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# 4 New Methods and Data for the Study of New Media

The nature of the new media—facilitating communication interactivity with the help of computers (or microprocessors)—generates a host of evaluation issues and motivates a considerable reassessment of communication theories and concepts, as the prior chapter discussed. A reasonable question to ask is whether research on the new media also generates or requires new methods and data. The goals and objects of research, the theories used, the methods applied, and the data analyzed all are interdependent. This chapter considers the question with some suggestions about new methods and new data that might be appropriate for the study of new media.

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FIRST PRINTING

NEW METHODS FOR THE STUDY OF NEW MEDIA

This section makes several arguments. The first is that traditional research designs may involve elements that limit our possible understanding of the uses and impacts of new media. (Warnings as to the limits of mass media research, particularly in the context of telecommunications policymaking, have been well raised by Meyer and Hexamer, 1982). The second is that the natural contexts of new media may limit how faithfully traditional research designs and methods may be applied. The third argument is that the nature of new media themselves may create limitations, as well as new opportunities, for the kinds of research typically applied to mass media.

It may first be useful to describe the main elements in conventional communication research on mass media effects. Such research represents the dominant approach followed by mass communication scholars over the past 30 years or so. The approach typically involves an experiment or, especially in recent years, a survey on mass media effects conducted by gathering data through questionnaires or interviews. A large number of individual respondents (usually at least several hundred) is often randomly sampled so as to provide data on a large number of variables (perhaps as many as 80 or 100). The reliance is upon quantitative analysis of moderately large data sets. The individual is the unit of analysis and data are gathered cross-sectionally at one point in time. Analysis tends to focus on correlations, partitioning of variance into explained and unexplained portions, or tests of differences.

Figure 4.1 diagrams a somewhat typical research design for studying the impacts of a new communication technology. The main elements in the design are a sample of users of the new technology from whom data are gathered, often by means of personal interviews, both before (at  $t_1$ ) and after (at  $t_2$ ) the introduction of a new communication medium. This design is a typical field experiment, based on the kind of experimental design that behavioral scientists have taken from classical agriculture experiments of some years ago (i.e., Fisher's analysis of variance design).

As suggested above, a number of methodological questions, problems, and lessons accompany using this type of research design for investigating new media.

(1) Evaluation activities, informed by communication research, could be brought to bear earlier in the field experiment, to take advantage of their potential contributions. Very seldom is behavioral science research explicitly involved in designing the communication technology or the implementation strategy.

Evaluation research is typically kept separate from the management of new media. Conventional wisdom about evaluation research holds that the evaluators should be independent and separate from the system or program that they are evaluating. Politicians and other policymakers often require such separation, so as to minimize possible biases in the evaluation. The independence of the evaluation research from the design and operation of the system is thought to maintain the credibility of the

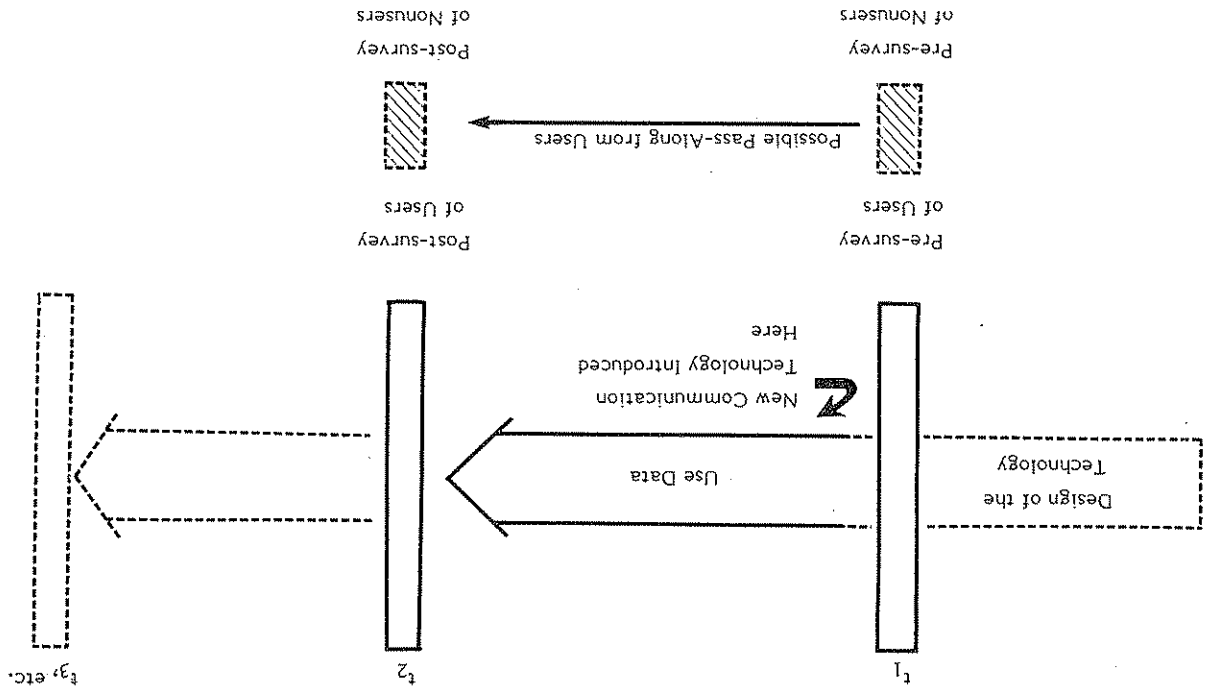


FIGURE 4.1 Typical Research Design for Study of New Communication Technology

SOURCE: Rogers and Picot (1983).

research results. In many cases such independence and separation may indeed create a healthy tension between the evaluation and system management, and lead to more reliable research findings about the technology's effects.

However, it seems that the system design, evaluation, and management must be closely integrated if an evaluation is to be conducted in an effective manner. For example, if research and evaluation activities are begun after  $t_1$ , there may be no baseline data on prior media use, attitudes toward new media, or comparative outcomes (as in Rice and Case, 1983). Then research comparisons at  $t_2$  must depend on users' perceived and remembered impacts of the new media. Research input into the design and implementation process would avoid this limitation; it may even lead to designing the system in ways that facilitate data collection, as the second half of this chapter suggests.

Further, the research findings can be utilized to improve the communication technology through its redesign. Often this redesign occurs during the time period ( $t_1$  to  $t_2$  in Figure 4.1) in which the communication system is being evaluated; the evaluators suggest needed improvements to the technologists, which may then be implemented. When the users are providing formal evaluation feedback, or even reinventing the system (see Chapter 7), then system design, use, and evaluation clearly represent an integrated, ongoing process.

One example is the *Bildschirmtext* Project in the Federal Republic of Germany (Rogers and Picot, 1983). Here the evaluation included an acceptability study of potential users of *Bildschirmtext* and of the actual users in a short test phase of this interactive TV technology. The purpose of this formative evaluation research was to gain understanding of the future acceptance of *Bildschirmtext*, by dealing with such questions as how many (and which) households would purchase the services, at what price, and how the technology should be designed/re-designed for user acceptance. A somewhat similar strategy was chosen for the planning, design, and implementation of the new teletex service in Germany (Picot and Reichwald, 1979). Note that formative evaluation itself grew out of efforts to better design educational and prosocial television (see Chapters 3 and 11).

Such acceptability studies of a new communication technology face many difficulties, stemming from the basic limitations of available social science methods in predicting future behavior. Nevertheless, acceptability studies represent one type of formative evaluation that involves evaluators along with the system designers and managers early in the process of designing and implementing the communication medium.

(2) Typically a new media system is introduced to and used by an ongoing organizational or social context in which the users comprise a specific department or even the whole community. Thus, there is no control group for comparison with the users, so it is impossible to remove the effects of other variables on use of the communication technology or to exclude certain rival hypotheses (see Figure 4.1). It is difficult to introduce new communication systems otherwise, given the network

nature of interactive technologies.<sup>1</sup> Perhaps another unit could be selected as a control group, if it matched fairly well. But even then, the random assignment of respondents to treatment and control groups is usually impossible. There are so many problems involved in having and maintaining true control groups in these situations that they are almost never utilized in evaluations of new communication media. As a consequence, such evaluations consistently overestimate the effects of the medium, because any extraneous effects that may exist are included as a disguised residual in the measured effect. This problem should not be forgotten when analyzing and reporting research results of these studies. Other means of control can be (and are) utilized in evaluating new communication media, such as multivariate statistical control. But such an evaluation design is weaker than an experiment with control groups because all of the variables to be controlled must be measured; in a well-designed experimental design, relevant variables are controlled, whether measured or not. Historical controls, such as comparing a user community at  $t_0$ ,  $t_1$ , and  $t_2$ , are another solution.

(3) Users of new communication media often are not representative of the population of future users, so research results cannot be generalized to the wider population. The issue of the generalizability of an experiment's results is illustrated by respondents in an electronic mail study who were the top 110 administrators at Stanford University (Rice and Case, 1983). These administrators were selected, in part, in order to stimulate further adoption by other administrators in the university. Yet are they typical of the next 110 users who accepted Terminals for Managers at Stanford? Hardly. And how representative is Stanford University of other organizations that are expected to adopt electronic mail in the near future? Probably not very.

One specific way in which initial users are not representative is illustrated by the concept of the knowledge gap. In the case of such past communication as television, it seems that it first widened knowledge gaps in society, but eventually closed them, after most everyone had adopted the innovation (Katzman, 1974). The first-widening then-closing sequence occurs if the technology is widely adopted, and the temporary inequalities are less serious when the rate of diffusion is rapid (as with television in the United States). But what about an expensive and complex communication technology like home computers that may never become a consumer item in all households? This case is portrayed in Figure 4.2.

Why does information-gap widening occur?

(a) The new media of home computers, teletext and videotext systems, video recorders, teleconferencing and electronic messaging are expensive. So only the socioeconomic elites can afford them. They adopt them first, and others can only follow slowly, if at all.

(b) Because these new media are computer-based information tools, an individual must in general be a motivated information searcher to use them (at least effectively; though see Chapter 5 for alternative system designs). The information-rich are most likely to be the first adopters, as they are more likely to be computer literate.

(c) The new media that support interindividual communication require that potential communicators are equipped with compatible devices (electronic mail, picture phone, teletex, telecopy, computer conferencing, etc.) so that a relevant network can emerge.<sup>2</sup> Thus, a critical mass of users with similar equipment must be involved as respondents in evaluations of the new media.

(d) The information-rich particularly want specialized information, which new media are uniquely able to provide. Thus they increase their information advantage.

The general lesson here is that individuals, families, and organizations that participate in a communication technology experiment are very atypical of the population of potential users. Instead, the users in such an experiment are usually typical of the early adopters of an innovation: information-rich and socioeconomically advantaged (Rogers, 1983). This problem seems a typical and unavoidable aspect of early stages of research on early users of new media.

It is very difficult to avoid this threat to generalizability, even when one tries. For example, in the Green Thumb Project in Kentucky (Case et al., 1981; Paisley, 1983; Rice and Paisley, 1982), the 200 users of this free system were chosen by a local committee from the approximately 400-500 farmers who applied for a Green Thumb Box (in response to a mailed announcement from the local county extension agent to about 2600 farmers in the two counties of study). The committee chose the 200 users so they were approximately representative of three categories of farm size (small, medium, and large sized farmers). This selection procedure guaranteed a range of socioeconomic statuses among the 200 users, but it introduced another bias: The small farmers who volunteered to participate tended to be atypical of all small farmers in the two counties, in that they had a high degree of prior contact with their county extension agent. (Most small farmers do not have much extension contact.) So the Green Thumb selection procedure guaranteed that small farmers were included in our study, but also tended to make these small farmer-users atypical of all small farmers.

A further problem: The Green Thumb system was free to the user in 1981 (thanks to the U.S. Department of Agriculture), but a fee was charged after the end of the evaluation project. Thus, not many small farmers will use Green Thumb in the future. So again our small farmer-users in the 1981 study are a sample whose research results cannot be generalized to future users without considerable qualification.

(4) Quantitative research approaches, particularly manipulated experiments, based on variance research, seldom can provide a satisfactory understanding of the behavioral change process through which a new communication medium has effects. See Monge (1982) for a conceptual discussion of this problem, along with suggested methods, such as structural equation modeling and time series analysis (Monge and Cappella, 1980).

Variance research is a type of data gathering and analysis that consists of determining the covariances among a set of variables but not their time

NOTE: At any particular point in time, a new communication technology has the effect of widening the knowledge gaps in society, because the first to adopt are the socioeconomic elites who are already the information-rich. But later, when everyone has adopted the technology, it again has an equalizing effect between the information-rich and the information-poor. But what about a technology like home computers that may not reach 100% adoption?

SOURCE: Rogers (1983).

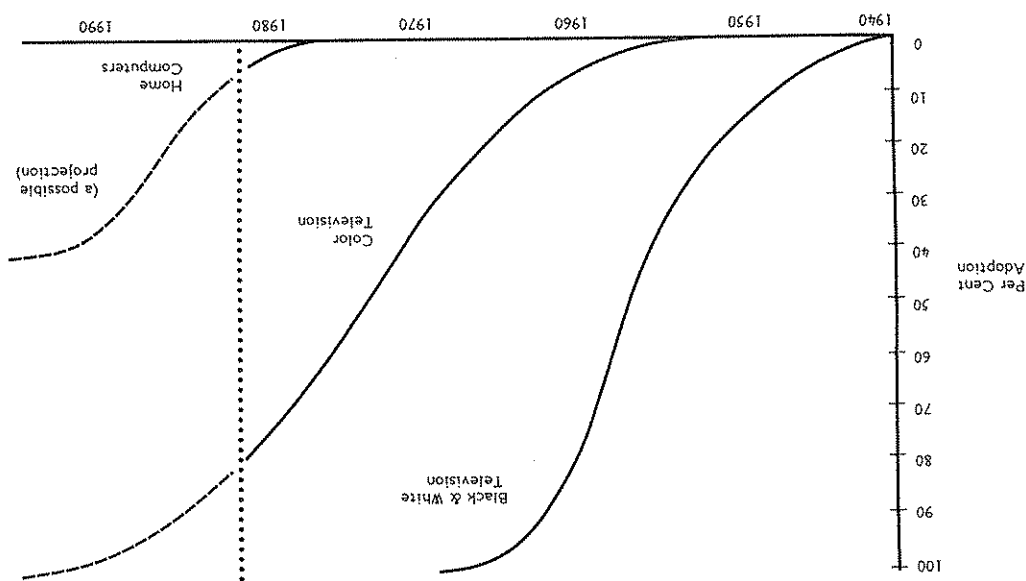


FIGURE 4.2 Diffusion Curves for the Adoption of Three Household Communication Technologies

order (Mohr, 1982). A  $t_1/t_2$  pre/post design (Figure 4.1) heads an investigation toward using (a) "difference" statistics (like the t-test between means or analysis of variances) or (b) "correlational" statistics (like zero-order correlation, multiple correlation and regression, or partial correlation techniques) in which the researcher seeks to determine the correlates of dependent variable(s), which often is either acceptance or use of the new medium. This approach typically assumes *linear* associations between variables, and focuses on the impact of a medium. As discussed in the beginning of this section, typical variance research involves a limited number of concepts operationalized by specific questions asked of a random sample of respondents. Thus, some of the limitations of a variance approach include measurement as well as analysis, because completeness in understanding the process is exchanged for representativeness in describing the relations.

Variance research alone usually cannot tell us much about the time order of the variables in a study, other than rather crudely (through the  $t_1$  to  $t_2$  differences in a variable), and seldom can provide a very complete understanding of the over-time process nature of the change behavior effects that are caused by the new communication technology. In this situation, a process research approach may be more appropriate. *Process research* is a type of data gathering and analysis that seeks to determine the time-ordered sequence of a set of events and to explain the process by which the sequence occurs (Mohr, 1982). Data-gathering methods for process research are often more qualitative in nature (like participant observation, case studies, and unstructured interviewing). A special advantage of such qualitative methods is that they allow the investigator (a) to identify unexpected variables and (b) to study the wider context of the user system and of the new communication medium. Case studies may be particularly appropriate in the early stages of a new medium, as process research can be used to obtain understandings of the range of uses, impacts, and applications. For example, the *Bildschirmtext* evaluation involved qualitative data gathering via user diaries and from an in-depth study of 30 low-income users (Rogers and Picot, 1983).

Process research is not necessarily qualitative, however. For instance, the *Bildschirmtext* evaluation included quantitative data gathering from the six-stage panel of 200 users, in which a set of core variables was measured every four months or so. This panel strategy allowed tracing user behavior changes over a number of time periods. (This approach is highly intrusive in that the repeated data gathering undoubtedly conditions the responses that are gathered, although with the large sample of *Bildschirmtext* users that are available, this intrusion may not be too serious.) Rice's (1982) study of over 800 users of a nationwide computer conferencing system involved quantitative log-linear analysis of two years' monthly messaging data.

There are several aspects of "good practice" research that should be included in variance and process approaches (Mankin, 1983). These include (a) multiple measures from several independent sources; (b) objective data sources—not just computer-monitored data as discussed

below, but corporate records, external agency or association records, and the like; (c) unobtrusive measures, such as absenteeism and turnover as an indicator of job satisfaction; (d) other indicators of measures that typically are collected only via subjective questionnaires—because two external traits may be psychological artifacts of the respondent's attitudes, a researcher might want to use a variable that research has shown to be a good indicator or correlate of another variable of interest, which itself is likely to be confounded with a perceived impact; and (e) measures of organizational climate and work climate, which might also explain contingencies of uses and impacts. Mankin also suggests the development and use of "information primitives," constructs that describe the functions and behaviors of information work. Paisley (1980) has gone a long way toward this goal. By understanding what it is that people do when they do information work, we can better understand how functions migrate across roles and individuals when new organizational media become part of the work life. The use of such standard functional variables would improve compatibility across studies, aid in redesigning office work, and assist in assessing and directing changes.

Indeed, variance and process research are not necessarily mutually exclusive; a research design can include both approaches, with each providing a unique type of data. Hewes (1978), for example, suggests a compromise between the two approaches. His technique

permits a researcher to describe the impact of a communication process . . . without having panel data. As a result, it has the advantages of both "process" and "variance" approaches without some of the disadvantages.

In fact, he suggests several approaches to the problem. The primary technique is discrete-state, discrete-time, Markov analysis. Required data include a vector of probabilities that the sample at time 1 occupies each of several nominal-level categories, and a matrix indicating the probability that the response of the sample (i.e., an "average" subject) will be in a particular category in time 2 given its response in time 1. There are rather severe assumptions for Markov analysis, which Hewes explains well, and for which he shows examples of the effects of transgression. In the examples of effects of stimulated radio interviews, and of political opinion, Markov analysis was remarkably robust.

One aspect of the Markov approach—analysis of a pooled transition matrix—was used by Rice (1982) on the communication linkages from a computer conference to test a model of group role categorization based upon information flows in the system (see Chapter 6). The apparent entropy-laden role structure of the system could not have been revealed without the Markov perspective. In general, though, it is difficult to imagine the theoretical validity of one of the assumptions: that human attitudes or behaviors are dependent only upon attitudes or behaviors from the previous time period, and not related to attitudes or behaviors or prior time periods. Further, Markov analysis requires homogeneous groups for separate analyses, which is a particular problem for the study of

new media where clear subgroups have yet to be established by a body of research.

But Hewes's contribution lies in showing how Markov analysis may be applied to independent samples from the same population at different points in time: via simultaneous solution for the unknown parameters by algebra; by ordinary least squares (OLS) estimation, which requires more data but provides better quality estimates; and by more advanced estimation techniques. One of these techniques is pooled cross-sectional time series (Hannan and Young, 1977), which handles some difficulties that OLS regression does not (such as autocorrelation); moreover, it is designed to handle multiwave panel data in time-series fashion. Hardy (1980) successfully applied this procedure to analyzing the relation between the introduction of telephones and economic development. He used UNESCO data on 52 nations in intervals using a variety of lags; his primary use of pooled cross-sectional time series utilized 633 nation-years as the units of analysis.

Insofar as new media may interact with interpersonal communication, the very qualitative nature of such communication may be partially explicated by using the process models of conversation and cognition advocated by Cappella (1980) and colleagues. Their models may easily take advantage of computer-monitored data described later in this chapter.

Consider another approach to combining qualitative and quantitative, variance and process research. Mohrman and Novelli (1983) argue that because

- (a) office technology is still evolving,
- (b) it is becoming more integrated and thus changing and expanding its functionality,
- (c) its consequences and direction are contingent on many factors, and
- (d) simple cause and effect analysis is inferior to a systems perspective in such research,

researchers cannot predict the levels or kinds of change that might occur in an organization implementing such technology. Therefore, they call for "adaptive research." It involves periodic questionnaires as well as in-depth, open-ended interviews with users; the results of prior data gathering (or even of sections of the questionnaire during an interview session) are relayed back to the groups of users. The use of focus groups for impact research, as opposed to product development, has shown great promise in office automation studies as Mohrman and Novelli's (see also Mankin, 1983) and in interactive cable studies (Dozier and Ledingham, 1982; see also Chapter 5). Mankin suggests using guided imagery to help future user groups reveal possible uses, system features, tasks and impacts; these may be further developed in ongoing computer conferences during implementation.

In light of their awareness of the shifting office environments, Mohrman and Novelli (1983) used factor analyses at different points in time to show shifts in how users of advanced electronic work stations conceptualize the effectiveness of certain office activities. Over one hundred systems analysts, technical specialists, unit managers, and secretaries at a large international organization were asked about their attitudes on these activities before implementation (Pre) and one year after implementation (Post), and, during the post questionnaire, what their attitudes had been a year earlier (Then). Figure 4.3 shows how the activities were conceptualized across the three time frames. The rows are pre factors, columns are post factors, and the boxes are then factors.

We might add at this point that this use of factor analyses at three conceptual intervals provides insight, but may not be methodologically rigorous. Hewes (1983) suggests that LISREL, a full-information maximum-likelihood estimator that can test structural relations across time periods, or GALILEO (Woelfel and Fink, 1980), a metric multidimensional scaling system that can map the development of conceptual spaces overtime, may be appropriate techniques. The use of either would be an appropriate way to establish quantitatively the basis for qualitative analyses of the process of concept reformation involving the implementation and use of new office communication technologies.

The effectiveness of activities in boxes on the diagonal (cells 1A, 2B) was not conceptualized differently at any time period, the activities in column C were generally reconceptualized in the post phase, while activities in columns D and E were reconceptualized in both post and then phases. Activities performed by more than 85% of users (double asterisks) or by more than 33% (single asterisks) appear only in the reconceptualized factors. An example of the utility of this analysis is that, while the mean effectiveness score on activities in columns C-E appeared to remain the same or even decline by the post period, they were scored *much* lower during the then assessment. That is, by time 2, what had been satisfactory before implementation was now seen as unsatisfactory effectiveness; the post measures were based on rescaled dimensions. Further, the ways in which activities were reconceptualized were significantly different by time 2. The authors argue that implementation and use of office systems led to changes not only in effectiveness, but perhaps also in the scale upon which effectiveness is evaluated, or even in reconceptualization of what activities are and the dimensions of their effectiveness. They use results such as Figure 4.2 to argue that implementation in organizations leads to unpredictable, shifting situations, requiring adaptive research methods.

This sort of reconceptualization has been found in other studies of office automation. For example, Tapscott (1982: 207) reports that although several measures of "information received" improved between the pretest and posttest periods (nine months) of a pilot office communication system (N of pilot users = 19; N of control group = 26), the perceived "information needed" also increased. "The findings suggest that as access to information improved, so did expectations regarding what is possible and perceived requirements regarding what is necessary."



but how we look at the world. In sum, the authors suggest ways to employ quantitative methods in order to understand qualitative process.

Organizational media, in their organizational contexts, are not static. In particular, office technology can be designed and redesigned by users in ways that cannot be predicted by implementor, user, or researcher. Chapter 7 considers this ongoing innovation in greater detail.

### NEW DATA FROM NEW MEDIA<sup>3</sup>

Many of the new media are possible because of microprocessors or are in fact managed by larger computers, which can facilitate and structure communications. We use these technologies to support routine tasks, from text processing to records management, and to support human communication. Importantly, such systems also provide information about how a medium is used and what it transmits. Refer to Figure 4.1 again. Computer-monitored data can indicate actual usage of the system after the new medium has been implemented. These data may provide a direct measure of user behavior, may complement attitudinal and reported use data, and can be used in ongoing, processual, and quantitative research to supplement some of the qualitative analyses mentioned before. (Sometimes data are gathered by traditional means from a sample of nonusers of the system; these people may be asked about information passed along by users.) *Computer monitoring* of an information or communication system consists of the automatic logging of the type, content, or time of transaction made by a person from a terminal with that system.

### Description of Systems and Kinds of Data Possible

Most past monitoring studies involved either (a) information retrieval systems, or (b) computer-based communication systems.

*Information retrieval systems.* An online information retrieval (IR) system is "one in which a user can, via computer, directly interrogate a machine-readable data base of documents or document representations" (Lancaster and Fayen, 1973: 1). IR systems can be classified either by the type of data base on which they operate or by their search capabilities (Meadow and Cochrane, 1981; Williams, Lannom, and Robins, 1982). Bibliographic data bases include descriptions and accessibility of literature, such as journal articles or books. Nonbibliographic data bases include everything else, such as statistical files, company records, stock exchange activity, and so on. Searching capabilities may allow multiple elements and Boolean logic, or require exact matches on a few characters of input.

More recently a class of IR systems aimed at the consumer market has developed. This class includes videotext and teletext systems that typically require little or no training for use. Such systems are described in Chapters 2 and 5. Many IR systems exist in private organizations and

government for the purpose of maintaining internal records and various kinds of management information.

*Computer-mediated communication systems.* A computer-based communication (CMC) system is a generic term for electronic messaging or computer conferencing as well as for functions of more sophisticated knowledge worker augmentation systems. (See Chapter 6 for a consideration of computer conferencing and Chapter 9 for an overview of electronic mail.) Using a CMC system, people can send text (data, memos, letters, reports) to one another (to one or several individuals or predefined groups of individuals) or may share files (conference comments, working drafts, coauthored papers) while communicating (usually not at the same time) via geographically dispersed terminals (video or hard-copy) in structured ways using a shared host computer and telecommunications lines e.g., national networks and cable (Ellis and Nutt, 1980; Hiltz and Turoff, 1978; Newell and Sproull, 1982; Panko, 1980, 1981b; Uhlig, Farber, and Bair, 1979).

### Possible Types of Data

Online monitoring produces large data sets. The precise data elements collected will vary by the type of system, but most data are either transactional (what happened when, where, and by whom) or temporal (what was the pacing of the interaction, how much time is spent in certain activities, and so on).

By collecting a few well-defined "primitive" measures (such as terminal and user IDs, start and end time, commands used, text content, system response, messages sent and received, sender and receiver, matches, and errors), we can generate a variety of useful aggregate and ratio measures of communication behavior.

We can use computer-monitored data to uncover and describe patterns of system usage. Generally, a string of IR commands can be aggregated to comprise a search task, while all commands and results within a single user session may be aggregated to constitute a "session" datum. The data are usually used to look at user behavior within individual sessions and to look for comparisons between users, perhaps across systems or tasks. In CMC systems one research goal may be to describe or model patterns of communication networks, built up from links between senders and receivers, as described below (see Rice, 1982).

We can focus on the analysis of the frequency, type, and context of errors. A particular system can identify only certain types of errors (e.g., incorrect entries and commands out of sequence). The system will typically miss logical errors and some content errors that appear correct (e.g., message was sent to wrong person; wrong item was searched for, but matches were made).

We can focus on issues of timing and duration. Some caution must be taken in interpreting user start and end times due to differences between

system-clock and real-clock time, or due to system-response time. The elapsed time between transactions may provide useful information about an individual's "think time" associated with specific commands and identify some of the more difficult-to-use features in the system. Also, the choice of time interval affects the meaning of the analysis unit. For example, how quickly does a message recipient have to respond for the message to be considered "answered" or "reciprocated"?

Once the basic data elements have been parsed into user sessions, some aggregate measures can be computed for use in pattern, error, and time analysis. A number of analytical techniques, including Markov and network analysis, may then be appropriate (see Dominick, 1977; Penniman and Dominick, 1980; Rice and Richards, 1984).

### Uses of the Data

Researchers and analysts will be concerned with two purposes for such data:

(1) For *evaluations* of the uses and utility of such communication media by individuals, in their social settings, such as organizations or research groups (see Rouse, 1981; Paisley, 1980). Computer-monitored data are clearly only one source of information for system evaluators and researchers, and implications from such data are only one component of a thorough evaluation. Any evaluation of such systems consists of some small intersection of dimensions including (a) the stakeholders, (b) evaluation goals or criteria, and (c) analysis domain. Other issues include historical and methodological approaches (Johansen, Miller, and Vallee, 1975; Penniman and Dominick, 1980); organizational objectives (Hamilton and Chervany, 1981); multiple evaluation perspectives (Carlson, 1974; Dominick, 1977); and constraints in the interaction between systems and users (Chandler, 1982).

(2) For indicators of the *impacts* of such communication media as perceived by the users and within their social settings. Empirical impacts of computer-mediated interpersonal and organizational communications (Rice, 1980a,b; also Chapter 8) or the theoretical foundations of such research (Kling, 1980; also Chapter 3) can be used to help avoid negative impacts and to alter prejudicial attitudes that potential users may have about such systems. Such analyses may also help to understand how such systems are "created" by the organization and users—i.e., how the socioeconomic context of the system affects the nature, design, implementation, and use of the system itself. In this sense, evaluation research and impact research are interconnected: Prior knowledge of potential consequences and typical usage patterns establish baselines for later comparisons and for initial system design and organizational planning.

### Advantages of Computer-Monitored Data

From a logistical point of view, using the computer automatically to collect data increases the possibility of analyzing many subjects over time. In addition, having accessible, computer-collected and -maintained large, complex data bases encourages reanalysis by other researchers with differing perspectives. Replications and meta-evaluations are more likely.

Unlike many questionnaires, field experiments or controlled experiments, the collection of computer-monitored data typically involves little or no response bias or demand characteristics from the subjects. It is essentially *unobtrusive*, which may increase the validity of the data (Webb, Campbell, Schwartz, Sechrest, and Grove, 1981). Experiments run on a system are replicable, the timing of commands may be controlled, questions can be randomized, and so on. Consider also the recent controversy as to whether respondents' reports of their communication activities diverge widely from their *actual* communication behavior as observed or monitored (see Berger and Roloff, 1980; Bernard, Killworth, and Sailer, 1980, 1982; Nisbett and Wilson, 1977; Shweder, 1980).

A related aspect of computer-monitored data, is that these accurate census data allow us to investigate the *communication networks* of groups of users. Rogers and Kincaid (1981: 346) define communication networks as consisting of relations among "interconnected individuals who are linked by patterned flows of information." These networks link organizations and user groups with each other and with the environment and are, in fact, one picture of an organization's or group's structure (O'Reilly and Roberts, 1977; Rice and Richards, 1984; Richards and Rice, 1981; Tichy, 1981; Weick, 1969).

The servicing computer can capture extensive *longitudinal* network data so that researchers avoid the ungrounded assumption of much cross-sectional research that the system under study is at some equilibrium state. These data may be discrete or continuous; the notion of analyzing continuous time-dependent communication processes is perhaps foreign to most social science researchers precisely because obtaining such data is so difficult. Collection of longitudinal data, particularly if it is continuous or collected at frequent discrete time intervals, allows the researcher to analyze alternative time frames and aggregation schemes. Typically survey data have only a few time intervals, if at all, so different cycles or intervals cannot be compared (Danowski, 1983). Longitudinal network data may be collected and analyzed to an extent simply not possible otherwise (see Danowski, 1982; Rice, 1982).

Finally, the same computer that provides the facilities for human information exchange or retrieval can also administer controlled experiments, collect the data directly, "document the problems, and the decisions made at each stage," and follow up the experiments with joint online authorship of reports (Hiltz and Turoff, 1978).

### Disadvantages of Computer-Monitored Data and Collection

The very fact that massive amounts of particulate data can be collected means that someone has to manage all those data. This has serious implications in terms of budgets, time, and expertise. Budgets are affected because preprocessing these data may take quite large sums of computer time, both in the ongoing day-to-day collection and in the conversion of the raw data into analyzable data sets. Evaluators need to integrate plans for using such data into system design to minimize later processing requirements.

Time is involved because, as anyone who has had to handle computer tapes, multiple data files, and custom-developed programming knows, these complex operations generally mushroom into time-consuming activities.

Expertise is involved because some member of the research team must know how to program or execute the necessary routines and transfer sets of data. Penuman and Dominick (1980: 23) strongly recommend that researchers "store monitor data in (data-base management systems) capable of interfacing with external software." Another aspect of expertise is that the researcher needs, perhaps, to be more systematic and theory/hypothesis-driven than usual. Sorting the study down to a manageable set of questions to pursue is a much greater problem in a monitoring study than is a lack of data. For example, Heeter, D'Alessio, Greenberg, and McVoy (1983) in analyzing monitored cable-viewing data, were impressed by having to handle data with 10<sup>7</sup> data points for each day's viewing. They note, "The challenge lies in posing significant questions and reducing the data in meaningful ways."

One related issue salient to the average person is the *ethics* of storage and use of data on that person (Westin and Baker, 1972). People have the right to exchange information in privacy. In some cases it is clear that textual content is *meant* to be public, and analysis is less questionable, such as from publicly-funded pilot research or organizational evaluation of system use. However, we emphasize that subjects must have the right to deny permission for access to portions of the data. A project may limit data collection to the users' commands, with content bypassed, or require the randomization of system identification numbers.

Computer-monitored data obviously do not portray the whole picture of human communication. Studies clearly show the social power and utility of very informal, unmonitored organizational communication (Wynn, 1979). We also know that much of our human communication occurs on the nonverbal level. And, as the literature on respondent inaccuracy notes, people do apparently base their decisions upon their *attitudes*. But if we are to understand the actual use of such systems, and the impacts of exchanging specific kinds of information, we must study behavior at least as much as attitudes. Danowski (1983) warns, however, of ignoring the fact that a computer-based communication system (therefore its usage patterns and the kinds of data it can collect) are designed and organized by people—perhaps only a group of system designers, or perhaps the user

group within an organization. But this limits the meaning of the words "objective" and "behavioral"; the data produced are already constrained in perhaps unknowable ways. Thus, comparisons *across* systems are crucial to verify system-specific data. (See Kerr and Hiltz [1982] for a vigorous multisystem comparison of research findings.)

### SUMMARY

The study of new media exists in historical, methodological, and technological contexts. We must understand those contexts in developing research methods and data collection efforts for communication research on new media. Certainly current methods and forms of data are useful and necessary. But we must become aware of new limitations, and new opportunities, in studying new media. One opportunity is to shift to analyses of process rather than strictly of variance. Another is to combine quantitative and qualitative analyses when appropriate. This seems particularly the case in understanding how users reconceptualize their expectations and activities after using new office technologies. Another challenge and opportunity is to design research that can use data collected or monitored by the computer component of new media systems. These data can provide materials for process research, but also require more qualitative data to provide the context for the massive amounts of behavioral data that become available. A severe challenge will come when electronic messaging gives way to voice mail in organizations; data sources may become less accessible. Indeed, one explanation for the dearth of research on telephone use and impacts may be that there is no available record of communication content.

### NOTES

1. A particular aspect of many new media is that they provide an improved means for connecting with other individuals (or organizations); thus these technologies essentially are "networking," not "one-way broadcasting" nor "stand alone" technologies. This distinctive aspect affects the acceptance and use of the new interactive technologies. At one extreme, consider the only individual in an organization who has an electronic messaging system; it is worthless as a means of communicating with co-workers. As each additional individual gains access to this technology, its usefulness increases to each of the individuals already on the system as well as to potential adopters.

2. See Note 1.

3. A much longer and more complete version of this section appears in Rice and Borgman (1983). That article references known research that uses computer-monitored data for analysis.