

Residential-Terminal Survey Description and Results

by Deborah L. Estrin

1. Introduction

The objective of this survey was to obtain a rough estimate of the number of computer terminals or personal computers that are currently used in households¹. This data is helpful in estimating the size of the existing market for residential data communication and information services. To our knowledge neither the telephone companies nor computer terminal vendors have collected such data and no other publicly available information sources were identified.

The data collected suggests that a significant percentage (over 4%) of households, in cities with demographic compositions similar to that of Newton, Massachusetts (see Appendix C), make use of computer resources in the home. In addition, the data gives some indication as to the expected growth in home use of computer technology; namely, the number of households that anticipate the need for such technology in the future (over 20%) and the number that currently make use of a simpler form of the technology for entertainment purposes, i.e., video games (over 12%).

This information will be of interest to:

- ~ Data-communications services providers, i.e., telephone and cable television industry.
- ~ Home and community information system designers.
- ~ Terminal and data communications equipment designers.
- ~ Educators.

¹This survey was designed by Prof. Jerry Saltzer and Deborah Estrin.

2. Survey Results

Detailed descriptions of the telephone survey method and the statistical significance of the survey results are given in Appendix A. Appendix C contains relevant demographic information for the city that was surveyed, Newton, MA.

2.1. Overview

Telephone numbers were generated using a partially random process which did not guarantee that a generated number was actually in service or that it belonged to a residence. As a result, a large number of *attempted* calls were found to be disconnected, business numbers, or chronically not answered.

1. Total calls attempted: 779
2. Total responses: 382, 1.4% of the households in Newton
3. Total number of computer terminals (9, 2.4 %) and personal computers (11, 2.9 %) counted: 16, 4.2 %²
4. Total number of video games located: 49, 12.8 %
5. Total number of households not having a terminal or personal computer now but expecting to have a need for one or the other in the future: 81, 21.2 %

2.2. Complete Results

Following is a summary of the responses of the 16 households that answered in the affirmative to the first question, i.e., they use a terminal or personal computer (PC) in their home:

1. Breakdown:

- ~ 7 owned a PC (1.8 % of total polled, 44 % of PC or terminal owners).
- ~ 5 owned a terminal (1.3 %, 31 %) ³.
- ~ 3 owned both a PC and a terminal (.7 %, 19 %).

²The first figure listed is the number of respondents that answered in the affirmative; the second figure is the percentage that this number represents out of the total number of households polled.

³The first figure is the percentage of the total number of households polled (382); the second figure is the percentage of the total number of households that own computer terminals or PC's (16).

~ 1 owned a PC and rented a terminal (.2 %, 6.3%).

2. Communications:

~ Of the 11 households owning PC's, 3 were equipped with communications capabilities (27 % of PC owners)⁴.

~ Of the 9 households owning or renting terminals, 4 had special telephone lines installed (44 % of terminal owners).

~ None of the PC or terminal users complained of inadequate communications speed for their current applications.

3. Only 2 of the 16 households also had TV games; both of these 2 were PC owners (12.5 % of PC and terminal owners).

4. Time installed:

~ Of the PC's, 4 had been installed for 6 months or less (2 weeks, 6 months, 2 months, and 5 months); and 5 had been installed for 2.5 years or less (1, 1.5, 1.5, 2.5, 2.5). Two PC owners did not respond to this question.

~ Of the terminals, 3 had been installed for less than 6 months (1, 5, 5); 2 had been installed for 1 year; and 2 had been installed for 3 years. Three terminal owners did not respond to this question.

5. Frequency of use:

~ Of the 11 PC owners, only 2 gave estimates of usage: 5 hours/week and 1 hour/week, respectively.

~ Of the terminal owners, 7 gave estimates: the two heaviest users estimated 18 hours/day and 8 hours/day, respectively; four estimates ranged from 1 to 12 hours/week (1, 1.5, 4, 12); one estimate was 2 days/week with no specification of number of hours; and 3 did not respond to this question.

2.3. Sources of Error

Some possible sources of error are discussed below:

1. The actual numbers involved in this survey are all very small and therefore estimates must be considered rough; see Appendix A for a discussion of the statistical significance of the results.

⁴Note that 2 out of these 3 also own computer terminals.

2. The particular city surveyed is composed of a relatively high percentage of white-collar professionals. In addition, the Boston metropolitan area, of which Newton is a suburb, has one of the highest concentrations of high-technology companies in the nation. For these reasons the results of this survey are probably not representative of a national or even state average (see Appendix C).
3. It is likely that some respondents answered in the negative so as not to reveal that they own an expensive piece of equipment, i.e., if they were suspicious as to the identity and intentions of the caller.
4. Although we tried to account for business numbers and varying numbers of extensions per exchange, it is possible that our method of generating telephone numbers was still biased by a correlation between the age of the various telephone exchanges and the number of lines being used for data communications purposes (see Appendix A). For example, it may be the case that newer exchanges have a disproportionate number of telephone lines used for data communications because many households decide to employ a separate telephone number for use with their terminal or PC so as not to disrupt regular, voice telephone communications. All such separate lines would have recently-assigned telephone numbers and would thus be more likely assigned to a new exchange that has more available numbers.

3. Implications for the city of Newton

This survey of 382 households represents approximately 1.4% of all households in the city of Newton, for which the 1980 census identified 26,900 households (see Appendix C). As is discussed in Appendix A, on the basis of our sample size we can be 95% certain that the actual figures are within two percentage points of our survey results⁵. The following estimates for the entire city of Newton were extrapolated from our survey data⁶; the numbers given in parenthesis represent the 95% confidence interval.

~ 1,130 households have either a terminal or a personal computer (500, 1,690)

* 630 households have computer terminals (108, 1,180).

* 770 households have personal computers (240, 1,320).

⁵As an example of how we can determine the statistical-significance of figures extrapolated from our survey results, we examine the responses to the first survey question. We are 95% confident that the actual percentage of Newton households owning computer terminals or PC's resides somewhere between 2.2% and 6.2% (4.2% +/- 2%). We are therefore 95% certain that there are PC's or computer terminals in at least 560, or as many as 1,690, Newton households.

⁶We assume that every household has a telephone and that no household was polled more than once, even if there are multiple telephone extensions in the household.

* 280 households have one of each (number is too small to provide statistical certainty).

~ 3,450 households have video games (2,900, 3,980).

~ 5,700 households that do not have a terminal or personal computer now expect to have a need for one or the other in the future (5,160, 6,240).

We are interested in drawing conclusions from the above figures about the size of the existing and future residential data-communications market. To some degree these conclusions also pertain to the markets for home and community information services and related equipment.

Our survey is too small to assign much statistical significance to a figure as small as, for example, the number of PC owners using data-communications, .8 %. Nevertheless, keeping in mind the high degree of uncertainty, we might speculate that as many as 760 households are currently using the telephone local loop for data-communications. We arrive at this figure by the following reasoning: Because the computer terminals are not useful without making use of the telephone lines, we can assume that there are at least as many households currently using telephone lines for data communications as there are terminals⁷, i.e., 630. According to our sample, fewer than half of these users have installed special lines for their terminals, i.e., 280; presumably the remainder use their existing residential telephone extension for both voice and data. In addition, somewhat fewer than one third of the PC owners currently have communications capabilities, indicating another 130 potential data-communication lines⁸.

Our estimate of the total number of households that currently have a computer terminal or PC, 1,130, provides a rough, lower-bound measure of the home and community information services markets, i.e., the number of households not requiring a capital investment in order to take advantage of such services. Similarly, the estimated number of video-game owners and future computer terminal or PC owners provides a far more liberal measure of these markets, 3,450 and 5,700, respectively.

⁷This assumption is based on the following line of reasoning. Unlike a PC, a computer terminal has no stand-alone function and is therefore only useful for communicating with a computer of some sort. Assuming that the computer or computers are not in the household itself, it must be the case that telecommunications is used to connect the terminal to the remote computer. Finally, the only existing telecommunications line to the home is the telephone local loop.

⁸Note that those households that own both a computer terminal and personal computer with communications are likely to use only one data communication line, not two, so in this calculation we count only those PC owners that do not also own computer terminals.

Although we have no past data with which to compare our survey results, we can nevertheless glean some insight into the likely growth of the home computer and data-communications markets.

- ~ Those persons who own personal computers today are likely to use communications capabilities in the near future, should informational and other services of interest become available. For example, Shawmut Bank of Massachusetts recently began offering free home-banking services to any customer who owns a personal computer that is compatible with the software provided by the bank.
- ~ A related development will be the demand for *higher speed* data communications to the home. Although respondents indicated that the 300 or 1200 baud rates currently supported by telephone facilities were adequate, envisioned information, transaction, entertainment, and communication services will require significantly higher speed connections to the home in order to provide acceptable user-interfaces.
- ~ The growth in personal-computer ownership will accelerate during the next five years, as prices continue to decrease and capabilities and available services increase (1983-84 timeframe).
- ~ The growth in computer-terminal ownership will remain stable or will decrease due to the availability of affordable and more functional personal computers. The nature of future community information services is likely to reflect the fact that users have some local processing and storage capabilities, i.e., PC's as opposed to dumb terminals.
- ~ Should multi-player video games become available and affordable, we might expect a comparable number of households to subscribe as do currently own non-interactive video games, 10 % (1985-86 timeframe).
- ~ Our estimate of home computer and data-communications usage in Newton might serve as an estimate of future usage in other less-affluent communities that nevertheless contain a fairly high percentage of middle to high income residents.

We recommend conducting a similar survey one year hence to measure the rate of growth of home computer and data-communications usage more accurately, and to evaluate the appropriateness of our estimation techniques⁹.

⁹We note two questions that should be added to future surveys:

1. Does the household subscribe to cable television services ?
2. If a household currently owns a computer terminal, does it anticipate the need for a personal computer in the future ?

In addition would be interesting to log whether the respondents were surprised at the nature of the question, i.e., whether the notion of owning a computer in the home is an unusual one.

Appendices

A. Method

At the outset of the survey no data was available from which to determine the statistically appropriate number of homes to survey. Therefore, 100 homes were surveyed and the resulting percentage of yes respondents (3 %) was used as the point estimate. This point estimate indicated that an additional 300 households should be called in order to achieve a 95% confidence interval for results of the form $(p \pm .02)$. This means that we are 95% confident that the actual numbers are within 2 % of the figures collected, i.e., given a figure of 5%, we are 95% confident that the actual figure resides somewhere between 3% and 7%. For results of the form $(p \pm .01)$ the sample size would need to be increased by a factor of four.

Although information supplied by the telephone company indicates that the households associated with each of the six Newton telephone exchanges are randomly geographically-distributed, the reverse-index telephone book shows that some of the exchanges are new and less saturated than others. Those exchanges that are new are more likely to serve households that have recently requested additional extensions, possibly for the purposes of accommodating the use of a home computer terminal or personal computer. The method used to generate telephone numbers had to ensure that the number of households polled on each of the exchanges be proportional to the number of households served by that exchange. In order to achieve this result we *attempted* an equal number of calls per each exchange (approximately 130 per exchange). On the newer and emptier exchanges more attempted calls resulted in disconnects and businesses and thereby reflected the proportionately fewer households served by those exchanges. Equal numbers of *attempted* calls were made to each exchange until the desired number of *completed* calls was achieved. Of the 779 phone calls attempted 382 were successful and 397 were not; of the unsuccessful calls, approximately 15% were businesses, 45% were disconnected numbers, and 40% were chronically not answered.

The four-digit extensions were obtained using the random-number generator on the PDP 10 TOPS-XX operating system at MIT. Disconnects and business phone numbers were discarded. No-answers were discarded only after they were attempted at various hours of the day for a period of two weeks. Most of the phone calls were made on weekday evenings with daytime and weekend

phoning to account for no-answers and business phones. The telephone calls were made over the course of three months by two MIT undergraduates.

B. Survey Questions

Hello. I am from M.I.T., and I am conducting a survey to find out how many Newton households have computer terminals or personal computers. Is this a household, and am I talking to the right person for this kind of survey?

This survey should take no more than two or three minutes. Depending on your answers, I may ask as few as three or as many as fifteen questions.

1. Is there either a computer terminal or a personal computer in your household?
no-//_-go to 2. yes-//_-go to 4.
2. Does anyone in your household have a job or business for which a computer terminal or personal computer might be required in the future?
no-//_-go to 30. yes-//_-go to 30.
4. Is it a computer terminal?
no-//_-go to 20. yes-//_-go to 5.
5. Is it rented or is it purchased?
rented-//_-go to 6. purchased-//_-go to 6.
6. How long has it been installed in your household, in years?
-/_years/-go to 7
7. In a typical week, how much do you use this terminal. . .
how many sessions in a week?
-/_sessions/wk/-continue
How many minutes in a typical session?
-/_minutes/session/-go to 8
8. Is there a special telephone line installed for this terminal?
yes-//_-go to 9. no-//_-go to 9.
9. Is the communications speed adequate for your application?
yes-//_-go to 10. no-//_-go to 10.
10. Do you also have a personal computer?
yes-//_-go to 22 no-//_-go to 30
20. So it must be a personal computer?
yes--go to 22 no--you shouldn't get here
22. How long has it been installed, in years?

-/_years/-go to 23.

23. Do you own it, or does your employer?
 personal-//_-go to 24. employer-//_-go to 24.
24. Do you use any communications facilities with it,
 such as a telephone data link?
 no-//_- go to 30. yes-//_-go to 25.
25. Is the communications speed adequate for your
 application?
 yes-//_-go to 30. no-//_-go to 30.
30. Does your household have any TV games?
 yes-//_-go to 40. no-//_-go to 40.
40. That is the last question. Thank you for your help.
 Goodbye.

C. A brief profile of Newton, Massachusetts

The following data was taken from a document prepared by the Newton Department of Planning and Development [1], page 25.

Table 1: Population Summary Profile

Total population, 1980	85,235
Median age (years), 1980	32.3
Total households, 1980	26,896
Average number of persons per household, 1980	2.55
Median number of school years completed, 1970	12.9 ¹⁰
Median family income, 1970	\$15,381
Average household income, 1980	\$23,500
Median household Effective Buying Income, 1979	\$26,618
Households with EBI greater than \$25,000	39.3%
Occupation of those in workforce	
Professional -- technical	49%
Managers -- administrators	15%
Clerks	10%
Other	26%

¹⁰For persons of age 25 and above.

References

[1]

Economic Development Division.
Economic Profile; City of Newton, Massachusetts.
Technical Report, Newton Department of Planning and Development, 1982.