sum to 100. Therefore, when there is a lower percentage in some categories, such as the lowest and highest age ranges, there must be a higher percentage in some other categories to compensate (the middle age ranges). Given that literacy is required to use the system the difference in the young age categories is expected, and overall the NCF population has representation from a broad range of age groups.
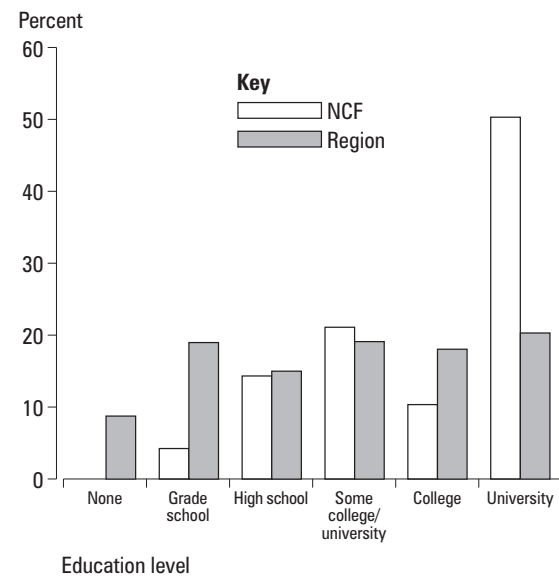
Figure 3 Age distribution compared to census data for the local regions

Education

NCF users were asked about their education in terms of the highest level achieved so far, ranging from grade school to university degrees. A total of 1,061 answers were collected and the results are summarized in Figure 4. The main finding is that NCF users have a range of education backgrounds, from grade school to university degrees. The NCF users differ most from the local region in the category of university educated, with more than 50 percent of the NCF users being university educated (this is also the largest category for the region). There

Figure 4 Education distribution compared to census data for the local region

Who is going online? Results from the NCF
Andrew S. Patrick and Alex Black

Internet Research: Electronic Networking Applications and Policy
Volume 7 · Number 4 · 1997 · 305–319

were also fewer NCF users with a grade school education than might be expected from the regional data. The Ottawa region is dominated by public service and high-technology workers and this leads to a highly educated population, and the NCF does require a certain level of literacy, so the large number of university educated users is not unexpected.

The only other research that looked at education in a comparable way was the survey of WWW users (Schalken and Tops, 1994). A comparison of education levels with the results of that survey is shown in Figure 5. WWW users are also well educated, with many more users having graduate or professional degrees than was seen on the NCF. WWW users also differ from NCF users in that fewer of them have only a grade school or high school education. The education results, therefore, are similar to the other findings; while there is some discrepancy from the local population, it is less extreme than the results seen with other online systems.

Personal income
One of the survey questions asked users to list their annual gross income in Canadian dollars. Only 991 respondents (92 percent of the sample) answered this question and some indicated a reluctance to disclose personal information. On the other hand, other respondents were glad to see questions about income and looked forward to seeing the results. Data about income levels may be particularly important for

designing information highway services that users might pay for. Further, it is valuable information for FreeNets that rely on donations for a large part of their funding.

The distribution of income levels for the NCF sample and the local region is shown in Figure 6. These results show a wide range of income levels for NCF users, indicating that the service is not exclusive to well-off members of the population. When comparing the personal income levels with the regional census data it is important to note that the regional figures are not corrected for inflation and there is a three-year gap between the data gathering periods. Average wages and support programs for students and others may have risen in this period, although the inflation rates for this region have been very low. Thus, any indication those NCF incomes are higher than the regional data should be considered in light of the possibility of inflation. The comparison with the regional income levels shows that NCF users are somewhat better off than the local community (incomes greater than $50,000) and less well off (incomes less than $9,000). There is a corresponding under-representation of people in the middle income ranges ($10,000-$40,000).

Household income
Only 918 users (85 percent of the sample) answered a question about household income. This low response rate may be due to an unwillingness to provide personal information and perhaps unwillingness by some younger people to

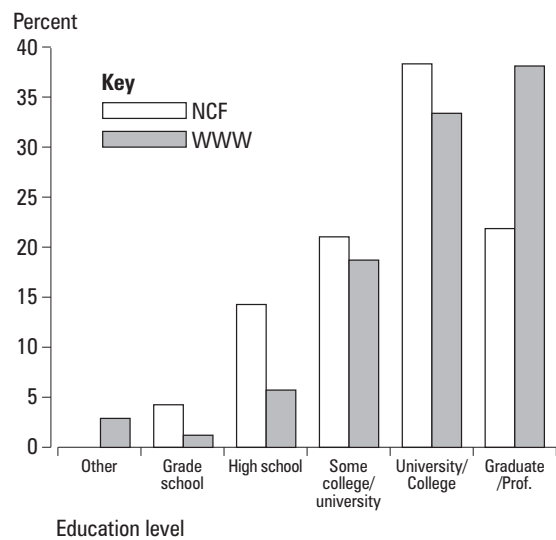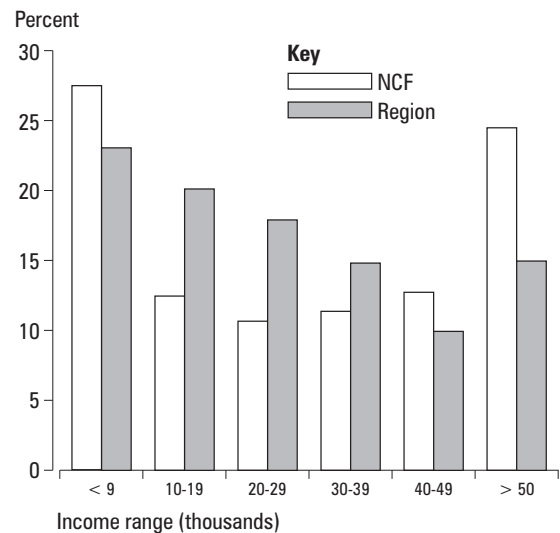**Figure 5** Education distribution compared to the WWW

Figure 6 Personal incomes compared to census data for the local region (not corrected for inflation)

Who is going online? Results from the NCF
Andrew S. Patrick and Alex Black

Internet Research: Electronic Networking Applications and Policy
Volume 7 · Number 4 · 1997 · 305–319

ask their parents about income levels. The distribution of household income levels for the NCF users and the regional census data are shown in Figure 7. Again, the results show a range of household incomes in the NCF population. Similar to the results for personal income, the large discrepancies from the regional census data are at the extremes of the range (less than $9,000 and greater than $70,000). Overall, however, there is a close match in household income levels between the NCF and the local community.

Connection locations

Users of the NCF were asked: "What percentage of the time do you connect to the NCF from (numbers from 1 to 100, total should be 100): home, work, libraries, other public terminals?" The results for this question are summarized in Table I, where it is clear that connections from home were the most common, with most users connecting from home at least some of the time. Further, 44 percent of the users reported that they only connected to the NCF from home. Connecting to the FreeNet system from work was less common than home connections, and it was rare for users only to use work connections. Library and public access terminals were used by only a few NCF users, and total reliance on these terminal types was very rare. Together, these connection results show that the NCF is being used primarily from users' homes, and secondarily from places of business. Further,

Table I Percentage of users connecting from various locations

	Some connections from	All connections from
Home	90	44
Work	35	5
Libraries	14	0.6
Public terminals	4	0.4

users do not have to rely on public access locations to make connections to the system. Anderson's (1992) survey of Cleveland Free-Net users included a question about the connection locations that are used "most often." Anderson also found that connections from home were the most common (61 percent). Connections from work were reported by 25 percent of the respondents, and the remaining users reported connecting from schools or some other location. Thus, the connection location patterns are similar for the two systems.

Connection methods

The NCF system is accessible via dial-in connections using a modem, via "Telnet" connections across the Internet, and via dedicated public access terminals located in some libraries and public buildings in the region. The survey asked users to describe their use of these connection methods: "What percentage of the time do you connect to the NCF using (numbers from 1 to 100, total should be 100): dial-in using NCF modems, Telnet across the Internet, library or other public terminals." The connection methods results are shown in Table II. The most frequent method was modem with the majority of users reporting some use of modems. Nearly half the users reported that they used modems for all of their connections to the NCF. Connection via the Internet was reported by less than half of the users surveyed, and only 15 percent always used Internet connections. This reliance on the Internet corresponds with the demographic analysis that showed that 15 percent of the users live somewhere outside of the local area, and thus they must always connect via the Internet (or make long-distance telephone calls). Only a small portion of the users reported using dedicated public terminals for any of their connections and very few rely on the public terminals for all of their connections.

Anderson's (1992) study of the Cleveland Free-Net found that modem and Internet

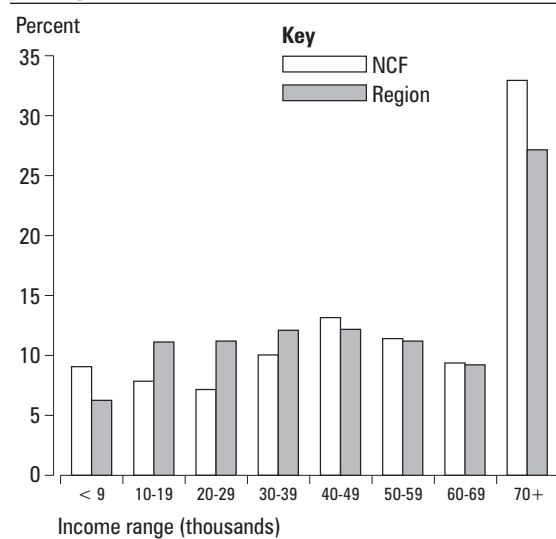**Figure 7** Household incomes compared to census data for local region (not corrected for inflation)

Who is going online? Results from the NCF

Andrew S. Patrick and Alex Black

Internet Research: Electronic Networking Applications and Policy

Volume 7 · Number 4 · 1997 · 305–319

Table II Percentage of users connecting using various methods

	Some connections from	All connections from
Modem	79	48
Internet	40	15
Public terminals	15	1

connections were equally common (49 percent each). This high use of Internet connections relative to the NCF is probably related to the fact that most of the Cleveland Free-Net users (76 percent) were not from the local Cleveland area, and thus had to rely on remote connections.

Purchase of equipment

Users of the NCF were asked if they had "purchased a modem in order to access the FreeNet system." A total of 1,055 people answered the question and 251 (24 percent) indicated that they did purchase a modem to connect to the system. Users were also asked if they "installed an additional phone line in order to access the NCF." A total of 1,050 users answered this question and 107 (10 percent) said that they had purchased such a line. The purchases of a new modem and telephone line were related. Whereas only 21 percent of the people who did not buy a new phone line purchased a new modem to access the system, 44 percent of those who did buy a new line also purchased a modem (Chi-Square(1) = 25.14, $p < 0.001$). These findings show that users are often willing to spend money to access this service, and this could have a financial benefit for local suppliers.
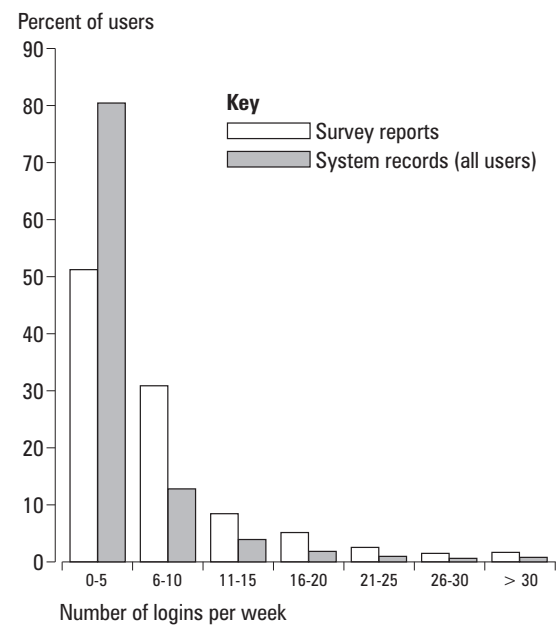
Frequency of use

Users of the NCF system were asked "How many times per week do you login to the NCF, on average?" Data from 1,051 members are available and the results are summarized in Figure 8. A majority of the users reported using the system five times or less per week. The average number of logins per week was 7.77 (SD = 7.77), but the data were positively skewed with a few people reporting a very large number of logins (the maximum was 80 logins per week). The median of five logins per week is probably the best estimate of reported frequency of use. These connection results show that

the NCF system is used habitually by its users, and some people access the system a great deal.

The NCF system also keeps login records each time a user accesses the system. In order to compare the frequency of use reported in this survey with the actual system logs, the login records for a period of eight weeks corresponding to the last few weeks of the survey period and beyond were collected. Users were considered "active" for this analysis if they logged in at least once during the week being analyzed. The average number of logins per week for all the 19,963 active users was 3.74 (SD = 4.71), and the distribution of login frequencies obtained from the system logs is also shown in Figure 8. The actual login frequencies are also positively skewed with a few users using the system a great deal (one user used the system 165 times during one of the weeks analyzed). The median of 2.11 logins per week is probably the best estimate of actual login frequencies. Users who completed the survey reported using the system twice as frequently as the actual login records for all the users of the system (U = 5613294, Z = 25.62, $p < 0.001$).

Users who completed the survey may use the system more than the total user population. Given that this was an online survey, it is not surprising those users that are more active had a greater tendency to complete the survey. It is also possible, however, that those users who completed the survey tended to overestimate the

Figure 8 Comparison of number of logins per week, actual data from users and reported data from surveyed users

Who is going online? Results from the NCF

Andrew S. Patrick and Alex Black

Internet Research: Electronic Networking Applications and Policy

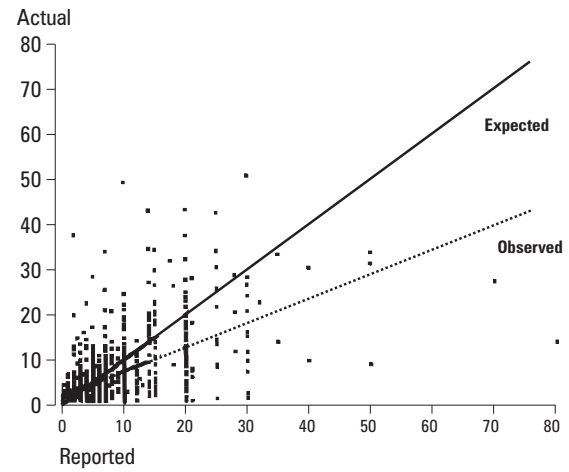Volume 7 · Number 4 · 1997 · 305–319

number of times they use the system each week. To explore the possibility an analysis was done of actual login frequencies for the subset of users who answered this question on the survey. This analysis involved matching the survey responses to the system logs using the login identifications collected automatically during the survey; 947 users logged into the system at least once during the eight-week data collection period and completed this question on the survey.

While the average reported number of logins per week for the 947 users in this analysis was 7.78 (SD = 7.54), the system records showed that the actual number of logins for the same users was only 6.42 (SD = 7.11) (medians are 5.00 and 4.00 respectively). This difference was statistically significant (Wilcoxon $Z = 8.77$, $p < 0.001$). Thus, users did over-estimate the number of times they used the system per week, at least for the eight-week period studied here. Nevertheless, this actual login frequency for survey respondents is greater than the actual login frequency for all the users of the system (medians are 4.00 and 2.11 respectively; $U = 6503109$, $Z = 17024$, $p < 0.001$). Thus, users who completed the survey did use the system more often than average.

The correlation of reported and actual login frequencies was 0.57 ($p < 0.001$), and a scattergram of the reported and actual login frequencies is shown in Figure 9. Users were only moderately accurate in describing their frequency of use, and the observed regression had a lower slope than would be expected if users correctly described their behavior, indicating a consistent over-estimation. A rank order analysis to determine if users at least described their relative use of the system in comparison to other users also revealed a moderate correlation (rank order correlation, $\rho = 0.58$).

Anderson (1992) included a question about login frequency in her survey of Cleveland Free-Net users. The Cleveland users reported using the system three to four times per week, while the median reported for the NCF system was five. Anderson also included an analysis of the actual login frequencies in her study. During a two-week study period, the Cleveland system records showed that the average number of logins for all users was 6.5 times per week. This is higher than the average of 3.7 found in the analysis of NCF system logs. Survey respondents in Anderson's study actually used the system eight times per week, which is twice the estimate of three to four times per week given on the survey. Thus, where-

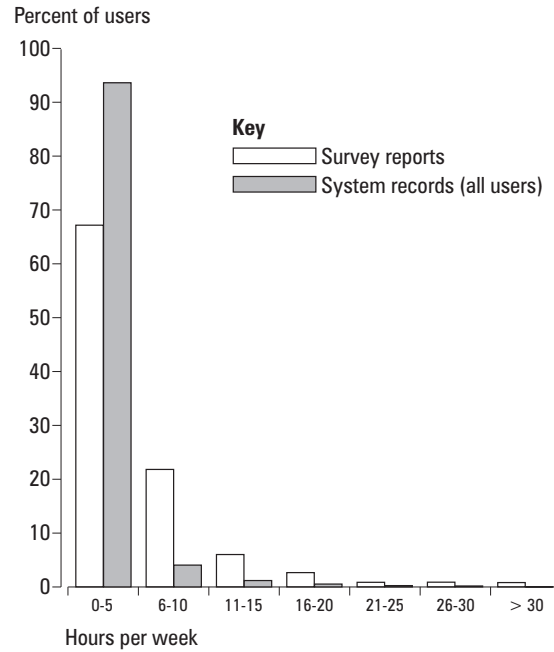**Figure 9** Scattergram of reported and actual login frequencies for survey users

as the NCF users over-estimated their use of the system, the Cleveland users underestimated theirs. Finally, Anderson also found only a moderate correlation between the actual and reported login frequency ($r = 0.55$).

Time spent online

Users were also asked about the amount of time spent on the system: "How much time do you spend on the NCF per week, on average (hours)?" The average time spent on the system for the 1,050 users who answered this question was 5.57 hours per week (SD = 5.97), and the distribution of durations is shown in Figure 10. Again the distribution is positively skewed with a majority of the users using the system for less than five hours per week, but a few users reported much longer login durations. The maximum time spent online was 50 hours per week, and eight users claimed to use the system for more than 30 hours per week. Since the distribution of use is skewed, the median of four hours per week is probably the best estimate of time spent online. These time results indicate that many users are spending considerable amounts of time on the system, and this may have an impact on their other daily activities that should be explored in future research.

The system login records were also analyzed for the time spent on the system and a comparison of the distributions of actual and reported login durations is shown in Figure 10. The average for all the 19,959 users who used the system during an eight-week period was 1.62 hours of use per week (SD = 2.98). The data were also positively skewed with most users using the system for less than five hours per week, but a

Who is going online? Results from the NCF

Andrew S. Patrick and Alex Black

Internet Research: Electronic Networking Applications and Policy

Volume 7 · Number 4 · 1997 · 305–319

Figure 10 Comparison of hours spent on-line per week, actual data from all users and reported data from surveyed users

few users recording much more use. The median login duration for all users is 0.77 hours per week and the actual login durations for all users was significantly less than that reported on the survey (U = 2990963, Z = 35.60, p < 0.001).

Similar to the analysis of login frequency, a comparison was made between the actual and reported login durations for users who completed the survey. A total of 947 users contributed survey data for this question and used the system at least once during the eight-week study period for the system logs. The median actual use of the system for these users was 1.54 hours per week (Mean = 3.22, SD = 4.83), which is significantly less than the median of 4.00 hours of usage reported on the survey (Wilcoxon Z = 18.30, p < 0.001). Nevertheless, this actual median duration per week for users who completed the survey is greater than the median for all the users of the system (U = 6685389, Z = 16.11, p < 0.001). Users who completed the survey used the system more than average, and they over-estimated their actual use of the system. Again, there was only a moderate correlation between the actual and reported data (r = 0.57, ρ = 0.52). Thus, users were not very accurate in describing their use of the system, both in terms of actual time spent and relative to their peers.

Anderson's (1992) analysis of time spent on the Cleveland Free-Net system showed that the average for all the users of that system was 2.8 hours per week. This is higher than the durations calculated from the system logs of the NCF system (1.62 hours per week). Respondents to Anderson's survey reported using the system for an average of five hours per week, while the system data showed they actually used the system for only three hours per week. This over-estimation of time spent on the system is similar to the results for the NCF data. Finally, Anderson found a somewhat lower correlation between the self-reported and actual time spent on the system (r = 0.43) than the current study.

At the time of this study, the NCF had a per-session time limit of one hour but users were free to have as many sessions per day as they wished. Since then the NCF has also implemented a duration limit of two hours per day during peak periods (7:30 am through 1:30 am). This may have the effect of reducing the usage of the system, especially for those users who were spending long periods online.
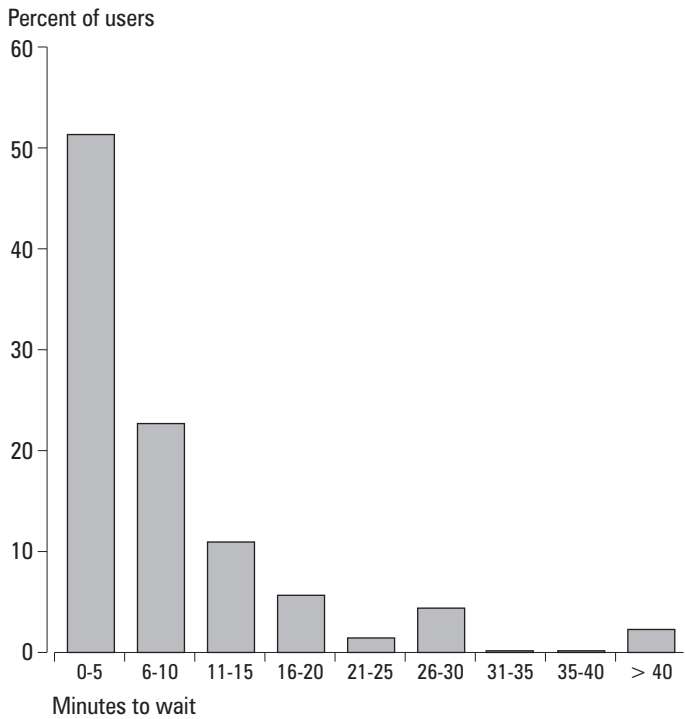
Dial-in delays

The NCF is a very popular system and perhaps the most frequent complaint about the service is long waiting periods when accessing the system by modem. The NCF does not have enough modem lines to support the demand for the service so members often have to re-dial repeatedly until they are connected. To measure the waiting periods the survey included the following question: "How long do you usually have to wait while dialing into the NCF (minutes)?" The results from 836 respondents are shown in Figure 11, and it can be seen that the majority of users reported waiting five minutes or less. These data are also positively skewed, with a few users reporting very long delays. The average was 10.35 minutes (SD = 13.83) and the median was five minutes. These relatively short waiting times reported by the members are surprising, given that long waits are often reported as a major limitation of the system.

Relations among the connection variables

Statistical analyses were conducted to examine the relationships between the various connection variables. Not surprisingly, there was a strong correlation between the number of logins per week and the total time spent on the system per week (r = 0.75). There were also dependencies between the different options for

Who is going online? Results from the NCF
Andrew S. Patrick and Alex Black

Internet Research: Electronic Networking Applications and Policy
Volume 7 · Number 4 · 1997 · 305–319

Figure 11 Distribution of reported dial-up waiting times

access methods and locations since users reported fewer connections of one type (e.g. using public terminals) if they had more connections of another type (e.g. using modems). In addition, accessing the NCF system from home was correlated with use of modems ($r = 0.53$), while accessing the NCF from work was correlated with use of the Internet ($r = 0.45$).

Users who purchased a modem in order to access the system reported more time on the system than those who did not purchase a modem (medians are 5.00 and 3.50 hours per week respectively; $U = 81761$, $Z = 3.90$, $p < 0.001$). Similarly, users who installed a new phone line to use the system reported more logins and more time spent online than those who did not install a new line (8 vs 5 median logins per week, $U = 35978$, $Z = 4.02$, $p < 0.001$; 5 vs 4 median hours per week, $U = 36511$, $Z = 4.07$, $p < 0.001$).

Users who purchased a modem reported connecting to the NCF via the Internet less frequently than those users who did not purchase a modem (46 percent vs. 67 percent; $t(412) = 4.13$, $p < 0.001$). Surprisingly, there was no significant difference in the rate of connection using modem equipment for users who had or had not purchased a modem to use the system (88 percent vs 84 percent). Also, users who purchased a phone line to access the system

connected via the Internet less frequently than those who did not purchase a new line (47 percent vs 65 percent; $t(409) = 2.78$, $p < 0.01$).

Relations with demographic variables
The connection data were also analyzed for relations to the most important demographic variables. The only variable that was related to gender was whether the users had purchased a modem to access the system. Women tended to purchase a modem to access the system more frequently than men did (38 percent vs 20 percent; Chi-Square(1) = 25.05, $p < 0.001$).

Users who bought a modem to access the system tended to live locally more often (93 percent vs 83 percent; Chi-Square(1) = 13.84, $p < 0.001$). Users were more likely to purchase an additional phone line if they were better educated (4.15 vs 3.74 mean education rankings; $t(1040) = 2.67$, $p < 0.01$), had higher household incomes (\$61,000 vs \$54,000; $t(899) = 2.09$, $p < 0.05$), and more experience with the NCF (13.66 vs. 11.01 months; $t(1022) = 3.54$, $p < 0.001$).

Older users reported using the system slightly less than younger users (login times: $r = -0.09$, login durations: $r = -0.13$). Users with higher education levels tended to use the system slightly less frequently ($r = -0.22$) and for less time ($r = -0.25$), and accessed the system via the Internet more frequently ($r = 0.16$).

There was some tendency for users with higher personal income levels to use the system less (login times: $r = -0.18$; login durations: $r = -0.22$), and to rely on library and public terminals less often (library: $r = -0.19$, public terminals: $r = -0.30$). Each of these correlations with the demographic variables is small, however, and the main finding is that demographic factors do not account for a large portion of the variance in the usage measures.
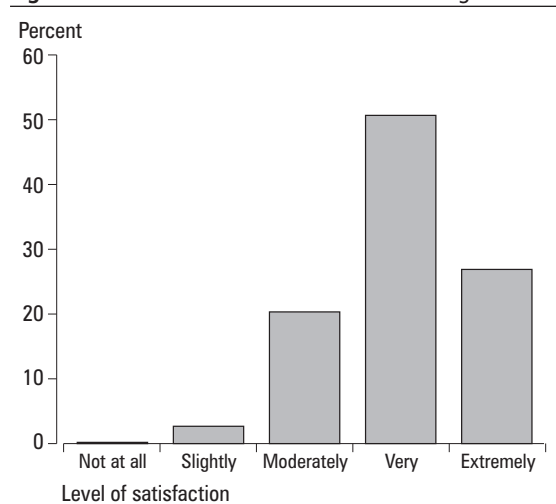
Overall satisfaction ratings
The NCF user survey included a general question about satisfaction with the system: "Overall, how satisfied are you with the NCF?" Users were asked to choose one of five ratings ranging from "not at all satisfied" to "extremely satisfied." The distribution of ratings in these categories is shown in Figure 12. The majority of the 1,061 responders to this question indicated that they were "very" satisfied with the system, and 76.9 percent described themselves as either "very" or "extremely" satisfied.

Who is going online? Results from the NCF

Andrew S. Patrick and Alex Black

Internet Research: Electronic Networking Applications and Policy

Volume 7 · Number 4 · 1997 · 305–319

Schalken and Tops (1994) also measured satisfaction by asking users to rate their "general opinion of the Digital City." Users could choose one of five ratings ranging from "very negative" through "neutral" to "very positive." That study found that 22.4 percent of the responders chose "very positive," while 61.9 percent gave the system a "positive" rating. In total, 84.3 percent rated the system as "positive" or "very positive."

Anderson (1992) included a number of measures of satisfaction in her study of the Cleveland Free-Net. The most comparable question for the current discussion is one that asked users to indicate how much they agreed or disagreed with a statement that they found the system "usually enjoyable or interesting"; 39.4 percent of those users "strongly agreed" to this statement, while 50.2 percent "agreed." Thus, 89.5 percent of the users gave the system a positive rating with this question.

It is difficult to compare the results across systems because the questions were quite different. There is some suggestion, however, that NCF users are somewhat less satisfied with their system than users of the Cleveland Free-Net or the Amsterdam Digital City. Users were given an opportunity to leave general comments about the NCF and these comments were very positive overall. Areas where users did complain about the system included long delays to access the system via modem, slow system response times, a desire for more Internet services, and some complaints about the user-friendliness of the system.

Figure 12 Distribution of overall satisfaction ratings

Donations

Since the NCF relies heavily on donations from its members, one measure of satisfaction and support is the amount users donate. In this survey, users were asked to indicate the "Total amount you have donated to the NCF (Canadian dollars)?" Only 654 people (60.95 percent of the survey sample) answered this question. It is not clear if users who did not respond had not donated to the NCF, or chose not to answer the question. Of the responders to the question, only ten gave an answer of zero dollars donated. This leaves 644 (60.02 percent) people who reported donating some amount to the NCF.

The average donation for users responding to this question was $31.63 (SD = 42.43). The distribution of donations is displayed in Figure 13. This distribution is positively skewed, with most of the donations in the 0-$20 category, but a few in the higher categories. Two users reported donating $500, and five users reported donating $250 or more. These extreme values bias the average in the positive direction, and a better description of a typical donation is the median of $20. With no comparable data from other systems, it is not clear if these data represent a high or low level of support.

Support for a tax increase
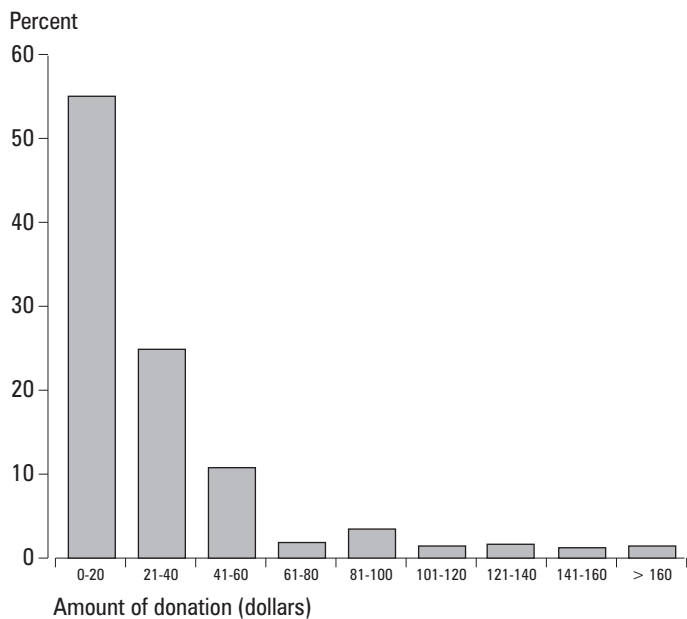
Users were also asked: "Would you support a municipal or regional tax increase of $1/year to support community networks?" A total of 1,038 people responded to this question and 84.9 percent indicated "yes." A similar question was examined in the Cleveland Free-Net study, where users were asked "should the government spend tax money to support FreeNet?" Here 77 percent of the 312 responders gave a response of "yes." It is clear that there is a high degree of support for community networks when it comes to spending tax money.

Should the FreeNet charge a fee?

This survey also included the question: "Do you think the NCF should charge a user fee?" A total of 1,051 people responded to this question and only 20.1 percent chose the "yes" option. It is clear that NCF users wish the system to remain free of charge.

The survey of the Digital City in Amsterdam asked a somewhat related question. Users of that system were asked: "When participation of the

Who is going online? Results from the NCF

Andrew S. Patrick and Alex Black

Internet Research: Electronic Networking Applications and Policy

Volume 7 · Number 4 · 1997 · 305–319

Figure 13 Distribution of donation amounts

Digital City would be charged monthly, would you continue your participation?" This is quite a different question than the one asked in the present survey because it asks about "when" there is a fee, not "if" there should be one. Further, NCF users were not asked what they would do if the NCF were to charge a fee. Nevertheless, the comparison of results is interesting. Of the 1,192 Digital City users who answered the question, only 26.2 percent indicated that they would continue to participate with a fee; 32.1 percent of the people said they would not participate, and 41.7 percent chose a "Don't Know" response. These results suggest that users enjoy the free services these community networks provide, and it is not clear what would happen to the service if a fee was charged.

Factors related to satisfaction and donations

The overall satisfaction ratings were examined to determine if any of the demographic variables were related to users' satisfaction. The satisfaction ratings were converted to numerical values ranging from 1 to 5 and subjected to statistical analyses.

An analysis of the satisfaction ratings given by men and women indicated a small but statistically significant difference: women gave the NCF higher ratings (Mean = 4.16, SD = 0.72) than men did (Mean = 3.98, SD = 0.77) ($t(1,039)$ = 2.98, $p < 0.05$). The cause of this rating difference is not known and it may be interesting to

pursue, especially in the context of the relatively low participation by women on the system.

The correlation between personal income and satisfaction with the NCF was in the negative direction and statistically significant ($r = -0.13$). There was no significant correlation with household income ($r = -0.06$). Other variables that were related to satisfaction were education ($\rho = -0.11$) and age ($r = -0.08$). It should be noted that these correlations, while statistically significant, are very modest and account for very little of the variance in the satisfaction ratings. Taken together, the satisfaction results indicate that none of the demographic variables is strongly related to satisfaction. Satisfaction with the NCF is not something that is easily explained by the characteristics of the users.

None of the connection variables was strongly correlated with rated satisfaction. Users who used the system more frequently ($r = 0.23$) and for longer amounts of time ($r = 0.20$) were slightly more satisfied. Not surprisingly, users who reported longer waiting times were slightly less satisfied with the system ($r = -0.24$). Finally, users who reported more connections to the system from work ($r = -0.15$) or public terminals ($r = -0.24$) also tended to be somewhat less satisfied with the system. Users who purchased a modem to access the system were somewhat more satisfied than those who did not (4.14 vs 3.96; $t(1043) = 3.24$, $p < 0.01$). In addition, users who purchased an additional telephone line were also more satisfied with the system (4.25 vs 3.98; $t(1038) = 3.51$, $p < 0.001$). All of these relationships are very small, however, and the connection variables account for very little of the variance in the satisfaction ratings.

A similar analysis was conducted to examine variables related to donation amounts. A correlation analysis showed that, income levels were only moderately related to donation amounts (personal income, $r = 0.23$; household income, $r = 0.16$). In addition, the satisfaction ratings were not related to the amount people donated ($r = 0.06$). The variable with the strongest relationship with the amount donated was experience with the NCF ($r = 0.30$). Like the satisfaction results, the analysis of donation amounts indicates that none of the demographic variables is strongly related to donations.

Use of the system was also only slightly related to the amounts users donated. Users who

Who is going online? Results from the NCF
Andrew S. Patrick and Alex Black

Internet Research: Electronic Networking Applications and Policy
Volume 7 · Number 4 · 1997 · 305–319

used the system frequently ($r = 0.25$) and users with more time spent online ($r = 0.24$) tended to report somewhat higher donation amounts. Users who purchased an additional telephone line to access the system reported donating more than those that did not ($54.82 vs $29.13; $t(640) = 4.67$, $p < 0.001$). This might be related to the finding that users who purchased a telephone line also had higher household incomes. None of the other connection variables was related to the amounts donated. Taken together, these results show that the amount users donate is not strongly related to their use of the system.

Conclusions

The main finding of the current research is that the NCF users are not a specialized group in the community. Although there is a large gender imbalance, they are not exclusively male (especially when compared to other similar systems). There is a broad range of ages represented on the system, and a variety of education levels. Income levels for NCF users, especially household incomes, are quite comparable to the local region. The wide representation of the community in the NCF user population suggests that this system is a good model for the development of future information highway services. The NCF attracts a wide range of people and developers of future services can learn by examining members' use and attitudes toward this system.

NCF users are quite satisfied with their system. Their levels of satisfaction are not strongly related to the demographic variables measured here. Further, the majority of NCF users do support the system with donations, with groups more advanced in life donating more than those less advanced in life.

The National Capital FreeNet can be characterized as a system providing two types of services: access to an electronic network, and content provided by the community and the members. Nearly one half of the users rely on direct dial-up connections to the NCF for all their connections. This suggests that providing access to the network is an important role of the NCF, and a service that just provided content without providing the access method might not be as successful. On the other hand, while providing access is an important role for the NCF, library and other public terminals were only used by a small portion of the members, and complete reliance on these connections was very rare. It is far more common for users to use connections from home or work locations.

Personal and community impacts

Introduction of the NCF system has had an impact on how people spend their time. For example, the mean time spent online for the nearly 20,000 active users was 1.62 hours per week (taken from objective measures of the system record for all the users). This translates into 32,400 person-hours per week on the system, or 193 person-minutes per minute. This means that in the minute it has taken you to read this paragraph, NCF users have spent a total of 193 minutes using the system. This usage rate must be having an impact on other daily activities, and this should be a topic for future research.

Not all of the impacts have been positive. NCF users reported waiting for modem connections to access the system. The average waiting time was ten minutes, and the system records showed that users connected to the system an average of 3.74 times per week. The results also showed that 79 percent of the users use a modem to connect to the system for 85 percent of their connections. Extrapolating from these results produces the finding that users spend 502,282 minutes per week waiting to connect to the system. This means that for each minute that passes, NCF users have spent 50 minutes waiting to get on the system.

The NCF system has had a large impact on the local business community. For example, 85 percent of the surveyed users reported living in the local region, and 26 percent of these users have purchased a new modem (only 11 percent of the remote users reported purchasing a modem). With approximately 20,000 active users, this translates into a large financial impact for the local business community. If the modems were an average of $100, then the NCF is responsible for $442,000 in local modem sales. Further, this figure is only for the active users, since this is the group that was sampled in this survey research. It is quite possible that many inactive users also purchased a modem in order to access the system at one time.

There has also been a large positive impact for the local telephone company (Bell Canada).

Who is going online? Results from the NCF
Andrew S. Patrick and Alex Black

Internet Research: Electronic Networking Applications and Policy

Volume 7 · Number 4 · 1997 · 305–319

The survey results show that 10 percent of the local NCF users have purchased a new telephone line to access the system. Extrapolating from the results shows that this leads to at least 1,700 additional local phone lines being ordered from the local telephone company ($20,000 \times 0.10 \times 0.85$), and if the cost is $12 per month this translates into continuing revenues of approximately $20,400 per month. NCF users may also purchase a "Call Answer" service so callers can leave a message while they are using the phone to connect to the system and this would be a further source of revenue not measured here. In addition, the NCF system pays for 169 telephone lines into its system at a cost of $3,800 per month, so the total revenues for the telephone company are $24,200 per month, or $290,400 per year.

Lessons for future research

The analysis of actual system records showed that users who completed the survey used the system twice as much as average. This may not be surprising since the survey was conducted online and more frequent users may be more motivated to describe their use of the system. These results do lead to questions, however, about the validity of survey results when being generalized to the whole user population. Another interesting finding was that users were poor at describing their use of the system. Users over-estimated their use of the system, both in the number of logins per week and the time spent online. The correlations between the reported and actual use were moderate at best, even when only the rank order of usage was examined. These findings emphasize the need to employ objective measures of use wherever possible, and suggest that subjective reports without supporting evidence should be considered weak data.

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