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Computer Networks in Field Research

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In applied social research, the questions we can ask and the data we can collect depend on our tools. Computers have made possible many new tools—for instrument design, sampling, scheduling research, coding and editing, data entry, data cleaning, scale and index construction, data base organization and retrieval, statistical analysis, documentation, and report writing (Karweit & Meyers, 1983, pp. 379–414). In the past two decades, these tools have led to efficiencies and a scale of research heretofore impossible, but the data collection process remains much as it was. Today, most field researchers rely on paper questionnaires, personal observations, and interviews carried out face-to-face or by telephone. For example, of the 90 articles published in the *Journal of Applied Social Psychology* in 1989, 46 report data from a paper-and-pencil survey or face-to-face interview; in another 22, investigators used a personality inventory or similar paper-and-pencil instrument as part of experimental research. In this chapter we consider new tools for data collection based on networking and computers.[1] These tools can increase the efficiency and scale of research. More interesting, they make possible new ways of collecting data and give access to data that in the past were virtually unobtainable.

[1]The first half of this chapter is based on Kiesler and Sproull (1986) and Turner, Dubnoff, and Kiesler (1987). More detailed discussion of the data and issues raised in the second half of the chapter is contained in Sproull and Kiesler (1991).

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Development of Networks

In 1889, Herman Hollerith patented a punch-card data tabulating system that increased the speed of data enumeration and expanded the scope of data analysis over previous hand-tabulation systems. Its use in the 1890 U.S.census reduced analysis time by a third from the previous census and allayed fears that the 1890 analysis would not be finished before the 1900 census (Beniger, 1986). The 1890 census case prefigured how later computing technology would improve the scope and efficiency of social research data processing and analysis (it also prefigured some later surprises, when technology, introduced to reduce costs, ended up increasing them instead). By the 1970s most social researchers used descendants of Hollerith's machine for data processing. As the cost of computing declined, universities and private research organizations bought more computers and processed more information with them. Personal computing proliferated in the 1980s. Today most applied social researchers have access to at least one personal computer.

Computer scientists developed another technology in the 1960s and early 1970s that changed their behavior at least as much as personal computing did: computer networking. With the invention of networking, it became possible to exchange data and messages with remote computers. Computer networks made computer resources accessible independent of geography. Thus today, small university libraries can access up-to-date lists of publications on their computer system. Individual researchers can link into their university's network with a portable computer and a telephone call. The first extensive computer network, the ARPANET, begun in 1969, was intended to let researchers log on to remote computers and share scarce resources such as large programs, data bases, or special hardware. Although this kind of linking and sharing did come to pass on the ARPANET, to everyone's surprise the most popular and extensively used feature of the network was computer mail (Licklider & Vezza, 1978). Soon the designation "computer network" came to have both technical and social meanings. Technically, a computer network is a package of "computing machinery" that connects computers to one another through a transport medium carrying packets of information through nodes and pathways. Socially, a network is an artifact connecting people to one another in diverse forums to exchange benefit. A network community is a social group consisting of people who use computer-based communication regularly. Such a community has norms and social structure. Its membership may or may not have a nonnetworked counterpart (even so, a network community often has many more members than its nonnetworked counterpart). Technical components of a network provide the necessary infrastructure to connect people but by themselves do not create a network community.

Network computer mail made it possible for a computer scientist at one

location to send a free-text message on any topic over the network to a computer scientist at a different location. It also made it possible, by using distribution lists stored in computer memory, to send the same message to many people just as easily as to one person. Once computer mail was available on the ARPANET, large numbers of computer scientists around the country could exchange ideas spontaneously and rapidly on topics ranging from system design to programming bugs to movie reviews. Graduate students "visited" different laboratories by computer. Scientists could choose their colleagues based on shared interest rather than proximity (Lederberg, 1978). A large network community formed, filled with friends who didn't know each other and collaborators who had never met in person. We are now beginning to see similar network communities developing in groups and organizations that make extensive use of computer mail (Finholt & Sproull, 1990).

Three key technical changes in computer technology made possible network communities, as well as the new tools for research we will be discussing. One was networking; the second was improvements in computer power, including memory and processing capability; the third was communication software such as computer mail. Before these innovations, a computer "understood" and did computations on standardized, fixed-format information. A researcher can interact with such a computer to find out, for example, how many subjects failed to complete a long questionnaire (the computer counts and reports how many answers are incomplete). Networking, computer power, and computer mail programs made possible a marriage of computer and communication technologies.

Now, a computer is not limited to prespecified formats; it does not have to make computations, and it does not have to understand the information on which it acts. Like other communication technologies, it can accept and move information *in vivo,* leaving people to make sense of it. Yet networks differ from other communication technologies. Unlike telephones, facsimile machines, and so forth, they are designed to use computer processing power and programs for storing and manipulating information about the information exchanged among people: for doing such things as storing messages and interaction records in computer files; imbedding documents in messages; listing files by date, subject, or person; searching for people using the network; creating distribution lists; and editing communications and data. Processing power and programs minimize the effort of search and distribution, expand access to information and ideas, and increase flexibility in using communications.

It is not necessary to have a network to do computer-based field research. Researchers already use stand-alone computers as data collection devices. For instance, they may have respondents sit down at a personal computer and type in answers to a questionnaire (for a review see Synodinos & Brennan, 1988). Networked computers offer advantages beyond stand-alone machines. They make it possible to administer questionnaires as easily to many people as to a

few, nearby or remotely. Researchers can conduct interviews remotely, or run panels, focus groups, or long-distance experiments. To aid data collection, programs within networks can help locate respondents manually or automatically, deliver survey instruments to unknown locations, and control their timing or trigger delivery of an instrument to certain behaviors or events. Repeat mailings can be generated automatically if responses have not been received by a certain time. Meanwhile, respondents can respond at once or at their own convenience. Once the responses are collected either on site or remotely, they can be forwarded automatically to computer files for statistical analysis, to other sites or researchers, or to a data base that can be shared by many researchers. Programs can make remote, unobtrusive observations possible too: they can "watch" people interacting on-line or collect public conversation records, and they can manipulate these data statistically to insure confidentiality.

Of course, the sampling frame for studies using such tools is restricted to members of networked groups, organizations, or communities. Until such time as network communication is as easy and ubiquitous as the telephone, computer-based research will be infeasible for general purposes such as citywide citizen surveys. More limited applications, however, are increasingly appropriate. Below we consider the characteristics, advantages, and disadvantages of network-based field research. We emphasize especially the remote computer-based survey because it is the tool with which social researchers have had the most experience. We do not discuss how to design and construct computer-based surveys or tests, a topic too broad for the space limitations of this chapter (see Kiesler & Sproull, 1986; Sproull, 1986; Synodinos & Brennan, 1990; Waller & Reise, 1989; Walsh, Kiesler, Sproull, & Hesse, in press).

Data Collection on Networks

The full application of computers to research has been limited by the fact that raw data are collected off-line. But with a computer, a respondent can self-administer a questionnaire on-line. Add network technology, and the computer survey can reduce barriers of distance, time, and sample size more easily and more quickly than other ways of delivering surveys. As an example, in one organization whose CEO wanted to survey his employees directly, the CEO sent a questionnaire using the firm's network to the 9,000 employees of the firm, reaching them all over the world in minutes.

The technology most like a network-based computer survey is computer-assisted telephone interviewing (CATI; e.g., Groves & Mathiowetz, 1984). In CATI, the interviewer telephones respondents and types their oral responses directly into a computer. However, in CATI a person (the interviewer) stands between the respondent and the data to be analyzed. In a computer survey,

respondents enter their own data directly into the computer. When people are linked by a computer network, the computer survey can be administered to any person having access to the network.

Advantages of Network Data Collection

Reduced Research Costs

If only because it can reduce research costs, network data collection someday may become widespread. Once respondents have access to a networked computer, relatively lower marginal costs of collecting and transmitting data digitally can be substituted for the substantial costs of interviewing people in person, telephoning them, observing them by following them around physically, or sending questionnaires through the mail or distributing them in person. In addition, it has been estimated that 20–40% of the total computing costs of conducting a survey may derive from transforming data collected off-line into a form that can be processed by the computer (Ferrara & Nolan, 1974, p. 27). A network survey eliminates data entry costs and can substantially reduce coding and cleaning costs as well. Some open-ended material will still need to be hand coded, but even this task can be aided by computerized text-processing and analysis programs (Carley, 1988).

From the respondents' perspective, if computing and using computer mail are part of their ordinary work or home activities, then the effort required to respond to a network survey can be low (the opposite is true if people have to learn special procedures or take special steps to receive and complete a network survey). A major advantage for respondents of network surveys may be in reducing the effort of answering questions. Because questionnaires can be customized, the respondent need not work through a long and imposing booklet and items constructed for many kinds of people. The computer can screen responses as they occur to determine whether or not a longer series of items is needed; then it transparently skips unnecessary items. Thus, a researcher's questionnaire can be long and complex while still being brief and simple for most respondents.

Improved Data Quality

Because of its flexibility, a network survey can be adapted not just to questionnaire formats suitable for polling, personality inventories, and the like but also to interview formats. Interviews typically are more interactive than questionnaires: items "branch" and "skip" in different directions depending on the respondent's responses. Also, interviewers can explain items that are not clear, and they can ask ("probe") respondents to say more about their answers.

Rhoda, did your parents talk to you about sex when you were growing up?

no

Children often consciously or unconsciously interpret their parents' silence concerning sex as an indication that sex is bad or at the least is something not to be talked about. Obviously, parents who are uncomfortable talking about sex or who are themselves misinformed may also transmit negative messages. One way or the other, it isn't very useful to blame them for this. I suspect they tried their best and were probably only acting like their own parents. Now it is up to you to improve on it for yourself.

Did you learn about sex from other sources such as books, friends, siblings, school, etc?

yes

Do you feel the information you got was accurate?

yes

I'm really pleased to hear that. Most of my clients do not feel that way. Although accurate information about sex is highly desirable and often helps sexual performance, it is sometimes not sufficient to insure a pleasurable sex life.

Have you experienced any sex related events such as rape or incest that were traumatic for you?

1 You have 2 You have not 3 You don't want to talk about it

1 [Here the client's answer triggers a "sexual trauma dialogue plan". . .]

Ron, are you aware of what happened?

no

I'm not sure why you haven't discussed this, however there are often valid reasons to avoid such a discussion. The most immediate reason may be that discussing or even thinking about what happened can bring back many of the emotions and fears related to it. I'm a little concerned that I've raised an issue that you might not be ready to deal with. If one or both of you feel this way, it may be better to further delay discussion. It may also be highly advisable to seek human help concerning this.

Rhoda, do you want to continue talking about this now?

no

Fine, let me just say that even if we were to discuss the details of what happened, it would be very difficult for me to know how your sex life would have developed had this trauma not occurred. I hope that it is reassuring for you to know that there are many women who experienced a sexual trauma but were able to develop their orgasmic capacity.

[At this point the therapy pertaining to orgasmic concerns resumes.]

Figure 1. Excerpt from a computer-administered sex counseling interview. Responses of the couple to the computer are given in italics. From Servan-Schreiber & Binik, 1989, pp. 254–255.

An assumption in the statistical analysis of interview data is that all respondents are responding to the same stimulus. A significant disadvantage of face-to-face interviews is that interviewers' behaviors differ both randomly and systematically. These differences contribute a nontrivial interview variance component to the obtained data (e.g., Bailey, Moore, & Bailar, 1978, Groves & Kahn, 1979; Turner & Martin, 1984, pp. 109–111, 136–138; U.S. Bureau of the Census, 1968, 1979). But computer interviews are like self-administered paper questionnaires in that they can deliver a completely standardized stimulus; that is, each respondent sees questions presented in precisely the same manner. At the same time, with some programming, computer interviews can incorporate branches, skips, optional explanatory material, probes, and on-line help. To a surprising degree, a computer interview can simulate an interested and sympathetic interviewer.

Figure 1 shows an excerpt from a computer interview with a married couple in the highly sensitive domain of sex counseling. An experimental study of this program showed significant changes in participants' attitudes after trying it. Whereas before using the program the subjects thought a computer counselor would be little better than reading a book on sex, afterwards they thought it much better though not quite as good as having a marriage counselor (Binik, Westbury, & Servan-Schreiber, 1989).

Improved Assessment of Measurement Error

Among the factors that affect survey and interview responses are question wording and order (e.g., Rugg, 1941; Schuman & Presser, 1981). In studies designed to investigate these issues, two or more randomly assigned groups of respondents can be given questionnaires with different wordings or different orderings of the survey questions. A panel of the National Academy of Sciences has recommended that such experimentation should become a routine part of all survey data collection in order to provide a reasonable accounting for the measurement errors that affect survey estimates (Turner & Martin, 1984, pp. 316–318). Although it is possible to conduct these experiments using personal interviews, telephone interviews, or self-administered paper questionnaires, the mechanics of juggling multiple survey forms make such efforts costly and difficult to execute. As a result, despite their theoretical advantage, these experiments are done infrequently. In contrast, the computer survey makes the use of alternative question wordings, orderings, and skip patterns inexpensive to both researcher and respondents.

More Feasible Measurement of Ongoing and Daily Events

Surveys of experience taken while events are happening are superior to retrospective surveys (see Dawes, 1988, pp. 106–120). They help to reduce

underreporting and inaccuracies because of memory lapses, telescoping of time in memory, or current mood. Health diary surveys produce greater reporting of minor health problems, diffuse symptoms, and time lost from acute conditions than do retrospective surveys. In surveys of mental health, the diary method has been used successfully to map the relations between "daily hassles," mood, and health. Unfortunately, it is extremely expensive and difficult to arrange and supervise ongoing or frequently repeated surveys or interviews, or daily diaries, even when they are partially automated, for example, with beepers to remind respondents to complete items (e.g., Hannaway, 1989). And when paper-based, they suffer from the same defects as other self-administered questionnaires—skips and branches are difficult to administer, incomplete and inconsistent responses are common, and response rates are relatively low.

If frequent administration of items were more practical, we could do more research on ongoing and daily events and we could better address questions about how the frequency, magnitude, or severity of daily events and ongoing changes in peoples' environments affect them. Network data collection tools can make this approach much more feasible. For example, in a network survey we conducted, each questionnaire was triggered by a particular event in an employee's workday—a request for technical information or help. We were able to collect data on the triggering event as well as on consequent events at a cost that was not much greater than a single interview done in person. The more than 200 employees we surveyed in this manner were located in 60 different cities and countries. Observing events for these employees, let alone surveying them about the events, would have been impossible without this technology.

Better Measurement of Sensitive Data

Because computer-mediated communications hide much social information—situational definitions, audience reminders, social status attributes, and so forth—respondents may experience less evaluation anxiety and less self-consciousness than when they respond through other forms of survey administration (Erdman, Klein, & Greist, 1985; Plutchik & Karasu, 1991; Sproull & Kiesler, 1986; Walsh et al., in press). Respondents seem to feel they are safe and that the information they are giving is private. Research consistently shows that computer surveys and interviews not only elicit good response rates, but also that answers are more detailed, more disclosing, more extreme, and less socially desirable than comparable paper questionnaires or face-to-face interviews (see Table 1) (Kiesler & Sproull, 1986; Martin & Nagao, 1989; Sproull, 1986; Waterton & Duffy, 1984). In the Waterton and Duffy study, for example, men from Edinburgh reported more alcohol use when interviewed with a computer than by a person, and the reports on the computer better approximated alcohol sales in the city (see Table 2). In a study we conducted for our university, staff and

Table 1. Percentages Who Responded "True" to Questions about Good Behavior

	Paper survey	Computer survey
I am always careful about my dress.	50	20
I always try to practice what I preach.	79	72
I would never think of letting someone else be punished for my wrongdoings.	87	57
I never resent being asked to return a favor.	74	59

Note. From Kiesler & Sproull, 1986.

students reported more illicit drug use when surveyed through the network than through a mailed paper-and-pencil questionnaire, even though the paper survey was self-administered, anonymous, and untraceable.

One way to think about sensitivity in measurement is in terms of response effects, which are entailed in every survey administration (Bradburn, 1983, p. 289; Kiesler & Sproull, 1986). Thus self-administered paper questionnaires, which are impersonal but also relatively private, are not very motivating to respondents. Compared with other methods, paper questionnaires elicit fewer responses and less accuracy overall, but better responses to sensitive questions. Face-to-face interviews are more motivating but also increase anxiety. They tend to elicit more total responses and more accurate reports of unthreatening information but less disclosure of sensitive information. In comparison, computer surveys and interviews can be highly motivating while minimizing anxiety. They therefore elicit a high number of responses, good accuracy, and much disclosure.

Table 2. Weekly Consumption of Alcohol Reported by a Sample of Men in Scotland

	Personal interview	Computer interview
Glasses of beer	15.0	19.0
Glasses of wine	1.2	1.7
Shots of whiskey	3.4	5.4

Note. Half the men were given the questions on a computer, and half were given the questions in person. From Waterton & Duffy, 1984.

Disadvantages of Network Data Collection

Limited Populations

A major shortcoming of doing network-based field research is that potential populations are limited to people who are actively connected to a computer network and routinely use network communications. Access and routine communication are important since nominal membership in a network is insufficient for contacting respondents, enabling them to respond, and motivating them to do so (having the computer mail address of someone who never reads computer mail is much like having the telephone number of someone who is never home). Although there are some interesting studies that can be done using "reading the questionnaire" as a variable (see Salancik, 1983, for more on this research strategy), generally we are interested in the substance of the questionnaire.

Currently, scientists and members of large corporations, government organizations, and universities seem to be the primary users of computer mail (we know of no general survey of computer mail use that would allow us to specify the base rates). We therefore suspect that networks are a poor medium for doing election polls or general market surveys, for example. However, the telephone once was seen as a business tool and for a long time was considered an invalid medium for surveys because of income bias. Computer mail may never become as ubiquitous as the telephone, but increased diffusion will increase the potential populations for study.

There is a kind of backhanded advantage to the current state, in that researchers will be tempted to confine their network-based research to groups and organizations in which people use computer mail and other computer communication programs frequently. In these kinds of settings, a critical mass of network communications is more likely to exist as are genuine network communities (e.g., project groups or scientists interested in a particular specialty). Studies of active social groups are likely to yield much higher response rates than studies of people who just happen to subscribe to the same computer mail service. Previous research has shown that surveys administered to respondents who feel an attachment or commitment to an organization in which a survey is done, or to the subject matter of the survey, give higher response rates (Goyder, 1987; Larson & Catton, 1959). Previous findings of high response rates in network surveys (Kiesler & Sproull, 1986; Sproull, 1986; Walsh et al., in press) may be the result of studying populations that are somewhat community minded. When researchers begin to study nominal groups and unrelated collections of people who happen to have accounts on a network, they are likely to see the same decline in response rates that has been observed in surveys employing similar nominal populations (Goyder, 1987; Steeh, 1981; Thomsen & Siring, 1980).

A major constraint to the use of any computer-based technology for doing research is that it generally requires the respondent to read questions from a computer screen, and usually, to type responses into the computer. Currently available technology will not work with blind people or with anyone who is illiterate. The technology, however, does not require English to be the language of the survey. In fact, computer surveys may be more flexible in this regard than previous methods. With appropriate branching, respondents can choose their language and we need not send multiple copies of the instrument to each respondent or have multilingual interviewers.

The loss of the blind in network surveys is similar to the loss of the hearing impaired in telephone and face-to-face surveys. Either loss can be minimized with special (probably costly) equipment. Literacy is a bigger relative disadvantage in that it is not required in telephone or face-to-face surveys but is required for network surveys. National statistics on literacy collected by the U.S. Census Bureau indicate that less than 1% of the American adult population is unable to read and write (U.S. Bureau of the Census, 1971). Because the definition of literacy in this statistic is not very stringent, this doubtless is a lower-bound estimate of the fraction of the population that would be inaccessible to a computer survey. Nonetheless, it does provide crude guidelines as to the subpopulation that would be most difficult to survey using this technology. For example, illiteracy is higher among older people and among immigrants.

Threats to Privacy

In network-based field research, it is very difficult to guarantee complete anonymity. If a questionnaire is sent to individual computer mailboxes and respondents mail back their replies over the network, no respondent can be truly anonymous. Techniques can be used to increase the protection of privacy. For instance, we have asked respondents to send their completed questionnaires to a special computer mailbox, where a program automatically strips off all identifying information. But questionnaires can be intercepted and techniques can be circumvented. We might send potential respondents computer mail asking them to log on to a public account and complete and mail back their survey questionnaire from that account. Yet still it is possible to learn who was logged on to the public account at what time. While the actual incidence of violating anonymity probably will be rare, its potential may discourage respondents. So far, just the opposite seems true: in our studies, respondents act less afraid of privacy violations when they type responses into a computer than when they give them on paper or to a person.

A potentially serious disadvantage to network-based field research is that

guidelines, laws, and procedures protecting confidentiality and informed consent may be inadequately suited to the new technology. Networks give people access, in principle, to ever-increasing information about others. The potential for access can be abused by researchers and others who snoop in people's mail files or access data bases containing personal information without permission from the persons whose information these data bases contain. Network technology can be used to collect data automatically and unobtrusively to provide statistical reports on how employees spend their time in and away from the office, when and where they travel, whom they talk to, what they read, how they spend their money, and how healthy they are. Laws, regulations, and procedures, although improved in recent years, still do not cover all the possibilities for abuse. Lawmakers must continually try to catch up to advances in computer and communication capabilities. Most applied social researchers have little knowledge and experience of potential privacy issues in domains of new technology; they will not even find an adequate discussion in the research literature of how new privacy laws and actual behavior by government officials and others may affect their network research. (A good introduction to this topic is Katz, 1988. Also, potential problems and actual cases involving privacy are discussed on the Internet bulletin board, "Risks.")

A related issue is that of acceptable levels of informed consent for respondents. Today, researchers obtain consent from each respondent to a survey; we say it is informed because the respondent understands what will be done with responses. Usually they will be used for a specific research project. Data-collecting organizations, including universities, protect the confidentiality of the information obtained from respondents, but guarantee only that information about specific individuals or corporations will not be released in such a way that they can be identified. The extent to which informed consent can be given to unknown future uses of survey data, in particular to their use by other investigators or merger with other data sources, is of great concern to survey researchers. Controlling the eventual uses of merged, widely distributed data sets will be difficult. One natural response is to say, "Well, we'll just keep our data at home." But there are strong pressures in the opposite direction. The National Science Foundation now requires that data collected with the support of the economics program be archived in machine-readable form, and that any professional article citing program support be accompanied by a fully documented disk describing the underlying data. In the social sciences, a 1985 report of the National Research Council's Committee on National Statistics recommended that "sharing data should be a regular practice" and that a "comprehensive reference service for computer-readable social science data should be developed" (Fienberg, Martin, & Straf, 1985; for more discussion of data base-related policy issues see National Research Council, 1989).

New Data and Different Questions

Research efficiency and technical advantages probably will be the primary factors that move social researchers toward or away from computer-based data collection tools. Yet the way such tools allow researchers to collect new kinds of data and ask questions that have been difficult to ask in the past also may prove important. In our own research program, we did find efficiency changes in data collection, but these were not the most interesting changes. Below we draw on our studies of network communication to illustrate both quantitative changes in our ability to study remote or rare phenomena and qualitative changes in our ability to study social phenomena. In some cases we have gained a new perspective on complex phenomena such as organizational participation and commitment; social scientists have long had an interest in these topics but they have proved difficult to study in the field.

Reaching Remote People through Surveys

To conduct a network survey of oceanographers we sent a computer questionnaire to a stratified random sample of 338 scientists and technicians who used SCIENCEnet (Hesse, Sproull, Kiesler, & Walsh, in press). These scientists were working in many regions of the world including New Zealand and the Arctic, and some were on ships, yet our response rate was good—76%. Respondents could complete and return the survey by computer or, if they wished, they could print a hard copy of the survey and return it using postal mail. Our response rates (and early returns) were highly correlated with respondents' routine use of computer mail and with their responding by computer, but not with their geographical distance. Thus, the computer medium seems to have made possible and even encouraged high levels of survey participation among respondents who would have been more difficult to include using traditional methods. Unexpectedly, an additional 104 persons who were not in our sample requested a copy of the survey, filled it out, and returned it on their own initiative. We realized then that because the survey was sent on a network and was announced on a computer bulletin board read by many scientists, members of the network who were not selected into the sample could also participate in the study. This phenomenon of voluntary participation in a survey meant to be a random sample survey is one we have never before observed and seems to have been a direct consequence of using a computer forum. Almost all (96%) of the self-selected respondents replied by computer rather than on paper. By comparison, 58% of the random sample respondents replied by computer and 42% replied on paper.

Surveys using self-selected groups, such as questionnaire polls of magazine

readers, broadcast polls of radio listeners, and newsletter surveys by members of Congress to their constituents, frequently are used to give people a voice. Although such surveys are not properly scientific, they are nonetheless used to gather information on people considered likely to vote, buy consumer goods, and so forth. Like these other forums, networks can be a medium for giving people a voice at little cost, especially among populations similar to the scientist group we studied—people who are very literate, and comfortable with a survey format and expressing themselves in text (Tallent & Reiss, 1959). The sciences also support norms of communication (Hagstrom, 1965; Hargens, 1975). We would expect to see similar behavior in other professional settings where computer mail has been institutionalized; it is an open question whether spontaneous survey participation would occur in more reserved cultures or in autocratic, hierarchical organizations.

To investigate their motivations for participating, we compared the spontaneous, self-selected respondents in our study of oceanographers with the random sample respondents (Walsh et al., in press). In many respects the two groups were similar, but the self-selected group were especially active in the oceanographic community and seemed to be motivated to make their opinions known on the topics covered by the survey. For example, they left fewer items blank and wrote longer open-ended answers. Of course, this comparison has many limitations, mostly connected to the fact that we did not plan it before collecting our data. But our experience suggests some future possibilities for research involving self-selected samples. Survey researchers view self-selected samples as "really terrible" (Bradburn & Sudman, 1988), but when random samples are not available (as is the case now with samples of people at risk for AIDS) they may be all we have. The situation would be somewhat improved if we could estimate the bias in these samples. This is usually impossible, but using a network we can conduct planned comparisons of self-selected and random sample respondents.

Event-Driven Computer Surveys

Event-driven surveys are usually conducted in face-to-face settings where the event of interest can be observed (e.g., exit polling on election day or market basket surveys in grocery stores). With network-based communication, it is possible to observe behaviors on the network and then send questionnaires triggered by these events. This is how we and David Constant are studying discretionary information sharing at a Fortune 500 high-technology firm. First, during a specified period (several months), we monitored all the messages sent to public distribution lists. Whenever an employee sent a message requesting help in answering a question or finding information (a message sent to all members of

the organization), we sent a network survey questionnaire to the person who had asked the question. We also asked the employee to save any answers that the query generated. Next, we sent a (slightly different) survey to every person who replied to the request for help. After a week, we sent a second survey to the question asker to get his or her reaction to the replies.

Using this method, we were able to survey people while their behavior (asking or replying to a question) was still fresh in their minds. Also, because we have an exact record of the behavior—the text of the question and the text of replies—as well as self-reports from the surveys, we were able to study how variance in the nature of the behavior affected survey responses. This made possible such questions as: Are longer answers, or answers from more people, considered more valuable? Does the form of the answer make a difference to the question asker? We were also able to evaluate the contribution of asker attributes and replier attributes to perceptions of questions and answers.

We are using this study to evaluate contrary predictions made by theories of economic exchange and theories of altruism (both of which were generated from observations in noncomputer interactions), as well as to examine hypotheses about the quantity and quality of discretionary information sharing in organizations.

Ethnographic Studies of On-Line Behavior

Because social interaction on a network can be stored in computer memory, network-based field research can be used to "capture" interactions, even those that occur rarely and are too costly to measure using traditional methods. If the researchers' interests are in private conversations and exchanges, they can ask people to forward or save their computer mail messages (e.g., Sproull & Kiesler, 1986). Messages can be moved automatically to computer files, where identifying information is stripped and data prepared for statistical and content analysis.

Researchers in anthropology (Collier, 1967) and qualitative sociology (Whyte, 1984) have used photographs of the social situation being studied to elicit additional information from respondents. We used a similar technique with computer mail messages (Sproull, 1986; Sproull & Kiesler, 1986). We asked respondents to save a week's computer mail, and then used these messages as a focal point for interview questions. Like photographs, computer mail captures a snapshot of social interaction. We can examine the interaction indirectly by asking the respondent why the message was sent, what the respondent's relationship with the sender (or receiver) is, how typical the message is, and so forth.

Researchers have direct access to social interaction and groups through private and public computer bulletin boards ("bboards"), conferences, and distribution lists in network communities (our university subscribes to more than

Message offers item for sale:

Date: 31 Oct 90 17:47:30 EST

To: BBoard-Market

From: William.Walker@A.GZ.CX.CMU.EDU

Subject: Body Armor

MIL-B-44053 spec vest, life-saving multiple layers of Kevlar aramid ballistic cloth. Protects against typical missile fragmentation from mines, grenades, mortar shells and artillery fire. It may decrease the severity of wounds from rifles and machine guns and can stop small arms fire from an angle or if the projectile has low velocity. Outer shell features nylon webbing grenade hangers above each pocket. Size L(41-45). Never used. $550

One of 8 messages advising against purchase:

Date: Fri, 2 Nov 1990 14:51-EST

From: Clayton.Bridges@GZ1.SP.CS.CMU.EDU

Caveat Emptor on Mr. Walker's offer.

The August 90 Consumer Report has a penetrating article on the MIL-B-44053 spec vest which reveals serious design flaws. The article is a synopsis of a US Army study which discovered that flawed construction techniques "seriously endangered the lives of Army personnel dependent on the vest for protection." Even the present mail-order prices for these vests is too high now. Soldier of Fortune predicts that the MIL-B-44053 vests will eventually be dumped for as little as $80 for the minimal protection they offer.

The interested consumer should look instead to the MIL-B-44068/A spec vest, which the study showed to be correctly designed, and can be had for as little as $350 (last time I checked).

If Walker knew about this study, he is a rip-off artist of the worst kind. Enough said.

Angry message from seller (excerpt)

Message Date: 2 Nov 90 15:37:09 EST

From: William.Walker@A.GP.CS.CMU.EDU

So, who appointed you "Miss Body Armor Consumer Advocate Know-It-All, USA"? Anybody who would order from a police-supply catalog -- sheesh. The vests you typically see in these publications are NIJ-0042 spec or of that ilk. That's fine for stopping the a random shotgun blast or two, and maybe deflecting a .38 slug if the angle's wide (you'll still eat big on the backface deformation), but its just not the kind of thing I'd want when some 'SLiberty bag-lady starts hosing down the 71-A with one of those ghetto .802 knockoffs the kids are making these days instead of bolo ties and potholders. . ..The price on the vest stands at $550, firm. Serious inquiries only, I'm not here to entertain a bunch of milk-babies with M1 tank jokes. --will

Peer pressure, 2 of several such messages:

Date: Fri, 2 Nov 90 16:54:19 -0500 (EST)
From: Barbara Clarkson <bclw+@andrew.cmu.edu>
re: welsh's scathing reply

I think I need body armor to READ that! Milk-baby? Uh ... yeah. Just don't call me a panty-waist (or is it waste??) or I'll tell my mommy on you.

--Barb--

PS What are you people DOING out there, anyway?

Date: Sat, 3 Nov 90 19:24:18 -0500 (EST)
From: Brian Michael Keesey <bk1a+@andrew.cmu.edu>

excuse me. . . is this really important????????
---brian

Seller tries to end messages:

Date: 3 Nov 90 21:34:20 EST
From: William.Walker@A.GZ.CS.CMU.EDU

We have a happy new owner. No further discussion will be required.

"Discussion" continues:

Date: Sun, 4 Nov 90 19:44:59 EST
From: Christopher.Medea@A.GZ.CS.CMU.EDU

I disagree. I think discussion of these consumer related topics is entirely appropriate to cmu.market. I think this discussion prevented me from making the mistake of my life.

By the way, now that SCS has instituted austerity measures in the supply closet, where can you get teflon-coated bullets. There is a thesis-defense coming up soon...

Date: Mon, 5 Nov 90 00:09:51 -0500 (EST)
From: Michael Jacks <mj5z+@ANDREW.CMU.EDU>

If I recall Mr. Walker's original post he claimed that it would stop shards from quite an array of common war materials. Against bullets he claimed effectiveness ranging from almost worthwhile to fatal. Just where are all of these vests going? I guess I missed all the inner-city mortar bombardments in the headlines. This stuff is a bit bulky to wear to the laundromat just in case someone opens up on a dryer. Or have the neighbors been laying mines again?

Just curious,

Mike Jacks

Figure 2. Excerpts from a board discussion of an unusual item offered for sale on the computer network "classifieds" at Carnegie Mellon. In addition to the messages shown, there were 10 from other people.

2,000 bboards). The fact that all these interactions are stored and can be read on-line makes it possible for researchers to unobtrusively study the emergence and dynamics of such interactions and groups and to study their various "cultures." Within so-called electronic groups, one can examine many kinds of behavior, including decision making, problem solving, bargaining, selling, scapegoating, and certain behaviors that would be difficult to observe in any other circumstance.

In Figure 2, we show a discussion that took place over a few days on the "market" bboard, which faculty, staff, and students use to advertise items for sale. This discussion has some unusual attributes: the discussants had not met in person and had no interest in buying the item yet they felt free to "comment" publicly on the sale; no one revealed his status or expertise (can you tell which person is the professor or which message is completely inaccurate?); situational norms were ambiguous (as in the conflict over where the discussion "belonged" and whether it was serious or a joke); disagreement resulted both in "flaming" (use of aggressive language, sarcasm, etc.) and in attempts at social control. Equally unlikely exchanges can be found in network communications of professionals, scientists, managers, and engineers.

Because most network-based communication systems have some mechanism for saving messages, the researcher can easily capture a long stream of communications in a computer forum for later analysis. John Walsh, for example, collected all the postings to a computer bulletin board whose function was to facilitate the coordination of a fantasy baseball league. Some of the messages had an instrumental function, but many of the messages were just sociable. Message traffic began to develop a common format, and users developed on-line personae. During the life of the bulletin board (a period of several months), the board developed into an on-line community, with many similarities to what anthropologists have called "third places"—places such as taverns and corner stores, which serve as an outlet for nondiscursive interaction.

Finholt and Sproull (1990) studied culture in electronic groups at a Fortune 500 firm by examining all incoming and outgoing messages saved by a sample of employees over a 3-day period (the computer could have automatically saved all of these messages, but the researchers wanted to give respondents the opportunity to delete any personal messages from the data set before the researchers saw it). Approximately 60% of respondents' computer mail was group mail sent to all people who were on a particular distribution list such as ComputerScience-Group or Cinema. Some of these groups were mandatory, some voluntary, some work related, and some extracurricular. They found that these electronic groups shared many characteristics with other types of social groups, despite the fact that members were geographically dispersed and the communication was asynchronous.

One way electronic groups differed from other types of groups was that

Person A's Message to UserFeatureForum:

```
I cannot imagine a pathname standard that does not
reserve * as a wildcard.  It's much more than PHC
we're dealing with here - I think most other major
operating systems use the same conventions:  TOPS-
20, RSX-11W...  Users of these systems are exactly
the few hundred thousand people who are most likely
to be our first customers - people who'll be
talking to these other operating systems via TTY
emulation.
```

Person A's Message to Cinema:

```
an'I likes Joe Bob.  Shucks, I though tall the
humorless prigs had already migrated to Review.
If'n ya dun lak it, y'all kin CLICK DELETE once a
week on any msg with "Joe Bob" in the header.  AH
HAS SPOKEN!  I suggest directing your brickbats,
kudos, etc. to me rather than subjecting the whole
list to any further meta-discussion.
```

Figure 3. Changing personas in electronic messages. From Finholt & Sproull, 1990.

whereas they were often large, some having more than 100 members, they did not exhibit the formality and structure that is usually associated with increasing group size. Because the size of the group was largely invisible to group members, they may have perceived it as smaller, which may in turn have encouraged informal participation. The flexibility of the network system (which made it relatively easy for people to generate a new distribution list) also meant that employees could create new electronic groups as they liked, providing a dynamic vehicle for addressing new interests, problems, and opportunities as they arose. New groups developed different styles of interacting and cultures, and members adapted to these differences. Figure 3 illustrates how one person changed his persona when interacting with two different electronic groups.

Using a similar methodology, Eklundh (1986) analyzed the "dialogues" in message traffic of a Swedish network to study the nature of language in a computer medium. She concluded that computer communication is somewhere between "speech" and "writing," and her results challenge some of the assumptions of communications research about the inherent differences between written and oral communication (that spoken language is more informal and context bound than written language). Computer mail communication had some properties that differed from both other forms of communication. For example, there were fewer "face" aspects such as the greetings and pleasantries that often introduce a telephone call, face-to-face conversation, and letters.

In capturing on-line communication, researchers can observe naturally occurring organizational phenomena over time. Danowski and Edison-Swift (1985), for example, analyzed the communications patterns and content of an organizational crisis as they were reflected in interactions on a computer mail network of a midwestern state extension agency. This agency went through a budget crisis and reorganization in October of 1981. The researchers analyzed network traffic for 5 months before and after the crisis. During the crisis the number of messages increased dramatically, as did the number of people sending messages, but messages got shorter. In a social network analysis of the message traffic during the crisis, individuals' social networks became less interlocking, and the social network coalesced into one group of about 85 people (out of a total of 300 users over the year of data collection). In a content analysis of the messages sent, the researchers found that during the crisis the messages tended to focus more on the organization qua organization, rather than on the work of the organization. After the crisis, communication behavior reverted to its precrisis characteristics.

Finally, researchers can create electronic groups or otherwise intervene in computer interactions to carry out experiments or to guide data collection. Myers (1987) created a focus group bulletin board on a public-access system in New Orleans where respondents discussed their feelings and attitudes toward computer mail use. In capturing all of the message traffic, Myers attempted to understand important themes that underlie bulletin board behavior, such as a desire to have personal interaction yet remain anonymous. At present much more of this type of research is taking place than is reflected in the academic literature. Several market research firms routinely use on-line focus groups to study consumer behavior and attitudes and to evaluate products.

Studies Using Computer Data Bases and Archives

As organizations put more information and data into computer data bases, that same information becomes more accessible to researchers with network

connections to them. For instance, performance measures, employee survey data, personnel background data, and organizational charts that used to reside in people's heads, memoranda, scattered file cabinets, or personal computers now may be accessible on networks to researchers. Organizations also have begun digitally archiving information they never stored before. One of the most interesting types is archives of informal information exchanges. For example, "does anybody know . . . ?" is a common phrase in organizations—typically heard in informal encounters in office hallways, before meetings begin, at the water cooler, coffeepot, and in lunchrooms. Now it is possible not only to ask and reply to such questions on-line, but also these exchanges can be saved in an archive on the network so others can use them.

Archives and data bases containing informal communications are very unlike archives and data bases containing formal communications and numerical data. Usually the information was elicited because a person was seeking a piece of current or arcane information not easily found in official documents or numerical data bases. The audience for such questions usually is sympathetic or at least tolerant because the behavior is conventional, the questions are not onerous, and answerers themselves may one day need to ask a question. In the conventional world, if an asker's acquaintances cannot provide an answer, the asker is stymied. He or she must seek an acknowledged expert, or perhaps will hold the question until an auspicious meeting, convention, or visit away from the office. But on a computer network, the asker has access to a much broader pool of information sources.

For example, an oceanographer broadcast a message to a computer network of oceanographers: "Is it safe and reasonable to clamp equipment onto a [particular type of insulating] wire?" The official instructions said, "Do not clamp." Right away the sender got several messages from other places saying, "Yes, we do it all the time, but you have to use the following type of clamp." The oceanographer did not know the scientists who responded and would never have encountered them in a face-to-face setting or in a paper memorandum, but through computer communication, he benefited from their knowledge and experience. He did not have to know in advance who would have helpful information, nor did they have to know in advance that their advice would be wanted. Organizations can create on-line archives of these questions and all the answers they receive. Then before asking a does-anybody-know question on the network, a person can check the archive for recent replies to similar questions. In this way people can share knowledge across time as well as across space. In contrast to standard data base systems that contain only answers, the archives of reply files contain questions as well as answers and thus provide information on what people want to know as well as to what they do know.

Tom Finholt is studying an archive of this form that is used at a high-tech firm and comparing it to an archive that stores more formal exchanges between

Question:

We have a prospect that is considering using Einzig as part of a multi-million dollar network. They already have several miles of fiber-optic cable in their facilities to be utilized as the LAN.

I need to know where Einzig is interfacing to or utilizing fiber optics (with the exception of FOX!). Any details that can be provided as to what, where, how, etc would be of great benefit.

Replies will be stored in \LB.$DATA.RALPH.FIBER and secured for netview access.

Thanks,

Ralph Kinzey

A few of the 8 replies from 3 countries that Ralph received:

From: Mazerilski_Bill @ CASG

There's a company (in Mass. I think) which sells fiber obtics modems, multi-plexors, etc. I can't recall the name. We were using the equipment at Memorex to provide electronical isolation from some test stands. We were interfacing using a standard async port. The person at Memorex who would know is Tom Silver. You'd probably better check with the sales person before calling him though.

From: BLASE_STEVE @ THAMES

I have come across a couple of fibre optic systems connected to the Einzig for terminal networks. In one case a customer uses them because they are secure (a govt customer) the other is an in house use. In both cases they are connected to the async controller and are invisible (!) to the Einzig. I can only give you the in house use which is at \thames where we use a fibre optic mux SPL lightplex 6001 with 16 ports for rs232 terminal connections. (this is being entered using it).

Hope this helps, Steve

From: MADDIN_BILL

Hi Ralphie

One of my accounts here on the planet of Riverside is using a fiber optic network and it works great. Of course the optics is totally transparent to any of the Einzig products. They just think they are talking to a modem or some EIA interface. The real brains in that network is the muliplexor that serves as the interface to the fiber optic link. In other words if the personnel in charge of the fiber optic network set you up a port on the mux, what ever your using now, I.e., Exchange, AM6520, TERMPROCESSS, etc. . will probably continue to work.

Hope this helps. Bill

Figure 4. Sample network messages from the "Einzig Computers" archive of "does anybody know?" questions and answers.

employees and designated experts. One could imagine that the network does-anybody-know procedure could generate a data base full of questions and no answers (or poor answers), thereby completely defeating its purpose. Theories and studies of this problem suggest that people will not supply as many answers, or as many good answers, as might be most beneficial to the organization as a whole (Marwell & Ames 1979; Messick & Brewer 1983; Thorn & Connolly 1987). Yet in the network and archive Finholt is studying, both the informal information-sharing procedure and the archive seem to work reasonably well, and are faster and more popular than the "ask-the-designated expert" procedure and archive. Enough people voluntarily answer the does-anybody-know questions that people find it worthwhile to ask them. These procedures are available to all employees but are used most often by sales and service representatives. A sales representative might describe a potential customer's situation and ask if any other sales representatives had dealt with similar situations. Or a service representative might ask if anyone had encountered a technical configuration similar to one he or she was trying to debug (Figure 4 displays a sample question and reply from the firm's network). Employees broadcast about six questions a day eliciting about eight replies apiece. About half of the question askers create reply files that can be read by all of the firm's other employees. The archive of reply files is accessed over 1,000 times a month.

One of Finholt's and our research aims is to understand how and under what conditions employees, and network procedures and policies, elicit the goodwill of people who are willing to provide answers voluntarily when they see questions they can answer. Also we want to learn who benefits most from this behavior and how the behavior might change social relations in the firm. These questions are related to more general theoretical questions about altruism, information exchange, and organizational citizenship, all of which have proved exceedingly difficult to observe and measure in the field. With discretionary information-sharing behavior captured in an archive, these questions are more open to systematic study.

Action Research

A traditional form of applied social research is "action research" involving systematic attempts both to study and improve social systems. A few examples of action research on networks exist in realms such as education (Salomon, in press), community participation and service (Dutton & Guthrie, 1990), and therapy. One example in the latter domain is a smoking cessation program developed for CompuServe, a commercial communications network (Schneider, Walter, & O'Donnell, 1990). Schneider et al. argue that computer communication may be a particularly useful medium for bringing smokers into behavioral treatment. Patients can access an individualized program anytime they wish without traveling

to a treatment site. Also, they can begin treatment privately, without announcing that they have done so. A program evaluation indicated that of those who got the full treatment and stayed with the program, about 23% had abstained from smoking 6 months after beginning treatment. Abstinence rates were significantly higher among those patients who received the full treatment (which included an expert system to control interactions) than among a comparison group that received a simplified version of the program that did not include any personalized interactions. Schneider et al. estimate that with a small amount of expense and effort they reached about 1% of the population of smokers on CompuServe, which has a population equal to that of a medium-sized city. This suggests that network-based clinical systems have some potential for making clinical help available to a larger audience. At the same time, since the computer can be used to record the exact pattern and content of interactions during therapy, we expand the possibilities for research comparing different counseling strategies.

Networks as an Intervention in the Social World

Network-based data collection techniques such as the computer interview can help us study more people, different groups, remote respondents, and phenomena that have been difficult to study. If networks only made these data more accessible they might lead to some new insights. Yet networks have another, less direct but perhaps just as important, impact on data collection and research: they change the very environment or setting—the "field"—of our field research. Some of the studies described above, such as those of "electronic groups" and discretionary information-sharing archives, examine behavior or social arrangements that do not exist outside of a networked environment. In these cases, the network is not simply a means for passively collecting data but represents a kind of social intervention or social change. For answering some research questions, such intervention poses a source of error or bias to be avoided or minimized. Alternatively, it offers a new arena for evaluating theories and hypotheses that were developed from observations in more traditional social settings. In some cases, the intervention may be worthy of study in its own right, as an example of social change.

Studies of network communities reveal many interesting ways that network technology can be said to intervene in and alter the social world. For example:

- Communications among people who have never met in person can be frequent and close (with the result, for instance, that we can disentangle variables such as frequency of contact and self-selection that contribute to proximity effects in field research).
- Information access to organizational data that were previously centralized

and controlled by a few can be decentralized; control can be decoupled from organizational position.

- Reference groups can develop in the absence of social similarity.
- Direct participation by large numbers of employees can take place. This participation may be passive (employees gain access to information), active (employees have a voice), or both.
- People can "belong" to tens or even hundreds of electronic groups, creating the potential for dynamic and complex "linking-pin" roles and for information sharing on a scale heretofore unimaginable.
- Much of the social and contextual information that helps regulate behavior, makes for social distinctions, and defines social situations and decision frameworks is not inherently available in a network. Thus, behavioral regulation and social inequalities tend to break down, at least temporarily.

Researchers have examined each of these phenomena in studies of social and organizational processes such as coordination, distributed decision making, and control (Carley, 1988; Eveland & Bikson, 1988; Kraut & Streeter, 1990; Rule & Brantley, 1990). A different issue is whether these phenomena represent potentially significant social changes. When new technologies are introduced in organizations or society, social scientists are interested in whether the changes are temporary or not, and if they are permanent, whether the average efficiency or quality of life improves, as well as how different groups are affected by the change. A hypothesis that many people entertain about computer communication is that it will democratize communication patterns (Hiltz & Turoff, 1978). If geographical distance and time zones are less of a barrier to participation, those people who are far from the centers of activity or power will have more access to information. If social information is reduced, then social distinctions will be less of a barrier to information access. We have argued that network technology in organizations potentially benefits remote or low-status employees more than it does central, nearby, or high-status persons who already have good access to information and other people. Thus, whereas communication outcomes may improve across all groups, they should improve most among "peripheral" people. We have used both paper and computer surveys, as well as experiments, to study this hypothesis.

A survey of oceanographers' use of SCIENCEnet was one vehicle we used to study the relative impact of computer communication technology on "central" and "peripheral" people (Hesse et al., in press). We were interested in whether oceanographers who use the network and who are relatively peripheral to their discipline (e.g., those who are younger, or work at inland institutions) gain more access to resources and benefits than are gained by central scientists who use the network (Merton, 1968; Merton & Zuckerman, 1973). In addition to an overall

positive relationship between using computer mail and scientific outcomes, we found that under some conditions scientists' use of the network interacted with measures of peripherality. For example, a scientist's use of computer mail was positively associated with his or her receiving professional recognition such as awards or appointment to national committees. That is, scientists who were heavier users of computer mail were more likely to receive professional recognition than scientists who were light computer mail users. But additionally, the difference between younger scientists who did and did not use computer mail heavily was significantly larger than the difference between older scientists who did and did not use it.

Because the data from our oceanographers' survey are cross-sectional, we do not know whether or not using the network played any causal role in scientists' professional recognition, but the pattern of results is consistent with such a view and also fits with the results of laboratory experiments (Dubrovsky, Kiesler, & Sethna, 1991). They are intriguing because they suggest that networks could change the structure of communication in groups and organizations by increasing the participation of previously isolated or ignored employees. Data from another study we conducted suggest, however, that the nature of this participation will be important. In that study (Huff, Sproull, & Kiesler, 1989), we examined the relationship between using computer mail and feelings of organizational commitment. The overall relationship was significant, especially for shift workers (a peripheral group compared with day workers). However, when we compared how much computer mail people received with how much they sent we found that only sending computer mail was related to commitment. These results suggest that new communication technology will have a more significant impact through changes in the participation of peripheral employees when that participation gives people a voice.

Conclusion

The populations for network-based field research will be communities and organizations with access to and familiarity with computer networks. These groups will tend to be well educated, young, and technologically sophisticated. Within these limits of feasibility, and assuming that investigators take active responsibility for ensuring privacy and informed consent, computer surveys and other network-based data collection methods offer some advantages for data collection. Our research has shown that when used in lieu of paper questionnaires or interviews, computer surveys and interviews elicit similar or "better" data (Kiesler & Sproull, 1986; Sproull, 1986). Because computer surveys and interviews can be standardized and controlled (as through counterbalancing of items), and customized for individuals, subgroups, and types of responses, they can

reduce effort for both researchers and respondents, increase response rates, and improve the technical quality of data. Ease of use, interactivity, and an absence of social information (such as cues associated with presence of others) encourage respondents to disclose more information, especially personal or sensitive information. Although these advantages may induce some researchers to try computer field research, we have found that networks are interesting in their own right. Measuring the natural behavior of people in computer networks offers a glimpse of how people behave in a new communication environment. During the past decade some of our colleagues have argued that research on networks is uninteresting because the results are not generalizable to "real life." We believe that as computer networks and other computer-based technologies become ubiquitous in society, network-based field research will be increasingly useful for studying behavior in a relatively new yet "real" real-life communication environment.

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