8 Issues and Concepts in Research on Computer-Mediated Communication Systems

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Computers and telecommunications networks have converged to provide a new category of communication media: computer-mediated communication systems (CMCS). The increasing development and application of these systems is matched by increasing research concerning their uses and implications. However, it is often difficult to integrate this body of research across disciplines, technologies, and research processes. Further, such research is often too narrowly focused. This chapter suggests four dimensions of research—stakeholders, goals, analytical domain, and tools—that scholars may use to guide and expand future studies of CMCS.

THE study of the uses and effects of computer-mediated communication systems (CMCS) has been drawing increased attention from researchers in a variety of disciplines—communication, information science, psychology, computer science, education, and management science, among others.[1] Besides the varied methodologies of these disciplines, studies of different kinds of CMCS—videotext, audiotext, personal computers, computer conferencing, word processing, computer bulletin boards, office information systems, and electronic and voice mail—tend to emphasize technological idiosyncrasies rather than communication commonalities. Finally, much of the insights to date about use and implications of CMCS is integrally bound up in, and confounded with, the research processes applied

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in specific studies. Thus the developing body of research on the uses and implications of CMCS reflects variations in three areas: disciplinary paradigms, technological distinctions, and evaluation approaches.

This chapter suggests a framework for integrating the contributions of these three streams of knowledge about CMCS, by focusing on and elaborating four general dimensions: stakeholders, goals, analytical domains, and tools. The presentation here is an initial attempt to identify broad categories of dimensions and their components, and to discuss some of their assumptions and possibly conflicting interpretations. Awareness of the existence and interaction of these dimensions may lead to more systematic research that considers influences, constraints, and implications of CMCS, and relationships among them. Such an approach is in line with conclusions of Danzinger, Dutton, Kling, and Kraemer (1982) and others that "computing (in general) is more accurately viewed as a 'package' that includes many complex social and technical elements."

Section 1 defines the communication perspective of this chapter by identifying CMCS as one of four basic applications of computers. Then it describes the characteristics and contributions of CMCS in the context of media in general. Section 2 provides an overview of the four dimensions, with some examples of their use and interaction. Section 3 outlines the range of stakeholders who might fund, conduct, oppose, or await CMCS applications and research. Section 4 notes some possible goals or criteria of CMCS research. Section 5 identifies domains of analysis. Section 6 considers tools of the research process, including designs, data, and methods of analysis of particular relevance to the study of CMCS. Section 7 discusses two examples of how applying the framework can identify alternative perspectives on CMCS and the concept of information. Section 8 summarizes the idea that components of the suggested dimensions interact within a given dimension, and across dimensions. Section 9 concludes by discussing implications of this framework for the study of CMCS.

DEFINING CMCS AND THE SCOPE OF THE CHAPTER

To begin, it is necessary to identify and define the specific focus of this chapter. Based upon a typology of general communication activities developed by Bordewijk and van Kamm (1982) and McQuail (1986), we can see that the wide and rapidly growing uses of computers for the processing and exchange of information include (1) allocution (processing of transactional information for forms and records, management information systems, computer-generated music and art), (2) registration (online polling, computer-based patient diagnostic systems), (3) consultation (computer-assisted instruction, information retrieval from online databases, video games), and (4) conversation (communication between individuals via computer systems). The first and

Source of control of timing and choice of information	Source of Information: System	Source of Information: Individual
System	"allocation"—offer of information for immediate use and later processing Example: batch transaction processing	"registration"—collection of information available to or about individuals Example: online voting
Individual	"consultation"—selective use of stored information Example: computer-aided instruction, management information systems, online databases	"conversation"—exchange of information between individuals Example: electronic messaging, computer conferencing, computer bulletin boards, some videotex

Figure 8.1 Typology of uses of computers for communication activities. Adapted from Bordewijk and van Kamm (1982) and McQuail (1986).

third categories represent the bulk of research so far on the organizational and social implications of computers (see, for example, Danzinger & Kraemer, 1986, or Kling, 1980). (See Figure 8.1.)

Reasonable people may well categorize all these activities as communication of one degree or another. For instance, all of these examples involve the exchange of information by means of computers, perhaps interactively. However, only the "conversation" category usually involves an interactive *relationship* directly among individuals or groups of individuals. (This distinction may be debated of course: does the user of an online database communicate with the person who abstracted and indexed the articles, or is the user simply reading sets of information retrieved by combinations of search terms?) This chapter primarily considers studies and concepts appropriate to the research of computer applications in the "conversation" category as focusing on conversational aspects emphasizes the attributes of computers that are common to other communication media. This category comprises computer-mediated communication systems (CMCS), media that facilitate the exchange of semantic content, transmitted through telecommunication networks, processed through one or more computers, between individuals and among groups who in one way or another can be identified as such.

CMCS involve *telecommunication networks*, part of larger systems that allow interactive exchanges among sets of users at different places. CMCS also facilitate the *processing* of the content of human communication. In this

context, processing means the ability to use the algorithmic, computational, and data-handling capabilities of a computer to alter the input, conversion, or output of content either directly by the user by submitting commands to the system's computer or indirectly, by storing, indexing, editing, retrieving, and distributing the content. The networking and processing aspects of CMCS heavily influence the four sets of media characteristics. It is the *convergence* of telecommunications networks and computers that makes CMCS distinct, say, from personal computers and word processors: In isolation, they cannot be used for direct communication among multiple individuals.

Two forms of CMCS are electronic messaging (EM) and computer conferencing (CC). The simplest use of CC is similar to using an EM system: sending a private message from one user to another. Recent developments in EM include voice mail, in which voice communications are digitized and stored until the other communication participants retrieve and listen to those messages, and perhaps further process them by forwarding, copying, or storing. CC systems provide structured access to shared files by one or more users. CC systems are more group-oriented than are EM systems. One example is a computer bulletin board system (CBBS) that allows users to post a message for all or some subset of users on the system to read. In full CC systems, content may include short notes, personal messages, headlines, data, reports, drafts of articles, and open discussions of technical and social topics, and support online polling and tabulation, partitioning of memory for joint authoring of documents, electronic publishing, retrieval of information by the use of indices, alteration of information in content or display format, selection of transmission and reception time and location, prioritizing access by individuals to real-time conferences, and more. Thus the most complex CMCS are difficult to distinguish from systems intended to augment the activities of knowledge workers or integrated office automation systems.

One way to assess the potential significance of CMCS is to compare them to prior communication media. Media can be said to differ with respect to a variety of generic characteristics (Rice, 1987b):

(1) Freedom from constraints as determined by: the need to know target receiver, the ability of the sender to select the target, the ability of the receiver to select the medium and content, the need for participants to be using the medium at the same time or to be in the same location, and the ability of participants to store the contents in the medium, retrieve the contents from the medium, or use the medium to reprocess the content.

(2) Mode or technical band width indicated by the ability to communicate physical proximity, gestures, paralinguistic cues, semantic connotations, semantic denotations.

(3) Feedback and interactivity shown by the number of prior communication loops reflected in the most recent exchange, the quickness of response, the ability to terminate the interaction, and the sequential nature of communication among several individuals.

(4) Network flows indicated in the pattern of distribution of the communication, control of and access to the communication system and content, and the effect of particular positions or roles in the pattern of distribution.

For example, a letter requires the sender to know at least the address of the target, allows the receiver to choose whether and when to open the medium and select what to read but not to choose other content, does not require the communicants to be in the same place or to share the letter at the same time, does store the content for later use but does not provide ways to reprocess or retrieve selected aspects of the content or combine the content with other information without reentry of the material.

CMCS differ significantly from a letter with respect to freedom from constraints. CMCS do not always require that the sender know the address or even the existence of potential receivers (or may identify them by means other than name and address), can allow the receiver to choose when and whether to read or respond to the communication, can allow the receiver to decide not only what to read but how to retrieve it in association with other information, do not require the participants to be using the system in the same place or the same time, can store the content for later use, provide ways to reprocess or redistribute selected aspects of the content to one or numerous other individuals, but are generally still too inaccessible or expensive for most individuals.

Even from the simplistic comparison of letters and CMCS on the characteristics of freedom from constraints, we can see that CMCS are an additional kind of communication medium with advantages and disadvantages, appropriate and inappropriate uses, and common and unique characteristics, perhaps a blend of interpersonal and mass media. Because of these characteristics and communication aspects, research on CMCS must not only consider traditional issues and concepts, but also consider newer and additional ones. The following sections consider four such sources of these considerations: stakeholders, goals, domains, and tools.

OVERVIEW OF DIMENSIONS

Research on CMCS can be seen as the product of four interacting dimensions (Figure 8.2), as follows:

(1) *stakeholders*: actors or agencies who have an interest in or claim to the outcome of specific research, and particularly actors who initiate and/or fund given research activities;

(2) *goals* or criteria: what is to be studied, the purposes of the system, audiences of the research, what constitutes "positive" or "negative" results (criteria here are used not as significance levels or decision rules, but as standards).

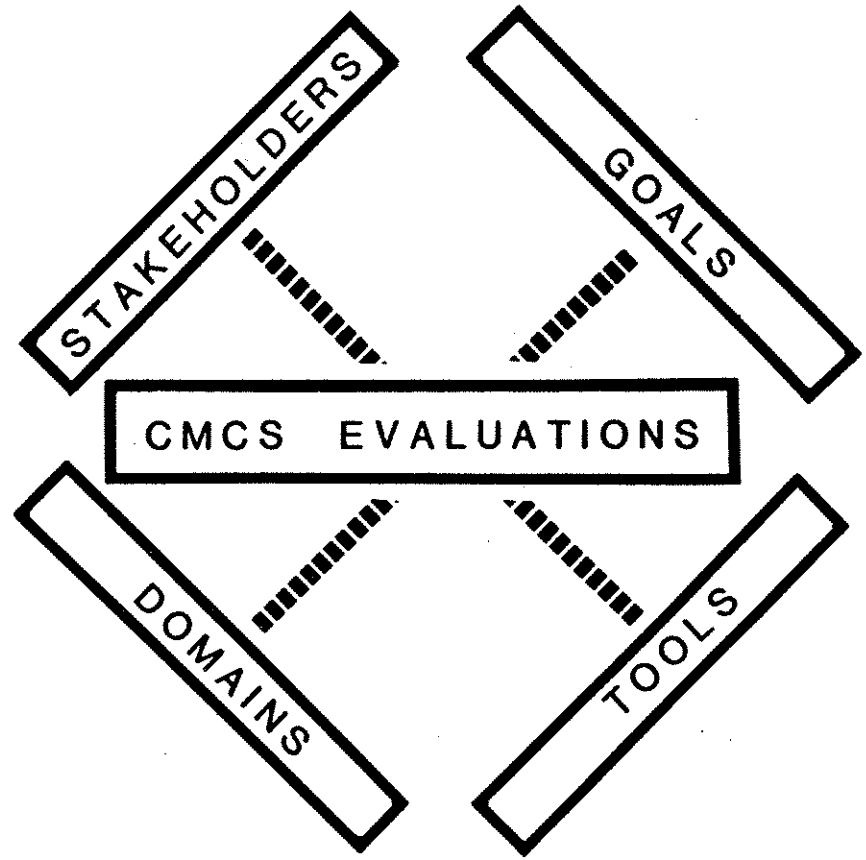

Figure 8.2 Interaction of dimensions of social evaluations of CMCS.

(3) *domains*: the levels of complexity, relationship, or organization at which the communication process takes place;

(4) *tools*: the research designs, kinds of data, and methods of inquiry and analysis that researchers apply.

For example, research on the use of a CMCS designed to understand the convergence of meaning among participants might focus on users as the primary stakeholders, explicitness of metacommunication as the primary goal, dyadic interaction as the primary domain, and content analysis as the primary tool.

The four dimensions discussed in this chapter—stakeholders, domains, goals, and tools—capture some of the process and content of social research of CMCS to date. Technical evaluations and their relevant dimensions, though also important, will not be considered in this chapter. But researchers

of the development, diffusion, implementation, use, applications, implications, meaning, and nature of CMCS may improve the utility and relevance of their efforts by identifying which actors and forces within each of these dimensions are playing a role and which dimensions are interacting to bias or constrain the research.

STAKEHOLDERS

Stakeholders were defined earlier as actors or agencies who have an interest in or claim to the outcome of a specific research. They differ in their finances, political security, constraints, expertise, goals, research, and criteria. Consider, for example, a system vendor with an extensive development investment in a new CMCS, a manager of information systems on a tight budget, and a group of innovative employees who have no prior experience in computing: They all differ significantly on these factors and will have greatly different criteria of success and stakes in the outcome. Further, the identity or the attributes of stakeholders may change over time, leading in one case to the eventual rejection of a computer system that had been initially adopted (Dutton, 1981).

The stakeholder approach rejects the notion of isolated, independent researchers assessing a nonpoliticized, somehow "objective" project. Instead, stakeholders should be either a significant focus or significant participants in evaluation activities (see, for example, the March 1983 issue of *New Directions for Program Evaluation*; Majchrzak, 1984; Mitroff, 1983). Identifying and involving significant stakeholders is important in assuring that the final research results will be contextualized and useful, but also that possible recommendations will be more likely to be accepted. Some recommended stages in stakeholder analysis include:

(1) identify initial and additional stakeholders, including cultural and psychological forms;
(2) determine definitions, values, assumptions, and power held by these stakeholders;
(3) assess the willingness of various stakeholders to change with respect to the topics of interest;
(4) explore ways that stakeholders expect to use the research; and
(5) rate the acceptability and implementability of classes of potential recommendations.

Murray (1983) summarizes the benefits and disadvantages of the stakeholder approach to research:

> The stakeholder approach is a useful device for getting the leading players to cooperate, for understanding a program intimately, for attracting attention to interim evaluation findings, and perhaps even for getting decision makers to take evaluation findings into account when they make decisions. [It also] carries a high price tag. The intense, continual personal interactions that it requires with all the parties... are both its strength and its danger. (pp. 59-60)

One of these dangers is that stakeholders involved early on will influenc who should formulate the research questions and who should have th opportunity to ask which questions. What is asked naturally limits what ca be answered. For example, administrators rarely involved word processin operators in decisions about initial system acquisition or implementatio strategies because of demands on their time and assumptions about clerica workers (Johnson & Rice, 1987). This approach ignores the need for divergen views and user involvement in systems design (Bostrom & Heinen, 1977 a, b) Possible researcher bias is influenced by both political and pragmati processes in choosing the researcher and the extent to which the researche participates in the design, implementation, and use of the system. The dange of bias seems particularly likely when the researcher "is dependent on th project being evaluated or the funders . . . not only for access to data (permission to observe, etc.) but also for the continuation of employment" (Cook & McAnany, 1979).

Many stakeholders reject or downgrade "theoretical" components o research. The proper balance between theory and practice is, of course, a very subtle and complex issue. Perhaps the main difficulty is assuming that they *are* separate. Theory can help determine what to look for, what constitutes change, what forms "new" awareness might take. Planning is, after all, one form of applied theory. The researcher brought in to "evaluate," *post hoc*, a new system may experience considerable frustration in seeing the results used to bolster the prior predispositions of those in control rather than to test theoretical expectations. On the other hand, systems managers and users need useful and implementable implications of research and either are not sufficiently aware of the implications of research design for achieving these goals or do not have the time and resources to implement before/after or treatment/control designs. While many of the perceived gaps between practicality and rigor may well be insurmountable given the different cultures, goals, and training of evaluators and users (widely defined), there seems to be at least two ways to improve the situation.

The first is to identify ongoing issues of importance to stakeholders rather than just situation-specific issues for evaluation. Recent analyses of enduring strategic and managerial issues in computers and communication are discussed by Culnan and Bair (1983) and Dickson, Leitheser, Wetherbe, and Nechis (1984). The second is to show how research efforts provide more insights into these top agenda issues than do hurried, ad hoc estimations. This effort requires an awareness of past research as well as an understanding of what represents convincing evidence for those stakeholders.

Involving stakeholders and their concerns in research efforts may help to identify perspectives and assumptions that may be unknowingly guiding

system introduction, management, and evaluation. Kling (1980) suggests that there are two broad perspectives permeating analyses of computing: systems rationalism and segmented institutionalism. Each perspective reflects assumptions of different sets of stakeholders, influences what is analyzed and how the results are interpreted, and effects the design and implementation of a CMCS as well as the research process itself.

Systems rationalism includes three variants, emphasizing technical experts, managers, or users respectively. Systems rationalism focuses on rational design and use of the system, managed for efficiency and possibly user satisfaction, with the assumption that consensus (perhaps in the form of hierarchical authority accepted by organizational members) is possible. An extreme example occurs when highly trained system designers establish criteria for success based solely on system performance measures such as throughput, cost, and downtime. Another example is when traditional measures of cost are used to evaluate the worth of a new communication system. This particular example is explored in greater detail in the section on information.

Segmented institutionalism, on the other hand, assumes instead that the meaning of a particular system is socially constructed, that organizational politics serve to protect resources, conflict is pervasive because social structure is stratified. This perspective focuses on pluralism of interpretation and interests of the various stakeholders who are part of the social milieu of system use. Potentially severe organizational conflicts resulting from the introduction of CMCS might be more readily understood and avoided by identifying different organizational positions or individual members and how they interpret the potential system.

General categories of potential stakeholders in CMCS evaluation include the following actors, as listed in Table 8.1:

(1) Macrosupporters. Macrosupporters are those agencies, institutions, and organizations that fund evaluations of CMCS. There seem to be three general models for macrosupport of CMCS: research and development (R & D) grants, industry-university collaboration, and proprietary studies.

The first model is the traditional grant for research and development of a model or a specific system for governmental or policy-related purposes. The National Science Foundation (NSF) and the Department of Defense are two major sources of such funds (Bamford & Savin, 1978). The early development of CMCS (Hiltz & Turoff, 1981), ARPANET and packet switching (Roberts, 1978) and online databases (Schiller, 1982) were stimulated by requirements for defense and national emergencies.

Perhaps the best example of the R & D grant model is the continued evolution of the Electronic Information Exchange System (EIES) developed by Murray Turoff (New Jersey Institute of Technology) and evaluated by Roxanne Hiltz (Upsala College and NJIT). EIES has been funded largely by the National Science Foundation (NSF) and the Annenberg/CPB Program.

TABLE 8.1

Stakeholders
Macrosupporters
Regulators
Social analysts
Industries and vendors
Administrators and system designers
Users
Researchers

While the initial development of the prototype system was motivated by national economic policy and funded through the Office of Emergency Preparedness, the major stimulus came from NSF's interest in using information systems to increase research productivity and diffusion of scientific and technical information, especially within invisible colleges (Crane, 1972; Tombaugh, 1984). This thrust led to a large number of studies of the use of EIES by nonprofit university or government researchers (see Kerr & Hiltz, 1982; Hiltz, 1983). In a sense, this funding source and the nature of many of the studies seem perfectly matched. However, what might appear to be a reasonable match of resources and respondents has in fact weakened the influence of this program of research. Management and communication researchers alike have questioned the generalizability of results from "unrealistically priced" CMCS used by "atypical" R & D scientists. Further, the longevity of the system and the research program leads some critics to dismiss the relevance of the results on the ground that EIES is no longer a "leading edge" system. However, one may well argue that until a system represents easily available technology and has been used by a large number of people over time, results cannot be generalizable.

A related example of this R & D grant model is the support of cross-national studies by nonprofit international agencies such as UNESCO (1980). Precisely because of its multiple stakeholders, such research has difficulty arriving at conclusions that are not obscured by the diplomatic need to compromise. The goal of such support is often the articulation of ideological principles and the description of trends and current conditions (such as the extent of transborder information flows or difference in regulatory polices toward technical communication standards). Such evaluations clearly provide baselines for further debate.

The second model, industry-university collaboration, may be represented by the research of the Institute for the Future (Johansen, 1984; Johansen, Vallee, & Spangler, 1979; Tydeman, Lipinski, Adler, Nyhan, & Zwimpfer, 1982) and the School of Social Science at Carnegie-Mellon University (Kiesler, 1986; Kiesler, Siegel, & McGuire, 1984; Sproull, 1986). Both of these institutions work extensively with corporate organizations that provide

equipment and financial resources as well as research sites, but also receive government grants and publish many of their results in academic journals. This shifting blend of the agendas of corporations and nonprofit research institutes avoids the more monolithic focus of the EIES effort and provides conclusions that are more generalizable for organizational communication research and practice. However, certain aspects of results from such studies are considered proprietary and thus are inaccessible to the wider scholarly community. Further, the primary audience for such research, as well as the populations to which the results are generalizable, are often limited to managers and management researchers. One may criticize such research for not being generalizable to any person not part of a formal, Fortune-500 organization. Of course, most of this research and its associated methods are administrative in nature and not especially critical.

The third model is the proprietary study done for a specific company or industry, either as in-house projects or multiclient reports. Because the value of these studies is a global overview of markets and industries, and summaries of information are not generally available, their reports tend to focus on either technological and financial reviews or provide generalizations about trends based upon strategic analyses and market penetration. Proprietary research cannot advance theory much because it does not encourage replication or external critique of its methods and data.

(2) Regulators of resources, rights, and laws. As stakeholders, regulators, such as the Federal Communications Commission, Federal Trade Commission, World Administrative Radio Conference, International Telecommunications Union, and State Public Utilities Commissions (and other agencies which regulate businesses in general), constrain or change the jurisdiction or goals of telecommunications system evaluations. The convergence of computing and communication technologies is creating new battlegrounds and uncertainties for regulators as well as vendors (see Compaine, 1984; De Sola Pool, 1983; Robinson, 1978). Lack of uniform standards for EM systems, for example, prevents not only interconnections across systems and countries, but generates different sets of system functions, which make evaluation replications and generalizations difficult (Panko, 1981a). Policymakers are interested in who should have access, who should be funded, data flow regulations (Schiller, 1982), copyright issues (Keplinger, 1980); and privacy and secrecy (Rule, 1974; Westin & Baker, 1972) may set the agenda for system evaluations. For example, Palmer (1981) relates how Swedish statutes concerning freedom of information required detailed descriptions of the kind of content and records structure information that systems would contain before they could operate; because the content of CMCS is unknown before use, the Swedish COM system was stymied until the policy could be revised.

(3) Social analysts. These are generally interested in the social use and effects of computers in general and occasionally CMCS in particular, as opponents, proponents, or technological forecasters. Such authors include

Bush (1945), Beniger (1986), Ganley and Ganley (1982), Hiltz and Turoff (1978), Kling (1980), Martin (1981), Mosco (1982), Moshowitz (1976), Parker (1976), Rice and Associates (1984), Schiller (1982), Weizenbaum (1976), Wessel (1976), among others.

(4) Industries, vendors, and system designers. These overlap in their interests. Systems designers working for vendors are sensitive to research on programming languages, human-computer interfaces, software, operating systems, databases, communications, human factors, and the like (Ellis & Nutt, 1980; Ramsey & Grimes, 1983; Rouse, 1975). Technical evaluations of system performance (Carlson, 1974; Svoboda, 1976; and the journal *Performance Evaluation*) are better understood and more pervasive than are social evaluations (Hamilton & Chervany, 1981). Indeed, it is this imbalance between technical and social aspects of design and implementation that advocates of the sociotechnical systems perspective attempt to address. Bostrom and Heinen (1977a, 1977b) call upon system designers to inspect their assumptions about the level of involvement, ownership, and knowledge that users can provide; Pava (1983) argues that information work presents new challenges for both designers and managers to match technological and social systems.

(5) Administrators. Administrators have many interests at stake concerning CMCS: (a) Institutional directors, such as library planners, must redefine their services and needs to respond to technological opportunities and threats (ASIS, 1980); (b) system directors and managers tend to be cost-oriented, have a procomputer bias and be concerned with budgets, short-term time frames, organizational goals, management policies and mandates, and prioritization of use and support; (c) programmers and support staff will emphasize error statistics, new services, customer support, flexible and forgiving languages, documentation, as well as informed users; (d) moderators of computer conferences might desire information on how CC may facilitate or impede group decision making, level of participation by the conference members, access to past transcripts of the conference, relative appropriateness of other media, and technical obstacles (Kerr, 1986).

(6) "Users." This includes a wide array of stakeholders: (a) Potential users include service communities, those unfamiliar with computers such as students and the disadvantaged. Many potential users first have to overcome obstacles such as physical distance to the system, inequitable pricing strategies, insufficient education, general attitudes toward computers, misunderstanding of information needs, difficult human-machine interface, lack of control over the content, and so on; (b) organizations and institutions can include the individual representing an organization (raising issues of effects on workers, and alteration of the individual's role and status); the organization using CMCS as part of society (institutions such as schools, universities, and libraries); and social concerns (such as occupational dislocation and industry-wide needs for skills training); (c) groups, involving questions of group

dynamics, effects of the group's task, or the emergence of leadership; (d) users' social networks (raising issues of altered living patterns, decreased sociability, increased communication networks, increased knowledge gaps between those communicating by using CMCS and those not); (e) current individual users (who might be concerned about satisfaction with the system and its ergonomics, their anxiety about learning new systems, access to information in the system, changes in their attitudes and roles, and so on).

(7) Researchers. Researchers, of course, have their own skills, needs, norms, constraints, and goals in research activities. Needs may range from making contributions to knowledge to increasing their status in a discipline. Norms include what are considered "acceptable" research topics and the kinds of methodological tools brought to bear. And these norms shift as researchers bring new theories and tools to bear upon important topics and as different paradigms gain adherents. For example, there is a growing dissatisfaction with studies that do not include insights gained from qualitative or contextual analyses and with studies that focus solely on individual levels of analysis. Constraints may be inadequate funding or limited access to an appropriate field setting. Goals may be the testing of theory, improved system implementation, or increased chances of tenure.

GOALS

The goals or criteria of a research effort specify what is to be analyzed, what the purpose of the system and the research is, what constitutes "positive" or "negative" results. Goals constitute the motivations for conducting the research and using its results. Tools, discussed in Section 6, constitute the ways of gathering evidence for, and the criteria for assessing the conclusions of, such research. The major distinction among categories of research goals is whether they are formative or summative (Table 8.2).

Formative Research

Formative research about CMCS acquires information useful in designing and improving project components, and provides feedback during the design, implementation, and use of the system. The EIES developers (Hiltz & Turoff, 1978) consider formative research a fundamental part of system development. EIES includes a computer language for developing customized communication structures, online consultants who apply users' suggestions and problems to the continued redesign of the system and continuing evaluation projects that provide the foundations for training and satisfaction of CMCS users.

Formative research raises such issues as, Why are you doing this? Or, why do these users find this system so difficult? Or, what is the goal of this evaluation? These questions are clearly political and may be quite different in

TABLE 8.2

Goals
Formative evaluation
needs assessments
ongoing systems design
implementation
evaluation of research process
Summative evaluation
distribution of resources
functionality
political process
knowledge
actualization
information-processing skills
problems and tasks
structure
sensation
cost
symbolism

character than the questions of summative research. An ongoing series of research projects may profit from formative analysis, which asks such questions as these: What are the effects of evaluation itself? Will a CMCS be reinterpreted by various stakeholders after the recommendations suggested by the formative results are implemented? (For a further discussion, see Acher, this volume.)

Summative Research

Summative research aims to summarize how the system affected those involved with the system as well as the wider social context, including intended and unintended effects, and to detect to what extent the system's goals were achieved. Summative research typically attempts to determine causal processes leading to those effects and goals. Intensity and duration of effects are measured as well as the extent to which the intended project treatment was in fact delivered (Suchman, 1967). For example, Kerr and Hiltz (1982) argue persuasively that having *access* to a CMCS, *using* it, and *accepting* it are very different components of system delivery, so they must be measured explicitly and separately. Culnan (1984) also discusses the concept of access with respect to office information systems. She concludes that accessibility encompasses physical access to a terminal, the actual information system, the command language, and the ability to retrieve the desired information successfully.

The following list suggests social dimensions of summative evaluation goals for CMCS; other dimensions for the evaluation of computer and information systems have been suggested by Carlson (1974) and Kling (1984).

(1) Resource distribution, equity, and participation: Studies of CC systems usage show increased equality of participation by users compared to similar users in face-to-face situations (Hiltz & Turoff, 1978; Kerr & Hiltz, 1982; Rice & Associates, 1984, chap. 6). The presence of computer-based networks do not always guarantee that users gain the full positive benefits of such systems, or even guarantee that the general effects *are* positive. For example, as previously noted, users must first gain access to such systems, and then must also gain access to information and other users on these systems. "Access" usually requires financial resources, cultural support, and prior knowledge about the availability and operational logistics of a particular system. Thus it is necessary to analyze "the structure of social inequality and the consequent differential access to key communication resources across the population" (Golding & Murdock, 1986, pp. 71), and constraints owing to infrastructure, technology, economics, sociocultural norms, and politics (Vitalari & Venkatesh, 1986) before we can adequately talk about "increased choice" from the new media on a societal level. Further, Lowi (1983) argues that computer communications can simultaneously increase individuals' power and the flow of information as well as increase the public's susceptibility to manipulation by those who control large systems and the origination of information. For example, the increased ability to narrowcast information and target audiences by distribution lists or system directories could lead to a fragmentation of attitudes and the development of separate interest groups which may become empowered by their unity or isolated by their lack of awareness of other publics (Lowi, 1983; Rice, 1987a). Schiller (1982) and Mosco (1982) claim that international information networks support the increased economic domination of lesser developed countries by multinationals.

Issues of resource allocation may even determine which projects are worth evaluating. Goals of both efficiency and ethics demand an analysis of the trade-off between using scarce resources to evaluate a project or using them to provide more services. If a project involves fairly familiar ground or if the likelihood is small that the treatment (or system, for example) being evaluated will be widely implemented, then the resources may well be better spent elsewhere.

(2) Functionality: What is the user doing, or what does the user want or have to do? What can the medium do for the user? Within an organization, functionality is constrained by organizational climate, policies on efficiency and productivity, history of innovation, responsiveness to workers, and so on. A recent analysis of the diffusion of the intelligent telephone (PBX) in two divisions of a large organization showed that only nine out of more than 100 phone functions were used in a year, and three of those represented most

usage; organizational politics and insufficient training contributed to this low functionality (Rice & Manross, 1986).

(3) Political process: What role does or could CMCS play in creating an informed public, providing access to congressional representatives, distributing community information, and stimulating grassroots activity, or developing information resources? One example is the EIES Legitech group (see Hiltz & Turoff, 1978), which responds to queries from one state's agency staff with another state's staff experience in the matter. Another example is the use of computer bulletin board systems (CBBS) by constituents to participate in political discussions with their elected representatives. Garramone, Harris, and Anderson (1986) applied a uses and gratifications model to understanding the use of a political CBBS based in a university near a state capitol. Personal identity and surveillance (communicating with others about political issues) were the most commonly mentioned motivations for general use of the system, while those who actively placed messages on the system reported the greatest personal identity satisfaction. Haight and Rubinyi (1983) found that community groups used computers to augment and improve their local operations, but rarely used the systems to communicate with other community groups. (With the decreased cost and increased diffusion of computers and bulletin board software, this situation may have changed significantly since 1982.)

(4) Knowledge: How do CMCS play a part in the progression of a bit to data to information to knowledge to wisdom in creating, accessing, sharing, expanding, valuing knowledge, and experience bases? This move is of particular interest to research communities: Hiltz (1983) argues that CMCS can increase the amount and distribution of scientific and technical information, but scientific norms and individual's expectations often limit this potential.

(5) Actualization: What are the possible roles of CMCS in well-being, religion, spirit, human potential, life-styles? The Japanese are the trend-setters in evaluating effects of information and its technologies on these measures of quality of life in the information society (see Edelstein, Bowes, & Harsel, 1978, and especially Bowes, 1981).

(6) Information processing skills: How do individuals, groups, and organizations represent, encode, transmit, and decode information? Some aspects include management of information load and related stress, ability to adapt to processing asynchronous rather than simultaneous exchanges, performing multiple tasks through multiple media, constraints on reflective thinking due to rapid turnaround, and development of computer literacy. Zuboff (1982) argues that office workers must be trained to think in more abstract ways because office automation systems do not allow visual or tactile organization of information. Rice (1982) argues that human information-processing limits lead individuals to more instrumental and reciprocal use of CMCS.

(7) Problems: How can CMCS help—or hinder—individuals in handling and solving individual, group, and social problems and tasks (Paisley, 1980)? Research shows that CMCS have considerable and consistent effects on group decision making (Rice & Associates, 1984, chap. 6).

(8) Structure: How might the use of CMCS change the magnitude and distribution of relations among users, and effects of these changes on users' roles and behavior? Freeman (1980), for example, analyzed the effect of CMCS on users' social networks. He found that although theory predicted that no new strong links between participants ("close friend" compared to "acquaintance") could develop from using the system if the relationships did not already have the potential to do so (based upon common educational institutions, colleagues, research interests, and so on), several participants who had no prior potential linkages did become very close. Further, these larger clusters of "close friends" became more differentiated from the remaining social structure represented by the participants in the computer conference.

(9) Sensation: How might CMCS interact with physical and emotional arousal, pleasure and pain, including direct effects as well as indirect effects on other activities, such as the use of communication systems to relieve tension arising from other activities or to compensate for or respond to information from other experimental domains? Theories of uses and gratifications derived from these media include the possibility that many people use media out of habit or for the pleasure of "consumption" (Rice & Associates, 1984, chap. 5; Urban, 1984).

(10) Cost: What are the fixed and variable costs of hardware, software, training, operation, maintenance. Panko, for example, has provided several detailed economic analyses of electronic mail systems (1980, 1981b, 1985; Bair, 1978, 1980; Rice & Associates, 1984, chap. 8). In general, dollar costs of computing, particularly in decentralized systems, are underestimated (King & Kraemer, 1981) and social costs are rarely even estimated. For example, Strassman (1985) argues that only a moderate percentage of the total first-year cost for an end-user workstation is attributable to the obvious costs of acquisition. Other costs include training, supplies, overhead, telecommunications, software, support staff, furniture, organizational learning, implementation, uncertainty, and conflicts. (See the information section for an elaboration of this point.)

(11) Symbolism: What are the symbolic and political reasons for justifying the implementation of a CMCS, or for CMCS research? For example, organizational evaluation of a pilot electronic mail system, when long-range policy has already mandated extensive implementation and specific results will not alter this decision, may defuse possible resistance. Having access to a CMCS may be important to creating an image of an "informed" and "innovative" professional (see Feldman & March, 1981, for a discussion of the symbolic uses of information).

DOMAINS

A domain is the level of complexity or organization at which the computer-mediated communication relationship is evaluated. Domain is used rather than "level of analysis" to emphasize the sphere of communication behavior, rather than just the analytical unit chosen by the researcher. As Rogers and Kincaid (1981, chap. 2) argue, much communication research has assumed a linear model of communication, audiences comprised of noninteracting individuals, and the absence of constraining social structures. Particularly because CMCS support interactions among changing sets of individuals who can structure their communications, distinctions among domains are appropriate and necessary. Research efforts should be explicit about which domains are being studied. Stakeholders may be concerned about resources in different domains and users may experience varied benefits and disadvantages in different domains. A single domain, the boundary between domains, an individual's behavior throughout several domains, the interaction of domains across two or more individuals, and so on, constitute the kinds of research areas possible. The metastudy of the existence and forms of these domains is one of the possible goals of analysis. All the following domains may interact, of course: An *individual's* use of CMCS is likely to be hampered by *national* standards and access regulations owing to concerns about data flows and control of telecommunications markets (Panko, 1985; Shipley, Shipley, & Wigand, 1985). Possible domains and particular examples, as summarized in Table 8.3, include the following:

(1) The individual. In this domain, psychological, emotional, physiological, and behavioral aspects of CMCS use and effects are studied typically by aggregating responses from a sample of system users (potential, actual, or a control group), or by conducting a case study of specific users. Changes in the amount or channels of communication attributed to, or the role of user's attitudes in the level of, use of a CMCS (Miller & Nichols, 1981; Rice & Associates, 1984, chap. 9; Tapscott, 1982) are typical topics.

(2) Dyads. These are two individuals who participate in, or are identified through, a particular communication process. Here, asymmetry, reciprocity, source, direction, and amount of communications between two individuals or sets of individuals are typical topics. Gutek (1982), for example, spent a year studying the work relationship of one secretary-manager dyad before, during, and after the implementation and removal of an office CMCS. Gutek based her study design on the assumption that the relationship between the two was a rich source for understanding the use and interpretations of CMCS.

(3) Roles. This includes sender, transmitter, isolate, group member, gatekeeper, leader, occupation, organizational position, social status, and so on. The particular role may influence an individual's access to a CMCS (for example, top university administrators had first access to an EM system in order to encourage later adoption by subordinates—Rice & Case, 1983), while

TABLE 8.3

Domains
Individual
Dyads
Roles
Groups
Organizations and institutions
Societal relations

the nature of one's CMCS usage may determine which role that individual occupies in an information environment (Rice, 1987a).

(4) Groups. These range from triads to portions of "invisible colleges." The dynamics of group decision making are altered when members communicate through CMCS (see Rice & Associates, 1984, chap. 6); one group of geographically dispersed researchers intensified their personal networks by using CMCS (Freeman, 1980).

(5) Organizations and institutions. These are collections of individuals and relationships that have constraints and goals different from those of their constituent individuals. Organizations can change those constraints by using CMCS, for example, to support telecommuting programs (Nilles, Carlson, Gray, & Hanneman, 1976), or to redefine the nature of information work (Johnson & Rice, 1987). Frameworks for identifying types of, and relationships among, effects of CMCS in the organizational domain have been suggested by Giuliano (1982), Simon (1973), and Olson and Lucas (1982).

(6) Societal relations. These range from community computer bulletin boards and public CMCS services (Glossbrenner, 1983) to wired cities (Dutton & Kraemer, 1985), networked nations (Dordick, Bradley, & Nanus, 1981; Hiltz & Turoff, 1978; Martin, 1981), information economies, and a global world information order.

As an example of some of the implications of emphasizing one or more particular domains in the study of CMCS, consider one of the more widely accepted concepts of societal relations concerning information and communication technologies: the "information economy."

Many authors and researchers have argued that the economies of the United States, Japan, and several European countries have, in the last decade, become predominantly information-based. That is, the information sector, rather than the service, industrial, or agricultural sector, represents the largest component (over 50% in the United States) of the national economy. This predominance may be measured by labor employed, capital invested, or outputs produced, but also may be indicated by the continued exponential growth in scientific and technical information, by the continued diffusion of a wide variety of information technologies, by diverse access to and consumption of media products, and by the convergence of computing and communication

technologies (Bell, 1976, 1981; Beniger, 1986; Huber, 1984; Ito, 1981; Machlup, 1962; Porat, 1977; Price, 1963).

While these and similar measures do indicate a clear growth in information-related activities, there is considerable debate not only about the benefits of such a transition, but also about the extent of the transition. For example, Weizenbaum (1981) rejects not so much the concept itself, but more the underlying assumptions about the information society that lead many authors to herald its development. Weizenbaum criticizes Simon's (1981) faith in humans' use of computer technology to generate new knowledge that is accountable, understandable or humane. He argues that the rise of the information society is paramount to an abdication of human control of human reason, that computers can be used to communicate facts but not understanding, and that those theoretically in control may use such systems for their own ends or may not even understand how the information was created or used. Marien (1985) makes a different kind of critique: he argues that whatever changes are associated with the information economy, they cannot be acclaimed "revolutionary." There are arguably many other current developments that are far more revolutionary, such as genetic engineering. Schement and Lievrouw's (1987) volume contains basic questions as to the extent and nature of the change in work that the information revolution is supposed to support.

Schiller (1982), UNESCO (1980), and others argue that there *is* a major transformation of economies and perhaps societies associated with the development of information technologies, but that it is primarily symptomatic of the continuing trends of industrial nations, multinational corporations, and advanced capitalism. That is, shifts toward information economies expand the realms for economic and cultural domination, increase social and economic differentiation, and increase the privatization and control of information itself (Mehra, 1987; Schiller, 1985; Traber, 1986). Thus the terms *information economy* or *information revolution* are problematic and can represent very contradictory moral, economic, and social visions. Evaluations of CMCS in this domain must be careful to analyze the assumptions behind both traditional and new measures of job categories, information flows, economic development, and societal influences on and outcomes of communication technologies.

Relationships are fundamental in the use and understanding of CMCS. Research studies should identify relevant domains and their interaction.

TOOLS: DESIGN, DATA, AND METHODS

There is a wide variety of issues related to the choice and use of tools in CMCS research (Williams, Rice, & Rogers, 1988). This section does not intend to provide a survey of tools and data sources generally available, but

TABLE 8.4

Tools: Design, Data and Methods
Designs:
issues of sampling randomization
controlled experiments
panel and time-series studies
quasi-experimental field trials
surveys
focus groups
case studies
benchmark comparisons
impact assessments
Data:
literature reviews
observations (participant or remote)
interviews
questionnaire responses
open-ended comments from questionnaires or focus groups
archival data
unobtrusive measures
computer-monitored data
system transcripts
Methods of Analysis:
description
content analysis
interpretive
critical
univariate and multivariate techniques
network analysis
activity analysis
change over time

notes a few issues particularly relevant to designs, data, and methods in CMCS research, as listed in Table 8.4. We here consider one or two examples in each of three major categories: design, data, and analysis.

Design

(A) Appropriate designs. There has already been considerable work, not only in research on CMCS, but in identifying appropriate designs and methods for the study of CMCS. A fairly comprehensive typology of approaches and variables has been developed by Johansen, Miller, and Vallee (1974). Their typology included (a) controlled lab experiments, (b) quasi-experiments, (c) directed field trials, (d) open-ended trials, (e) survey research, and (f) impact assessment of, for example, scenarios, simulations, and models. These are standard alternatives open to any research project, but the authors cross-reference the numerous studies of CMCS of which they were aware by these alternatives (Johansen, Vallee, & Spangler, 1979, pp. 166-191). Johansen, Vallee, and Spangler (1979) expanded the 1974 typology of variables by developing the pioneering work of Bailey, Nordlie, and Sistrunk (1963). The revised typology consisted of five sets of group communication attributes—medium, task, rules, person, and group (Johansen, Miller, & Vallee, 1974, p. 16)—and was part of a very detailed and useful schema that incorporated the analysis of changes over time in a group's use of a CMCS and associated outcomes (Vallee, Johansen, Randolph, & Hastings, 1974, p. 25).

Case studies, participant observation, and descriptive analyses are useful research tools to provide ethnographic and interpretive insights into the use and meaning of CMCS (Hiltz & Turoff, 1978; see also Erlandson, 1980 and Rice, 1984). In these approaches, the evaluator may be a group participant, and the analysis chronicles the group's passage through time and difficulties, revealing external and internal obstacles or factors, the social aspects of jointly working on a task via computer, and other situational processes that perhaps could never be adequately measured or predicted. The question of potential bias looms large, as the controversy over stakeholder analysis emphasizes, but system designers, managers, and users of CMCS may be keenly interested in the kinds of insights possible from the approach. Further, transcripts from interviews and actual system sessions provide examples of problems or possibilities that use the language, symbols, and criteria that are immediately interpretable and usable to stakeholders in the particular setting. For example, Hiemstra (1983) used focus groups, content analysis, and personal interviews to extract underlying themes in discussions about office automation, and then analyzed relations among these themes.

(B) Generalizability. The goals of a particular project will influence the value of particular research designs. For example, if generalizability has been established as one of the research goals, then the value of summative research is affected by the extent to which findings are convincing and ecologically valid. Satisfying these and other criteria is traditionally a function of subject and treatment randomization and study design. Suchman (1967) emphasizes that (a) effect, (b) adequacy, and (c) process of the impact must be discussed in order to gauge the generalizability of the effect.

As defined by Suchman, *effect* is the amount of significant impact, typically specified by subgroup. Very large groups will typically show significant effects; the lack of significant effects in small groups may not indicate no impact, only low statistical power. Many studies of organizational use of CMCS are limited to small or convenience samples, owing to the pilot nature of the system, a desire to have an identifiable and task-related set of users, or poor questionnaire response rate.

Adequacy is the meaningfulness and duration of the impact. A valid and statistically significant effect may not be very meaningful to the stakeholders, or may not last very long. For example, a study of the uses and effects of an agricultural videotext system showed statistically significant relationships, but the variance explained (10%) was not large enough for the policy

recommendations to be meaningful for the program administrators (Rice & Paisley, 1982). Poor design may make generalizability risky or misleading. Short-term effects may appear overnight, or other important effects, such as the change in users' attitudes toward computers and the appropriateness of CMCS for certain tasks, may develop only in the long run (Hiltz & Turoff, 1981). Or the kinds of users who have early access to a CMCS system are not likely to be typical of users who gain later access to a system.

Process is Suchman's term for specification or contingency analysis: the specification of the social and psychological factors that mediate or impede effects. For example, Rice (1982) found that task-orientation was a major determinant of a group's wider participation in a nationwide CMCS.

These criteria are discussed in the context of positivist social science approaches, but interpretive and critical approaches are also concerned with effect, adequacy, and process, but without a necessary concern with statistical inference and quantification. For example, effect may involve the determination of the extent of access to a CMCS by a particular social or organizational group (Haight & Rubinyi, 1983). Adequacy may involve the analysis of ongoing and indirect social changes brought about by pervasive telecommunication networks (Rice, 1987a; Schiller, 1982). Process is a main focus of interpretive analysis, intended to uncover the ways in which a system comes to be used, controlled, or changed (Kling & Scacchi, 1980). From this paradigm, generalizability to a particular *population* is not necessarily the goal, but to enduring *issues* or deeper social structures.

(C) Control and randomization. Because of the several stakeholders and domains involved in a particular CMCS, it often is not obvious which experimental or quasi-experimental designs could be used or are appropriate (Cook & Campbell, 1979). In the case of CMCS, whether in homes, communities, or organizations, it seems highly unrealistic, if not impractical, to select users randomly. Not only do most studies analyze self-selected users, but the value of CMCS is fundamentally based upon the interactions among a network of users. That is, by definition, random sampling seems an inappropriate way to study such communication systems. There are also ethical issues, as with many research designs, such as who (randomly) would get access to the system? Do those who do not have access continue to suffer from problems that the system is supposed to solve?

Then too, there is the question of whether there can ever be a true randomized control group when individuals and organizations are actively using CMCS for their ongoing work. However, controlled and quasi-experiments involving specific groups of new as well as experienced users have been conducted to compare how groups use different media in decision-making processes or in conducting normal organizational conmmunications (Bair, 1978; Kerr & Hiltz, 1982; Rice & Associates, 1984, chap. 6; Tapscott, 1982, p. 207). The controlled experiments are often conducted online, using a CMCS which presents the treatments and collects and analyzes the data, and

involve variables, such as the complexity of task, communication channel, prior familiarity of subjects, time to decision, consensus reached, satisfaction, and so on.

The CMCS is conceptually a treatment or an intervening variable, and must be considered as only one of many possible channels of communication (such as telephone, memo, face-to-face, letters and reports, video, interpersonal, psychic). Analyses taking this treatment into account have led to the considerable knowledge we now have in cross-media comparisons in various domains (Johansen, 1977; Short, Williams, & Christie, 1976). Indeed, research might place more emphasis on understanding the role of media diversity and media choice in influencing the use and effects of CMCS.

Data

The presence of a computer in many new media systems creates new opportunities for the kinds of data that can be collected and analyzed. That is, both content and flows can be collected by the system itself, enabling analyses of a full census of users, of transcripts of content, of interactions among large sets of users, and of content and flows over time (Penniman & Dominick, 1980; Rice & Borgman, 1983). Such data avoid problems of measurement error, developing enumeration lists, missing responses, and discrepancies between respondents' actual usage of a system and their reported usage. Indeed, the availability of measures of actual CMCS communication behavior has provided more fuel to the attitude-behavior consistency controversy (Berger & Roloff, 1980). While some have argued that communication behavior (as measured by computer-monitored usage data) is not necessarily the criterion against which self-report data should be evaluated, and that they probably measure different aspects of usage, the debate has raised the question as to the underlying assumption social science has held about interview and questionnaire data. That is, if these two sources of data *do* diverge, this divergence is a different question from whether attitudes are good predictors of behavior. Rather, the question is whether we have too easily accepted the assumption that respondents' self-reports are valid reports of anything other than rather enduring but otherwise unfounded opinions (Bernard, Killworth, Kronenfeld, & Sailer, 1984).

CMCS, as new sources of data, may help us better understand the biases and differential predictability of reported versus actual communication behavior (Ettema, 1985). On the other hand, simple measures of number of log-ons or hours on-line may summarize CMCS usage, but say nothing about function, user satisfaction, or political conflict about the meaning and implications of the system. For example, Ettema (1984) argued that videotext users who operate the system more effectively may also use the system less, precisely because they achieve their information needs quickly: usage can be negatively correlated with reported satisfaction or benefits, but that does not mean that the system should be removed!

Methods of Analysis

(A) Content analysis. The content of communications via CMCS has not received sufficient study, in spite of the fact that precisely because the medium can keep a record of the content there are opportunities to measure the kinds of content and interaction exchanged by CMCS users. Further, most analyses of organizational systems assume that the content of the systems is objective, routine, and unproblematic information used to perform rational tasks, or that CMCS are inherently impersonal and inappropriate for social topics. Exceptions have been studies of the subjective evaluations of the uses and value of the content by system users (Ives, Olson, & Baroudi, 1983). Steinfield's (1986a) analysis of a large organization's use of electronic messaging showed that the social uses of the medium were in fact frequent, and quite important, especially to newer employees who used the system to learn about the organization's social and business norms.

Another strand of research has focused on the consequences of the limited range of nonverbal communication content possible in CMCS (Rice & Associates, 1984; Rice & Love, 1987). Sproull and Kiesler (1986) found that the content of an organizational electronic messaging system indicated that people were more self-absorbed in system messages than in face-to-face communication, that hierarchical boundaries are crossed more in electronic communication, users tend to violate organizational norms more in electronic messaging behavior, and much of the content was new information that was not otherwise available. Hiemstra (1982) applied Goffman's theory of "presentation of self" in human communications to the transcripts of a series of CMCS sessions, and found, with only a few exceptions, very similar patterns of "face-saving" behavior. Other content analyses of CMCS transcripts are more descriptive and anecdotal (Philips, 1982).

Some studies of CMCS have specifically focused on the interaction between flows and content in CMCS. Danowski (1982) evaluated the content of community computer bulletin board messages to suggest applications of discussion leadership that could lead to optimal convergence of participants around a topic or around a participant. Automated content analysis revealed linkages of topics across messages. The linkages were then scaled via metric multidimensional analysis, and possible related topic clusters were extracted. The goal was to be able to train group leaders to recognize these clusters, or sequential patterns, and perhaps steer discussion back to the task via topics closer to the stated goals of the conference. Clearly, different stakeholders would hold very different opinions as to the utility or even ethics of such research. A related approach has been the analysis of "threads of discourse" or the multiple themes that often coexist in CMCS (Black, Levin, Mehan, & Quinn, 1983).

(B) Network analysis. Another CMCS research approach emphasizes the importance of the domains and involves the analysis of communication patterns in organizations. One methodology appropriate to communication

flow analysis is network analysis (Aldrich, 1979; Farace, Monge, & Russell, 1977; Goldhaber, Yates, Porter, & Lesniak, 1978; Rogers & Kincaid, 1981). Network analysis can be used to describe (or "audit") the communication flows and roles at dyadic, group, organizational, and societal domains, and to test theories of organizational communication. Lowenstein (1979), Rice and Richards (1985) and Tapscott (1982) give detailed procedures for collecting and measuring network variables for evaluating CMCS design, use, and consequences.

A network-oriented evaluation might measure communication flows before, during, and after the implementation of a CMCS, for example, to determine whether the technology assists the development of desired communication flows, whether other organizational media (memos, face-to-face conversations, meetings, visitations, telephone calls, conference travel, and so on) are affected, whether certain tasks are performed better in these altered communication patterns, whether the same information can be handled in fewer transformations among media, whether the same information can be shared and accessed with less cost, or whether decision making is centralized or decentralized (and the desirability of either of these). Rice (1982) and Rice and Barnett (1985) used computer-monitored data to show how, over time, task-focused research groups using a nationwide CMCS were more likely to become and remain "isolates," while nontask groups were more likely to remain as information-rich "carriers." Network indices, such as the ratio of within-group to system-wide communication, were useful indicators of potential group cohesion or dissolution. Metric multidimensional scaling procedures were used to determine the effect of groups' entry and exit upon the larger CMCS network. Thus network analysis as one research tool seems to provide helpful insight into important goals, at a variety of domains, to inform a number of stakeholders.

(C) The nature of change. Traditional designs assume that pre- and posttest measures simply detect the difference, along a fixed scale, in variables between two time periods. More rigorous designs would collect data over time to understand how patterns of use and consequences develop, how the sociotechnical system responds to the shock of new communication structures, and how users develop new patterns of communication networks. However, if hypotheses that using a CMCS actually changes the nature of work and alters one's communication environment are correct, then evaluations must also measure changes in the *scales* and *dimensions* upon which respondents base their responses. Golembiewski (1986), among others, has suggested a framework for measuring such changes, called alpha, beta, and gamma change. Alpha change is the traditional measure of change: variation along specific intervals in a given scale. Beta change indicates that the intervals and boundaries of the scale have changed, so identical scale ratings do not indicate identical attitudes or behaviors. Gamma change involves reevaluation of the scale: It may be measuring something else entirely after the treatment. In one

study of an organizational CMCS, workers' notions of what effectiveness meant, as well as the extent to which workers were effective at different tasks and how effective one could actually be in performing those tasks, changed after the system was implemented and respondents had used it for a period of time (Mohrman & Novelli, 1983). Another study of a large-scale CMCS showed that users' attitudes toward the system became more positive, and their use of different functions expanded, as the individuals passed through different thresholds of usage (Hiltz & Turoff, 1981).

There are at least three major implications from such evidence that change is a fundamental part of CMCS. One is that social evaluations of CMCS should use tools—quantitative or qualitative—that allow the collection and analysis of data over time. The second is that different stages in the life cycle both of the system and of individuals' usage patterns should be analyzed separately. The third is that analyses should test whether the dimensions on which users evaluate their usage and the consequences of CMCS have changed over time. Although the first implication is well recognized by communication researchers, it is still infrequently practiced. The second two implications are as yet extremely rare in CMCS research.

INFORMATION AND CMCS

Dervin (1981) and Rogers and Kincaid (1981, chap. 2) have well summarized the growing rejection of a linear model of communication (Shannon & Weaver, 1949) and conceptions of information as objective content sent by one party to be received and consumed as fact by a passive, mass audience. While the denotative meaning of communicated content clearly *is* highly significant and relevant, and while many audiences value and *are* satisfied by the mass media, this concept of information has dominated much of CMCS research. Further, this conceptualization tends to limit research to the domain of individual communication behavior (the user as an isolated processor of information, or the recipients of messages as homogeneous "accounts"). Hirschheim (1985) argues that this "analytical" perspective tends to focus on communication tasks as rational and overt instead of political and nondeterministic, on organizations as structures instead of agents and cultures, on communication actions as manifest behavior instead of socially constructed meaning, on quantitative rather than qualitative tools, and on analysis instead of understanding meanings. Focusing on the information exchanged via CMCS as an interpreted social good can lead to very different goals, system designs, and communication applications (Rice & Parker, 1979).

This section, then, takes the opportunity briefly to investigate this changing concept of information with respect to several aspects of the four evaluative dimensions as applied to CMCS. The first section considers how stakeholders who conceptualize information as an objective commodity may be misled by narrow goals. The second section considers how a wider conceptualization of information exchange as an interpretive activity, along with wider domains and appropriate evaluative tools, can lead to new system designs and applications of CMCS.

Information as an Economic Object

A narrow conceptualization of information—information as a commodity with an objective price set by market mechanisms—constrains the kinds of information that will be evaluated as appropriate or valuable (Johnson & Rice, 1987). This bias is particularly likely when stakeholders, their goals, and their evaluation tools emphasize cost and efficiency while ignoring the meaning, context, and purpose of the content communicated by system users. Stakeholders who use the criteria of traditional economic goals to justify or evaluate CMCS are often unaware of the underlying assumptions about the nature of information and consequent problems or contradictions (Hall, 1981). These assumptions and their reanalyses are presented as follows:

(1) Assumption: In a particular market, the production of all firms, and the consumption of all individuals, are independent.

Reanalysis: (a) Creators and owners of specific information are hard to identify, so benefits and costs from the final product cannot be fully or correctly allocated. Therefore, information (such as new knowledge exchanged through a CMCS) will be underproduced, unless outcome criteria are based upon production of material units (a tangible product, such as a bound report), in which case it will be overproduced. (b) Because information, unlike physical commodities, can often be separated from its physical medium, additional consumers generally create few additional costs but are also difficult to exclude. This characteristic means that information that is valuable will not be communicated in sufficient quantities unless it is subsidized or tightly controlled. For example, evaluations of the Institute for the Future's PLANET computer conferencing system, in which most field trial participants paid for usage (Johansen, Vallee, & Spangler, 1979), and the New Jersey Institute of Technology's EIES system, in which most participants did not pay (Hiltz & Turoff, 1978), showed that subsidized users evaluated the systems positively, but decreased or stopped usage when they had to bear the full costs. (c) A different version of this problem is that consumption of information does not necessarily deplete it; information, therefore, may grow or decline in value in ways unrelated to consumption and may appreciate or depreciate at a nonlinear rate. (d) Communicating certain information may change the value of other information, or lead to redistribution of resources. Thus the value of content at one point in time may have little to do with the value of the content at a later point in time. Thus, for situations in which the value of the communication must be confirmed, face-to-face interaction, even if subject to greater constraints and involving greater costs in time and energy,

will be preferred over CMCS, because receipt of and reply to an electronic message cannot be guaranteed within a prespecified time interval.

(2) Assumption: All actors have sufficient information to make optimal choices.

Reanalysis: (a) Because of (1a), the value and consequences of information are uncertain. (b) Because this value is uncertain, full evaluation of the worth of some communicated content is possible only through direct consumption (listening, purchase, reading, and so on). Since this evaluation requires some cost in status, money, or time, indirect consumption mechanisms have arisen to help reduce this problem (Aldrich, 1979; Baligh & Richartz, 1964; Williamson, 1979). Indirect evaluations in academic communication include publishing in or reading only refereed articles in high quality journals within one's discipline, publishing or reading review articles, reading publications by well-known authors, and inspecting the reference list before deciding to read an article. Applying this process to CMCS research, we can begin to understand why nearly 40% of those with free access to a nationwide CMCS declined to use it on personal cost/benefit grounds (Kerr & Hiltz, 1982). Some individuals responded that they derived greater benefits from their limited time and energy using other media and channels. Others, assessing the value of CMCS for supporting and extending an invisible college of researchers, feared that other users might appropriate their ideas into research before they could establish ownership and reward through publications. Therefore, they underinvested in scholarly innovation in the uncontrolled information marketplace of the CMCS.

(3) *Assumption*: No one buyer or seller can affect the price of a product.

Reanalysis: (a) The costs of communicating some content are so high that mechanisms such as patents and academic tenure have been established to guarantee returns on long-term investments and to influence the price for subsequent users and potential market entrants. (b) Because information is easily replicated once created, in some situations distribution and marketing costs become predominant considerations, leading to natural monopolies. This consideration is one of the reasons that multinational CMCS are unlikely to support a truly free flow of information: They are more likely to consolidate control and stratify users' access to information (Golding & Murdock, 1986; Mosco, 1982).

(4) *Assumption:* In an efficient market, the price of a product reflects its marginal value after costs are recovered. The classic evaluation approach typically measures economic efficiency as an increase in an output/input ratio, through increased outputs and/or decreased inputs. One form of efficiency is *cost avoidance*; for example, after the implementation of a CMCS, fewer telephone circuits, clerical workers, or business trips are necessary, so communication costs will be avoided in the future.

Reanalysis: (a) Because the costs of producing the information, the costs of the medium used to transmit the information, and the value of the information to a particular stakeholder are generally unrelated, the actual price paid or costs saved are misleading criteria for evaluating whether a CMCS achieved specific goals. In general, the huge investment in social systems (relationships, status, norms, expectations, patterns of communication) vastly overwhelms the actual costs and possibly the returns from new communication technology. Therefore, evaluations should consider a variety of stakeholders and goals in order to understand the contexts for use and outcomes of CMCS. For example, Markus (1987) shows that organizations that "charge back" for a CMCS, based upon cost-recovery methods imposed by stakeholders in accounting and data processing departments, in fact are stifling the adoption process by encouraging potential users to continue using currently "free" or easily accountable media, such as copying machines, telephones, and paper memos. The influential stakeholders (the data processing department) in the organization that Markus studied never included the users' or the wider organization's goals in their set of evaluation goals.

Information as an Interpretative Activity

Paradoxically, precisely because CMCS have media characteristics derived from both telecommunication networks and computer processing, there is the potential not only to analyze them using tools based upon a different conceptualization of information but also to design them to support more interpretivist communication processes in multiple domains.

Considering first the question of domains and tools, one characteristic of CMCS that makes them particularly different from interpersonal and mass media is the ability to support *group* communication processes. While discussions of EM tend to emphasize the ability to *send* a message easily to one or more other users, conferencing and bulletin board systems enable prescribed or emergent groups to communicate jointly—collaboratively creating meaning out of diverse sources of information, commenting on and editing messages and documents, indicating ways in which individual opinions may diverge from the common material, and possibly continually evolving the group's shared experiences and meaning. Thus the interactive and processual nature of both the act and content of communication can be emphasized in CMCS research by tools such as network analysis and longitudinal data.

The interpretivist approach to communication can also be used to understand interaction among individuals and groups in organizations (Hirschheim, 1985). General approaches include:

(a) considering work roles as sets of rights and duties, or social contracts, that govern social behavior in ways that fit the sources and content of current beliefs;

(b) analyzing decision-making as the content, process, and location of examining a problem and creating meaning, based on a mixture of evidence, intuition, analysis, and value judgments;

(c) understanding the transactions involved in acquiring, exchanging, and distributing information and the collective or hierarchical sources (such as policies, rituals, and ceremonies) of those transaction mechanisms (Williamson, 1979); and

(d) identifying how communication mediates people's intentions and behaviors, either through defensible, valid reasons or by vested interests and conventions (Habermas, 1984). This language action approach argues that subjective bias, physical constraints, distortions of information by social conditions, and lack of awareness of intention and implications for performance all create obstacles to intersubjective intelligibility of communications.

For example, Hiemstra (1983) identified meanings of the set of terms associated with "information technology" in four organizations. The evaluative dimensions of conversations about CMCS included *fast/slow, dynamic/static, patent/impatient, young/old, future/past, creative/routine, mysterious/obvious, exciting/dull.* Extremes of users (clericals versus computer operators) and technology (typewriters versus computer terminals) are arranged along these dimensions. Information technology is referred to in metaphors such as *magic, toys,* and *moving objects.*

The interpretivist approach seems to raise serious challenges not only to the CMCS research, but also to the validity of communication through such systems. The prevalent argument is that CMCS, because of their bandwidth limitations, cannot convey much of the nonverbal and social communication among individuals and will thus reinforce the conceptualization of information as rational, objective content to be transferred from one person to another. While this position is subject to considerable debate just on the basis of the kinds of communication that *do* occur in CMCS (see Sproull & Kiesler, 1986; Rice & Associates, 1984; Rice & Love, 1987), it is perhaps more important to realize that the computer-processing capabilities can be used to *emphasize* these language actions rather than to suppress or limit them. Further, tools such as network analysis, content analysis, and participant observation are appropriate tools for understanding communication as an interactive process of convergence (Rogers & Kincaid, 1981).

Indeed, CMCS provide opportunities for individual, social, and technical mechanisms to explicitly or subtly structure and filter the flow, content, and exchange of communication (Hiltz & Turoff, 1985). In the more narrow context of group decision making, there is considerable research activity in designing capabilities in such systems for agenda-setting, decision-modeling, and structured group methods (Delphi analysis, group polling, nominal group techniques, brainstorming, interaction rules, and feedback to group members; DeSanctis & Gallupe, 1987).

The need to remove the obstacles to understanding intention has been the expressed rationale of some system designers behind the development of the *Coordinator* CMC system (Flores & Winograd, 1986; Winograd, 1984). The system allows individuals and groups to identify their communication intent—facts, requests, offers, commitments, and expressions—in the structure of their exchanges by associating categories of intention with the content, choosing from directories of individuals sharing common discussion topics, or establishing follow-up messages appropriate to the intentions. These and other capabilities allow shifting groups of users to make explicit their communication acts and reduce the negative mediation of communication between intention and behavior.

INTERACTION OF COMPONENTS OF DIMENSIONS

Specific components of each dimension can interact with other components in the same dimension and in other dimensions to create a matrix of cells representing potential social realities and areas of research.

Interaction Within a Dimension

For example, different users have different stakeholder roles which may interact. Consider the use of CMCS in educational settings (Black, Levin, Mehan, & Quinn, 1983; Hiltz, 1986; Quinn, Mehan, Levin, & Black, 1983; Welsch, 1982). The institution has needs, such as providing services across campuses and clientele (for example, evening students and distance learners), and in situations of insufficient classroom space. Faculty who need to match their scheduling constraints with their desires to provide assistance to large classes, often would like to share their comments with the full class or even colleagues, and enjoy reading neatly printed papers. Students need access to courses and faculty without having to move or leave work, need increased interaction not only with faculty but also with other students, may have difficulty with understanding classroom discussion if their language skills are not sufficient, and enjoy their ability to revise and to have a valid version of the assignment. Studies have shown that the nature of instructional communication changes: Rather than the typical interaction between teacher and student that consists of linear and hierarchical questions and responses, there is more sharing of information and more group discussion among students, a greater perception of participative learning, more simultaneous threads of discourse, increased evaluations of students' comments by other students, and longer and more complex sentences in students' responses. The needs of each category of user, however, may conflict with the constraints of technological resources, system reliability and accessibility, evaluation standards, norms of privacy, computer literary, attitudes toward technology, and perhaps the needs of other categories of users.

Interactions Across Dimensions

Components of one dimension can be used to facilitate—or constrain—the use of components in another dimension. For example, in their description of the sociotechnical approach to total system design, Bostrom & Heinen

(1977a) argue first for a formative evaluation of managers' or system designers' assumptions (such as seeing people only as inefficient information processors with insufficient information, underestimating the amount of legitimate responsibility users have for changing a system, optimizing the system at the cost of the organization, overlooking users as part of the design process, seeing the development process as rational and static, and using limited implementation techniques). Once these are identified, other research efforts can be applied to create both an improved organizational environment and a useful information system (Bostrom & Heinen, 1977b).

Constraints Across Dimensions

If few studies represent a particular interaction of components in several dimensions, we might well ask whether that interaction is uninteresting or difficult, or whether support for research on an aspect in one dimensions is not forthcoming for some reason relating to an aspect of another dimension. For example, Kerr and Hiltz (1982) conclude that there are few *empirical* studies of CMCS in the *societal* domain, in contrast to research in individual and group domains.

One reason for this dearth of studies is that such research requires longitudinal, multiple-source data in the industrial or societal domain. Such data are difficult to come by and analysis cannot easily disentangle the influences of other pervasive social changes. Another reason is that administrators, respondents, or funding agencies may resist the collection of necessary data such as network rosters or computer-monitored data because of concerns over confidentiality or scarce programming resources. It may be difficult to justify research at all to managers who must account for the use of employees' time, users who do not really make fine distinctions among the media they use in daily life, or unions that criticize the collection of job activity measures.

Traditional social science designs and tools also may be preventing stakeholders from setting goals that are more useful to them but can be achieved only by other sources of insights, such as computer-monitored data, archival data, in-depth interviews, focus groups, participant observation, interpretive narratives, or participative redesign of the system. For some stakeholders, causality may be of interest on a local level only, because funding decisions are largely political, or may be irrelevant precisely because the *concept* of causality is seen as an epistemological and ideological bias. For example, King, Kling, Kraemer, Scacchi, and their colleagues at the University of Irvine have rejected causality in favor of concepts such as *social action, evolutionary systems,* and the *web of computing* to understand the ongoing processes of design, usage and application of computing systems (Kling & Scacchi, 1980).

For others, insights from a case study may be sufficient and generalizability of little concern—circumstances particularly true for most proprietary office automation studies, because the associated competitive environments create

conflicting goals for different stakeholders. Two sets of stakeholders may remain uninterested in CMCS research for opposite reasons: users, because the proposed research does not address their practical needs, and theoreticians, because the analysis of actual systems is seen as too applied. Clearly, the different goals of these and other stakeholders influence the cost-benefit ratio of any proposed research effort.

Further, it is difficult to disambiguate the influences on, contexts of, and societal aspects associated with large-scale CMCS. For these and other reasons, some stakeholders feel that case studies, economic and demographic approaches, and political analyses seem generally more suited to this interaction across dimensions than the more traditional social science research methods (see, for example, Forester, 1980; Kling, 1984; Lowi, 1983; Mosco, 1982; Schiller, 1982). Some of these studies are part of analyses or critiques of the "information society" as a whole.

CONCLUSION

This chapter began by postulating that the developing body of research on the uses and implications of CMCS reflects a variety of disciplinary paradigms, technological distinctions, and evaluation approaches. Awareness of the four dimensions of social evaluations of CMCS suggested in this chapter—stakeholders, domains, goals, and tools—can aid in understanding how ideological, social, economic, political, technical, organizational, and individual factors constrain or expand the uses and implications of this new medium of human communication. The suggested framework for social evaluations of CMCS may be used to identify how different academic disciplines make different assumptions about the acceptability or familiarity of certain topics and methods in CMCS research. It may be used to provide common dimensions with which to evaluate different forms of communication technologies. And it may be used to identify in what ways the evaluative process may be confounded with the results used by managers or community groups to guide their use of CMCS, or with the evidence used by researchers in extending their own research into the use and implications of a new communication medium.

This preliminary framework has been applied to a specific and perhaps narrow aspect of communication and computer technology. Other aspects of human communication, that are experiencing the convergence of these two technologies, such as providing instruction, the delivery of health services, the retrieval of database information, or the computerization of political campaigns may well be considered by a similar framework, or may require expansions and alterations of the framework. Further, the dimensions of social research of CMCS should be joined with the technical and economic dimensions to provide a more complete framework. However, because

CMCS directly facilitate communication among individuals, and because the extant social science literature on CMCS is so widely dispersed, the present four-dimensional framework for identifying issues and concepts in social evaluation of CMCS may provide a focused and helpful beginning.

NOTE

1. Reviews of the nature of CMCS and research on their uses and effects may be found in Hiltz and Turoff (1978), Kerr and Hiltz (1982), Hiltz (1983, 1985), Johansen, Vallee, and Spangler (1979), Kiesler, Siegel, and McGuire (1984), Rice (1980b), Rice and Associates (1984), Steinfield (1986b), Tapscott (1982), Vallee (1984), and Uhlig, Farber, and Bair (1979).

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